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PESTICIDES' NEGATIVE EFFECTS ON SOIL-WATER-AIR CYCLE AND ALTERNATIVE APPROACHES Pestisitlerin Toprak-Su-Hava Döngüsünde Oluşturduğu Olumsuz Etkiler Ve Alternatif Yaklaşımlar <i>Damla MUSTAFAOĞLU, Yeşim DEDE SAĞSÖZ</i>	1-19
TBDY 2019 VE EUROCODE 8'E GÖRE BİNA HEDEF YER DEĞİŞTİRMESİNİN HESABI Target Displacement Calculation According To Tbec 2019 And Eurocode 8 <i>Elif BORU</i>	20-38
AN EVALUATION OF TECHNOLOGY AND ARTIFICIAL INTELLIGENCE'S RELATIONSHIP WITH CULTURE AND ART IN TERMS OF LITERATURE Teknoloji Ve Yapay Zekâ'nın Kültür Ve Sanatla Olan İlişkinin Literatür Açısından Değerlendirilmesi <i>Oğuz DÜZ, Ozan DÜZ, Ozan KARABAŞ, Senai YALÇINKAYA, Mihalıs Michael KUYUCU</i>	39-62

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- Elektronik Ve Haberleşme Mühendisliği
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- Endüstriyel Tasarım
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- Gıda Mühendisliği
- Harita Mühendisliği
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- Yönetim Mühendisliği
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Prof. Dr. Ashok JAMMI
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Prof. Dr. Ashok JAMMI
Chief Editor

Dear readers, distinguished scientists,

In this issue of our journal, there are a total of 03 research and application studies. In this issue of the journal, we would like to express our sincere thanks to the authors who support us with their valuable studies. We would also like to express our thanks and appreciation to the precious arbitration committee members who never leave us alone and enable this issue to meet with our dear readers with their worthwhile efforts and contributions, as they have done in each issue. We also greatly appreciate the efforts of the editorial board, system management, and the precious scholars taking place in the editorial board for making an effort in the background of the publication of this journal. Dear scientists, we still continue our applications and works to enable our journal to be in different indices. Our announcements about the evaluation of the studies published in our journal to be assessed by different readers and literatures also still continue. We have also speeded up our communication studies and the delivery of the journal and its issues to scientists and scholars all around the world. We thank you for your support and contributions already, and we pray for reconciliation.

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PESTICIDES' NEGATIVE EFFECTS ON SOIL-WATER-AIR CYCLE AND ALTERNATIVE APPROACHES¹⁻²

PESTİSİTLERİN TOPRAK-SU-HAVA DÖNGÜSÜNDE OLUŞTURDUĞU OLUMSUZ ETKİLER VE ALTERNATİF YAKLAŞIMLAR

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Abstract: Aim: One of the most critical problems in the world today is the problem of hunger. Parallel to the rapid increase in the world population, the decrease in usable agricultural areas day by day increases the importance of this problem day by day. In addition to studies such as breeding and fertilization to solve the problem, pesticide applications are frequently made against various pests to prevent the loss of yield in basic food sources. Pesticides cause environmental problems when misapplied and uncontrolled. The study discusses environmental problems caused by pesticides and pesticide alternative applications. The aim of this study is to raise awareness about this issue.

Method: The information obtained by examining the current data, published reports, and, studies about the cycle of pesticides in nature was evaluated and interpreted.

Results: Chemical control against pests is preferred over physical and biological control. During the application of pesticides by spraying, some of them are released into the atmosphere through dispersion and evaporation, and some remain on the plant and soil surface.

Conclusion: Pesticides used to increase yields in agriculture include complex chemicals and heavy metals. Pesticides that cause environmental pollution participate in the environmental cycle and damage the soil-water-air trio. Instead of these chemicals, which change form in this cycle and progress by multiplying their negative effects, environmentally friendly alternative approaches should be expanded to combat pests and applied in macro areas.

Keywords: Pesticides, Water Pollution, Soil Pollution, Air Pollution

Öz: Amaç: Günümüz dünyasında en önemli sorunlarından biri açlık sorunudur. Dünya nüfusunun hızla artmasına paralel olarak kullanılabilir tarım alanlarının her geçen gün azalması bu sorunun önemini her geçen gün artırmaktadır. Sorunu çözmeye yönelik ıslah, gübreleme gibi çalışmaların yanı sıra temel besin kaynaklarında verim kaybını önlemek amacıyla çeşitli zararlılara karşı pestisit uygulamaları sıklıkla yapılmaktadır. Pestisitler yanlış ve kontrolsüz uygulandığında çevre sorunlarına neden olmaktadır. Çalışmada pestisitlerin neden olduğu çevre sorunları ve alternatif uygulamalar ele alınarak bu konuda farkındalık yaratılması amaçlanmıştır.

Yöntem: Pestisitlerin doğadaki döngüsüne ilişkin yayınlanmış raporlar, çalışmalar ve güncel veriler incelenerek elde edilen bilgiler değerlendirilerek yorumlanmıştır.

Bulgular: Zararlılara karşı kimyasal mücadele yöntemleri; fiziksel ve biyolojik mücadeleye göre daha çok tercih edilmektedir. Ancak pestisit uygulanma sırasında yeterli tedbirlerin alınmaması bu kimyasalların bir kısmının buharlaşma ve dağılma nedeniyle atmosfere yayılmasına, diğer kısmının ise bitki ve toprak yüzeyinde birikmesine neden olmaktadır. Atmosfere yayılan, bitki ve toprak yüzeyinde biriken pestisitlerde yağışlarla yüzeysel ve yeraltı sularına sızmaktadır. Dolayısıyla pestisitler doğal döngülere katılmaktadır. Bu durumda çevre ve insan sağlığı için olumsuz etkilere sebep olmaktadır.

Sonuç: Tarımda verimi artırmak için kullanılan pestisitler karmaşık kimyasallar ve ağır metaller içermektedir. Çevre kirliliğine neden olan pestisitler çevre döngüsüne katılarak toprak-su-hava üçlüsüne zarar vermektedir. Bu döngü içerisinde form değiştiren ve olumsuz etkilerini katlayarak ilerleyen bu kimyasalların yerine, zararlılarla mücadele için çevre dostu alternatif yaklaşımlar genişletilerek makro alanlarda uygulanması sağlanmalıdır.

Anahtar Kelimeler: Pestisitler, Su Kirliliği, Toprak Kirliliği, Hava Kirliliği

¹ Sorumlu Yazar / Corresponding Author: Yeşim DEDE SAĞSÖZ, Ataturk University, Faculty of Engineering, Department of Environmental Engineering, Erzurum / Türkiye, yesim.dede@ogr.atauni.edu.tr, Geliş Tarihi / Received: 02.06.2023, Kabul Tarihi / Accepted: 28.08.2023, Makalenin Türü / Type of Article (Araştırma - Uygulama / Research - Application), Çıkar Çatışması / Conflict of Interest: Yok / None, Etik Kurul Raporu Yok / None, Ethics Committee Report Unavailable "Çalışma içeriği ve yapısı gereğince etik kurul ve kurum izni gerektirmemektedir"; "The study does not require ethics committee and institutional approval due to its content and structure"

² Çalışma, araştırma ve yayın etiğine uygun olarak hazırlanmıştır. Çalışmada herhangi bir intihale rastlanmamış olup dergi kapsamında istenen %20 alıntı oranına uygun olarak hazırlandığı bu yönlerden makalenin tüm sorumluluğu ile bilgilerin doğruluğu ilgili yazar(lar) tarafından kabul edilmiştir. İşbu makalenin her türlü telif ve sair diğer hakları açık erişim olmak üzere yazar(lar) tarafından dergiye devredilmiştir. "The study was prepared in accordance with research and publication ethics. No plagiarism was found in the study and it was prepared in accordance with the 20% citation rate required within the scope of the journal, and in these respects, the full responsibility of the article and the accuracy of the information has been accepted by the relevant author(s). All copyright and other rights of this article have been transferred to the journal by the author(s) as open access."



INTRODUCTION

Pesticides by the World Health Organization (WHO); are defined as substances used to abduct, kill or control unwanted species found in food, agricultural products, forest products, or animal feed that carry diseases that may occur in humans and animals. In another definition, pesticides are substances employed to avert, manage, or eliminate detrimental organisms, encompassing insects, rodents, bacteria, fungi, and weeds. The term 'pest' may also refer to weeds that adversely affect or compete with the growth and maturation of crops, trees, grasses, and other vegetation. Again, pesticides are also known as substances that can be applied to control the pests that can be found in the bodies of animals (Polat, 2022).

Pesticides cover all chemicals used in agricultural pest control. They are classified according to the active agent. Insecticides-insecticides (ant, insect, caterpillar, etc.), acaricides-acaricides (ticks, dust beetles, etc.), fungicides-fungicides. It is possible to add pesticide groups such as herbicides, rodenticides, molluscicides, nematocides, and avicides to this list. Considering the use of pesticides in Türkiye by pesticide groups; it is observed that the most important group is insecticides with 47%, herbicides followed by 24%, and fungicides have a share of 16% (Öğüt, 2008).

Increasing consumption of pesticides around the world adversely affects the natural life and sensitive ecosystem in the water, air, and soil environment. Pesticides are among the environmental pollutants, because environmental pollutants have harmful

effects on a global scale because they release chemicals and cause harmful wastes (Dede Sağsöz & Taşdelen Eren, 2023). Pesticide applications not only kill the target organism but also cause harmful organisms to become immune to pesticides.

Pesticides applied in agricultural areas pass into the air, water, and soil through evaporation and dispersion. Therefore, living things living in these environments are affected by these pesticides. Pesticides, which are used to remove agricultural products from all kinds of harmful effects and to harvest better quality products, bring many problems in terms of environmental health and human health (Altıkat et al., 2009).

Pesticides are applied directly to the soil surface and into the soil, on the plant, or the seed pod as a seed spray. Most of the pesticides used directly to the plant pass into the soil; depending on its type, solubility, and seasonal conditions, it can change place in the soil environment over time. These chemical pollutants, penetrating deep into the soil, first join the food chain by contaminating millions of agricultural products grown in the soil. These harmful pesticides, which threaten living life by advancing with dynamic steps in the food chain, cause water pollution by mixing with surface waters and underground waters over time. As a result of the mixing of aerosol, particles, and vapor form into the atmosphere, they cause air pollution. With the release of pesticides from their sources, their journey on Earth begins. Pesticides, which harm the environment and living organisms in the environment with the soil-water-air

cycle, are significant environmental pollutants.

AIM

With the increasing population in the world, the need for food is also increasing, which has forced the use of pesticides in today's modern agriculture. The increase in the use of pesticides adversely affects the environment and human health. While environmental elements such as air, soil, and water are polluted, the negative and toxic effects of pesticides on all living things have also become an important issue.

Purpose of the study; In addition to investigating the negative effects of pesticides by examining their circulation in soil-water-air environments, which are the basic environmental elements; Acting in line with this basis; It is to introduce green-environmentally friendly approaches that can be used instead of pesticides.

CONTENT

In the study, the chemical contents, classifications, and important effects of pesticides were investigated, and the risks they created on the environment (soil-water-air) and on living things were discussed separately and in detail. The toxic effects of pesticides in different environments by changing their place and how they are involved in the environmental cycle have been investigated.

RESEARCH LIMITATIONS

The research has potential restrictions. Extensive and up-to-date data are needed to examine the effects of pesticides in the

natural cycle. This may limit the scope of the research. In addition, since these chemicals remain intact for a long time, examining their long-term effects may be a time constraint limiting the research. In addition, working for many years may complicate the funding of the research. For the study to be universal, it is necessary to conduct studies in different regions. Analysis techniques developed to see the full effects of pesticides can be expensive and have limited access. In addition, the complexity and feasibility of alternative approaches to reducing pesticide use may affect research results. There may be limitations on how these alternatives can be implemented in practice. These constraints reflect the common challenges faced by research examining the environmental impacts and alternative approaches of pesticides. Researchers need to use multidisciplinary approaches and careful planning to overcome these constraints.

RESEARCH PROBLEM

With the increasing use of pesticides in agricultural areas, the negative effects of pesticides on soil, water, and air cycles are increasing. This study aims to understand the effects of pesticides on natural ecosystems by examining in detail how pesticides participate in natural cycles and their environmental effects. The potential to reduce negative effects with the alternative approaches presented is also within the scope of the study.

This research problem addresses an important issue in understanding the environmental impacts of pesticides and alternative solutions, environmental

protection, and sustainability. It aims to contribute to the development of better environmental management and agricultural practices by examining the effects of pesticides on natural cycles.

THEORETICAL FRAMEWORK

The term pesticide, in short, means a substance used to kill harmful creatures called pests. Pesticides are chemicals used to prevent, destroy or mitigate the effects of insects, rodents, weeds, and other unwanted organisms. It is used to neutralize harmful organisms that affect humans, animals, and plants and reduce the nutritional value of plants (Pathak et al., 2022).

As a result of the increase in the use of pesticides since the middle of the twentieth century, many negative effects on the natural environment and human health have emerged. Pesticides are produced to be harmful to specific target organisms or

groups of organisms that harm economic agricultural products (Kayhan, 2020).

Pesticides; can be grouped according to their physical and chemical structures and target organisms. Although their distinctions are not very clear, they can be classified as inorganic, synthetic, and biological (biopesticides) pesticides. Biopesticides include microbial and biochemical pesticides (Tudi et al., 2021). It can be a pesticide, a chemical, a biological agent such as a virus or bacteria, an antimicrobial, a disinfectant, or any tool. The term includes algicide (algicide), bactericide (bactericide), fungicide (fungicide), avicide (bird killer), insecticide (insecticide), herbicide (weed killer); ovicide (egg killer), adulticide (adult killer), larvicide (larva killer), molluscicide (snail killer), acaricide (acaricide), nematocide (nematode killer), viricide (viral killer), and rodenticide (rodenticide) (William et al., 2020).

Table 1. Classification of Pesticides

Pesticide Classifications	
According to Biological Targets	Insecticides (insecticidal drugs), Acaricides (red spider-killers), Fumigants and Nematocytocides (nematode killers), Rodenticides (rodenticides), Molluscicides (snail killers), Fungicides (fungicides), Bactericides (bactericidal drugs), Herbicides (weed killers), Aphicides (aphid killers), Repellants (kidnappers), Winter Fight Medicines.
According to the Forms of Influence	Contact Pesticides, Stomach Poison Pesticides, Respiratory Poison Pesticides, Asphyxiant Pesticides, Insecticides that Prevent Chitin Formation in Insects, Insecticides that Prevent Spore Formation in Fungi, Fungicides with Eradicant Effect on Fungi, Fungicides with Combined Action on Fungi.

According to Biological Periods	Ovicidal (insecticides that kill eggs), Larvicide (insecticides that kill larvae), Ova Larvicide (insecticides that kill eggs and larvae), Adulticide (insecticides that kill adult insects).
According to Pesticide Formulation Forms	Liquid (Liquid) Formulations (EC), Water-wettable Powder Formulations (WP), Water-soluble Powder Formulations (SP), Flowable Formulations with Yogurt Consistency (SC), Powder Formulations, Granular Formulations, Pellet Formulations, Gas Formulations.
According to Active Substance Groups	It is one of the most scientific methods used in the classification of pesticides, and each pesticide group is divided into subgroups according to the molecular differences within itself and shaped in detail. Insecticides (insecticidal drugs), Acaricides (red spider-killing drugs), Fumigant and Nematocytetes (nematode killers), Rodenticides (rodenticides), Molluscicides (snail killers), Fungicides (fungicides), Bactericides (bactericidal drugs), Herbicides (weed killers), Aphicids (aphid killers), Repellants (kidnapper), Winter Fight Medicines.

Chemical residues of pesticides that accumulate in soil and water are called environmental pollutants. Pesticides are separated chemically according to the active substance they contain. These; can be classified as those containing inorganic substances, those containing organic matter, natural organic pesticides, and synthetic organic pesticides. The properties of these active substances are that they are permanent or temporary in the environment. According to this; organophosphorus (non-permanent), generally belonging to the herbicide group, moderately persistent, long-lasting (usually chlorinated hydrocarbons), and finally permanently persistent (containing arsenic, lead, or mercury) (El-Nahas et al., 2017).

Pesticides can pose risks to the ecosystem and human health, as they are transportable to air, water, soil, and biomass after multiple applications. Therefore, pesticides are important and risky substances in terms of toxicology. First of all, they cause harm to the

environment as a result of their circulation in nature (Alengebawy et al., 2021).

In this study, how pesticides have been displaced in basic environmental elements (soil-water-air) and their effects on the environment they penetrate have been discussed in detail.

Environmental Pollution Caused by Pesticides

Pesticides are dragged from the applied areas to other places by external factors such as rain and wind. Some of the pesticides evaporate, causing the accumulation of toxic substances in the atmosphere (Zaller et al., 2022). Some remain in the soil, causing soil pollution. Some of them are dragged from the soil by snow, rain, and flood waters, polluting underground and surface water resources. The use of pesticides in agriculture causes pollution of air, soil, and water ecosystems over time. For this reason, pesticides threaten all living things in these ecosystems (Yazgan, 1997).

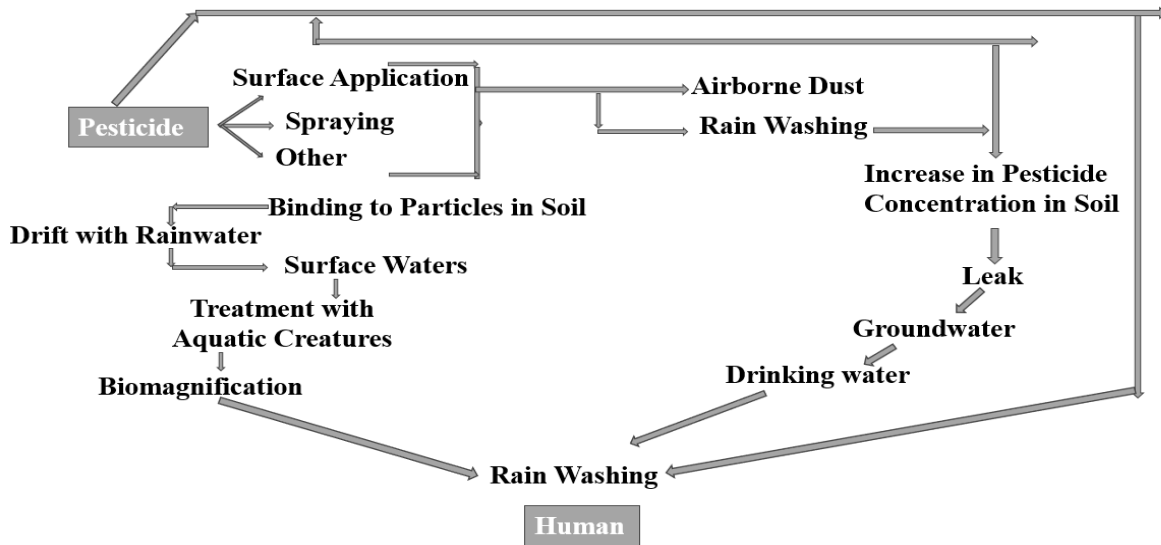


Figure 1. Circulation of Pesticides in Nature

Figure 1 shows the movements of pesticides in nature. When pesticides are applied to the target, some of them hang in the air, while most of them easily pass into the soil and are dragged. Pesticides, which go deep into the soil and mix with groundwater, reach water wells and pollute drinking water. From here, it enters the food chain and enters the living body. These chemicals, which cannot be removed from the living body, cause bioaccumulation and have a carcinogenic effect (Mitra et al., 2022).

Effects of Pesticides on Soil Pollution

Soil is the most basic living space that embraces most living things on Earth. It is a vast house where we cultivate, eat, and drink, come to life with a bud, shelter, and grow. Whatever you give to the soil, it will grow back to you.

Soil is a vital resource for plant and animal life, which is important for human survival and forms a large part of nature. Soil is the

largest sink of organic pollutants, and soil reserved for agricultural land is the most basic part of the agroecosystem. For these reasons, products; The fact that it is of good quality, safe and risk-free in terms of human health is related to the quality of farmlands (Sun et al., 2018).

Soil constitutes the production areas of the plants, which are the first producers in the macro plan. In this environment, plants assimilate and produce essential nutrients necessary for animals and humans. The microorganisms are; It breaks down the biomass of plants, animals, and humans that have lost their life activities in the soil and returns them to the ecosphere as basic nutrients. There are important drawbacks of pesticides applied to the plant. Soil absorbs harmful substances by providing an effective buffer and filter against pesticides by physicochemical and biological means (Altıkat, 2009).



Figure 2. Pesticide Applied to Agricultural Fields (Tarfin, 2021; The Food and Agriculture Organization, n.d.)

When pesticides that pass into the soil are combined with sunlight, they undergo photochemical degradation and biodegrade with an effect on plants and small organisms in the soil and other living things; pesticides that penetrate the soil reach the upper part of the soil with capillary water and can pass from there to the air environment. The texture of the soil, the amount of organic matter, the content of aluminium and iron

oxide, the amount of clay, and the pH value are the factors affecting the micro-life population in the soil. The adhesion and migration of pesticides to the soil and their biological uptake are prevented, so pesticides are transformed into more toxic metabolites. It is important to know and examine all these events since it is not desirable to change pesticides beyond this purpose (Altınbaş et al., 2004).

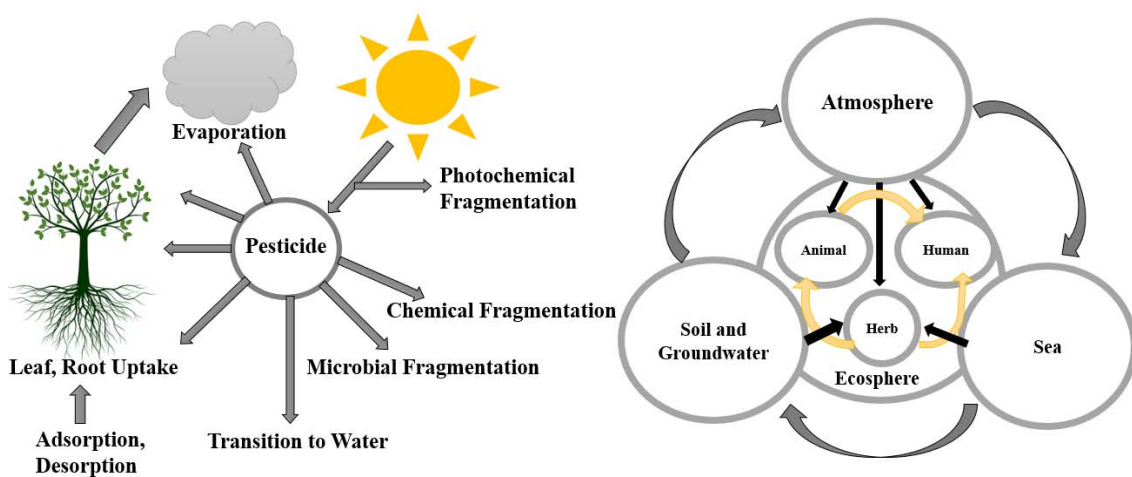


Figure 3. Behaviours of Pesticides in The Ecosystem (Soil-Plant-Environment-Atmosphere Systems)

The above figure shows the life cycle of pesticides. Pesticides have a cycle in the ecosystem as well as their circulation in nature. Pesticides, which can pass into all environmental environments shown in the figure, may evaporate and re-mix into the atmosphere. Pesticides often leak from the fields and reach the ground, where they can dissolve and interact with microorganisms (Lushchak et al., 2018).

Pesticides applied to the soil or directly to the bud contaminate vegetables and fruits, which are the most basic foodstuffs of humans (Mebdoua, 2018). Foods purified from insects and pests are added to our table by being coated with toxic chemicals whose long-term effects cannot be predicted.

Pesticides affect agricultural production and the soil quality of agricultural products in several ways (Bondareva et al., 2021). An increase in the concentration of herbicides above the recommended field application rates can affect the nutrient cycle in the soil, altering the growth and activity of microorganisms. It has been determined that herbicides applied to the soil reduce the root mass of the crops and cause the accumulation of phosphorus (P), sulphur (S), potassium (K), manganese (Mn), and magnesium (Mg) in the tissues of the plants (Sun et al., 2018).

Effects of Pesticides on Water Pollution

Water is one of our greatest natural resources and the foundation of life. Humans need clean water for drinking, cooking, and washing. Clean water is essential for irrigating farmers' crops and feeding livestock. Groundwater is the world's main source of fresh water. After soil and plant applications, pesticides

suspended in the soil and air can pass into surface waters and underground waters with external factors such as precipitation and wind (Akhtar et al., 2021). Pesticides continue to break down after they reach groundwater. But they decompose at a lower rate due to less light, temperature, and oxygen. When groundwater is polluted; contamination can also occur in water streams, rivers, and lakes. It takes time for an aquifer to purify itself by natural processes, even if sources of contamination have been stopped. When groundwater is contaminated, it is very expensive and difficult to clean. The best protection against groundwater pollution is the prevention of pollution (Altıkat, 2009).

The mixing of pesticides into the soil opens the doors of their transition to nature. Like all pollutants thrown into the soil, pesticides containing complex chemicals and heavy metals begin their journey in nature (Alengebawy et al., 2021). Pesticides, which take their first step on the soil, get into surface waters (sea, lake, ocean, river, etc.) due to rain, snow, wind, and different climatic events, and they infiltrate deep into the soil and mix with groundwater (Bhateria et al., 2016). Pollutants that mix with water and some of them dissolve in water turn into chemicals that create more effective pollution and threaten life in the water (Kılıç, 2021). Most pesticides cause bioaccumulation in aquatic organisms, poisoning and killing them (Katagi et al., 2016). These poisonous formations continue their existence by multiplying cumulatively within larger organisms that feed on small creatures (Kumar et al., 2023). Pollutants from these creatures and groundwater threaten human life by reaching the top of the food pyramid.

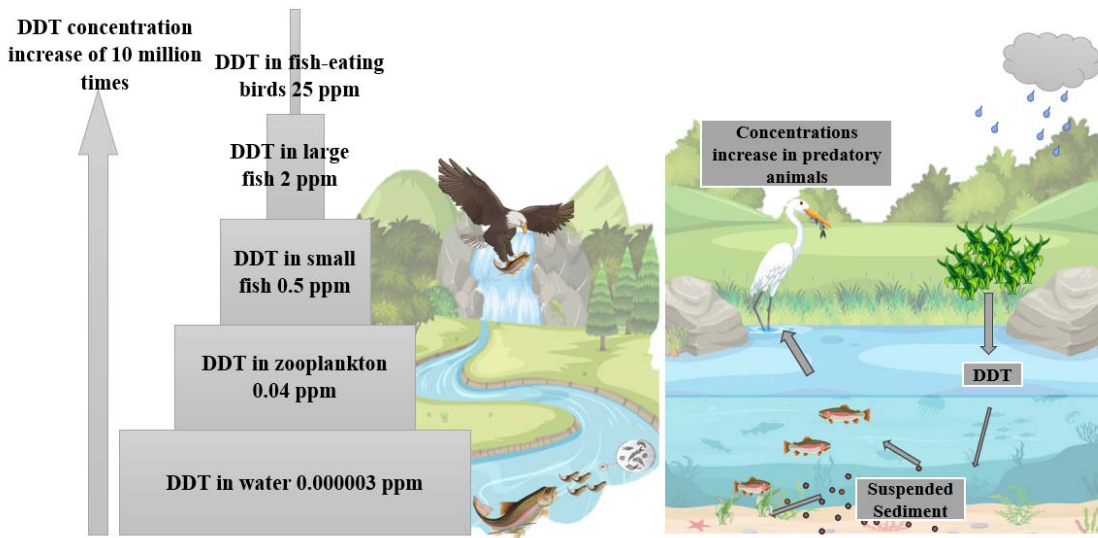


Figure 4. The Exponential Impact of DDT, The Most Common Type of Pesticide

There are many sources of pesticide transfer to the aquatic environment. They can come from both field sources (such as atmospheric precipitation, and farm fields) and point sources (such as sewage in various centres or hazardous-waste-disposal sewage). It can even be transported over long distances by air. When pesticides are in the aquatic environment, they are exposed to various processes. Physical (accumulation, dilution,

sedimentation, and diffusion), chemical (hydrolysis and oxidation) and biochemical (biodegradation, bio transport, and bioaccumulation) processes cause the increase of these substances with great toxicity. If pesticides accumulate in aquatic organisms, they may cause many hazards with irreversible changes (Akdoğan et al., 2012).

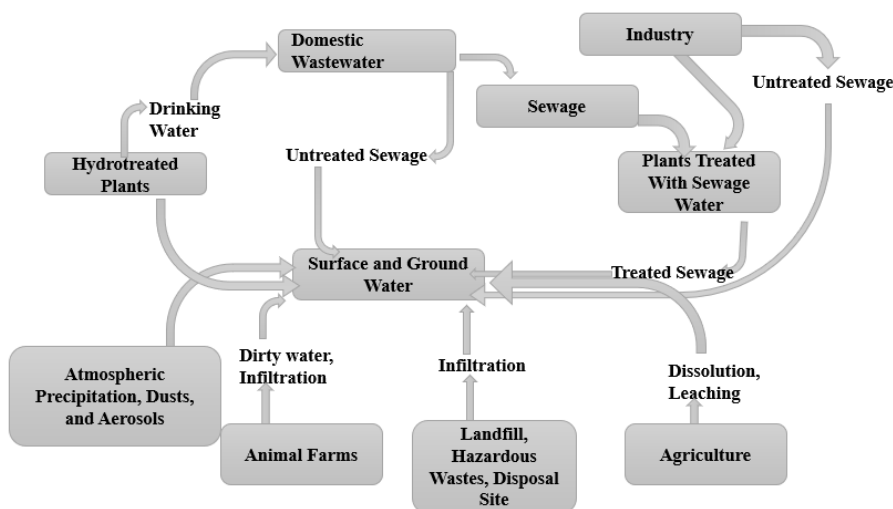


Figure 5. Circulation of Pesticides in Water Ecosystems

As can be seen in Figure 5, pesticide wastes that can be transmitted to surface waters from different sources (transported with the atmosphere, industry, domestic wastewater, sewage, etc.) infiltrate under the soil in the second step, polluting the groundwater, and damaging the ecosystem there.

For several reasons; hydrolysis, biodegradation, oxidation, and photochemical degradation of pesticide residues that pass from the environment to soil and water cause pesticides to turn into different products. Most recent environmental studies have focused on these conversion products because they can be more toxic than pesticides and many of these effects are unknown (Denizli et al., 2013).

Effects of Pesticides on Air Pollution

Air pollution occurs as a result of the condensation of harmful substances in the atmosphere. Air pollution is an environmental problem leading to premature deaths and diseases worldwide (Bronte et al., 2023).

Pesticides cause air pollution by mixing with the atmosphere in various ways. As a result of this situation, serious problems arise that threaten natural ecosystems and human health (Rajmohan et al., 2020).

Pesticides can spread in the air as dust, vapor, and droplets as a result of applications in agricultural areas. In addition, some pesticides with volatile compounds can evaporate quickly after application and remain volatile in the air (Zaller et al., 2022).

Pesticides may contain different air pollutants chemicals, depending on the active ingredients and other auxiliary chemicals they contain. The compositions of pesticides differ from product to product and from brand to brand. But they usually contain the following air pollutants (Kalyabina et al., 2021)

Organophosphates: These types of pesticides are used to control insects and other harmful organisms. Organophosphates

can cause serious effects on human health when inhaled or absorbed through the skin.

Carbamates: Carbamates form another class of pesticides and act by targeting the nervous system of insects. These substances can also harm human health by inhalation or contact with the skin.

Pyrethroids: Pyrethroids are a class of synthetic pesticides that kill or inactivate the nervous system of insects. These chemicals can be airborne as volatile compounds and can be toxic to humans.

Triazines and Organochlorines: Some herbicides used in agricultural applications include organochlorine and triazine derivatives. These substances can cause environmental pollution and have long-term persistence in soil, water and air.

Acrylamides: Acrylamides, which can be found in some pesticides, especially fungicides used in damp and watery areas, can be airborne and pose serious risks to health.

Among these pesticides, the following: organophosphate insecticides: not long-lived in the environment, organochlorine insecticides: resistant to environmental degradation, triazine herbicides: heavily used herbicides, persistent in the environment are frequently detected in the atmosphere (Ayegbokiki et al., 2022). Pesticide particles have the ability to spread over long distances by air. If pesticides are not controlled in the air, they can reach waterways, green spaces and homes. Pesticides used in urban and agricultural areas close to urban areas cause pollution of the atmosphere of large cities due to their volatile or semi-volatile nature (Trajkovska et al., 2009). Pesticides reaching habitats; they can harm wildlife, sensitive plants, pets and people.

The release of pesticides into the atmosphere occurs in the following ways:

Spraying and Pollination: Liquid spraying or pollination method is often preferred in the fight against plant diseases and pests. Liquid

spraying is applied through nozzles that provide homogeneous distribution of pesticides. It is desirable that the total spray volume be above 150 μm with a droplet size. Particles below 150 μm are the most prone to drift in windy weather (Tiryaki and Temur, 2010). These droplets, which rise into the air on agricultural lands during pesticide application, can then be carried to other regions by the effect of the wind.

Transport by Air: Pesticides can reach areas far from the application area by winds and air movements. The transport of pesticides from application areas to non-target areas causes various problems. Economic loss for farmers, inefficient control of pests, and possible environmental pollution are the main problems (Waite et al., 2002).

Improper Application: When pesticides are applied in windy weather and when pesticides are not applied from a suitable distance to the ground, these application errors or misuse may cause airborne spread.

In the Air Dissolution: Pesticides can turn into gaseous form by interacting with air after application, and these gases can be transported through the air.

Erosion of Soil by Wind: As a result of pesticide application, small soil particles adsorbing pesticides can be entrained by the effect of wind erosion. These airborne soil particles can be another reason for pesticides to spread through the air. The air at the edge of the pesticide-applied fields; during the application, it may be polluted with pesticides due to evaporation after the application and wind erosion of the applied soil (Tiryaki & Temur, 2010).

Pesticides suspended in the atmosphere threaten life and return to the soil surface with precipitation, and they undergo photochemical, microbial, and chemical degradation in the environment where they are applied (Tiryaki et al., 2010). This cycle is shown in detail in Figure 6.

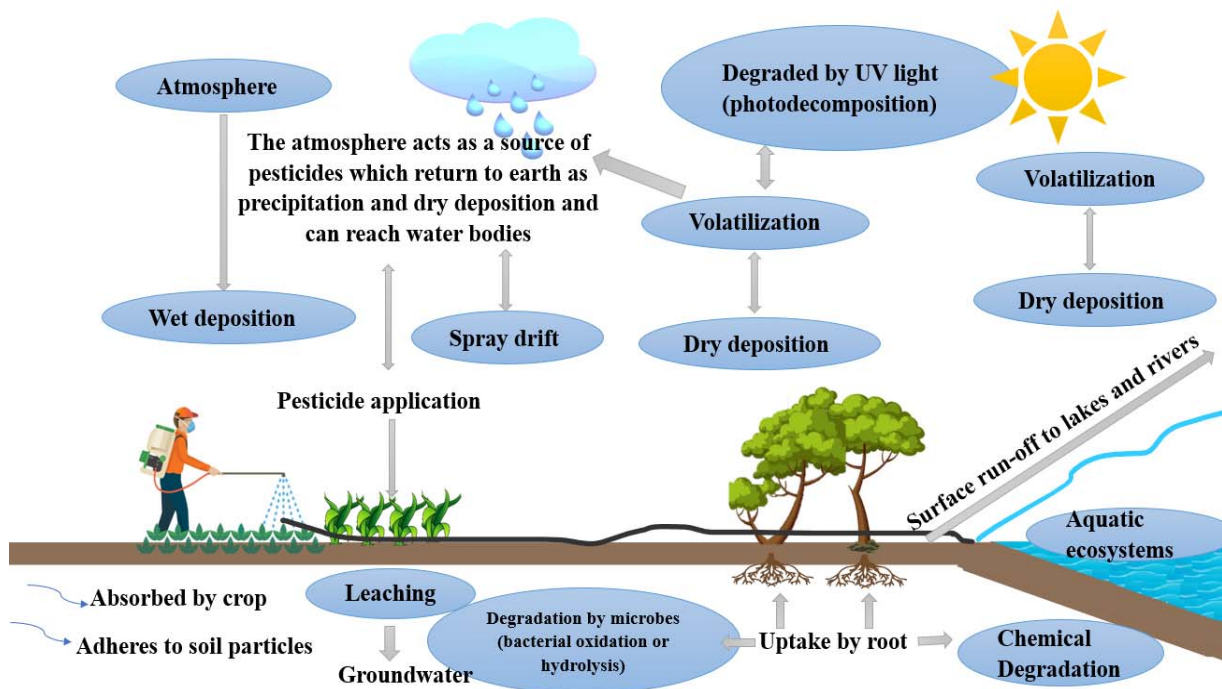


Figure 6. Circulation of Pesticides in the Air Ecosystem

To prevent pesticides from entering the atmosphere; non-volatile pesticides can be selected. In addition, the use of drift-controlling fillers, the application of the most effective large droplet diameter, the selection of the lowest applicable pressure, the correct measurement of the airflow, and the consideration of the wind direction are among the measures to reduce the release of pesticides into the atmosphere. Optimal proximity to the target, temperature, and humidity conditions are other important parameters to be considered.

The cycle of pesticides in the ecosystem is very dangerous for the environment and public health (Rajmohan et al., 2020). No matter how many precautions are taken during the application, it is inevitable that they will mix with water, soil, and air ecosystems. For this reason, today, some agricultural applications have emerged as an alternative to pesticides, which are very low in toxicity and therefore harmful to the environment. These applications are discussed in detail under the next heading.

Alternative Approaches to Pesticide Use and Less Harmful Substances

Pesticides have persistence in soil, water, and air ecosystems in the areas where they are applied (Benoit et al., 2023). They can also reach distant areas by being carried by wind or other air movements. Therefore, the effects of pesticides on soil, water, and air pollution should be taken into account both during and after application, and environmentally friendly agricultural practices and safe use methods should be preferred.

Correct and appropriate agricultural practices are one of the most important practices to be used instead of pesticides to obtain healthy products and to prevent the spread of pests, diseases, or weeds. It is possible to list the correct and appropriate farming methods as follows:

- Soil fertility and plant nutrition management based on organic matter; It

forms the basis of healthier products that are more resistant to diseases, pests, and weeds.

- Sowing in turns; It prevents the transfer of pests, weeds, and pathogens to the next seasons.
- Interrow and mixed planting can be done to limit the spread of pests and diseases.
- With the use of correct irrigation management, water stress, which makes the crops vulnerable to pests and diseases, can be prevented.
- Precision farming methods such as weed control can be applied through spot spraying and optical detectors (Eyhorn et al., 2015)

In addition to the appropriate and correct farming method, plant selection is also especially important. Plants differ in their susceptibility to diseases and pests and their weed control abilities. Therefore, it is particularly important to choose the right product types suitable for local conditions. This situation forms the basis of a preventive pest management system (Pretty, 2005).

The methods mentioned above, it is aimed to minimize the use of pesticides.

In cases where pesticide use is required, biopesticides can be preferred instead of direct chemical pesticides. Biopesticides utilize insects or parasites, pathogens, insect traps, and pheromones to keep pest populations low. Biopesticides can be divided into three groups.

Microbial pesticides: Microorganisms show pesticide effects due to the active ingredients they contain. The most used microbial pesticide is *Bacillus thuringiensis*. This microorganism controls vermin, especially on potatoes, cabbage, and other plants.

Plant pesticides: They are pesticide substrates produced by plants because of genetic materials being added to plants. For example, it is suggested that the gene of *B. thuringiensis* showing pesticide activity can

be taken and transferred to the genetic material of the plant.

Biochemical pesticides: These are naturally occurring pesticides. They control pests with non-toxic mechanisms. They prevent the growth and reproduction of the pest with the substances they contain such as pheromones (Yarsan & Çevik, 2007).

In addition to these, boron element has been used as an alternative to synthetic pesticides and effective results have been obtained (Dursun & Civelek, 2013). Boron is an element that is not difficult to reach. After Italy, the USA, Nevada, Chile, California, China, Russia, Serbia, Peru, Bolivia, Kazakhstan, Argentina, and Türkiye are among the countries with significant boron deposits (Taşdelen Eren & Dede Sağsöz, 2023). It is thought that effective results will be obtained by using it as a pesticide alternative.

Where these methods are not sufficient, Integrated Pest Management comes to the fore. FAO encourages Integrated Pest Management (IPM). The purpose of IPM is not to completely eradicate pests. Instead, its primary goal is to keep it below a certain population density. For this purpose, the concepts of "Economic Loss Threshold (ELT)" and "Economic Loss Level (ELL)" are used. The level of economic damage; It is the lowest population density that can cause economic damage to the crop. The economic damage threshold is defined as the point at which the pest population reaches the level of intensity that requires action before it reaches the level of economic damage. That is, chemical control of harmful organisms becomes economically satisfactory when pesticide use reaches a point where the estimated cost of harvest losses exceeds the cost of using chemical products, that is when the cost of using chemical products exceeds the cost of potential harvest losses. IPM owes its environmentally friendly structure, first of all, to sustainable pest management (İnak et al., 2019).

The IPM approach requires a comprehensive understanding of certain plant species, the harmful organisms (including weeds) that affect these plants, and their natural enemies. This approach focuses in particular on adopting true agricultural practices, selecting resistant plant varieties, identifying pest, regularly monitoring, and limiting the impact of harmful organisms with biological control methods. This approach supports sustainable agriculture and aims to preserve the ecosystem balance. To better understand the dynamic interactions of plants, pests, and natural enemies; It allows the use of more effective and environmentally friendly methods of struggle. In this way, agricultural activities can achieve better results in terms of both efficiency and environmental sustainability.

RESULTS

Pesticides used to increase agricultural productivity inevitably cause air, water, and soil pollution as a result of not applying them correctly. Because pesticides are resistant chemicals, they have a circulating and polluting effect on air, water, and soil ecosystems.

Pesticides can leach into surface waters or groundwater from areas where they are applied during erosion, rainfall, or irrigation unless necessary precautions are taken. Later, pesticides can mix with water sources and cause water pollution. Water pollution, on the other hand, destabilizes aquatic ecosystems and endangers aquatic life and drinking water resources.

Pesticides can leave residues in the soil and cause deterioration of the soil microbiome over time. Pesticides penetrate deep into the soil as a result of improper applications or erosion, reducing soil fertility. This is a major problem for soil health and sustainable agriculture.

Particles carried as a result of wind or application errors during the application of pesticides remain suspended in the air and

form respirable aerosols. These aerosols adversely affect air quality and harm the environment and human health. Pesticide particles can stay in the air for a long time, reducing the air quality. This is a situation that causes negative effects on the ecosystem.

These findings reveal the contribution of pesticide use to environmental pollution. Therefore, taking conscious and careful decisions regarding the use of pesticides and minimizing environmental impacts are of great importance.

Preferring pesticide alternative natural applications is the first parameter to be considered. But in cases where these applications are not sufficient, some applications should be considered. Considering the cycles of pesticides in the ecosystem, it is very important to pay attention to the following recommendations in order to minimize their negative effects on air, water, and soil pollution:

- Integrated Pest Management (IPM) should be implemented,
- Pesticides should be used according to label instructions,
- Protective areas should be created before spraying in sensitive areas,
- After the application, water, soil, and air samples should be monitored regularly,
- A sustainable agriculture approach should be adopted,
- Spraying should not be done on windless days,
- Pesticides should be applied alternately to prevent pests from developing resistance,
- Pesticides must be stored correctly and unused products must be disposed of properly.

CONCLUSION

This study was carried out to examine the cycle of pesticides in air, water, and soil ecosystems and the pollution they cause. The findings showed that pesticides, as chemicals used in agricultural production, have significant effects on air, water, and soil ecosystems. It has been observed that pesticides can adversely affect air quality by forming aerosols suspended in the air during application, cause water pollution by leaking into water sources, and cause soil pollution by leaving residues in the soil. These effects are the parameters that negatively affect ecosystem health, water resources, and agricultural productivity. Therefore, careful approaches to selecting, applying, and managing pesticides are required.

In conclusion, pesticide use should be applied consciously and alternative control methods should be evaluated for sustainable agriculture and environmental protection.

REFERENCES

- Akdoğan, A., Divrikli, Ü., & Elçi, L. (2012). Pestisitlerin önemi ve ekosisteme etkileri. *Academic Food Journal*, 10(1), 125-132.
<https://dergipark.org.tr/tr/download/article-file/1189273>
- Akhtar, N., Syakir Ishak, M. I., Bhawani, S. A., & Umar, K. (2021). Various natural and anthropogenic factors responsible for water quality degradation: A review. *Water*, 13(19), 2660.
<https://doi.org/10.3390/w13192660>
- Alengebawy, A., Abdelkhalek, S. T., Qureshi, S. R., & Wang, M. Q. (2021). Heavy metals and pesticides toxicity in agricultural soil and plants: Ecological risks and human health implications. *Toxics*, 29(3), 42.
<https://doi.org/10.3390/toxics9030042>



- Altıkat, A., Turan, T., Ekmekyapar Torun, F., & Bingül, Z. (2009). Türkiye’de pestisit kullanımı ve çevreye olan etkileri. *Atatürk Üniversitesi Ziraat Fakültesi Dergisi*, 40(2), 87-92. <https://dergipark.org.tr/tr/pub/ataunizfd/issue/3011/41813>
- Altınbaş, Ü., Çengel, M., Uysal, H., Okur, B., Okur, N., Kurucu, Y. & Delibacak, S. (2004). *Toprak bilimi*. Ege Üniversitesi Yayınları.
- Ayebokiki, A. O., Ayide, I. A., Okoye, H. O., & Oluyeye, D. E. (2022). *Spatial analysis of agrochemical application and risks to water quality and community health in Ogun state, Nigeria*. Research Square. <https://doi.org/10.21203/rs.3.rs-2312280/v1>
- Benoit, P., Mamy, L., Bedos, C., & Barriuso, E. (2023). Pesticide fate in soils. In M. J. Goss & M. Oliver (Eds.), *Encyclopedia of Soils in the Environment* (Volume 2, pp. 470-482). Academic Press. <https://doi.org/10.1016/B978-0-12-822974-3.00122-1>
- Bhateria, R., & Jain, D. (2016). Water quality assessment of lake water: A review. *Sustainable Water Resources Management*, 2, 161-173. <https://doi.org/10.1007/s40899-015-0014-7>
- Bondareva L, & Fedorova N. (2021). Pesticides: Behavior in agricultural soil and plants. *Molecules*, 26(17), 5370. <https://doi.org/10.3390/molecules26175370>
- Bronte, O., García-García, F., Lee, D. J., Urrutia, I., Uranga A., Nieves, M., Martínez-Minaya, J., Quintana, J. M., Arostegui, I., Zalacain, R., Ruiz-Iturriaga, L. A., Serrano, L., Menéndez, R., Méndez, R., Torres, S., Cilloniz, C., España, P. P., & The Covid-19 & Air Pollution Working Group. (2023). Impact of outdoor air pollution on severity and mortality in COVID-19 pneumonia. *The Science of the Total Environment*, 894, 164877. <https://doi.org/10.1016/j.scitotenv.2023.164877>
- Civelek, H. S., & Dursun, O. (2013). Örtüaltı yetiştiriciliğinde bazı zararlılar üzerinde bor içeren bazı bileşiklerin insektisit özelliklerinin araştırılması. *Turkish Entomology Bulletin*, 3, 141-149. <https://dergipark.org.tr/en/pub/entoteb/issue/5544/75046>
- Dede Sağsöz, Y., & Taşdelen Eren, E. (2023). Türkiye’nin döngüsel ekonomi uygulamasında elektronik atıkların yeri. *International Refereed Journal of Engineering and Sciences*, 19, 19-35. <https://doi.org/10.17366/uhmfd.2023.19.3>
- Denizli, A., Şener, G., & Özgür, E. (2013). Zararlarına rağmen vazgeçilemeyen tarım ilaçları: Pestisitler. *Bilim ve Teknik E-Dergisi*, 2013(5), 68-71.
- El Nahas E. F., Abdel-Razek A. S., Helmy N. M., Mahmoud S., & Ghazy H. A. (2017) Impaired antioxidant gene expression by pesticide residues and its relation with other cellular biomarkers in Nile Tilapia (*Oreochromis niloticus*) from Lake Burullus. *Ecotoxicology and Environmental Safety*, 137(1), 202-209. <https://doi.org/10.1016/j.ecoenv.2016.12.006>
- Eyhorn, F., Roner, T., & Specking, H. (2015). *Reducing pesticide use and risks of pesticides: What action is needed*. Helvetas, Swiss Intercooperation(Briefing Paper), 1-31. <https://doi.org/10.13140/RG.2.2.17146.80324>



- İnak, E., Özdemir, E., Alpkent, Y. N., İnak, A., & Özkan, C. (2019). Entegre zararlı yönetimi ve gelişmekte olan ülkelerdeki durumu. *Harran Journal of Agricultural and Food Sciences*, 23(1), 120-130. <https://doi.org/10.29050/harranziraat.426391>
- Kalyabina, V. P., Esimbekova, E. N., Kopylova, K. V., & Kratasyuk, V. A. (2021). Pesticides: Formulants, distribution pathways and effects on human health – a review. *Toxicology Reports*, 8(1), 1179-1192. <https://doi.org/10.1016/j.toxrep.2021.06.004>
- Katagi, T., & Tanaka, H. (2016). Metabolism, bioaccumulation, and toxicity of pesticides in aquatic insect larvae. *Journal of Pesticide Science*, 41(2), 25-37. <https://doi.org/10.1584/jpestics.D15-064>
- Kayhan, F. E. (2020). İnektisitlerin Doğadaki Döngüsü ve Sucul Çevreye Etkileri. *Selçuk University Journal of Science Faculty*, 46(2), 29-40. <https://dergipark.org.tr/en/pub/sufefd/issue/57620/695511>
- Kılıç, Z. (2021). Water pollution: Causes, negative effects and prevention methods. *Istanbul Sabahattin Zaim University Journal of the Institute of Science and Technology*, 3(2), 129-132. <https://doi.org/10.47769/izufbed.862679>
- Kumar, S., Verma, A. K., Singh, S. P., & Awasthi, A. (2023). Immunostimulants for shrimp aquaculture: paving pathway towards shrimp sustainability. *Environmental Science and Pollution Research*, 30, 25325–25343. <https://doi.org/10.1007/s11356-021-18433-y>
- Lushchaka, V. I., Matviishyna, M. T., Husaka, V. V., Storeyb, J. M., & Storeyb, K. M. (2018). Pesticide toxicity: A mechanistic approach. *EXCLI Journal*, 17, 1101-1136. <http://dx.doi.org/10.17179/excli2018-1710>
- Mebdoua, S. (2018). Pesticide Residues in Fruits and Vegetables. In J. M. Mérillon & K. Ramawat (Eds.), *Bioactive Molecules in Food* (pp. 1-39). Springer. https://doi.org/10.1007/978-3-319-54528-8_76-1
- Mitra, S., Chakraborty, A. J., Tareq, A. M., Emran, T. B., Nainu, F., Khusro, A., Idris, A. M., Khandaker, M. U., Osman, H., Alhumaydhi, F. A., & Simal Gandara, J. (2022). Impact of heavy metals on the environment and human health: Novel therapeutic insights to counter the toxicity. *Journal of King Saud University - Science*, 34(3), 1-21. <https://doi.org/10.1016/j.jksus.2022.101865>
- Öğüt, S. (2008, May 21-23). *Important Agrochemicals (Pesticides) Used in Agricultural Production in and Around Isparta*. Türkiye 10th Food Congress, Erzurum.
- Pathak, V. M., Verma, V. K., Rawat, B. S., Kaur, B., Babu, N., Sharma, A., Dewali, S., Yadav, M., Kumari, R., Singh, S., Mohapatra, A., Pandey, V., Rana, N., & Cunill, J. M. (2022). Current status of pesticide effects on environment, human health and it's eco-friendly management as bioremediation: A comprehensive review, *Frontiers in Microbiology*, 13, 1-29. <https://doi.org/10.3389/fmicb.2022.962619>
- Polat, A. (2002). Tarımda pestisitler: Dünya'da ve Türkiye'de kullanımları. In K. Kökten & H. Ş. İnci (Eds.),

- Tarımsal Kirliliğin Tarımsal Üretimdeki Ayak İzi* (pp. 31-50), İksad Publishing House.
- Pretty, J. (2005). *The pesticide detox towards a more sustainable agriculture*. Earthscan.
- Rajmohan, K. S., Chandrasekaran, R., & Varjani, S. (2020). A review on occurrence of pesticides in environment and current technologies for their remediation and management. *Indian J Microbiology*, 60(2), 125-138. <https://doi.org/10.1007/s12088-019-00841-x>
- Sun, S., Sidhu, V., Rong, Y., & Zheng, Y. (2018). Pesticide pollution in agricultural soils and sustainable remediation methods: A review. *Current Pollution Reports*, 4(3), 240-250.
- Tarfin. (2021). *Pestisit Nedir? Pestisit İlacı Ne İşe Yarar?*. Retrieved August 6, 2023, from <https://tarfin.com/blog/pestisit-nedir-pestisit-ilaci-ne-ise-yarar>
- Taşdelen Eren, E., & Dede Sağsöz, Y. (2023). Bor atıklarının geri kazanım uygulamalarının incelenmesi. *International Refereed Journal of Engineering and Sciences*, 19, 36-53. <https://doi.org/10.17366/uhmfd.2023.19.4>
- The Food and Agriculture Organization. (n.d.). Integrated Pest Management. Retrieved August 10, 2023, from <https://www.fao.org/pest-and-pesticide-management/ipm/integrated-pest-management/en/>
- Tiryaki, O., & Temur, C. (2010). The Fate of Pesticide in the Environment. *Journal of Biological and Environmental Sciences*, 4(10), 29-38.
- Tiryaki, O., Canhilal, R., & Horuz, S. (2010). Tarım ilaçları kullanımı ve riskleri. *Erciyes Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, 26(2), 154-169. <https://dergipark.org.tr/tr/pub/erciyesfen/issue/25574/269775>
- Trajkovska, S., Mbaye, M., Gaye Seye, M. D., Aaron, J. J., Chevreuril, M., & Blanchoud, H. (2009). Toxicological study of pesticides in air and precipitations of Paris by means of a bioluminescence method. *Analytical and Bioanalytical Chemistry*, 394, 1099-1106. <https://doi.org/10.1007/s00216-009-2783-z>
- Tudi, M., Daniel Ruan, H., Wang, L., Lyu, J., Sadler, R., Connell, D., Chu, C., & Phung, D.T. (2021). Agriculture development, pesticide application and its impact on the environment. *International Journal of Environmental Research and Public Health*, 18(3), 1112. <https://doi.org/10.3390/ijerph18031112>
- Waite, D. T., Cessna, A. J., Grover, R., Kerr, L. A., & Snihura, A. D. (2002). Environmental concentrations of agricultural herbicides: 2,4-D and Triallate. *Journal of Environmental Quality*, 31(1), 129-144. <https://doi.org/10.2134/jeq2002.1290>
- William A. R., & David J. W. (2015). 301 - Disinfection, Sterilization, and Control of Hospital Waste, In J. E. Bennett, R. Dolin & M. J. Blaser (Eds.), *Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases (Eighth Edition)* (pp. 3294-3309.e4). W.B. Saunders. <https://doi.org/10.1016/B978-1-4557-4801-3.00301-5>
- Yarsan, E., & Çevik, A. (2007). Vektör mücadelesinde biyopestisitler. *Turkish Journal of Hygiene and Experimental Biology*, 64(1), 61-70.

Yazgan, M. S. (1997). Pesticide pollution in Türkiye. *Environmental Pollution Priorities in Türkiye Symposium II* (pp. 571-577). Gebze.

Yıldırım, E. (2012). *Tarımsal zararlılarla mücadele yöntemleri ve ilaçlar*. Atatürk Üniversitesi Ziraat Fakültesi Yayınları.

Zaller, J. G., Kruse-Plaf, M., Schlechtriemen, U., Gruber, E., Peer, M., Nadeem, I., Formayer, H., Hutter, H. P., & Landler, L. (2022). Pesticides in ambient air, influenced by surrounding land use and weather, pose a potential threat to biodiversity and humans. *Science of The Total Environment*, 838(2), 156012.
<https://doi.org/10.1016/j.scitotenv.2022.156012>

EXTENDED ABSTRACT

Introduction: Pesticides are defined by the World Health Organization (WHO) as substances used to abduct, kill or control unwanted organisms that can be found in food, agricultural products, forest products, or animal feed that carry diseases that may occur in humans and animals. Pesticides are also known as substances that can be applied to control the pests that can be found in the bodies of animals (Polat, 2022). Pesticides, which are used to remove agricultural products from all kinds of harmful effects and to harvest better quality products, bring many problems in terms of environmental health and human health (Altıkat et al., 2009). As a result of the increase in the use of pesticides since the middle of the twentieth century, many negative effects on the natural environment and human health have emerged. Pesticides are produced to be harmful to specific target organisms or groups of organisms that harm economic agricultural products (Kayhan, 2020). When pesticides that pass into the soil are combined with sunlight, they undergo photochemical degradation and biodegrade with an effect on

plants and small organisms in the soil and other living things; pesticides that penetrate the soil reach the upper part of the soil with capillary water and can pass from there to the air environment. The texture of the soil, the amount of organic matter, the content of aluminium and iron oxide, the amount of clay, and the pH value are the factors affecting the micro-life population in the soil. The adhesion and migration of pesticides to the soil and their biological uptake are prevented, so pesticides are transformed into more toxic metabolites. It is important to know and examine all these events since it is not desirable to change pesticides beyond this purpose (Altınbaş et al., 2004). Pesticides are dragged from the applied areas to other places by external factors such as rain and wind. Some of the pesticides evaporate, causing the accumulation of toxic substances in the atmosphere. Some remain in the soil, causing soil pollution. Some of them are dragged from the soil by snow, rain, and flood waters, polluting underground and surface water resources. The use of pesticides in agriculture causes pollution of air, soil, and water ecosystems over time. For this reason, pesticides threaten all living things in these ecosystems (Yazgan, 1997). Water is one of our greatest natural resources and the foundation of life. Humans need clean water for drinking, cooking, and washing. Clean water is essential for irrigating farmers' crops and feeding livestock. Groundwater is the world's main source of fresh water. Pesticides remaining on the soil surface after soil and plant applications can reach groundwater and other water sources by being washed down in the soil or in the form of surface runoff with rainwater. Pesticides continue to break down after they reach groundwater. But they decompose at a lower rate due to less light, temperature, and oxygen. When groundwater is polluted; contamination can also occur in water streams, rivers, and lakes. It takes time for an aquifer to purify itself by natural processes, even if sources of contamination have been stopped. When groundwater is contaminated, it is very expensive and

difficult to clean. The best protection against groundwater pollution is the prevention of pollution (Altıkat, 2009). For several reasons; hydrolysis, biodegradation, oxidation, and photochemical degradation of pesticide residues that pass from the environment to soil and water cause pesticides to turn into different products. Most recent environmental studies have focused on these conversion products because they can be more toxic than pesticides and many of these effects are unknown (Denizli et al., 2013). Pesticides cause air pollution by mixing with the atmosphere in various ways. As a result of this situation, serious problems arise that threaten natural ecosystems and human health. Pesticides can spread in the air as dust, vapor, and droplets as a result of applications in agricultural areas. In addition, some pesticides with volatile compounds can evaporate quickly after application and remain volatile in the air. Pesticide is released into the air without safe application. Semi-volatile pesticides, which are exposed to atmospheric transport as a result of pesticide applications, may become more toxic by reacting with other chemicals in the atmosphere. These toxic chemicals can return to the atmosphere and stay in the ecosystem for a long time with evaporation of the soil with precipitation. In this case, other non-target organisms and plants may also cause residue and toxicity (Altıkat et al., 2009). If pesticides are not controlled in the air, they can reach waterways, green spaces, and homes. (Trajkovska et al., 2009). Pesticides have persistence in soil, water, and air ecosystems in the areas where they are applied. **Aim:** Pesticides cause environmental problems when applied incorrectly and uncontrolled. In the study, environmental problems caused by pesticides and alternative applications were discussed and it was aimed to raise awareness on this issue. **Method:** The information obtained by examining the published reports, studies, and current data about the cycle of pesticides in nature has been evaluated and interpreted. **Results and Conclusion:** It is inevitable that

pesticides used to increase agricultural productivity cause air, water, and soil pollution as a result of not applying them correctly. Pesticides can leach into surface waters or groundwater from areas where they are applied during erosion, precipitation, or irrigation unless necessary precautions are taken. Later, pesticides can mix with water sources and cause water pollution. Pesticides can leave residues in the soil and cause deterioration of the soil microbiome over time. Pesticides penetrate deep into the soil as a result of improper applications or erosion, reducing soil fertility. Particles carried as a result of wind or application errors during the application of pesticides remain suspended in the air and form respirable aerosols. These aerosols adversely affect air quality and harm the environment and human health. These findings reveal the contribution of pesticide use to environmental pollution. As a result, pesticide use should be applied consciously and alternative control methods should be evaluated for sustainable agriculture and environmental protection.

TBDY 2019 VE EUROCODE 8'E GÖRE BİNA HEDEF YER DEĞİŞTİRMESİNİN HESABI¹⁻²

TARGET DISPLACEMENT CALCULATION ACCORDING TO TBEC 2019 AND EUROCODE 8

Elif BORU

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Öz: Amaç: Ülkemizde ve dünyada yaşanan can ve mal kaybı yüksek depremler sonrasında mühendisler yapı tasarımında kriterlerin yer değiştirme ve deformasyon limitleri ile tanımlandığı tasarım yönteminin kullanılmasını gerektiği konusunda fikir birliğine varmıştır. Performansa dayalı tasarım ve mevcut yapılar için değerlendirme imkanı sağlayan bu yöntem üzerine bir çok araştırma yapılmıştır. Performansa dayalı tasarım ve değerlendirme çalışmalarında binaların 50 yılda aşılma olasılığı %10 olan tasarım depremi etkisinde yapacağı yer değiştirme miktarı önem arz etmektedir. Yönetmeliklerde hedef yer değiştirme olarak ifade edilen depremin binadan talep ettiği yer değiştirme miktarı bina performansını belirlemede doğrudan etkilidir.

Yöntem: Bu çalışmada Türkiye'deki orta yükseklikteki yapı stoğunu temsil eden 5 katlı X ve Y doğrultularında simetrik taşıyıcı sisteme sahip betonarme bir binanın Türkiye Bina Deprem Yönetmeliği (TBDY 2019) ve Eurocode 8'e göre hedef yer değiştirme hesabı yapılmıştır.

Bulgular: Binanın TBDY 2019'a göre elastik tasarım spektral yer değiştirmesi 0.19 m olarak belirlenmiştir. CR katsayısı 1 olduğu için binanın doğrusal olmayan spektral yer değiştirmesi de 0.19 m, hedef yer değiştirme ise 0.12 m olarak hesaplanmıştır. Eurocode 8'e göre ise dt^* 0,086 m hedef deplasman ise 0,11 m olarak bulunmuştur.

Sonuç: Her iki yönetmeliğe göre yapılan hedef yer değiştirme hesabında Eurocode 8'e göre elde edilen yer değiştirme değeri TBDY 2019'a göre elde edilen yer değiştirme arasında %9'luk fark elde edilmiştir.

Anahtar Kelimeler: TBDY 2019, Eurocode 8, Statik İtme Analizi, Hedef Deplasman

Abstract: Aim: After the earthquakes with high loss of life and property in our country and in the world, engineers have come to a consensus that the design method, in which the criteria are defined by displacement and deformation limits, should be used in building design. A lot of research has been done on this method, which provides performance-based design and evaluation for existing structures. The amount of displacement demanded from the building by the earthquake, which is expressed as target displacement in the Turkish Building Earthquake Code (TBEC 2019), is directly effective in determining the building performance.

Method: In this study, the target displacement calculation of a 5-story reinforced concrete building that represents the medium-height building stock in Turkey, with a symmetrical carrier system in the X and Y directions was done according to TBEC 2019 and Eurocode 8.

Results: According to TBEC 2019, the elastic design spectral displacement of the building was determined as 0.19 m. Since the CR coefficient is 1, the nonlinear spectral displacement of the building is calculated as 0.19 m and the target displacement as 0.12 m. According to Eurocode 8, the dt^* 0.086m and the target displacement was calculated as 0.11 m.

Conclusion: In the target displacement calculation according to both codes a 10% difference was obtained between Eurocode 8 and the TBEC 2019.

Keywords: TBEC 2019, Eurocode 8, Pushover Analysis, Target Displacement

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² Çalışma, araştırma ve yayın etiğine uygun olarak hazırlanmıştır. Çalışmada herhangi bir intihale rastlanmamış olup dergi kapsamında istenen %20 alıntı oranına uygun olarak hazırlandığı bu yönlerden makalenin tüm sorumluluğu ile bilgilerin doğruluğu ilgili yazar(lar) tarafından kabul edilmiştir. İşbu makalenin her türlü telif ve sair diğer hakları açık erişim olmak üzere yazar(lar) tarafından dergiye devredilmiştir. "The study was prepared in accordance with research and publication ethics. No plagiarism was found in the study and it was prepared in accordance with the 20% citation rate required within the scope of the journal, and in these respects, the full responsibility of the article and the accuracy of the information has been accepted by the relevant author(s). All copyright and other rights of this article have been transferred to the journal by the author(s) as open access."

GİRİŞ

Deprem sonucu oluşan maddi ve manevi kayıpları en aza indirmek için çeşitli yönetmelikler kullanılmaktadır. Depremde yapıda oluşacak hasarı minimuma indirmek için, yapıya etki edecek deprem yüklerinin tasarım aşamasında en gerçekçi şekilde tanımlanması ve yapı elemanlarının davranışının tahmin edilmesi önem arz etmektedir. Yeni yapıların performansa dayalı tasarımı ve mevcut yapıların performansa dayalı değerlendirmesi son yıllarda yaygın olarak tercih edilmektedir. Performansa dayalı yöntemlerde yapının elastik ötesi davranışı dikkate alınarak yapı ve yapı elemanlarının gerçek davranışının belirlenmesi tasarım aşamasında ekonomik ve güvenli bir tasarım imkanı sağlarken, deprem sonrasında yapı performansının değerlendirilmesi ve güçlendirilmesi konularında kolaylık sağlamaktadır.

Performansa dayalı tasarımda yapıya etki edeceği düşünülen deprem etkisinin belirlenmesi ve bu deprem etkisinde yapının belli performans düzeyini sağlaması beklenmektedir. Mevcut yapıların deprem davranışının değerlendirilmesinde ise deprem etkisinde yapıda meydana gelebilecek hasarların ve yapı performansının gerçeğe yakın şekilde belirlenmesi önem arz etmektedir. Yapının ve yapısal elemanların davranışlarının gerçekçi olarak belirlenmesi tasarım aşamasında ekonomik ve güvenilir bir tasarım imkânı sağlarken, depremden sonra yapı performansının değerlendirilmesi ve güçlendirilmesi aşamalarında belirleyici bir etken olmaktadır. Depreme maruz kalan yapısal sistemler için performansa dayalı

tasarımda hedef yer değiştirme hesabı, yapının göçmeden veya önemli bir hasar görmeden dayanabilmesi gereken beklenen yer değiştirme seviyesini belirlediğinden, sismik tasarımda önemli bir parametredir. Hedef yer değiştirme hesabı tipik olarak deprem yer hareketinin özelliklerine ve yapısal sistemin kütlesi, rijitliği ve sönüm kapasitesi gibi özelliklerine dayanır.

Coğrafi konumundan dolayı ülkemiz aktif bir deprem kuşağında yer almaktadır. Türkiye’de son otuz yıl içerisinde yaşanan yıkıcı depremler, 1999 Marmara Depremi, 2011 Van depremi ve 6 Şubat 2023 tarihli Kahramanmaraş Depremi sonrasında depreme dayanıklı yapı tasarımının önemi daha net anlaşılmıştır. Depremlerin maddi ve manevi kayıplarını en aza indirmek amacıyla, deprem etkisindeki yapı davranışını ve sonrasındaki performansını en doğru biçimde ortaya koyabilen performansa dayalı tasarım ve değerlendirme ülkemizde Deprem Bölgelerinde Yapılacak Binalar Hakkında Yönetmelik-DBYBHY 2007 ile kullanılmaya başlanmış, Türkiye Bina Deprem Yönetmeliği 2019 (TBDY 2019) ile detaylandırılmış ve bazı yapıların tasarımında kullanılması zorunlu kılınmıştır.

Avrupa kıtasının güney kısmı depremselliği yüksek olan bir bölgedir. Avrupa Standartlaştırma Komitesi tarafından 2005 yılında yayımlanan Eurocode 8 Yönetmeliği’nde (EN 1998-1, 2005) yapıların depreme dayanıklı tasarım felsefeleri yer almaktadır. Bu tasarım felsefelerinden biri de performansa dayalı tasarımdır. Yönetmelikte mevcut yapıların deprem etkisi altındaki performanslarının belirlenmesi ve

güçlendirilmesinde uygulanması gereken hesap adımları ve ilkeleri yer almaktadır. İki yönetmelik de benzer amaç-sonuç ilişkisi üzerine geliştirilmiştir.

Literatürde incelenen çalışmalar arasında farklı deprem yönetmeliklerinin karşılaştırıldığı çalışmalar mevcuttur (Jamal vd., 2021; Keyik, 2019; Gutiérrez-Urzúa, 2021; Türkay, 2013; Lagaros vd., 2011). Severcan ve Sinani çalışmalarında DBYBHY 2007 ve Eurocode 8 kullanarak 8 katlı mevcut betonarme bir yapının performans değerlendirmesini, doğrusal olmayan elastik yöntemlerden biri olan statik itme analizini kullanarak gerçekleştirmiştir. Eleman hasar düzeylerini dikkate alarak yapı performanslarını kıyaslamıştır. Eurocode 8'e göre özellikle düşey taşıyıcı elemanlarda performans düzeylerinin birbirine yakın olduğu fakat DBYBHY 2007'nin güvenli tarafta kaldığını vurgulamışlardır (Severcan & Sinani, 2019).

Karasu çalışmasında betonarme, zemin üstünde on normal kattan oluşan bir binanın Deprem Bölgelerinde Yapılacak Binalar Hakkında Yönetmelik (DBYBHY-2007) ve Amerikan yönetmeliklerinden ise deprem yükleri hesabı için kullanılan ASCE/SEI 7-10 (ASCE, 2017) ve ACI 318-11 (ACI COMMITTEE 318, 2011) ile Avrupa yönetmeliklerinden Eurocode 2 ve Eurocode 8'i kullanarak farklı yönetmeliklerin gerektirdiği koşulları incelemiştir. Çalışmanın sonucunda farklı yönetmeliklerin depreme dayanıklı tasarım felsefelerini karşılaştırmıştır. Analizler sonucunda en güvenli tasarımın Eurocode yönetmeliklerine göre tasarımda elde edildiği ancak

ekonomiklikten uzaklaşıldığı belirtilmiştir (Karasu, 2015).

Gök, çalışmasında planda çıkıntıları bulunan A3 tipi düzenli olan bir binanın Amerikan, Avrupa, ve Türkiye yönetmeliklerine göre tasarım ve analizini yaparak yönetmeliklerin tasarım kaidelerini karşılaştırmıştır. Yapı periyodları, taban kesme kuvveti değerleri (eşdeğer deprem yükü yöntemine göre hesaplanmış), kat yer değiştirmeleri, görelî kat ötelemesi değerleri, ikinci mertebeye etkileri, üzerinden karşılaştırmalar yapılmıştır. Sonuç olarak en elverişsiz sonuçların Eurocode yönetmeliklerine göre yapılan tasarımda elde edildiği, Türk yönetmeliklerine göre tasarım sonuçlarının deprem ve eğilme etkileri açısından en düşük sonuçları verdiği dolayısıyla en ekonomik tasarımı sağladığı belirtilmiştir. Amerikan ve Eurocode yönetmeliklerinin karşılaştırmasında ise iç kuvvetler, ilgili yük kombinasyonları sebebiyle birbirine yakın çıkmıştır (Gök, 2013).

Tekince ise farklı yerel zemin sınıflarındaki bina davranışını araştırdığı çalışmasında, farklı taşıyıcı sistemlere ve kat adetlerine sahip düşeyde ve planda düzenli ve düzensiz binaları DBYBHY 2007 ve Eurocode 8 yönetmeliklerine göre karşılaştırmıştır. Sonuç aşamasında mod birleştirme ve eşdeğer deprem yükü yöntemlerinden elde ettiği taban kesme kuvveti, maksimum yer değiştirmeler ve ikinci mertebeye etkilerini karşılaştırılmıştır. Çalışmada EC 8'in DBYBHY 2007'ye göre güvenli tarafta kaldığı, maliyet karşılaştırması açısından DBYBHY 2007'ye göre yapılan tasarımın daha ekonomik olacağı sonucu vurgulanmıştır (Tekince,

2015).

Benzer şekilde Kazancı üç farklı deprem bölgesi, dört farklı bina yüksekliği ve üç farklı zemin sınıfına göre tasarlanan betonarme bir binanın Eurocode 8 ve DBYBHY 2007’de verilen doğrusal elastik yöntemleri (Eşdeğer Deprem Yüğü ve Mod Birleştirme Yöntemi) karşılaştırmıştır. Karşılaştırmayı taban kesme kuvveti, moment ve tepe yer değiştirmeleri üzerinden yapmıştır. Çalışma sonucunda Mod Birleştirme yöntemin’ de Eşdeğer Deprem Yüğü Yöntemi’ne göre daha düşük taban kesme kuvveti, maksimum tepe yer değiştirmesi ve moment değerlerinin oluştuğunu vurgulamıştır (Kazancı, 2018).

Işıltan, farklı özelliklerde betonarme sünek kolonların yatay yükler etkisi altındaki performansını DBYBHY 2007, FEMA 356 ve Eurocode 8’e göre belirlemiştir. Literatürde daha önce yapılmış betonarme kolon deneylerini gerçek davranış kabul ederek farklı yönetmeliklere göre belirlenen performans sonuçlarını karşılaştırılmıştır. Çalışma sonucunda deneysel sonuçların ve yönetmelik sonuçlarının birbirinden çok farklı ve uyumsuz olduğunu vurgulamıştır (Işıltan, 2010).

AMAÇ

Mevcut çalışmalarda farklı deprem yönetmeliklerinin depreme dayanıklı ve performans dayalı tasarım felsefelerinin Türk Deprem Yönetmelikleri ile karşılaştırıldığı çalışmalar mevcuttur. Ayrıca DBYBHY 2007 ve Eurocode 8 performans dayalı tasarım yöntemlerinin

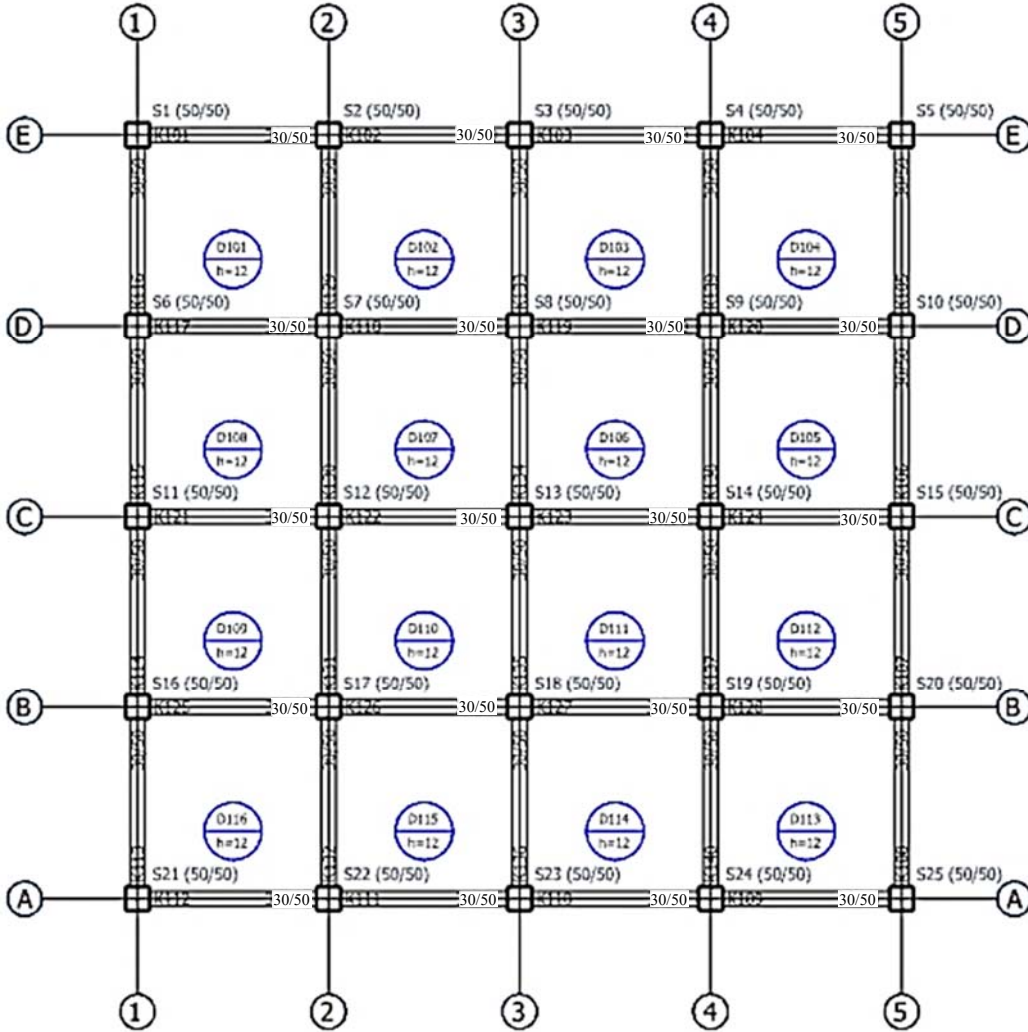
karşılaştırmaları mevcuttur. Ancak TBDY 2019 ve Eurocode 8 yönetmeliklerindeki böyle bir karşılaştırmaya rastlanmamıştır. Bu çalışmada TBDY 2019 ve Eurocode 8 yönetmeliklerindeki doğrusal elastik olmayan performansa dayalı tasarım yöntemleri (Tek Modlu İtme ve N2 Yöntemleri) kullanılarak bina hedef yer değiştirmesi hesaplanmış ve yönetmelikler karşılaştırılmıştır. Yönetmelikler arasındaki farkın belirlenmesi amaçlanmıştır.

KAPSAM

Belirlenen amaç doğrultusunda Türkiye’de mevcut yapı stoğunda önemli yere sahip olan orta katlı, taşıyıcı sistemi çerçeve olan binaları temsil edecek şekilde 5 katlı X ve Y yönünde simetrik konut tipi betonarme bir binanın tasarım depremi etkisindeki hedef deplasmanı TBDY 2019 ve EUROCODE 8’e göre statik itme analizi kullanılarak belirlenmiştir. Yönetmeliklerdeki benzer ve farklı olan sonuçlar sunulmuştur.

Betonarme Binanın Özellikleri

İncelenen 5 katlı bina X ve Y yönünde 4 açıklığa sahiptir. Simetrik davranışı sağlamak ve mevcut binaları temsil etmek amacıyla yapı açıklıkları her iki yönde 4m olarak alınmıştır. Tüm katlar eşit yükseklikte olup bina toplam yüksekliği 15m’dir (Şekil 1). Taşıyıcı sistemi kolon ve kirişlerden oluşturulmuş çerçeve sistemdir. Binanın kullanım amacı konut olarak tasarlanmış ve yükler TS498’den buna göre kullanılmıştır (TS 498, 1997). Binanın mevcut ve kapsamlı bilgi düzeyinde olduğu kabul edilmiştir.



Şekil 1. Binanın Tipik Kat Kalıp Planı

ARAŞTIRMANIN PROBLEMİ

Deprem bölgelerinde yer alan yapıların tasarımında ve değerlendirilmesinde önemli etkiye sahip olan yatay kuvvetin dikkate alınması önem arz etmektedir. Yapıların tasarımı aşamasında deprem yönetmeliklerinin dikkate alınması kaçınılmazdır. Mevcut yapıların deprem performansının değerlendirilmesinde ise çeşitli yönetmeliklerde farklı performans değerlendirme yöntemleri verilmiştir. Farklı deprem yönetmeliklerinde verilen

yöntemlerin benzer ve farklı parametrelerin belirlenmesi bu araştırmanın yapılmasını sağlamıştır. TBDY 2019 ve Eurocode 8 yönetmeliklerindeki doğrusal elastik olmayan performans değerlendirme yöntemlerinden elde edilen sonuçlar karşılaştırılmıştır.

ARAŞTIRMANIN KISITLARI

Tasarım aşamasında kullanılan yönetmelikler ve deprem etkisi araştırmanın kısıtlarını oluşturmaktadır. Binanın tasarımı TBDY 2019 (TBDY, 2019) ve TS 500 (TS 500, 2000)

yönetmeliklerine uygun olarak yapılmıştır. Kolonlar 50x50 cm, kirişler 30x50 cm boyutunda, döşeme ise 12 cm kalınlığındadır. Beton sınıfı olarak C25 donatı çeliği olarak B420C kullanılmıştır (Tablo 1). Binanın nümerik modellemesi ProtaStructure (2022) bilgisayar paket programında kullanılarak yapılmıştır. Bina modellemesinde döşemelerin rijit diyafram olarak çalıştığı, düğüm noktalarının rijit olduğu kabul edilmiştir. Bina simetrik ve planda düzenli

olduğu için yatay etkiler ek dış merkezlik olmaksızın kütleler kat ağırlık merkezlerinde toplu olarak etki ettirilmiştir. Doğrusal elastik olmayan davranış yığılı plastik mafsallar ile idealleştirilmiştir. Kirişlerde M3 mafsali, kolonlarda ise P-M2-M3 mafsali elaman uçlarına tanımlanmıştır. Mafsal özellikleri kesit analizi sonucunda elde edilen moment-eğrilik ve etkileşim diyagramı sonuçlarına göre tayin edilmiştir.

Tablo 1. Malzemelerin Karakteristik Özellikleri

Beton sınıfı	F _{ck} (MPa)	E (MPa)	Çelik sınıfı	F _{yk} (MPa)	E (MPa)
C25	25	30000	B420C	420	200000

Binanın Sakarya'nın merkez ilçesinde olduğu kabulü yapılmıştır. Mevcut zemin etüt raporundaki verilere göre yerel zemin sınıfı ZE, konut tipi bir bina incelendiği için TBDY 2019 Tablo 3.1'e göre bina kullanım sınıfı (BKS) 3, Tablo 3.3'e göre bina yükseklik sınıfı

(BYS) 6, Tablo 4.1'e göre taşıyıcı sistem davranış katsayısı (R) 8 olarak belirlenmiştir. Arsanın mevcut konum ve yerel zemin sınıfı bilgisi kullanılarak AFAD'ın sismik tehlike haritasından deprem hesabına ilişkin parametreler hesaplanmıştır (Tablo 2).

Tablo 2. Binaya Ait Deprem Parametreleri

Deprem Parametreleri	
Zemin sınıfı	ZE
Deprem yer hareket düzeyi	DD-2
Bina kullanım sınıfı (BKS)	3
Bina yükseklik sınıfı (BYS)	6
S _s , S ₁	1,539 - 0,422
Deprem tasarım sınıfı (DTS)	1

YÖNTEM

Binaya ait ilgili veriler kullanılarak ProtaStructure bilgisayar paket programında

binanın nümerik modeli oluşturulmuştur. Literatürde deprem etkisi altında betonarme taşıyıcı elemanların rijitlik değerlerinin

öngörülen değerlerden farklı olduğu belirlenmiştir. Bu sebeple yapıların tasarım ve değerlendirilmesinde etkin kesit rijitliklerinin dikkate alınması gerekmektedir.

Performansa dayalı analizlerde taşıyıcı elemanların etkin kesit rijitlikleri TBDY 2019

ve Eurocode 8 yönetmeliklerine etkin kesit rijitlik çarpanları oranında azaltılmıştır (Tablo 3). Taşıyıcı sistem elemanları çubuk eleman olarak modellendiği için TBDY 2019 Tablo 4.2'ye göre kiriş elemanların rijitliği 0,35, kolon elemanların rijitliği ise 0,70 olarak kullanılmıştır.

Tablo 3. Yönetmeliklerde Verilen Etkin Kesit Rijitliği Çarpanları

TBDY 2019			EUROCODE 8		
Betonarme taşıyıcı sistem elemanı	Etkin kesit rijitliği çarpanı		Betonarme taşıyıcı sistem elemanı	Etkin kesit rijitliği çarpanı	
	Eğilme	Kesme		Çatlamış	Çatlamamış
Çerçeve kirişi	0,35	1,00	Çerçeve kirişi	0,5	0,5
Çerçeve kolonu	0,70	1,00	Çerçeve kolonu	0,5	0,5

Hedef Yer Değiştirme Hesabı

Deprem yapıdan talep ettiği yer değiştirmeyi ifade eden hedef yer değiştirmenin hesabında ilk olarak statik itme analizi yapılır. Analiz sonucu elde edilen statik itme eğrileri her iki yönetmeliğe uygun dönüşümler uygulanarak modal kapasite diyagramları elde edilir. Talep spektrumu ile modal kapasite eğrilerinin üst üste çizilmesi ve uygun dönüşümlerle hedef yer değiştirme elde edilmiş olur. Çalışmada incelenen bina her iki doğrultuda simetrik olduğu için analizlerde ve hesap aşamasında sadece X yönü dikkate alınmıştır.

Statik İtme Analizi

İtme analizi adım adım arttırılan yatay yükler etkisinde yapının dayanım ve rijitliğinde

$$a_1^{(X,k)} = \frac{V_{tx1}^{(X,k)}}{m_{tx1}^{(X,1)}} \quad (5B.3)$$

$$a_1^{(X,k)} = \frac{u_{Nx1}^{(X,k)}}{\Phi_{N1}^{(1)} \Gamma_1^{(X,1)}} \quad (5B.4)$$

meydana gelen değişimin, doğrusal olmayan davranış özelliklerinin dikkate alınarak hesaplandığı bir analiz yöntemidir. İtme analizi iki aşamadan oluşmaktadır. Birinci aşama düşey yükler etkisinde (G+0,3Q) yapılan doğrusal olmayan analiz, ilk aşama sağlandığı takdirde, ikinci aşamada adım adım arttırılan yatay yükler altında itme analizi şeklinde yapılmaktadır.

Modal Kapasite Diyagramının Elde Edilmesi

TBDY 2019'a göre statik itme eğrisine, Denk.(5B.3) ve Denk.(5B.4) uygulanarak yapılan koordinat dönüşümü ile modal tek serbestlik dereceli sisteme (TSDS) ait modal kapasite eğrisi (modal sözde ivme – modal yer değiştirme) elde edilir.

Burada, $\Phi_{N \times 1}$ terimi N'inci katta birinci itme adımında belirlenen ve itme hesabında değiştirilmeyen X doğrultusundaki sabit mod şekli genliğini, $\Gamma_{1(X,1)}$ ise X deprem doğrultusunda birinci itme adımında belirlenen ve itme hesabında değiştirilmeyen sabit mod şekline göre hesaplanan modal katkı çarpanını ifade etmektedir. Geleneksel itme hesabında, modal yer değiştirme her itme adımında başlangıç adımındaki doğrusal sisteme ait sabit mod şekline bağlı olarak hesaplanır. Bu sebeple kısmen de olsa yapılan yaklaşıklığı gidermek amacıyla herhangi bir

itme adımında meydana gelen yer değiştirme artışı, yaklaşık olarak o itme adımındaki değişken mod şekli genliği olarak kullanılabilir. Tipik bir i'inci kattaki X doğrultusundaki serbestlik derecesi için mod şekli genliği hesabı için Denk.5B.5 kullanılır;

Dikkate alınan X deprem doğrultusu için, n'inci titreşim moduna ait modal katkı çarpanı Γ_n ile binanın taban kesme kuvveti modal etkin kütlesi m_{txn} aşağıdaki denklem ile hesaplanır;

$$\bar{\Phi}_{ix1}^{(k)} \approx u_{ix1}^{(X,k)} - u_{ix1}^{(X,k-1)} \quad (5B.5)$$

$$\Gamma_n^{(X)} = \frac{\sum_{i=1}^N m_i \Phi_{i(X)n}}{\sum_{i=1}^N (m_i \Phi_{ixn}^2 + m_i \Phi_{iyn}^2 + m_i \theta \Phi_{i\theta n}^2)} \quad ; \quad m_{txn}^{(X)} = \Gamma_n^{(X)} \sum_{i=1}^N m_i \Phi_{ixn} \quad (4B.1)$$

Eurocode 8'de ise Ek B'ye göre hedef yer değiştirmenin hesaplanması için benzer şekilde çok serbestlik dereceli yapısal sistemin tek serbestlik dereceli sisteme

dönüştürülmesi gerekmektedir. Eşdeğer TSDS'nin dönüştürülmüş taban kesme kuvveti, F^* ve bina tepe deplasmanı, d^* denklem B.4 ve B.5 kullanılarak hesaplanır;

$$F^* = \frac{F_b}{\Gamma} \quad (B.4)$$

$$d^* = \frac{d_n}{\Gamma} \quad (B.6)$$

Burada F_b ve d_n , sırasıyla, çok serbestlik dereceli sisteminin taban kesme kuvveti ve yapı tepe noktasındaki kontrol düğüm noktasının yer değiştirmesidir.

Denklemlerdeki dönüşüm katsayısı, Γ ve bunun hesabında gerekli olan eşdeğer kütle, m^* aşağıdaki bağıntılar kullanılarak hesaplanmaktadır;

$$m^* = \sum_{i=1}^N m_i \Phi_{ix} \quad (B.2)$$

$$\Gamma = \frac{m^*}{\sum_{i=1}^N m_i \Phi_i^2} \quad (B.3)$$

Hedef Yer Değiştirmenin Hesaplanması

Tek modlu itme analizinde yapı sistemi için hedef yer değiştirme, yapının hakim periyoduna göre beklenen maksimum yer değiştirme temel alınarak hesaplanır. Genel olarak TBDY 2019 ve EC 8'e göre tek modlu itme analizine göre hedef yer değiştirme hesaplaması benzerdir, çünkü her iki yönetmelik de hedef yer değiştirme hesaplamasının temeli olarak yapının hakim periyodundaki maksimum yer değiştirmenin kullanımını belirtir. Ancak, hedef yer değiştirmeyi ve tasarım taban kesme

$$d_{1,max}^{(X)} = S_{di}(T_1) \quad (5B.12)$$

Burada $d_{1,max}^{(X)}$ modal tek serbestlik dereceli sistemin en büyük yer değiştirmesi, $S_{di}(T_1)$ ise, sistemin birinci doğal titreşim periyoduna

$$S_{di}(T_1) = C_R S_{de}(T_1) \quad (5B.13)$$

Burada $S_{de}(T_1)$, elastik tasarım spektral yer değiştirmesini, C_R ise spektral yer değiştirme

$$C_R = \frac{\mu(R_y, T_1)}{R_y} \quad (5B.14)$$

Denklemdaki R_y , (akma dayanımı azaltma katsayısı) öngörülen süneklik kapasitesine bağlı olarak tanımlanan bir büyüklüğü değil, akma dayanımına bağlı, doğrudan itme

$$R_y = \frac{f_e}{f_y} = \frac{S_{ae}(T_1)}{a_{y1}} \quad (5B.15)$$

Bu denklemden f_e ve $S_{ae}(T_1)$ terimleri elastik dayanım talebini ve buna karşı gelen elastik

kuvvetini hesaplamak için kullanılan özel formüller ve denklemler ile yapısal sistemlerin sismik tasarımına ilişkin özel hükümler ve gereksinimler arasında bazı farklılıklar olabilir.

TBDY 2019'a göre deprem etkisinde binadan talep edilen modal yer değiştirmenin elde edilmesi, deprem etkisinde modal kapasite diyagramı ile temsil edilen modal TSDS'nin en büyük yer değiştirmesine karşı gelmektedir. TSDS'de bu değer, doğrusal olmayan spektral yer değiştirme olarak tanımlanır;

karşı gelen ve Denk.(5B.13) ile hesaplanan doğrusal olmayan spektral yer değiştirmeyi ifade etmektedir;

oranını ifade etmektedir, Denk.(5B.14) ile hesaplanmaktadır;

hesabından elde edilen bir büyüklüğü ifade etmektedir. Denklem 5B.15 ile hesaplanmaktadır;

spektral ivmeyi, f_y ve a_{y1} ise akma dayanımı ve buna karşı gelen akma sözde ivmesini ifade

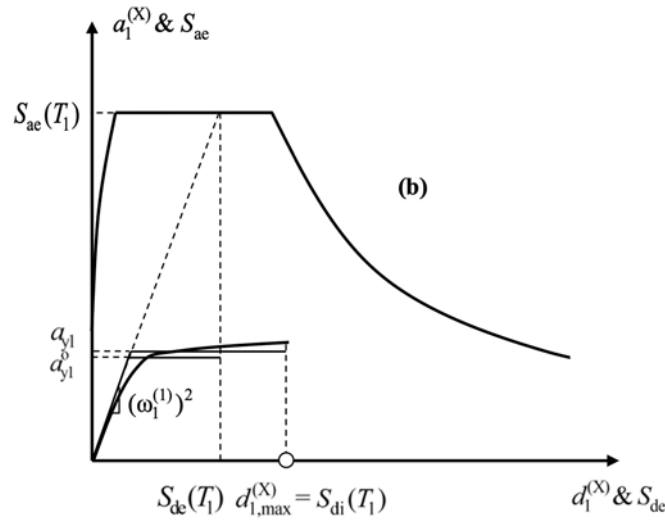
etmektedir (Şekil 2). R_y ve C_R incelenen binanın hakim periyodu ve hedef spektrum köşe periyoduna bağlı olarak iki farklı şekilde ifade edilmektedir. Çalışmada incelenen binanın hakim mod periyodu (T_1) 0,670 s ve yatay elastik tasarım ivme spektrumu köşe periyodu (T_B) 0,343s'dir. $T_1 > T_B$ olduğu için

$$\mu(R_y, T_1) = R_y \quad T_1 > T_B \quad (5B.16a)$$

TBDY 2019'da bu koşulla ilgili verilen denklemler kullanılmıştır. Denk.(5B.14)'deki depremin süneklik talebi $\mu(R_y, T_1)$, eşit yer değiştirme kuralı uyarınca rijitliği fazla olmayan taşıyıcı sistemler için akma dayanımı azaltma katsayısına (R_y) eşit alınır;

Spektral yer değiştirme oranı olan C_R ise, Denklem 5B.17a'da belirtildiği gibi 1 olarak alınmıştır;

$$C_R = 1 \quad T_1 > T_B \quad (5B.17a)$$



Şekil 2. TBDY 2019'a Göre $T_1 > T_B$ Olan Sistemin Hedef Yer Değiştirme Hesabı

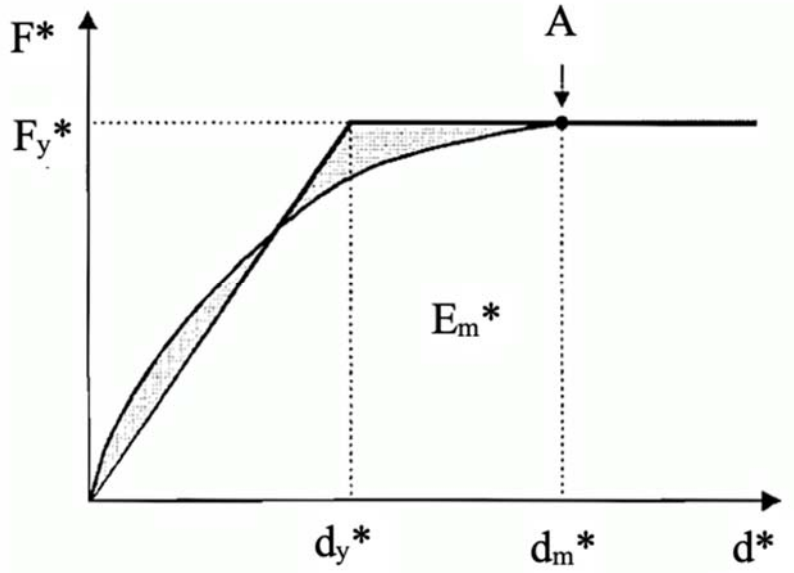
Eurocode 8'e göre eşdeğer TSDS'nin hedef deplasman hesabında kullanılan grafiksel çözüm Şekil 9'da sunulmuştur. Şekildeki F_y^* , akma kuvveti, idealize edilmiş (ideal elasto plastik davranış) sistemin plastik davranışının başlangıcındaki taban kesme kuvvetine eşittir. İdealleştirilmiş sistemin başlangıç rijitliği, idealleştirilmiş gerçek

kuvvet-deplasman eğrilerinin altındaki alanlar eşit olacak şekilde belirlenir (Şekil 3). Bu varsayıma dayanarak, idealleştirilmiş sistemin akma yer değiştirmesi (d_y^*) denklem B.6 ile hesaplanır;

$$d_y^* = 2 \left(d_m^* - \frac{E_m^*}{F_y^*} \right) \quad (B.6)$$

Denklemden E_m^* , plastik mekanizmanın oluşumuna kadar meydana gelen gerçek

deformasyon enerjisi, d_m^* , hesabı yapılan düğüm noktasının deplasmanıdır.



Şekil 3. Eurocode 8 TSDS İdealleştirilmiş Elasto-Plastik Kuvvet ve Yer Değiştirme İlişkisi

İdealleştirilmiş eşdeğer TSDS'in periyodunun (T^*) hesabında, aşağıdaki denklem kullanılmaktadır;

$$T^* = 2\pi \sqrt{\frac{m^* d_y^*}{F_y^*}} \quad (B.7)$$

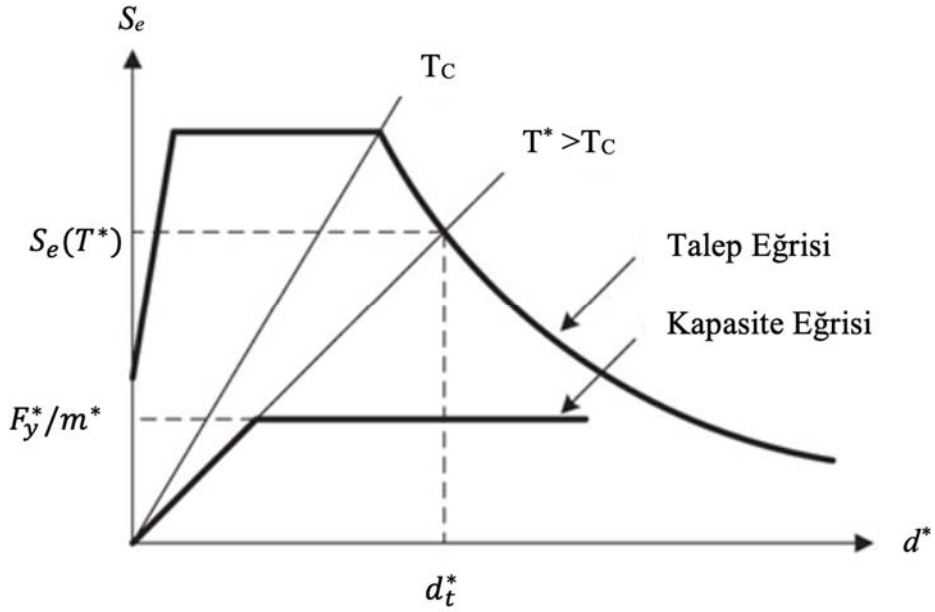
Periyodu T^* olan idealleştirilmiş yapının hedef deplasmanı ve sınırsız elastik davranışı denklem E.8 ile ifade edilmektedir. Burada

$S_e(T^*)$, T^* periyodundaki elastik spektrum değeridir.

$$d_{et}^* = S_e(T^*) \left[\frac{T^*}{2\pi} \right]^2 \quad (B.8)$$

Kısa periyod ve orta ve uzun periyod aralığındaki yapılar için hedef deplasmanı d_t^* 'in hesabı için farklı bağıntılar bulunmaktadır. Çalışmada incelenen yapı

ikinci davranış grubunda ($T^* > T_c$) olduğu için sadece bu bağıntılar detaylandırılmıştır (Şekil 4).



Şekil 4. Eurocode 8'e Göre $T^* > T_c$ Olan Eşdeğer Tek Serbestlik Dereceli Sistemin Hedef Yer Değiştirme Hesabı

TSDS'nin idealize edilmiş modal kapasite eğrisinin başlangıç rijitliğinden, talep spektrum eğrisine çizilen teğet yardımı ile

hedef deplasman bulunmaktadır. Hedef deplasman hesabı için verilen bağıntılar aşağıda verilmiştir;

$$d_t^* = d_{et}^* \quad (B.12)$$

$$d_{et}^* = S_e(T^*) \left[\frac{T^*}{2\pi} \right]^2$$

Burada d_t^* tek serbestlik dereceli sistemin hedef deplasmanını ifade etmektedir. $S_e(T^*)$, ilgili periyottaki yatay elastik spektrum değeridir. TSDS'nin hedef deplasman hesabından sonra çok serbestlik dereceli

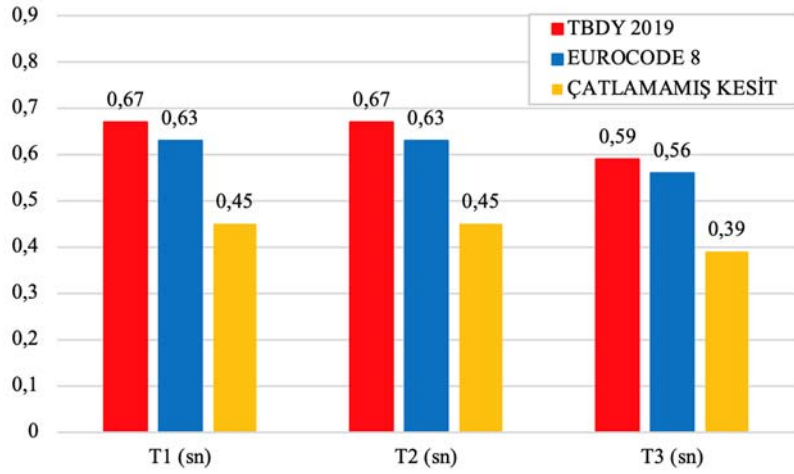
sistemin hedef deplasman hesabı yapılır. Çok serbestlik dereceli sistemin hedef deplasman hesabında aşağıdaki denklem kullanılmaktadır;

$$d_t = \Gamma d_t^* \quad (B.13)$$

BULGULAR

Yönetmeliklerin etkin kesit rijitlikleri dikkate alınarak yapılan modal analiz sonucunda binanın birinci hakim titreşim periyodu TBDY 2019'a göre 0,67 sn Eurocode 8'e göre 0,63 sn, çatlama kesit rijitlikleri kullanılarak

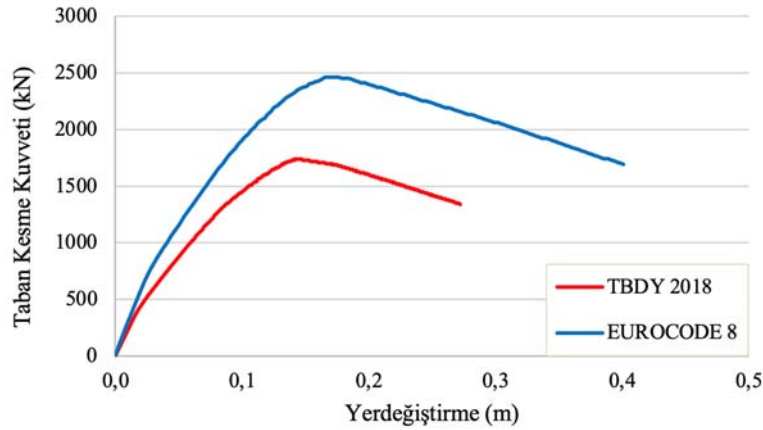
yapılan analizde ise 0,45 sn olarak elde edilmiştir (Şekil 5). Toplam etkin kütle katılımı ise TBDY 2019'da birinci ve ikinci modda %81,4, Eurocode 8'de ise birinci modda %41,5 ikinci modda %83 olarak elde edilmiştir.



Şekil 5. Binanın Farklı Etkin Kesit Rijitliklerine Göre Periyod Değerleri

Analizde doğrusal olmayan davranışı yansıtabilmek için kolon ve kirişlerin plastik mafsallık özellikleri, kullanılmaktadır. Her iki

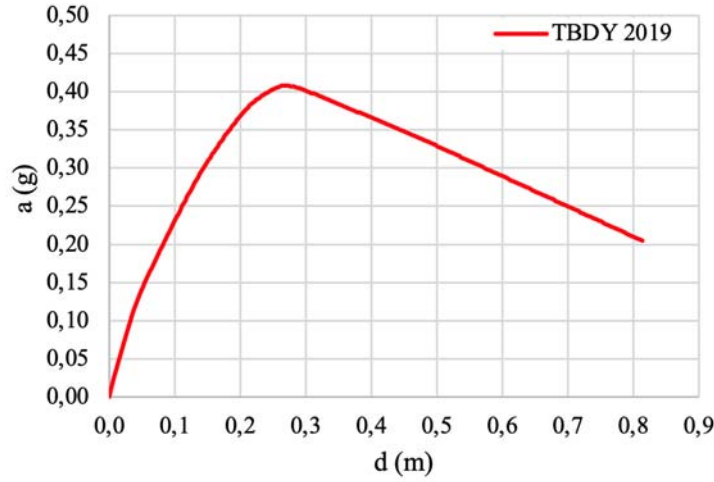
yönetmeliğe göre yapılan itme analizi sonucu elde edilen statik itme eğrileri Şekil 6'da verilmiştir.



Şekil 6. Binaya Ait Statik İtme Eğrileri

Eğriler incelendiğinde başlangıç rijitliklerinin aynı olduğu, ilk çatlak oluşumundan sonra mafsallaşmaların arttığı andan itibaren eğriler arasındaki farkın arttığı görülmektedir. Bu farkın yönetmeliklerdeki etkin kesit rijitlikleri katsayılarından kaynaklandığı söylenebilir. Elde edilen statik itme eğrileri gerekli eksen dönüşümleri

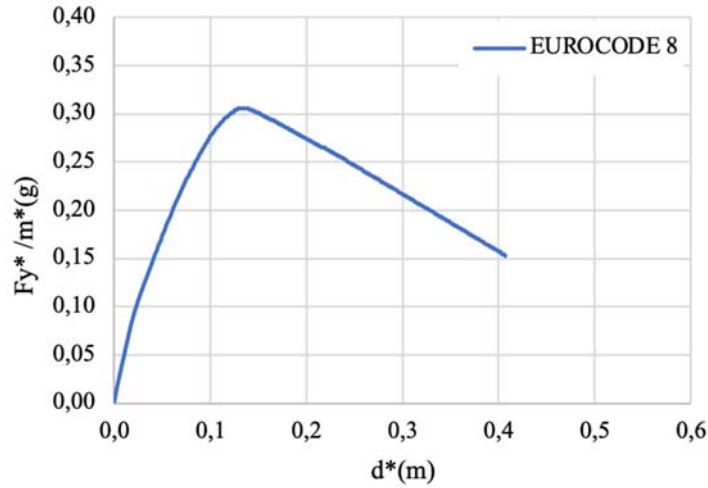
uygulanarak binaların modal kapasite eğrileri elde edilir. Yönetmeliklerde verilen ilgili denklemler kullanıldığında TBDY 2019'a göre modal katkı çarpanı (Γ) 24,54, tepe noktası mod şekli genişliği (Φ_{di}) 0,03 olarak hesaplanmıştır. İncelenen binanın elde edilen modal kapasite eğrisi Şekil 7'de sunulmuştur.



Şekil 7. TB DY 2019'a Göre Hesaplanan Modal Kapasite Eğrisi

Benzer şekilde Eurocode 8'e göre incelenen bina için idealize edilmiş kapasite eğrisinde akma kuvveti (F_y^*) 1530,56 kN, akma yer değiştirmesi ise (d_y^*) 0,073 m olarak hesaplanmıştır. Tek serbestlik dereceli eş

sistemin dönüştürme faktörü (Γ) 1.2754 olarak hesap edilmiştir. Gerekli bağıntılar kullanılarak binanın Eurocode 8'e göre çizilen modal kapasite eğrisi Şekil 8'de sunulmuştur.



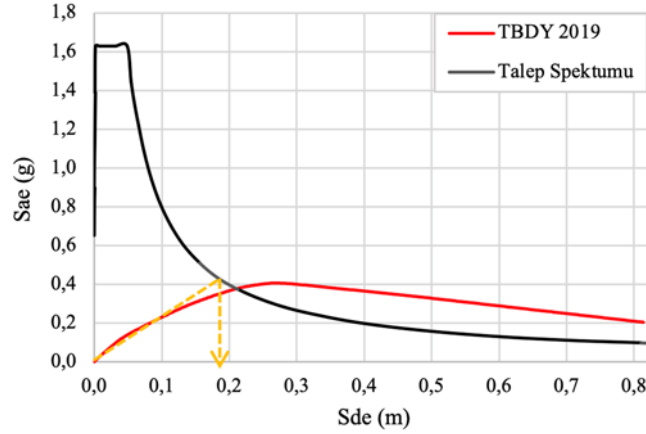
Şekil 8. Eurocode 8'e Göre Hesaplanan Modal Kapasite Eğrisi

TB DY 2019'a göre hedef yer değiştirme hesabında kullanılan binanın modal kapasite eğrisi ile koordinatları spektral yer değiştirme–spektral ivme (S_{ae} , S_{de}) olan deprem spektrumunun bir arada çizilmiş hali Şekil 9'da sunulmuştur. Binanın birlikte

çizilen modal kapasite ve doğrusal deprem spektrum eğrileri ile hedef deplasman hesabı kullanılarak binanın elastik tasarım spektral yer değiştirmesi (S_{de}) 0,19 m olarak belirlenmiştir. Denklem 5B.12 ve 5B. 13'den C_R katsayısı 1 olduğu için binanın doğrusal

olmayan spektral yer değıştirmesi de (S_{d1}) 0,19 m olarak hesaplanmıştır. Binanın hedef yer değıştirmesi ise $u_{xN1}^{(p)} = \phi_{dx} * \Gamma *$

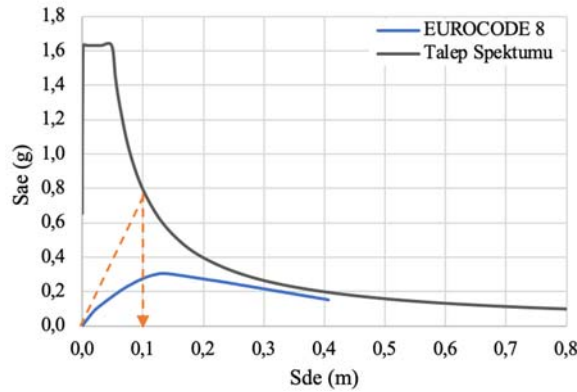
$d_1^{(x)}$ bağıntısı kullanılarak 0,12 m olarak hesaplanmıştır.



Şekil 9. Bina nın TB DY 2019'a Göre Hedef Deplasman Hesabı

Benzer şekilde Eurocode 8'de verilen denklemler kullanılarak edilen modal kapasite diyagramı ve deprem talep spektrumu çakıştırmasıyla d_t^* 0,086 m olarak

elde edilmiştir. Denklem B.13 kullanılarak yapılan hesaplamalar sonucunda hedef deplasman 0,11 m bulunmuştur (Şekil 10).



Şekil 10. Bina nın Eurocode 8'e Göre Hedef Deplasman Hesabı

SONUÇ

Yapılan çalışmada X ve Y yönünde 4m'lik 4 açıklığa sahip Türkiye'deki orta katlı binaları temsil eden 5 katlı, taşıyıcı sistemi simetrik olan konut tipi bir binanın TB DY 2019 ve

Eurocode 8'e göre hedef deplasman hesabı yapılmıştır. Modal analiz sonucunda elde edilen periyod değeri, etkin kesit rijitlikleri farkından dolayı, Eurocode 8'de, TB DY 2019'a göre %6 daha düşük çıkmıştır. Elde edilen

sonuç kolon rijitliklerinin yapı davranışı üzerindeki etkisini doğrular niteliktedir. Statik itme analizleri sonucunda elde edilen eğrilerde ise taban kesme kuvvetleri arasında etkin kesit rijitlikleri farkından dolayı iki yönetmelik arasında %42'lik fark elde edilmiştir. Eurocode 8'de taban kesme kuvveti kapasitesi TBDY 2019'a göre daha yüksek çıkmıştır. Modal kapasite diyagramları ve spektrum eğrilerine bağlı olarak elde edilen hedef deplasman hesabında ise Eurocode 8'e göre elde edilen hedef deplasman değeri TBDY 2019'a göre hesaplanan deplasmandan %9 daha düşük çıkmıştır. Her iki yönetmelikte hedef deplasman hesabında elde edilen sonuçlar yakın çıkmıştır. Bir spektrum eğrisi ve uzun periyodlu bina ile yapılan bu çalışma farklı deprem etkileri ve hakim periyodu, tasarım spektrumunun köşe periyodundan daha düşük olan kısa periyodlu binalar incelenerek genişletilebilir.

KAYNAKÇA

- ACI COMMITTEE 318. (2011). *Building code requirements for structural concrete and commentary (ACI 318-11)*. American Concrete Institute.
- ASCE. (2017). *Seismic evaluation and retrofit of existing buildings (41-17)*. American Society of Civil Engineers.
- DBYBHY. (2007). *Deprem Bölgelerinde Yapılacak Binalar Hakkında Yönetmelik*. Bayındırlık ve İskan Bakanlığı.
- EN 1998. (2005). *Eurocode 8: Design of structures for earthquake resistance, Part 1: general rules, seismic actions*

and rules for buildings. European Committee for Standardization.

- Gök, S. G. (2013). *A3 düzensizliği olan çok katlı betonarme bir yapının Türk, Eurocode ve Acı 318 yönetmeliklerine göre tasarımı* [Doktora Tezi, İstanbul Teknik Üniversitesi]. Polen - İTÜ Akademik Açık Arşiv. <https://polen.itu.edu.tr/items/ad19514b-0e30-455f-9882-35354564dae1>
- Gutiérrez-Urzúa, F., Freddi, F., & Di Sarno, L. (2021). Comparative analysis of code-based approaches for seismic assessment of existing steel moment resisting frames. *Journal of Constructional Steel Research*, 181, 106589.
- İşıltan, Ö. (2010). *Betonarme kolonlar için Dbybhy 2007, Eurocode 8 ve Fema 356 ile yapılan performans değerlendirmelerinin deney sonuçlarıyla karşılaştırılması* [Doktora Tezi, İstanbul Teknik Üniversitesi]. Polen - İTÜ Akademik Açık Arşiv. <https://polen.itu.edu.tr/items/06621541-c180-435e-b645-3d1dd49bd1ab>
- Jamal, R., & Yüksel, B. (2022). ASCE 41-17'ye göre doğrusal olmayan hesap yöntemleri ile betonarme taşıyıcı sistemlerinin performans analizinin elde edilmesi ve karşılaştırması. *Osmaniye Korkut Ata Üniversitesi Fen Bilimleri Enstitüsü Dergisi*, 5(1), 189-204.
- Karasu, A. (2015). Betonarme bir yapının Türk, Avrupa ve Amerikan yönetmeliklerine göre tasarımı

- [Doktora Tezi, İstanbul Teknik Üniversitesi]. Polen - İTÜ Akademik Açık Arşiv. <https://polen.itu.edu.tr/items/2ad2930a-bbcf-4070-b80e-04cbdea4a3bc>
- Kazancı, S. (2018). Türkiye Deprem Yönetmeliği 2007 ve Eurocode 8'e göre tasarlanan betonarme binalarda doğrusal analiz yöntemlerinin karşılaştırılması [Yüksek Lisans Tezi, İstanbul Gelişim Üniversitesi]. İGÜ Kurumsal Açık Erişim Arşivi. <http://acikerisim.gelisim.edu.tr/xmlui/handle/11363/1989>
- Keyik, T. Z., (2019). ASCE 41-17 ve Türk Deprem Yönetmelikleri kapsamında mevcut betonarme bir binanın performans analizi ve sonuçlarının karşılaştırılması (Tez No. 612002) [Yüksek Lisans Tezi, Dokuz Eylül Üniversitesi]. National Thesis Center. <https://tez.yok.gov.tr/UlusalTezMerkezi/tezDetay.jsp?id=6rGnggJwOnI4onrVH6dQTQ&no=Jp3lwtP9V2LCwoWn0djRwg>
- Lagaros, N. D., & Fragiadakis, M. (2011). Evaluation of ASCE-41, ATC-40 and N2 static pushover methods based on optimally designed buildings. *Soil Dynamics and Earthquake Engineering*, 31(1), 77-90.
- ProtaStructure. (2022). ProtaStructure 2022 v.6.0.392 (Versiyon 6.0.392). Prota Yazılım.
- Severcan, M. H., & Sinani, B. (2019). Mevcut betonarme yapıların deprem performansının analizi. *Niğde Ömer Halisdemir Üniversitesi Mühendislik Bilimleri Dergisi*, 8(2), 936-947.
- TBDY. (2019). *Türkiye Bina Deprem Yönetmeliği*. Afet ve Acil Durum Yönetim Başkanlığı, AFAD.
- Tekince, Ö. (2015). *Betonarme Binalarda Doğrusal Analiz Yöntemlerinin TDY 2007 ve EC 8'e göre karşılaştırılması* [Yüksek Lisans Tezi, İstanbul Teknik Üniversitesi]. Polen - İTÜ Akademik Açık Arşiv. <https://polen.itu.edu.tr/items/ff477e6c-60ed-4cfd-a54c-dcce013be49c>
- TS 498. (1997). *Türk Standartları, Yapı Elemanlarının Boyutlandırılmasında Alınacak Yüklerin Hesap Değerleri*. Türk Standartları Enstitüsü.
- TS 500. (2000). *Türk Standartları, Betonarme Yapıların Tasarım ve Yapım*. Türk Standartları Enstitüsü.
- Türkay, A. (2013). *Bir Okul Binasının Tasarımı ve Deprem Performansının Belirlenmesi* [Yüksek Lisans Tezi, İstanbul Teknik Üniversitesi]. Polen - İTÜ Akademik Açık Arşiv. <https://polen.itu.edu.tr/items/4fd654e4-d434-4b44-a437-f91ed247c029>

EXTENDED ABSTRACT

Introduction: Among the studies examined in the literature, there are studies comparing different earthquake codes (Jamal et al., 2021, Keyik, 2019, Gutiérrez-Urzúa, 2021, Türkay, 2013, Lagaros et al., 2011). Severcan and Sinani carried out the performance evaluation of an existing 8-storey reinforced concrete structure using DBYBHY 2007 and

Eurocode 8 in their studies, using static pushover analysis, which is one of the non-linear elastic methods. The structural performances were compared by taking into account the element damage levels. They emphasized that performance levels are close to each other, especially in vertical bearing elements, according to Eurocode 8, but TBEC 2007 remains on the safe side (Severcan & Sinani, 2019). In the Karasu study, a reinforced concrete building consisting of ten normal floors above the ground is used for the seismic loads calculation of the Code on Buildings to be Constructed in Earthquake Zones (TBEC 2007) and the American codes ASCE/SEI 7-10 (ASCE, (2017) and ACI 318-11 (ACI COMMITTEE 318, 2011) and the European codes Eurocode 2 and Eurocode 8. At the end of the study, the earthquake resistant design philosophies of different codes were compared. In his study, Gök compared the design bases of the codes by making the design and analysis of a building with an A3 type layout, which has projections in the plan, according to the American, European, and Turkish codes. Comparisons were made over the building periods, base shear force values (calculated according to the equivalent earthquake load method), story displacements, relative story drift values, second order effects. As a result, it was stated that the most unfavorable results were obtained in the design made according to the Eurocode, and the design results according to the Turkish codes gave the lowest results in terms of earthquake and bending effects, thus providing the most economical design. In the comparison of the American codes and Eurocodes, the internal forces were close to

each other due to the related load combinations (Gök, 2013). Tekince, on the other hand, in his study investigating the building behavior in different local ground classes, compared buildings with different structural systems and floor numbers, with regular and irregular vertical and planar buildings, according to TBEC 2007 and Eurocode 8 codes. In the conclusion phase, the base shear force, maximum displacements and second order effects obtained from mode coupling and equivalent earthquake load methods were compared. In the study, it was emphasized that EC 8 was on the safe side compared to TBEC 2007, and the design made according to TBEC 2007 would be more economical in terms of cost comparison (Tekince, 2015). Similarly, Kazancı compared the linear elastic methods (Equivalent Seismic Load and Mode Combination Method) given in Eurocode 8 and TBEC 2007 of a reinforced concrete building designed for three different earthquake zones, four different building heights and three different floor classes. The comparison was made over the base shear force, moment and peak displacements. As a result of the study, it was emphasized that lower base shear force, maximum peak displacement and moment values occur in the Mode Combination method compared to the Equivalent Seismic Load Method (Kazancı, 2018). Isiltan determined the performance of reinforced concrete ductile columns under the influence of horizontal loads according to TBEC 2007, FEMA 356 and Eurocode 8. The performance results determined according to different codes were compared by accepting the previous reinforced concrete column tests

in the literature as real behavior. As a result of the study, he emphasized that the experimental results and the results of the code are very different and incompatible with each other (İşiltan, 2010). **Aim:** There are studies comparing the earthquake resistant and performance-based design philosophies of different earthquake codes with the Turkish Earthquake Codes. There are also comparisons of TBEC 2007 and Eurocode 8 performance-based design methods. However, such a comparison in TBEC 2019 and Eurocode 8 codes has not been found. In this study, the target displacement of the building was calculated and the codes were compared by using the nonlinear inelastic performance-based design methods (Single-Mode Repulsion and N2 Methods) in TBEC 2019 and Eurocode 8 codes. The target displacement of the building under the influence of the design earthquake was determined according to both codes by performing a push analysis to the 5-storey, symmetrical X and Y direction residential building. Similar and different parameters in the codes are presented in detail. **Method:** In single-mode pushover analysis, the target displacement for the structural system is calculated based on the expected maximum displacement relative to the predominant period of the structure. In general, the target displacement calculation according to the single-mode pushover analysis according to TBEC 2018 and EC 8 is similar, as both regulations specify the use of the maximum displacement in the predominant period of the structure as the basis for the target displacement calculation. However, there may be some differences between the specific

formulas and equations used to calculate the target displacement and the design base shear and the specific provisions and requirements for seismic design of structural systems. **Results and Conclusion:** According to TBEC 2019, the elastic design spectral displacement (S_{de}) of the building was determined as 0,19 m. Equation 5B.12 and 5B. Since the CR coefficient from 13 is 1, the nonlinear spectral displacement (S_{di}) of the building is also calculated as 0,19 m. The target displacement of the building was calculated as 0,12 m. According to Eurocode 8, d_t^* was obtained as 0,086 m by superimposing the modal capacity diagram and earthquake demand spectrum using the equations. As a result of the calculations using Equation B.13, the target displacement was found to be 0,11 m. When the results are evaluated in general, the period value obtained as a result of the modal analysis was 6% lower in Eurocode 8 than in TBEC 2019 due to the difference in effective section stiffnesses. In the curves obtained as a result of the static pushover analysis, a 42% difference was obtained between the two codes due to the difference in the effective section stiffnesses between the base shear forces. In Eurocode 8, the base shear force capacity is higher. In the target displacement calculation based on the modal capacity diagrams and spectrum curves, the target displacement value obtained according to Eurocode 8 was 9% lower than the displacement calculated according to TBEC 2019. The results obtained in the target displacement calculation in both regulations were close.

AN EVALUATION OF TECHNOLOGY AND ARTIFICIAL INTELLIGENCE'S RELATIONSHIP WITH CULTURE AND ART IN TERMS OF LITERATURE^{1,2}

TEKNOLOJİ VE YAPAY ZEKÂ'NIN KÜLTÜR VE SANATLA OLAN İLİŞKİSİNİN LİTERATÜR AÇISINDAN DEĞERLENDİRİLMESİ

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Abstract: The main purpose of artificial intelligence is to create new works of art by developing the creativity of the machine. However, the idea that the pieces generated by artificial intelligence are evaluated as human imitations and do not reflect art in the true sense has become the focus of discussions. There are many different opinions on whether the works generated by artificial intelligence should be accepted as works of art and whether artificial intelligence has overtaken human artists.

Aim: The aim of this study is to review and interpret the literature on artworks prepared and generated using artificial intelligence.

Method: The method of the research is the interpretation of the works prepared with the use of artificial intelligence in the literature and brought to the literature. In addition, the study was expanded by making interpretative and personal approaches to the general flow of the study.

Conclusion: In the context of research and studies, artificial intelligence, which is the combination of technology and art, and its artistic works have become an important topic of discussion in the art world. Artificial intelligence's contribution to the evolution of art and new perspectives has the potential to explore the limits of art and move it forward. However, whether it will completely replace human creativity and affect the value of the human touch in artworks is an important issue that needs to be explored in more depth in the future. The role and impact of artificial intelligence in the art world will be better understood through future studies and will shape the future of the art world.

Keywords: Art, Artwork, Artist Tradition, System, Production, Artificial Intelligence

Öz: Yapay zekânın temel amacı, makinenin yaratıcılığını geliştirerek yeni sanat eserleri ortaya çıkarmaktır. Ancak, bu yapay zekâ tarafından üretilen eserlerin insan taklidi olarak değerlendirilmesi ve gerçek anlamda sanatı yansıtmadığı düşüncesi, tartışmaların odağı haline gelmiştir. Yapay zekâ tarafından üretilen eserlerin sanat eseri olarak kabul edilip edilmeyeceği ve yapay zekânın insan sanatçıların önüne geçip geçmediği konusunda birçok farklı görüş mevcuttur.

Amaç: Bu çalışmada yapay zekâ kullanılarak hazırlanan ve üretilen sanat eserlerine yönelik literatür çalışmalarının derlenmesi ve yorumlanması amaçlanmıştır.

Yöntem: Araştırmanın yöntemini literatürde yer alan yapay zekâ kullanımı ile hazırlanan ve literatüre kazandırılan eserlerin yorumlanması şeklindedir. Ayrıca çalışmanın genel akışına yönelik olarak da yorumsal ve kişisel yaklaşımlar yapılarak çalışma genişletilmiştir.

Sonuç: Yapılan araştırma ve çalışmalar bağlamında, teknoloji ve sanatın birleşimi olan yapay zekâ ve onun sanatsal çalışmaları, sanat dünyasında önemli bir tartışma konusu haline gelmiştir. Yapay zekânın sanatın evrimine ve yeni bakış açılarına katkı sağlaması, sanatın sınırlarını keşfetme ve ileriye taşıma potansiyeline sahiptir. Ancak, insan yaratıcılığının yerini tamamen alıp almayacağı ve insan dokunuşunun sanat eserlerine olan değerini etkileyip etkilemeyeceği, ileride daha derinlemesine incelenmesi gereken önemli bir konudur. Yapay zekânın sanat dünyasındaki rolü ve etkisi, ileride yapılacak çalışmalarla daha iyi anlaşılacak ve sanat dünyasının geleceğine yön verecektir.

Anahtar Kelimeler: Sanat, Eser, Sanatçı Gelenek, Sistem, Üretim, Yapay Zekâ

¹ Sorumlu Yazar / Corresponding Author: Senai YALÇINKAYA, Marmara University, Faculty of Technology, Istanbul / Türkiye, sycalcinkaya@marmara.edu.tr; Geliş Tarihi / Received: 12.03.2023, Kabul Tarihi / Accepted: 26.08.2023, Makalenin Türü / Type of Article (Araştırma - Uygulama / Research - Application), Çıkar Çatışması / Conflict of Interest: Yok / None, Etik Kurul Raporu Yok / None, Ethics Committee Report Unavailable "Çalışma içeriği ve yapısı gereğince etik kurul ve kurum izni gerektirmemektedir"; "The study does not require ethics committee and institutional approval due to its content and structure"

² Çalışma, araştırma ve yayın etiğine uygun olarak hazırlanmıştır. Çalışmada herhangi bir intihale rastlanmamış olup dergi kapsamında istenen %20 alıntı oranına uygun olarak hazırlandığı bu yönlerden makalenin tüm sorumluluğu ile bilgilerin doğruluğu ilgili yazar(lar) tarafından kabul edilmiştir. İşbu makalenin her türlü telif ve sair diğer hakları açık erişim olmak üzere yazar(lar) tarafından dergiye devredilmiştir. "The study was prepared in accordance with research and publication ethics. No plagiarism was found in the study and it was prepared in accordance with the 20% citation rate required within the scope of the journal, and in these respects, the full responsibility of the article and the accuracy of the information has been accepted by the relevant author(s). All copyright and other rights of this article have been transferred to the journal by the author(s) as open access."



INTRODUCTION

Production is one of the basic requirements for human beings to survive. Production refers to the process of producing goods and services necessary for the survival and development of society. The form of production is determined by factors such as the forces of production available to human beings and the relations of production. The forces of production include human labor, machine power, raw materials, tools and technology. These forces of production shape the social structure by affecting the communication of society with each other (Kale & Nur, 2016).

Art and science have also developed along with the form of production. The reflective understanding of thinkers such as Plato and Aristotle focused on how art is formed and continued its influence for centuries. However, by the middle of the 20th century, the understanding of art gained new dimensions and began to evolve into different views (Kavuran & Dede, 2014).

The evolutionary processes, lifestyles and thought structures that people have undergone throughout history have also shaped their perspectives on art. Art has been an important tool that people use to express and communicate their feelings, thoughts and imagination. With the innovations brought by technology, the way art processes reality has also changed and developed (Ökse, 2021).

The relationship between art and production is linked to creativity and productivity, which are natural human tendencies. While people use art to express their feelings and thoughts,

they also strive to meet the needs of society in the production process. Therefore, art and production are two important concepts that complement each other and cannot be considered separately (Bulut & Kurt, 2021).

Technological developments have led to significant changes in the field of art today and led to the emergence of new theories. As a result of these technological developments, artificial intelligence has become capable of creating intellectual products (Ballı, 2020; Gözübüyük, 2021; Y. Uzun et al., 2021). The main purpose of artificial intelligence is to imitate human intelligence and perform cognitive activities through computers. In this context, artificial intelligence has started to play an important role in the field of art.

In artistic activities, artists usually create a work of art using a fictional and imaginative language. However, the situation is different for artificial intelligence. Artificial intelligence needs the process of developing itself and creating new works by combining algorithms and artificial neural networks (Akbulut, 2020; Y. Uzun et al., 2021). Artificial intelligence cannot use emotional and creative thoughts as humans do, but it can process certain molds, patterns and information through mathematical and logical algorithms (Erdoğan, 2021).

Today, artificial intelligence has started to be used for creative works in the field of art. Artificial intelligence has the potential to produce various works in different branches of art, from literature to music, painting to sculpture. Especially in the field of visual arts, the pieces generated by artificial intelligence

can be remarkable and impressive (Balli, 2020).

The combination of artificial intelligence and art has been both an exciting and controversial topic in the art world. The comparison of pieces generated by artificial intelligence with pieces produced by artists has led to an in-depth reflection on the nature of art and human creativity. While some oppose the acceptance of pieces generated by artificial intelligence as true works of art, others argue that artificial intelligence represents the beginning of a new creative process by pushing the boundaries of art (Aslan, 2019).

In this context, the impact and importance of artificial intelligence in the field of art is increasing day by day. The art world is making efforts to adapt to technological developments and to enable the creativity of artificial intelligence. By using AI as a tool, artists can discover new methods to develop their own artistic expression. However, fundamental questions such as whether artificial intelligence will replace the artist, the originality and creativity of art are still under debate (Güney & Yavuz, 2020).

Technological developments and the use of artificial intelligence in the field of art are opening new horizons in the art world. Artificial intelligence has started to play an important role in the production of artworks and has provided an important interaction on how art will evolve in the future. However, how artificial intelligence will affect creative expression in the field of art and how it will change the role of the artist remains an important issue that requires further

research and discussion in the future (Kantürk, 2022).

Production and art, which are the basic needs of humanity, are important tools for the development and progress of society. While the mode of production determines the social structure, art contributes to the processes of expressing and making sense of people's emotional and intellectual world. The interaction of these two concepts has a great impact on the cultural and social evolution of society. Therefore, the way of production and the development of art are important elements that shape the future of humanity (Yılmaz, 2008).

PURPOSE

The aim of this study is to evaluate the relationship between artificial intelligence and culture and art in terms of literature. Issues such as how artificial intelligence is used in cultural and artistic fields, its role in the production of artworks, its potential for collaboration with artists, its use in the comprehension and interpretation of art are examined through literature review and analysis. The impact of artificial intelligence on the world of culture and art and its possible future directions are clarified in the light of the main views and findings in existing literature. This study aims to contribute to the discussions in the related field by providing information on how artificial intelligence is shaped in the cultural and artistic field.

SCOPE

This study focuses on the impact of the mode of production on society and the evolution of art. How art has developed and changed

throughout history and how it has transformed with technological innovations are analyzed. In addition, the development processes of art in different disciplines and its relationship with changes in social structures are discussed.

METHOD

In this study, a method is used to evaluate the relationship between artificial intelligence and culture and arts in terms of literature. First, a literature review will be conducted and important sources on how AI is used in the field of culture and arts will be examined. These sources include topics such as the role of AI in producing artworks, its potential to collaborate with artists, and its use in understanding and interpreting art. The results and discussions in the selected literature were analyzed and the main trends and discoveries in this field were identified. Different perspectives and evaluations on the relationship of artificial intelligence with culture and art are presented. By adopting a qualitative approach, it is aimed to understand and explain the different views and findings in the literature. Basic concepts, terms and key headings in the literature are defined and discussions on the relationship between artificial intelligence and culture and arts are analyzed in depth under these headings. Thanks to the methodology used, a comprehensive evaluation of the relationship between artificial intelligence and culture and art in terms of literature has been provided, offering an important understanding of the future interaction between artificial intelligence and art.

Research Questions

1. The relationship of artificial intelligence to culture and art, how artistic creativity is perceived in comparison to natural creativity?

This research problem will focus on how artworks generated by AI are perceived in comparison to traditional artworks. Humans' reactions and evaluations of AI-generated artworks will help us understand the implications of the imitation of artistic creativity by AI.

2. How do works of AI art affect the value and meaning of art?

This research problem will examine the impact of AI artworks on the value and meaning of art. The artistic qualities and meanings of AI artworks can raise controversial issues in the art world and determine the future role of art.

3. How do artworks generated with artificial intelligence affect the creativity of artists and what are its effects on artworks?

This research problem will examine the effects of artificial intelligence technology on artists' creativity and artworks. The contribution of AI to artists' creative processes will help us understand how it can make changes in the way artists express themselves and produce their artworks.

4. How are artworks generated by artificial intelligence evaluated and accepted in the art world?

This research problem will examine how artworks generated by artificial intelligence are evaluated and accepted in the art world.

The extent to which AI art is accepted in the art world can determine the debates between artists and critics and the future role of AI art in the art world.

5. What role does artificial intelligence play in the preservation and understanding of cultural heritage?

This research problem will examine what role AI plays in the preservation and understanding of cultural heritage. It will explore how AI is used to understand the historical and cultural context of artworks and how it contributes to the transmission of cultural heritage to future generations.

These research problems will help us to gain a deeper understanding of the relationship between AI and arts and culture and to address important debates and developments in the literature. What role AI will play in the field of arts and culture and its future implications will be evaluated through these research problems.

THE RELATIONSHIP BETWEEN ARTIFICIAL INTELLIGENCE AND CULTURE AND ART

Artificial intelligence is a technology that has developed rapidly in recent years and has had a major impact in many fields. This technology allows to imitate some aspects of

human intelligence and enables computers to gain the ability to perform complex tasks. Artificial intelligence is used in many sectors such as data analysis, automation, medicine, transportation and education and has become a part of our daily lives (Ünal & Kılınc, 2020).

The development of artificial intelligence has brought about a significant transformation in the field of culture and art. Culture and art are among the most fundamental and indispensable elements of human history. Through art, people have expressed their feelings, conveyed their thoughts and preserved their cultural identities. Art is a mirror that reflects the values, beliefs and lifestyle of society and is considered a common language of humanity (Y. Uzun et al., 2021).

Artificial intelligence's relationship with culture and art has brought about significant changes affecting these two fields. In addition to traditional art, artificial intelligence art, in which artificial intelligence is used creatively, has also developed. Artificial intelligence art enables the production of artistic works through algorithms and artificial neural networks and represents the beginning of a new creative process by pushing the boundaries of art (Chatterjee, 2022).

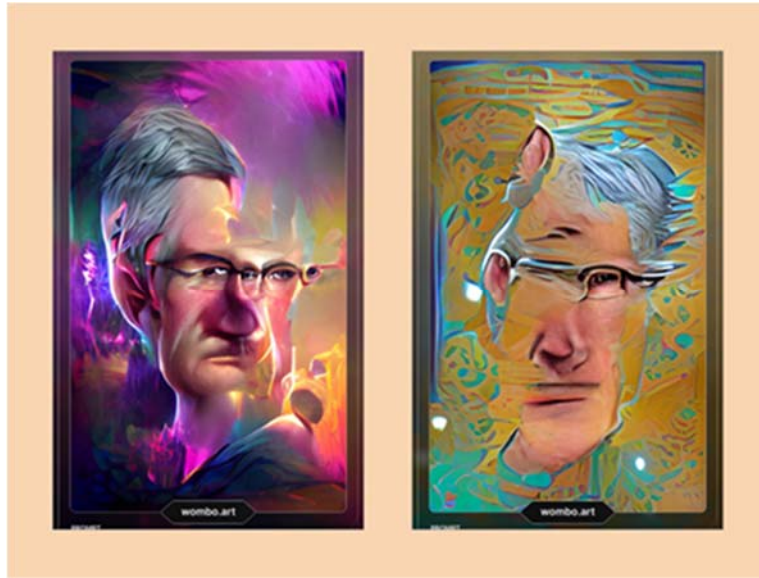


Figure 1. Wombo Dream Turns Your Typed Word into a Work of Art by Using Artificial Intelligence (Öğütçü, 2021).

When issues such as how artificial intelligence is shaped in the cultural and artistic field, its role in the production of artworks, its potential for cooperation with artists, its use in the understanding and interpretation of art are considered and evaluated, we see that it can be examined under different topics (Kantürk, 2022; Mazzone & Elgammal, 2019). These are;

➤ ***Artificial Intelligence and the Historical Context of Art***

The relationship between artificial intelligence and art is not a new phenomenon. Throughout human history, there has been a constant interaction between technology and art. Art has constantly evolved and changed under the influence of new technologies and discoveries (Özdemir, 2010). For example, with the invention of the camera, the art of painting gained a different dimension and the

art of photography was born. Similarly, with the development of digital technologies, significant progress has been made in the field of digital art and digital visual effects (Gülaçtı & Kahraman, 2021).

However, artificial intelligence has transformed art in a different way from other technological developments. Since AI has the ability to mimic human intelligence, it has operationalized human-like creativity and thought processes in the field of art. Artists and researchers are working to explore how AI technology will change artistic expression and gain a place in the art world (Cheng, 2022).

➤ ***The Relationship between Artificial Intelligence and Art***

Artificial intelligence is used in different ways in the field of art. In the production of artworks, artificial intelligence algorithms

and artificial neural networks play an important role in the design and creation of artworks. Especially in the field of visual arts, paintings generated by artificial intelligence are exhibited in museums and can be compared with the works produced by artists. By analyzing data, AI can create artworks in different styles, thus expanding the boundaries of art (Oksanen et al., 2023).

In addition, AI has the potential to collaborate with artists. By taking advantage of AI technology, artists can develop their artistic expression more effectively and have new experiences. Artificial intelligence allows artists to produce their works more quickly and efficiently, thus helping artists to better utilize their creative potential (Yusa et al., 2022).

The use of artificial intelligence in the cultural and artistic field also plays an important role in the understanding and interpretation of art. By analyzing the symbols and images contained in artworks, AI can provide information about the meaning and content of art. Furthermore, AI can be used to understand the historical and cultural context of artworks, which can lead to a better understanding of their value and significance (Anantrasirichai & Bull, 2021).

➤ **Art of Artificial Intelligence and Critical Debates**

Artworks produced by artificial intelligence are a controversial topic. Many critics have expressed concern that AI could replace artistic creativity and alter the human process of artistic expression. When the works of artificial intelligence are compared to the

works of human artists, it is often debated whether they can be considered works of art in the true sense (Gözübüyük, 2021).

The art of artificial intelligence has also raised new legal issues such as intellectual property and creativity rights. Problems such as who owns the works produced by artificial intelligence and how to own the copyrights of the works have become a controversial issue among lawyers and artists (Özçelik, 2021).

On the other hand, the advantages and new opportunities that artificial intelligence provides to artworks and artists is also an important topic of discussion. Artificial intelligence can support artists' creativity and help them create more interesting and impressive works. Moreover, thanks to AI technology, artworks can reach a wider audience and contribute to the democratization of art (Cheng, 2022).

➤ **Future Directions of Artificial Intelligence and Art**

The future directions of AI and art are still uncertain. However, the continuous development and advancement of AI technology suggests that it will find more uses in the art world. The development of AI art is an exciting field that requires further study on how it will affect the art world and artists' creativity (Liu & Tao, 2022).

It is one of the subjects of curiosity how AI art will expand the boundaries of art and create new forms of artistic expression. Artificial intelligence can help artists develop new ideas and perspectives while enabling the production of works in different styles and themes (Mazzone & Elgammal, 2019).

Moreover, the use of artificial intelligence in the field of culture and arts can have an important role in the preservation and understanding of cultural heritage. Artificial intelligence can be used to understand the historical and cultural context of artworks, thereby preserving and transmitting cultural heritage to future generations (Y. Uzun et al., 2021).

The relationship between artificial intelligence and art has led to significant changes in cultural and artistic fields, and the development of AI art has ushered in a new era in the art world. The relationship of artificial intelligence with culture and art is both exciting and controversial, and we see that it stands before us as an important field that requires further research and study in the future (Özselçuk, 2023).

HOW ARTIFICIAL INTELLIGENCE IS USED IN CULTURAL AND ARTISTIC FIELDS

There are some examples of the use of artificial intelligence in cultural and artistic fields. We can explain them under different headings as follows:

- **Artwork Production:** Artificial intelligence is used to produce works of art. Artificial intelligence algorithms and artificial neural networks are used in the production of painting, music, poetry and other artistic works, creating new and original works (Gülaçtı & Kahraman, 2021).
- **Cultural Heritage Protection:** Artificial intelligence is used in the protection and restoration of historical and cultural heritage. Artificial intelligence can develop image

processing and analysis techniques that can be used for the restoration of ancient pieces (Karataş, 2023).

- **Artwork Analysis:** Artificial intelligence is used to analyze and understand works of art. Image and text analysis can be used to understand the style, theme and emotional content of a work of art (Artut, 2019).
- **Supporting Artists' Creative Processes:** Artificial intelligence is used to support artists' creative processes. AI-based tools can be developed to inspire artists, suggest different styles and techniques, and facilitate their creative processes (Taluğ & Eken, 2023).
- **Art Experience and Interaction:** Artificial intelligence is used to enrich the art experience and interaction. Combined with virtual reality and augmented reality technologies, interactive art experiences can be created that increase the interaction of viewers and art lovers with artworks (Künüçen & Samur, 2021).
- **Cultural Analysis and Digital Archives:** Artificial intelligence is used to analyze and organize large cultural and artistic data sets. Digital archives and collections are becoming more easily accessible and editable thanks to artificial intelligence algorithms (Atalay & Çelik, 2017).
- **Artistic Expression and Storytelling:** Artificial intelligence is used in storytelling and artistic expression. Text analysis and natural language processing algorithms can be used in story and script writing to develop new storytelling techniques and forms of artistic expression (Ökmen, 2021).

These examples show how AI can be used in cultural and artistic fields. The use of AI in these fields is a potential tool that can make the processes of artists and cultural institutions more effective and efficient while enriching cultural and artistic experiences. However, discussions on issues such as ethics, aesthetics and creativity brought about using artificial intelligence technology in the field of art and culture should also be taken into consideration (Kantürk, 2022).

THE ROLE OF ARTIFICIAL INTELLIGENCE IN THE PRODUCTION OF ARTWORKS

The role of artificial intelligence in the production of artworks has brought about a significant change in the art world. Compared to traditional artworks, artificial intelligence produces artworks through algorithms and artificial neural networks, rather than a creativity based entirely on human intelligence. Therefore, artworks produced by artificial intelligence have become a controversial topic and have triggered various emotions and reactions in the art world (Gözübüyük, 2021). The role of artificial intelligence in the production of artworks can be summarized under the following headings.

- **Redefining Creativity:** Artificial intelligence has questioned traditional notions of how to understand creativity in the production of artworks. Artworks produced by AI are not considered by some to be true creativity, as they are the result of an algorithm. However, by representing a different kind of creativity, AI artworks have redefined the boundaries and diversity of creativity (B. Karabulut, 2021).

- **Artistic Innovation:** Artificial intelligence has enabled the production of new and original pieces in the art world. Artificial intelligence algorithms can produce artworks with different styles and themes and thus create new forms of artistic expression by going beyond traditional art (Cheng, 2022).

- **Accessibility and Diversity:** Artificial intelligence has enabled artworks to reach a wider audience. It has contributed to the democratization of art, allowing more people to have artistic experiences. At the same time, the emergence of works from different cultures and artists thanks to artificial intelligence has increased diversity in art (Hertzmann, 2018).

- **Supporting Artists' Creative Processes:** Artificial intelligence is used to support the creative processes of artists. Thanks to its features such as inspiring artists, offering new ideas and facilitating the process, it contributes to artists to work more efficiently (Kurt Kırıl & Paç, 2022).

- **Innovation and Digital Art:** Artificial intelligence has made significant contributions to the development of digital art. Combined with virtual reality and augmented reality technologies; it has become possible to create interactive art experiences. This has made art more interactive and dynamic (Töre & Güney, 2022).

Artificial intelligence plays an important role in the production of artworks and has a transformative impact on the art world. The use of AI in the arts offers new experiences and opportunities for both artists and

audiences. However, it is also important to address the ethical and aesthetic issues of AI on the authenticity of art and human creativity. Therefore, the role of AI in the art world is seen as a constantly debated and evolving topic (Taluğ & Eken, 2023).

THE POTENTIAL FOR ARTIFICIAL INTELLIGENCE TO COLLABORATE WITH ARTISTS

The potential for AI to collaborate with artists is huge and exciting. While AI can support artists in their creative processes, it also offers new and interesting creative opportunities. There are some important points about AI's potential for collaboration with artists (Güney & Yavuz, 2020). These can be summarized under the following headings.

- **Inspiration and Creativity:** Artificial intelligence has the potential to inspire artists and support their creativity. Artificial intelligence-based algorithms can enrich and inspire artists' creative processes by offering them new ideas and styles (Ballı, 2020).
- **New Techniques and Expressions:** Artificial intelligence offers artists the opportunity to explore new techniques and forms of expression. AI-based tools can enable artists to go beyond traditional art and work in new fields such as digital art, augmented reality or virtual reality (Baltacı & Toy, 2021).
- **Interactive Art Experience:** Artificial intelligence can be used to create interactive art experiences. Artists can design interactive art experiences with the audience through artificial intelligence technology and open

their works to the participation of the audience (Gökçe, 2010).

- **Digital Art and Creative Search:** Artificial intelligence can contribute to the development of digital art and new forms of artistic expression. By using artificial intelligence, artists can create experimental works that they have not tried before, pushing their limits (Kizilaslan & Kozlu İsmailoğlu, 2021).
- **Social and Societal Dimensions of Art:** Artificial intelligence can also contribute to artists' work on social and cultural issues. Artists can create works that reflect the voice of society by using artificial intelligence, data analysis and social media interactions (Atmaca, 2008).
- **Synthesis of Art and Technology:** Artificial intelligence allows artists to develop creative projects by combining technology with art. Artists can use AI technology to create new artistic experiences, such as robotic art, interactive installations or AI-generated music (Bunulday Hasgüler, 2012).

However, the potential of AI's collaboration with artists may also bring some challenges. For example, the artworks produced by AI may raise questions about the identity and creativity of the artist. Furthermore, the synthesis of technology and art may require a learning curve and technical skills for some artists (Coşkun Onan, 2005).

The potential for AI to collaborate with artists has great potential and offers the potential to take the art world in new and interesting directions. Using AI technology, artists can

expand their creative expression and work in previously unexplored areas. This collaboration allows for the emergence of new artistic experiences through the combination of art and technology, allowing artists to rediscover themselves and art (Karagöl & Kaplanoğlu, 2022).

UNDERSTANDING AND INTERPRETING ART

Understanding and interpretation of art is the process of grasping and evaluating the content, expression and emotional experiences offered by artworks. Understanding and interpreting art is an important process for viewers and critics, and different people interpret different works of art in different ways (Ören, 2015). This process emphasizes that art is a subjective and individual experience. There are also some important points about the meaning and interpretation of art. We see that these important points are collected and defined under different headings:

- **Subjective and Personal Experience:** Art is a subjective and personal experience for each viewer or critic. The meaning and impact of works of art may differ depending on factors such as one's experiences, thoughts, cultural background and emotional state (Mercin & Alakuş, 2005).

- **Artist's Intention:** The artist's intention and purpose play an important role in making sense of works of art. Understanding the message or emotion that the artists want to convey with their work can help in understanding the meaning of the work (İçli, 2022).

- **Content and Technique:** The content and techniques used in artworks can provide important clues in understanding the meaning of the work. Viewers can decipher the meaning of the work by paying attention to technical details such as composition, use of color, figurative or abstract expression (N. Karabulut et al., 2008).

- **Impact of Period and Culture:** The interpretation of works of art also includes the influence of the period and culture in which the piece was created. The social, political, economic and cultural context of the artworks within the period can contribute to a better understanding of meaning (Eliri, 2013).

- **Emotional and Aesthetic Reactions:** Emotional and aesthetic reactions are important during the interpretation and interpretation of art. Works of art can evoke different emotional and aesthetic experiences in viewers and these experiences can affect the meaning of the work (Ötgün, 2008).

- **Social and Critical Perspective:** A social and critical perspective is also important in the interpretation and interpretation of art. Works of art may have been created to draw attention to, criticize or question some issues in society, and the meaning and impact of such works can be evaluated from a social and critical perspective (Ülger, 2021).

The meaning and interpretation of art is a subjective process and offers a different experience for everyone. The meaning of art can vary depending on the viewer's perspective, experiences and emotional state (İ. Uzun, 2021). Works of art can be open to

different interpretations and evaluations, and this diversity reflects the richness and depth of art.

THE RELATIONSHIP BETWEEN ART, CULTURE AND TECHNOLOGY

There is a complex relationship between art, culture and technology and these three concepts are shaped by influencing each other. The advancement of technology has played an important role in the development of art and culture and created new opportunities (Uğurlu, 2008). The relationship between art, culture and technology has some important dimensions. Again, these dimensions and their contents can be grouped under the following headings:

- **Changes in Art with Technology:** The advancement of technology has greatly affected the production, exhibition and distribution processes of art. Artists can express their works in different ways by using new technologies such as digital media, virtual reality, augmented reality, interactive installations (Dolunay & Boyraz, 2013).
- **Digital Art and New Expressions:** The rise of digital art has been experienced with the development of technology. Digital artists contribute to the art world with new forms of expression such as computer graphics, digital paintings, interactive artworks (Vargün, 2023).
- **Cultural Transformation of Art:** Technology has influenced the content, themes and narratives of art as part of cultural transformation. Works of art have become a mirror in which technological

advances reflect social and cultural changes (Kayıhan, 2021).

- **Communicating and Accessing Art:** Technology has played a major role in the communication and access of art. The internet and digital platforms have enabled art to reach wider audiences and allowed artists to share their works with a global audience (Kırmızıgül, 2019).
- **Interaction of Art:** Technology has offered new possibilities for art to interact with audiences. Artists can offer audiences the opportunity to participate and experience through interactive installations, augmented reality experiences and digital art projects (Şahin, 2018).
- **Cultural Identity Redefined by Technology:** Art and culture can redefine the cultural identities of societies with the influence of technology. Thanks to technology, artistic expressions of different cultures can be shared more easily and quickly around the world (Azılıoğlu & Yılmaz, 2021).

However, the relationship between art, culture and technology can sometimes bring some problems. In particular, in the digital age, issues such as the originality of artworks, the identity of the artist and the commercialization of art can lead to debates (Kara, 2017).

The relationship between art, culture and technology is dynamic and interactive. While the advancement of technology transforms art and culture, art and culture can enrich technology with new creative fields and forms of expression (Uğurlu, 2008). This

relationship between art, culture and technology allows people to express, share and make sense of their thoughts, feelings and experiences (Vargün, 2023).

THE IMPACT OF ARTIFICIAL INTELLIGENCE ON THE WORLD OF CULTURE AND ART

The impact of artificial intelligence on the world of culture and art is far-reaching and continues to develop rapidly. Artificial intelligence has started a new era in the art world, challenging traditional approaches and boundaries. Artificial intelligence has significant impacts on the world of culture and art (Y. Uzun et al., 2021). We can summarize these impacts under the following headings.

- **Redefining Creativity:** Artificial intelligence has revealed a new type of creativity in art by changing the traditional understanding of creativity. Artificial intelligence, which produces works through algorithms and artificial neural networks, offers a different form of creativity compared to human intelligence (Bayraktar, 2022/2023).
- **Rise of Digital Art:** Artificial intelligence has contributed to the rise of digital art. Artists can explore new forms of digital art such as interactive installations, augmented reality art, virtual reality experiences using AI technology (Soyuer, 2023).
- **New Artistic Expressions:** Artificial intelligence offers artists the opportunity to explore new forms of artistic expression. Artificial intelligence technology allows

artists to produce works with different styles and themes such as abstract art, experimental art or expressionist art (Güney & Yavuz, 2020).

- **Art Education and Research:** Artificial intelligence can be used in art education and research to help artists work more effectively and develop their creativity. Artists can support their artistic processes with AI-based tools and gain new perspectives through data analysis (Deveci, 2022).
- **Social and Critical Art:** Artificial intelligence can contribute to the development of social and critical art. Artists can produce pieces that draw attention to and criticize social issues using artificial intelligence technology (Ballı, 2020).
- **Democratization of Art:** The fact that works produced with artificial intelligence can be easily shared and published on digital platforms has enabled the democratization of art. In this way, wider audiences can access artistic experiences (Y. Uzun et al., 2021).

However, there are also some concerns about the impact of AI on the world of culture and art. In particular, questions arise about the originality and creativity of works produced by artificial intelligence. In addition, it is thought that by replacing human artists, it may reduce the value of works produced by human hands (Gümüş, 2019).

Artificial intelligence is transforming the world of art and culture and is playing an important role in shaping the future of art. The synthesis of technology and art in the art world and the discovery of new forms of

artistic expression are just some of the contributions of AI. However, the ethical and aesthetic issues of AI on the originality of art and human creativity should never be ignored (Winegard, 2019).

ANSWERS TO RESEARCH QUESTIONS

The relationship between artificial intelligence and culture and art is a very intriguing subject. The use of artificial intelligence in cultural and artistic fields has both sparked debates and offered new opportunities.

✓ Artificial Intelligence and Artistic Creativity

Artificial intelligence offers a different perspective on artistic creativity than traditional natural creativity. Areas where AI is used in artistic creativity include forms of artistic expression such as painting, composing music, writing poetry and storytelling. Such applications have significant potential for efficiency and creativity, especially in low-level artistic productions.

Artificial intelligence can produce artistic pieces by learning from large data sets, analyzing them according to different styles and movements, and recognizing patterns. However, it is still debated whether the works generated by artificial intelligence can fully capture human emotionality and originality.

✓ Cultural Heritage and Artificial Intelligence

Artificial intelligence also plays an important role in preserving and digitizing cultural heritage. Digitizing and preserving artifacts is

an important step in passing on cultural heritage to future generations. Artificial intelligence can help preserve cultural heritage by being used in areas such as analyzing manuscripts, restoring ancient texts and correcting the deterioration of artistic pieces. In this regard, many points and dimensions that escape the human eye can be identified and captured by artificial intelligence.

✓ Ethical Issues and Artistic Authenticity

The use of artificial intelligence in the field of art also raises ethical issues. For example, there are uncertainties about whose artwork a piece generated by artificial intelligence is, the originality of the piece, and the role differences between humans and artificial intelligence. There are also debates about the copyright and artistic value of works generated by artificial intelligence.

✓ Human-Artificial Intelligence Collaboration

In terms of artistic creativity, the potential for human and AI collaboration is quite intriguing. Artists can produce more inspiring and original works by using the analytical capabilities of artificial intelligence and big data analysis. While artificial intelligence offers artists new ideas and perspectives, it also offers convenience and different advantages in integrating the emotional and aesthetic values of humans into their works.

Artificial intelligence's relationship with culture and the arts is a highly complex field, with both opportunities and ethical issues. In the comparison of artistic creativity with natural creativity, although it is currently

difficult for artificial intelligence to fully capture the emotional and aesthetic depth of human beings, it is conceivable that a more synergistic cooperation and interaction between humans and artificial intelligence can be seen in the future. At this point, it will likely assume a role that supports the human artist's identity and original creativity.

Artwork pieces of artificial intelligence influence the value and meaning of art in different ways. These impacts are controversial and have diverse views. Some of the influences on the artworks pieces of artificial intelligence are as follows:

✓ ***Creativity and Originality***

Artworks produced by artificial intelligence have led to debates among some art critics and viewers in terms of creativity and originality. There are many studies on this subject (Taluğ & Eken, 2023). Artificial intelligence can create artworks by learning from large databases and analyzing patterns. However, whether these artifacts are truly original and unique is questioned when compared to human emotionality and creativity. It is also stated in the literature that human emotions and feelings are not currently reflected in artworks by artificial intelligence (Güney & Yavuz, 2020).

✓ ***Accessibility***

Artificial intelligence art facilitates and increases the accessibility of artistic works. Digital artworks using artificial intelligence are more easily and widely accessible through digital platforms. This allows art to be seen and appreciated by more people.

✓ ***Cultural Heritage and Restoration***

Artificial intelligence plays an important role in the preservation and restoration of cultural heritage. Using artificial intelligence, historical documents, paintings and artistic works can be digitized, damage to buildings and artifacts can be detected and restored. This facilitates the preservation and transfer of cultural heritage to future generations.

✓ ***Combination of Technology and Art***

Artificial intelligence art is an example of the fusion of technology and art. The use of AI in the art world paves the way for new collaborations and discoveries between artists and tech experts. This offers opportunities to expand the boundaries of art and explore different forms of artistic expression.

✓ ***Problems of Ethics***

Artworks generated by artificial intelligence bring ethical (Yeşilkaya, 2022). For example, who should own the copyrights of a work generated by artificial intelligence? (Zorluel, 2019). Is it ethical to evaluate artificial intelligence works similar to human creativity (Öztürk Dilek, 2019). How is the originality and creativity of art defined in works generated by artificial intelligence? (Karaca & Karataş, 2022). Such questions are likely to lead to the emergence of ethical debates. In this regard, it is clearly seen that legal practices in terms of intellectual and artistic works bring some problems in terms of artistic and originality.

It is frequently emphasized in the literature that artworks generated with artificial

intelligence affect the value and meaning of art in a controversial way (Ballı, 2020). Although artificial intelligence provides a technological dimension to art and offers new possibilities, it also causes us to question the deep meanings and authenticity of art in human nature. This interaction between human and artificial intelligence is seen as an inevitable result that will bring more discoveries and changes in the art world in the future.

Artificial intelligence affects artists' creativity and artworks in various ways. Below are some of the impacts of artificial intelligence on artists and their artworks:

✓ ***Creativity and Inspiration***

Artificial intelligence provides artists with a new source of creativity and inspiration. AI algorithms are able to recognize patterns and relationships from large datasets to generate new and unique ideas. Artists can use the analytical capabilities of AI as a reference or inspiration to create more engaging and original works.

✓ ***Cooperation and Accompaniment***

Artificial intelligence can serve as a "creative partner" with which artists can collaborate. Artists can develop their own creative processes using AI algorithms and create different works by adding AI elements to their works. Such collaborations will also allow different perspectives and forms of artistic expression to come together.

✓ ***Digitalization of Art***

Artificial intelligence is accelerating the digitalization of art and the exploration of

new forms of media. Using AI-based technologies, artists can produce digital artworks and create new art experiences such as interactive multimedia or virtual reality.

✓ ***Automation in the Artistic Process***

Artificial intelligence automates and accelerates some artistic processes. For example, some artistic processes such as painting or composing music can be partially or fully automated by artificial intelligence algorithms. We can take today's music producers and composers as an example. Many of today's music producers and composers use such artificial intelligence algorithms to differentiate and create new works. This allows artists to focus more, save time, create different perspectives and spend more time on creativity.

✓ ***Limits of Creativity***

Artificial intelligence also makes it possible to question the limits of art and creativity. Artworks generated by artificial intelligence challenge human claims to creativity and originality. This increases the need for artists to compete with AI and emphasize the human touch in their works.

✓ ***Social and Ethical Dimensions of Art***

Artificial intelligence also brings along problems with its socially ethical dimension. In particular, the role of artificial intelligence on creativity and art leads to debates on issues such as copyrights, ownership of artworks and ethical use. In particular, changing the original structure by making changes on many pieces of art, which are considered anonymous, can lead to a

departure from the truth or authenticity. Because artificial intelligence, as a system that learns and constantly renews itself, can also cause changes in the existing structure. In this case, the structures of the original themed pieces may change and appear as a different piece of work. Such possibilities will lead to the formation of challenging negativities in terms of laws such as intellectual artworks and copyrights.

Artificial intelligence enhances artists' creativity, allowing them to explore new forms of media and artistic expression. At the same time, it questions the boundaries of art and opens up ethical and social dimensions to discussion. The impact of artificial intelligence in the art world shows that it has the ability to change even more in the future depending on the advancing technological developments and the attitudes of artists.

Artificial intelligence faces a mixed evaluation and acceptance in the art world. Opinions and attitudes on this issue vary widely among different artists, critics, museums, galleries and audiences. Some of the points of view on how artificial intelligence is evaluated and accepted in the art world are explained under the following headings:

✓ ***Innovation and Discovery***

Some artists and critics see artificial intelligence as an area of innovation and exploration. They believe that the use of AI enables the exploration of new forms and technologies of artistic expression. This group thinks that AI has a positive impact on the art world and supports it.

✓ ***Artistic Creativity and Originality***

One of the criticisms of artworks generated by artificial intelligence is the belief that they lack artistic creativity and originality. It is thought that works generated by artificial intelligence cannot fully capture human creativity and expression. For this reason, some consider AI artworks to be a poor substitute for real art.

✓ ***Entertainment and Popularity***

Artworks generated with artificial intelligence are evaluated in terms of entertainment and popularity in some segments. Artificial intelligence-based applications and filters, which have become widespread especially on social media and digital platforms, attract people's attention and gain popularity.

✓ ***Art Market and Valuation***

The market value and commercial acceptance of AI-generated artworks is also a contentious issue. While some collectors and galleries may find AI artworks special and intriguing, others are hesitant to substitute such artworks for traditional art.

Artworks generated by artificial intelligence have been a field that has caused various reactions and evaluations in the art world. Although some see AI art as an innovative and interesting field, others critically evaluate AI works that fail to capture human creativity and originality. We can say that the acceptance and permanent place of AI art in the art world will be shaped by the attitudes of artists and art lovers, the development of

technology and social acceptance in the coming years.

Artificial intelligence plays an important role in the preservation and understanding of cultural heritage. Below, some of the impacts of AI on cultural heritage are described:

✓ ***Digitization and Archiving***

Artificial intelligence allows and enables the digitization and archiving of historical documents, manuscripts, paintings and other cultural artifacts. This process facilitates the transmission of cultural heritage to future generations by protecting against physical deterioration of the original artifacts.

✓ ***Language and Manuscript Analysis***

Artificial intelligence is used in language and manuscript analysis. The analysis and translation of ancient texts and manuscripts can be done faster and more precisely with artificial intelligence algorithms. This helps to understand unknown texts and to better comprehend historical information.

✓ ***Restoration and Conservation***

Artificial intelligence is also used in the restoration and conservation of artistic pieces and ancient structures. AI can detect damage to artifacts and provide better guidance for their repair.

✓ ***Text and Data Analysis***

By analyzing large datasets, artificial intelligence extracts and summarizes information about cultural heritage, making it more understandable. This is recognized as an important research tool for archaeologists,

historians and art experts and can provide a more comprehensive understanding.

✓ ***Virtual and Augmented Reality Experiences***

Artificial intelligence enriches virtual and augmented reality experiences and offers virtual tours, museum experiences and educational materials on cultural heritage.

✓ ***Language Translations and Accessibility***

AI-based translation tools enable cultural heritage texts to be understood by more people. In this way, people speaking different languages can better understand and appreciate cultural heritage.

Thanks to artificial intelligence, the protection, understanding and dissemination of cultural heritage is carried out more effectively. However, the use of artificial intelligence in this field also brings along some ethical issues. In particular, issues such as copyright and ownership are and should be taken into account when digitizing and using cultural artifacts. Artificial intelligence is being used as a powerful tool for people to better preserve and understand cultural heritage. However, human sensitivity and ethical considerations play an important role in this process.

CONCLUSION

As a result of the examination and research conducted at the end of the study, the relationship of artificial intelligence with culture and art shows that it has a great impact on cultural and artistic fields today. Artificial intelligence is now accepted as a field of technology that imitates human

intelligence and has the ability of computers to perform complex tasks. This technology is also evaluated in various dimensions in terms of literature. In terms of literature, many studies emphasize that artificial intelligence will dominate in many fields in the future.

One of the most obvious impacts of AI in the field of literature and art is its transformation of creative processes and artistic production. AI is being used to create literary texts, poems and stories. AI systems with the ability to understand and produce large amounts of text, called language models, play an important role in the field of literature. This is viewed with concern by some critics in terms of creativity and originality, while others see it as an innovative approach.

Artificial intelligence is also used in the analysis and evaluation of works of art. Scanning and analyzing works of art, determining their structural characteristics and historical context are among the possibilities provided by artificial intelligence. Art critics and historians have different opinions on how AI can better understand the meaning and significance of works of art by using these analytical capabilities, but there are some issues on which they agree and have the same opinion.

Among the criticisms and conclusions that have not gone unnoticed is that AI's relationship with culture and art has also led to some critical debates. Some find the impact of AI on human creativity and artistic expression worrying. According to them, literary pieces and works of art produced using artificial intelligence create the fear that

they may replace and devalue human emotionality and aesthetic understanding.

Furthermore, the threats of artificial intelligence to the uniqueness and aesthetic experience of art are also among the results and conclusions of the literature. It is stated that the ability to generate artworks by artificial intelligence may reduce the uniqueness of artists' and writers' creations and the value of their labor. The role of AI in creative processes has also been commented on as raising concerns about the future development of art and literature.

However, some researchers positively evaluate the relationship of artificial intelligence with culture and art in their works published in the literature. They believe that AI can push the boundaries of art and enable new forms of expression. Artists and writers can use AI as a tool to enrich the content of their works and create new aesthetic experiences.

Overall, the relationship of AI with culture and art is complex and multifaceted. The literary assessment of this technology includes different dimensions such as its implications for human creativity and originality, the transformation of artistic expression, and the analytical use of AI. We can say that this evaluation will further enrich and advance the discussions on the impact of artificial intelligence on the fields of art and culture and shed light on the shaping of future artistic production and literary works.

REFERENCES

Akbulut, D. (2020). Sanatın ölümü Üzerine: Yanlış cenazeye ağıt. *Karadeniz*

- Uluslararası Bilimsel Dergi*, 1(47), 91-107.
<https://doi.org/10.17498/KDENIZ.755921>
- Anantrasirichai, N., & Bull, D. (2021). Artificial intelligence in the creative industries: a review. *Artificial Intelligence Review* 2021, 55(1), 589-656.
<https://doi.org/10.1007/S10462-021-10039-7>
- Artut, S. (2019). Yapay zekâ olgusunun güncel sanat çalışmalarındaki açılımları. *İnsan ve İnsan*, 6(22), 767-783.
<https://doi.org/10.29224/INSANVEINSAN.478162>
- Aslan, E. (2019). Yapay zekâ resimleri ve sanatın başkalaşan mecrası üzerine. *Güzel Sanatlar Enstitüsü Dergisi*, 42, 231-242.
<https://doi.org/10.32547/ATAUNIGSED.516382>
- Atalay, M., & Çelik, E. (2017). Büyük veri analizinde yapay zekâ ve makine öğrenmesi uygulamaları. *Mehmet Akif Ersoy Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 9(22), 155-172.
<https://doi.org/10.20875/MAKUSOBED.309727>
- Atmaca, A. E. (2008). Toplumsal yaşamda sanat eğitiminin gerekliliği ve medyanın rolü. *Sosyal Politika Çalışmaları Dergisi*, 15, 21-28.
<https://doi.org/10.21560/SPCD.79433>
- Azılıoğlu, K., & Yılmaz, M. (2021). Toplumsal ve kültürel değişimlerin sanat eğitimine yansımaları. *Eğitim ve Toplum Araştırmaları Dergisi*, 8(2), 443-461.
<https://doi.org/10.51725/ETAD.1034600>
- Ballı, Ö. (2020). Yapay zekâ ve sanat uygulamaları üzerine güncel bir değerlendirme. *Sanat ve Tasarım Dergisi*, 26, 277-306.
<https://dergipark.org.tr/tr/pub/sanavetasarim/issue/58750/848330>
- Baltacı, S., & Toy, E. (2021). Arttırılmış gerçeklik destekli açık alan sanat uygulamalarına bir örnek: Augmented Istanbul. *Medeniyet Sanat Dergisi*, 7(1), 56-67.
<https://doi.org/10.46641/MEDENIYETSANAT.930663>
- Bayraktar, K. O. (2023). Yapay zekâ estetiği ve insan merkezli yaratıcılık miti (E. Arielli & L. Manovich, Trans.). *Marmara Üniversitesi Sanat ve Tasarım Dergisi*, 14(1), 214-226.
<https://doi.org/10.29228/sanat.23>
(Original work published 2022)
- Bulut, Ü., & Kurt, E. (2021). Sanatsal yaratıcılık ve zekâ ilişkisi: Üstün yetenekli ve normal gelişim gösteren öğrencilerin karşılaştırılması. *Trakya Üniversitesi Sosyal Bilimler Dergisi*, 23(1), 171-190.
<https://doi.org/10.26468/TRAKYASOBED.738899>
- Bunulday Hasgüler, S. (2012). Sanat ile teknolojiyi performansta birleştiren sanatçı: Stelarc. *MSGSÜ Sosyal Bilimler*, 5, 39-49.
- Chatterjee, A. (2022). Art in an age of artificial intelligence. *Frontiers in Psychology*, 13, 1024449.
<https://doi.org/10.3389/FPSYG.2022.1024449/BIBTEX>
- Cheng, M. (2022). The creativity of artificial intelligence in art. *Proceedings 2022*, Vol. 81, Page 110, 81(1), 110.
<https://doi.org/10.3390/PROCEEDINGS2022081110>
- Coşkun Onan, B. (2005). *Sanat eğitimi yöntemleri / yeni yaklaşımlar*. (Publication No: 188693) [Master's Thesis, Bursa Uludağ University]. National Thesis Center of the Council of Higher Education.
<https://tez.yok.gov.tr/UlusalTezMerkezi/tezDetay.jsp?id=DzYUBA1JBLkuf>

- WcAUP5b2Q&no=-
LOR_8t76wTLK45CXMc57g
- Deveci, M. (2022). Yapay zekâ uygulamalarının sanat ve tasarım alanlarına yansması. *Vankulu Sosyal Araştırmalar Dergisi*, 9, 118-140. <https://doi.org/10.55089/YYUVASA.D.1115961>
- Dolunay, A., & Boyraz, B. (2013). Dijital sanatlar çerçevesinde üretilen eserlerde teknoloji kullanımı ve internetin sergilemeye etkisi. *İnsan ve Toplum Bilimleri Araştırmaları Dergisi*, 2(3), 109-124. <https://dergipark.org.tr/tr/pub/itobiad/issue/8755/109231>
- Eliri, İ. (2013). Sanat eseri ve ona yüklenen mana sorunsalı. *Akdeniz Sanat*, 6(12), 64-73. <https://dergipark.org.tr/tr/pub/akdenizsanat/issue/27659/291572>
- Erdoğan, G. (2021). Yapay zekâ ve hukukuna genel bir bakış. *Adalet Dergisi*, (66), 117-192.
- Gökçe, N. (2010). Sosyal bilgiler öğretmen adaylarının coğrafya dersine yönelik tutumları. *Education Sciences*, 5(4), 2071-2083. <https://dergipark.org.tr/tr/pub/nwsaedu/issue/19822/212262>
- Gözübüyük, B. (2021). Yapay zekânın meydana getirdiği fikri ürünlere ilişkin 5846 sayılı fikir ve sanat eserleri kanunundaki sorunlar ve çözüm önerileri. *Kırıkkale Hukuk Mecmuası*, 1(1), 54-81.
- Gülaçtı, İ. E., & Kahraman, M. E. (2021). The impact of artificial intelligence on photography and painting in the post-truth era and the issues of creativity and authorship. *Journal of Medeniyet Art*, 7(2), 243-270. <https://doi.org/10.46641/MEDENIYETSANAT.994950>
- Gümüş, F. (2019). *Müzelerde yapay zekâ uygulamaları, etkileri ve geleceği*. (Publication No: 554647) [Master's Thesis, İstanbul University]. National Thesis Center of the Council of Higher Education. <https://tez.yok.gov.tr/UlusalTezMerkezi/tezDetay.jsp?id=zgwJFRuTC2KnLB-vCRH7GQ&no=jqFp51UQIQYIleRPMScUaQ>
- Güney, E., & Yavuz, H. (2020). Yapay zekâ ile sanatsal üretim pratiğinde sanatçının rolü ve değişen sanat olgusu. *Sanat ve Tasarım Dergisi*, 26, 415-439.
- Hertzmann, A. (2018). Can computers create art? *Arts*, 7(2), 18. <https://doi.org/10.3390/ARTS7020018>
- İçli, A. (2022). Sebeb-i teliflerin önemi ve analizlerine dair. *Korkut Ata Türkiyat Araştırmaları Dergisi*, 9, 161-192. <https://doi.org/10.51531/KORKUTATATURKIYAT.1194367>
- Kale, M., & Nur, İ. (2016). Karl Marx ve Marksist teori açısından eğitim ve toplumsal cinsiyet. *Çağ Üniversitesi Sosyal Bilimler Dergisi*, 13(1), 40-55. <https://dergipark.org.tr/tr/pub/cagsbd/issue/44635/554491>
- Kantürk, B. (2022). Yapay zekânın günümüz sanat üretimlerinde katılımcı bir aktör olarak rolü: Türkiye güncel sanatından iki örnek. *Idil*, 94, 1007-1020. <https://doi.org/10.7816/idil-11-95-02>
- Kara, S. (2017). Teknoloji ve toplumsal değişim ilişkisinin sosyal inşa kuramı bağlamında incelenmesi. *Dört Öge*, 12, 117-132. <https://dergipark.org.tr/tr/pub/dortoge/issue/40213/478855>
- Karabulut, B. (2021). Yapay zekâ bağlamında yaratıcılık ve görsel tasarımın geleceği. *Elektronik Sosyal Bilimler Dergisi*, 20(79), 1516-1539. <https://doi.org/10.17755/ESOSDER.844536>

- Karabulut, N., Karakuzu, M., & Konca, Y. (2008). Sanat eğitiminde pedagojik eleştiri yöntemleri. *Güzel Sanatlar Enstitüsü Dergisi*, 21, 87-111. <https://dergipark.org.tr/tr/pub/atanigsed/issue/2557/32955>
- Karaca, U., & Karataş, E. (2022). Yapay zekâ tarafından meydana getirilen fikri ürünlerin 5846 sayılı fikir ve sanat eserleri kanununa göre korunması. *Maltepe Üniversitesi Hukuk Fakültesi Dergisi*, 1, 17-50.
- Karagöl, A., & Kaplıanoğlu, L. (2022). Sosyal medya ve sanat ilişkisi bağlamında sanat profesyonellerinin sosyal medya kullanımı. *Uluslararası Kültürel ve Sosyal Araştırmalar Dergisi*, 8(1), 126-138. <https://doi.org/10.46442/INTJCSS.1097107>
- Karataş, L. (2023). *Mimari restorasyon bölümlerinde verilen yapı malzemesi dersine ilişkin sanal evren (metaverse) tabanlı bir öğretim tasarımı önerisi*. [Doctoral dissertation, Bursa Uludağ University]. Bursa Uludağ University Repository. <http://acikerisim.uludag.edu.tr/jspui/handle/11452/32867?locale=en>
- Kavuran, T., & Dede, B. (2014). Platon ve Aristoteles'in sanat etiği, estetik kavramı ve yansımaları. *Sanat Dergisi*, 23, 47-64. <https://dergipark.org.tr/tr/pub/atanigsfd/issue/2611/33616>
- Kayhan, B. (2021). Dijital medya ile sanatın dönüşümü: Çağdaş sanatçıların Instagram paylaşımları üzerine bir inceleme. *Akademik İncelemeler Dergisi*, 16(1), 1-25. <https://doi.org/10.17550/AKADEMIKINCELEMELER.838162>
- Kızılaslan, N., & Kozlu İsmailoğlu, D. (2021). Teknolojinin ve dijitalleşmenin geleneksel Türk sanatlarına yansımaları. *Medeniyet Sanat Dergisi*, 7(1), 105-126. <https://doi.org/10.46641/MEDENIYETSANAT.930735>
- Kırmızıgül, F. Ç. (2019). İnternet ve sosyal medyanın sanattaki etkin rolü ve buna bağlı değişen dinamikler. *Sanat ve Tasarım Dergisi*, 23, 205-221.
- Künüçen, H. H., & Samur, S. (2021). Dijital çağın gerçeklikleri: Sanal, artırılmış, karma ve genişletilmiş gerçeklikler üzerine bir değerlendirme. *Yeni Medya*, 11, 38-62. <https://doi.org/10.34189/ymd.2021.11.003>
- Kurt Kıral, M., & Paç, D. G. (2022). Sanat ve mekân ilişkisini biyomimikri üzerinden okumak: Tomás Saraceno'nun ağları. *Akademik Sanat*, 17, 138-156. <https://doi.org/10.34189/asd.2022.17.010>
- Liu, W., & Tao, F. (2022). Art definition and accelerated experience: Temporal dimension of AI artworks. *Philosophies*, 7(6), 127. <https://doi.org/10.3390/PHILOSOPHIES7060127>
- Mazzone, M., & Elgammal, A. (2019). Art, creativity, and the potential of artificial intelligence. *Arts*, 8(1), 26. <https://doi.org/10.3390/ARTS8010026>
- Mercin, L., & Alakuş, A. O. (2005). Sanat eleştirisi ve pedagojik eleştiri yönteminin incelenmesi. *Dicle Üniversitesi Ziya Gökalp Eğitim Fakültesi Dergisi*, 5, 36-46. <https://dergipark.org.tr/tr/pub/zgef/d/issue/47965/606859>
- Öğütçü, H. (2021, December 9). *Wombo Dream, yazdığınız kelimeyi yapay zekâ sayesinde bir sanat eserine dönüştürüyor*. Eğirisim. <https://egirisim.com/2021/12/09/wombo-dream-yazdiginiz-kelimeyi-yapay-zekâ-sayesinde-bir-sanat-eserine-donusturuyor/>

- Ökmen, Y. E. (2021). *Gelenekselden dijital hikâye anlatıcılığı: YouTube örneği*. [Doctoral dissertation, İstanbul University]. İstanbul University Repository.
<http://nek.istanbul.edu.tr:4444/ekos/TEZ/ET002112.pdf>
- Oksanen, A., Cvetkovic, A., Akin, N., Latikka, R., Bergdahl, J., Chen, Y., & Savela, N. (2023). Artificial intelligence in fine arts: A systematic review of empirical research. *Computers in Human Behavior: Artificial Humans*, 1(2), 100004.
<https://doi.org/10.1016/J.CHBAH.2023.100004>
- Ökse, A. T. (2021). Eski insanın duygularının arkeolojik verilere ve yazılı belgelere yansımaları. *TÜBA-AR Türkiye Bilimler Akademisi Arkeoloji Dergisi*, 29, 153–176.
<https://doi.org/10.22520/TUBAAR2021.29.008>
- Ören, Ş. (2015). Sanatın doğuşunda iletişimle aralarındaki varoluşsal birliktelik ve sanat eyleminde psikolojik iletişimin önemi. *Atatürk İletişim Dergisi*, 8, 207–226.
<https://dergipark.org.tr/tr/pub/atauniiletisim/issue/33518/373948>
- Ötügen, C. (2008). Sanat yapıtına yaklaşım biçimleri. *Sanat ve Tasarım Dergisi*, 1(2), 159–178.
<https://doi.org/10.18603/STD.46187>
- Özçelik, Ş. B. (2021). Yapay zekânın veri koruma, sorumluluk ve fikri mülkiyet açısından ortaya çıkardığı hukuki gereksinimler. *Adalet Dergisi*, 66, 87–116.
- Özdemir, Ö. (2010). *Çağdaş sanatta dijital teknolojilerden yararlanan interaktif sanat*. (Publication No: 265752) [Master's Thesis, Erciyes University]. National Thesis Center of the Council of Higher Education.
<https://tez.yok.gov.tr/UlusalTezMerkezi/tezDetay.jsp?id=W400IrfxrX8bd7zkVtZnLA&no=akeT7vyYxxPvT9kjjwoACA>
- Özselçuk, S. (2023). Dijital sanat bağlamında yapay zekâ algoritmalarının kullanımına yönelik eleştirel bir inceleme: Refik Anadol'un "Makine Hatıraları: Uzay" sergisi. *International Journal of Economic and Administrative Academic Research*, 3(1), 1–21.
<https://www.ijerdergisi.com/index.php/ijer/article/view/36>
- Öztürk Dilek, G. (2019). Yapay zekânın etik gerçekliği. *Ankara Uluslararası Sosyal Bilimler Dergisi*, 2(4), 47–59.
<https://dergipark.org.tr/tr/pub/usdad/issue/51335/642184>
- Şahin, S. (2018). Interaction with 21. Century's technologies: Art - advertisement - individual. *Journal of Arts*, 1(1), 23–30.
<https://dergipark.org.tr/en/pub/jarts/issue/39196/461234>
- Soyuer, B. (2023). Dijital değiştirilemezlik çağında sanat eseri. *Bodrum Journal of Art and Design*, 2(1), 15–27.
- Taluğ, D. Y., & Eken, B. (2023). Intersection of human creativity and artificial intelligence in visual design. *Journal of Art and Iconography*, 4(1), 19–30.
<https://doi.org/10.5152/ARTICON.2023.1256114>
- Töre, T. Ş., & Güney, E. (2022). Performans sanatı: Kültür etkileşimli dinamik bir fraksiyon. *Artvin Çoruh Üniversitesi Uluslararası Sosyal Bilimler Dergisi*, 8(2), 100–115.
<https://doi.org/10.22466/ACUSBD.1197170>
- Uğurlu, H. (2008). Teknoloji sanat ilişkisi: Günümüzde teknolojik sanatların amacı. *Uşak Üniversitesi Sosyal Bilimler Dergisi*, 1(2), 247–262.
<https://doi.org/10.12780/UUSBD27>



- Ülger, K. (2021). Sanat eleştirisi dersinin işlenmesine eleştirel bir yaklaşım. *Sanat Dergisi*, 38, 33-51. <https://doi.org/10.47571/ATAUNIGSF.D.879739>
- Ünal, A., & Kılıncı, İ. (2020). Yapay zekâ işletme yönetimi ilişkisi üzerine bir değerlendirme. *Yönetim Bilişim Sistemleri Dergisi*, 6(1), 51-78.
- Uzun, İ. (2021). Fotoğraf sanatsallığının inşasında ışık ve görsel algı ilişkisi. *Yedi*, 26, 145-160. <https://doi.org/10.17484/YEDI.823576>
- Uzun, Y., Akkuzu, B., & Kayırcı, M. (2021). Yapay zekâ'nın kültür ve sanatla olan ilişkisi [Special issue]. *Avrupa Bilim ve Teknoloji Dergisi*, (28), 753-757. <https://doi.org/10.31590/EJOSAT.1010691>
- Vargün, Ö. (2023). Teknoloji ve sanatın dönüşümü: Dijital sanat. *Journal of Arts*, 6(1), 49-54. <https://doi.org/10.31566/arts.1968>
- Winegard, E. (2019). *Dijital medya teknolojilerinin sanatın ve tasarımın yaygınlaşmasındaki yeri ve önemi*. (Publication No: 584114) [Master's Thesis, İstanbul University]. National Thesis Center of the Council of Higher Education. <https://tez.yok.gov.tr/UlusalTezMerkezi/tezDetay.jsp?id=fyT1KorexbdjX9S5GgdCAw&no=MBOEyOTBsFv7LfAA80xP0w>
- Yeşilkaya, N. (2022). Yapay zekâya dair etik sorunlar. *Şarkiyat*, 14(3), 948-963. <https://doi.org/10.26791/SARKIAT.1189864>
- Yılmaz, E. (2008). Toplumsal değişme ve sanat ilişkisi üzerine bir deneme. *Selçuk Üniversitesi Edebiyat Fakültesi Dergisi*, 20, 35-45. <https://dergipark.org.tr/tr/pub/sefad/issue/16479/172048>
- Yusa, I. M. M., Yu, Y., & Sovhyra, T. (2022). Reflections on the use of artificial intelligence in works of art. *Journal of Aesthetics, Design, and Art Management*, 2(2), 152-167. <https://doi.org/10.58982/JADAM.V2I2.334>
- Zorluel, M. (2019). Yapay zekâ ve telif hakkı. *Türkiye Barolar Birliği Dergisi*, 142, 305-356.

UHMFD “Uluslararası Hakemli Mühendislik ve Fen Bilimleri Dergisi” 2014 yılı itibariyle yayın hayatına girmiştir. Dergimizde literatüre kaynak sağlayacak nitelik ve değerinde olan yayınlara yer verilmektedir. Dergimiz uluslararası hakemli bir dergi olup, yılda ÜÇ sayı çıkarmaktadır. Dergimizin sayıları NİSAN, AĞUSTOS ve ARALIK aylarında sistem üzerinden yayımlanmaktadır. Dergimiz gerek basılı gerek de internet üzerinden ulaşılabilen bir dergidir. Dergimizde Mühendislik ve Fen Bilimleri alanı içerisinde değerlendirilebilecek her türlü yayına yer verilebilmektedir. Dergimizin baş editörleri Prof. Dr. Ashok JAMMI, Prof. Dr. Mihaela BUCIUMEANU ve Prof. Dr. Yusuf ŞAHİN olup, dergi yönetim kurulunun aldığı kararlar doğrultusunda faaliyetlerini gerçekleştirmektedir.

Gönderilen her yayın kendi alanında uzman iki hakem ya da dergi sistem editörü ile yayın kurulunun belirleyeceği iki hakem dışında atama yapacağı hakemlerin onayından geçmeli ve hakemler tarafından yayımlanabilir görüşüne sahip olmalıdır. Aynı sayı içerisinde yazarın bir yayınına yer verilir. Birden fazla hakem ve yayın kurulu onayından geçen çalışmalar sıraya alınarak ilerleyen sayılarda yayınlanır. Hiçbir yazar hakem ve yayın kurulu üyeleri üzerinde etkili değildir. Dergimizde yayımlanmak üzere sisteme yüklenen çalışmalar için yayın telif hakkı sözleşmesi istenmez. Sisteme yüklenen çalışmalar dergiye devredilmiş olarak kabul edilir. Yazar ya da yazarlar bu durumu kabul etmiş ve derginin yayın kabul şartlarına uygun hareket etmeyi teyit ederek bu sisteme dâhil olmuştur. Hiçbir şekilde yazarların itiraz hakkı bulunmaz. İtiraz hakkını kullanamaz.

Dergimiz hakem ve bilim kurullarında yer almak isteyen akademisyen ve bilim araştırmacılarının mutlaka Dr. unvanı almış ve alanında uzman olması gerekmektedir. Ayrıca bilimsel çalışmalar yapmış olması şartı aranır. Dr. ya da Uzman unvanına sahip olmayan ve alanında yayın yapmayan hiç kimse bilim, danışma ve hakem kurullarında yer alamaz. Dergi yayın kurulu derginin en üst karar ve yürütme mekanizmasını oluşturur. Yayın kurulunun aldığı her türlü karar kesin ve değiştirilemez niteliktedir. Yayın kurulu kararı olmaksızın hiçbir koşul ve şartta dergi üzerinde işlem gerçekleştirilemez ve uygulamaya gidilmez. Dergi baş editörleri hakem onayına gönderilmeyen çalışmaların dergide kabul edilip edilmeyeceğine, hakem sürecine gönderilip gönderilmeyeceğine karar verebilir. Bu karar sürecinde yayın kuruluna bilgi vermek zorunda değildir. Dergimiz bünyesinde hakem, bilim ve danışma kurulunda yer almak isteyen bilim insanlarının katılımına ancak yayın kurulu karar verebilir.

Dergimizde bazı ulusal ya da uluslararası kongrelerde yayınlanmış sözlü ve hakem onayından geçmiş çalışmalar için özel sayılar şeklinde çalışmalar da gerçekleştirilmektedir. Bu tip özel sayılar ancak anlaşma yapılan kongrelerde sunulmuş sözlü bildirimler için geçerlidir. Bu bildirimlerin mutlaka kongre bilim kurulundan onay almış hakem değerlendirmesi yapılmış olmalıdır. Hakem değerlendirmesi yapılmamış hiçbir çalışma yayına alınmaz. Yayımlanmak için gönderilen çalışmalar dergi hakem onayına gönderilir. Her iki hakemden olumlu dönüş alan çalışmalar yayına alınır. Ayrıca sözlü sunulan bildirimlerin mutlaka basılı materyali ile hakem onay raporları dergimiz yayın kuruluna ve baş editörlerine sunulmuş olmalıdır. Bu bilgi ve materyallere sahip olmayan bildirimlere dergimizde yer verilmez.

Dergimizde işlem sürecine dair bilgiler yazar ve yazarlara mail olarak dergi internet mail adresinden bildirilir. Ayrıca dergimize üye olup sisteme giriş yapan her bir yazar süreç ile ilgili bilgileri derginin üye sayfasından kendisi izleyip gelişmeleri takip edebilir. Dergimizdeki koşul ve şartlar tüm yazar ve yazarlar için aynıdır. Hiçbir yazar için bu kurallar ve koşullar değiştirilmez. Farklılık sağlanması istenemez talep edilemez. Dergimiz bünyesinde yayımlanması istenen eserlerin mutlaka derginin yayın kabul ettiği alanlardan olması şartı aranır. Bu özellikleri taşımayan hiçbir yayına dergimizde yer verilemez. Hakem sürecine dair işleyiş baş editörler kontrolünde gerçekleştirilir. Baş editörler yayının dergide hakem sürecine dair işleyişine yönelik bilgi ve karar verme yetkisine sahip bulunur. Baş editörlerin uygun bulmadığı ya da kabul etmediği bir yayın dergide sürece dâhil edilmez. Bu konuda yazar ya da yazarlar dergi ile diğer organlar üzerinde bir yükümlülük oluşturamaz. Hakem onayından geçse bile editörler ya da yayın kurulu mevcut çalışmanın yayımlanmasına olumlu görüş bildirmemesi veya makale sistemde yayına alınsa bile kurulların kararı ile iptal edilebilir. Böyle bir durumda yazar ya da yazarlar dergiye bir yaptırım uygulayamaz. Her türlü yetki tek taraflı olarak dergi yayın ve editörler kuruluna aittir. Yüksek lisans ve Doktora tezlerinden üretilen çalışmalarda mutlaka bu durum kaynakça kısmında yazar notu olarak belirtilmelidir. Dergimizde yayımlanması talep edilen ve dergi sistemine yüklenen makalelerden mutlaka etik kurul raporu ya da çalışma izni belgesi talep edilir. Bu belgelere sahip olmayan çalışmalara dergimizde yer verilmez. Etik kurul gerektirmeyen çalışmalar için herhangi bir belge talep edilmez. Ortak yazarlarda mutlaka sisteme kayıt olan ve makaleyi yöneten yazar muhatap kabul edilir. Bu nedenle sorumluluk sadece sisteme üye olup yayını yükleyen yazara aittir. Dergimiz ve yönetimi/kurulları sorumlu yazar dışında hiçbir yazarla iletişim içerisinde bulunmaz bu yönde diğer yazarlar bir talep oluşturamaz.

Dergimiz T.C. hukuk kuralları çerçevesinde “5846” sayılı Fikir ve Sanat Eserleri Kanun ve Hükümleri’ne tabi hareket eder. Ayrıca KVKK kanun kapsamında dergimiz ve yönetimi yaptırımlara uygun hareket eder. Bu kanunların gerekliliklerini yerine getirmeyen yazar ya da yazarlar hakkında dergimiz tek taraflı olarak hukuki haklarını korumaya sahiptir. İlgili kanunlar kapsamında yetkili mahkemeler İstanbul Mahkemeleridir. Dergimizde yayımlanması amacıyla gönderilen çalışmalarda, ilgili hukuk ve yayın etiği kanunlarına uygun olarak gerçekleştirilmeyen alıntılar, intihal gibi konularda yazar ya da yazarlar tek taraflı olarak sorumludur. Dergimiz basılı ve online olarak hareket eden bir yayın organıdır. Akademik alanda hazırlanan çalışmaların yer aldığı bir materyal olarak bilimsel araştırma yapan kurum ve kişilere fayda sağlamak amacıyla toplumsal hizmet sunan sosyal bir organdır. Dergimiz paralı bir dergi olmayıp, hiçbir yazara ya da yazarlara basılı materyal göndermek zorunda değildir. Dergimizde kabul edilen ve basıma hak kazanan çalışmalar dergi yayın kabul şartları ve yazım kurallarına uygun olarak mizanpaj yapılır ve sisteme yüklenir. İhtiyacı olan yazar ya da yazarlar ile okuyucular sistemden bu sayıyı indirebilir. Mizanpaj yazar tarafından örnek makale baz alınarak yapılmaktadır.

UHMFD “International Refereed Journal of Engineering and Science” was published in 2014. In our journal, articles, which meet the criteria of scientific quality and contribute to the field, are included. Our journal is an international refereed journal and it publishes THREE issues per year. Issues of our journal are published on the system in APRIL, AUGUST and DECEMBER. Our journal can be accessed both in print and online. All kinds of publications that can be evaluated in the field of Engineering and Science can be included in our journal. The chiefeditors of our journal are Prof. Dr. Ashok JAMMI, Prof. Dr. Mihaela BUCIUMEANU and Prof. Dr. Yusuf ŞAHİN and its activities are carried out in line with the decisions taken by the journal’s board of directors.

Each submitted publication must be approved by the appointed referees, other than two referees or journal system editors who are experts in their field, and two referees to be determined by the editorial board, and must have the opinion that it can be published by the referees. Only one publication of the author is included in the same issue. Studies that have gained the approval of more than one referee and editorial board are put in order and published in the following issues. No author has any influence over the referees and the editorial board members. A publication copyright agreement is not required for the manuscripts uploaded to the system for publication in our journal. Studies uploaded to the system are considered to be transferred to the journal. The authors are supposed to have accepted this situation and have been included in this system by confirming to act in accordance with the publication acceptance conditions of the journal. The authors have no right of objection in any way. They cannot exercise the right of appeal.

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