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Evaluation of Sustainable City Performances from the Perspective of Sustainable Development: A Comparison Between the EU and Turkey

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Abstract

This article aims to analyze the differences and similarities between Turkey and the European Union (EU) regarding sustainable cities from the perspective of sustainable development. The study compares the practices of both regions by addressing economic, social, and environmental dimensions. The literature review and case studies on sustainable cities in Turkey and the EU focus on the components of sustainable development. The research reveals how Turkey and the EU differ in terms of sustainable cities and in which areas they share similarities. The economic analysis considers factors such as energy use, transportation, and waste management; the social analysis evaluates factors such as community participation, quality of life, and education. The environmental analysis focuses on issues such as water management, air quality, and biodiversity.

In this study, the comparison between the EU and Turkey within the framework of sustainable cities is conducted. Indicators under the main heading of sustainable cities and communities for the post-2010 period were examined. According to the comparison, Turkey performs better than the EU average in terms of the water usage index, soil permeability, and high public transportation usage, while it lags behind in housing deprivation, municipal waste recycling, and the use of water treatment systems. These results indicate that Turkey needs to undertake much more determined efforts to create sustainable cities.

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Sürdürülebilir Kalkınma Perspektifinde Sürdürülebilir Şehir Performanslarının Değerlendirilmesi: AB ve Türkiye Karşılaştırması

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Özet

Bu makale, sürdürülebilir kalkınma perspektifinde sürdürülebilir şehirler için Türkiye ve Avrupa Birliği (AB) arasındaki farkları ve benzerlikleri analiz etmeyi amaçlamaktadır. Çalışma, ekonomik, sosyal ve çevresel boyutları ele alarak her iki bölgenin sürdürülebilir şehirler konusundaki uygulamalarını karşılaştırmaktadır. Türkiye ve AB'deki sürdürülebilir şehirler üzerine yapılan literatür taraması ve vaka çalışmaları, sürdürülebilir kalkınmanın bileşenleri üzerine odaklanmaktadır. Araştırma, Türkiye ve AB'nin sürdürülebilir şehirler konusunda nasıl farklılaştığını ve hangi alanlarda benzerlikler taşıdığını ortaya koymaktadır. Ekonomik analizde, enerji kullanımı, ulaşım ve atık yönetimi gibi unsurlar dikkate alınırken; sosyal analizde, toplum katılımı, yaşam kalitesi ve eğitim gibi faktörleri değerlendirmektedir. Çevresel analiz ise su yönetimi, hava kalitesi ve biyolojik çeşitlilik gibi konulara odaklanmaktadır.

Bu çalışmada AB ile Türkiye'nin sürdürülebilir şehirler çerçevesinde karşılaştırması yapılmıştır. Bu çerçevede 2010 sonrası dönem için sürdürülebilir şehir ve topluluklar ana başlığı altındaki göstergeler incelenmiştir. Yapılan karşılaştırmaya göre Türkiye sürdürülebilir şehir konusunda AB ortalamasından daha iyi olduğu konular, su kullanım endeksi, toprak geçirimi ve toplu ulaşımın yüksekliği konularında olurken, düşük kaldığı konular ise konut yoksunluğu, belediye atıklarının geri dönüşümü, su arıtma sistemlerinin kullanımı konusunda olmaktadır. Bu sonuçlara göre Türkiye sürdürülebilir şehirler oluşturabilmek için çok daha kararlı çalışmalar yapması gerekmektedir.

1. Sustainable Development and Sustainable Cities

Sustainable development is recognized as one of the most important global goals of the 21st century. This concept aims to balance economic growth, social development, and environmental protection. The fundamental principle of sustainable development is to meet the needs of the present generation without compromising the ability of future generations to meet their own needs (WCED, 1987). In this context, sustainable development has been widely accepted and embraced by policymakers, academics, and practitioners at both local and global levels.

Sustainable development and cities are among the most critical global issues today. Rapid urbanization, population density, and environmental problems make it necessary to manage cities sustainably. In this context, the sustainability of cities is not only important for minimizing environmental impacts but also for ensuring social equality and supporting economic growth (United Nations, 2015).

Cities play a central role in achieving sustainable development goals. Given that a large portion of the world's population lives in cities, cities are both centers of economic activities and places with significant environmental and social impacts. According to the United Nations, by 2050, about 68% of the world's population is expected to live in cities (United Nations, 2018). Therefore, the sustainability policies and practices of cities are of critical importance.

Sustainable cities aim to increase the quality of life while minimizing environmental impacts. These cities implement innovative and sustainable solutions in various areas such as energy efficiency, water management, waste management, transportation, and green spaces. Furthermore, sustainable cities promote social equity and enhance community participation (Beatley, 2012). This is an important element that emphasizes the social dimension of sustainable development.

The importance of sustainable development and cities should be considered from a broad perspective that includes economic, social, and environmental dimensions. Economically, sustainable cities promote the green economy by creating new employment opportunities and ensuring sustainable economic growth (Rydin, 2010). Socially, these cities provide healthy and safe living environments, thereby enhancing community health and welfare. Environmentally, sustainable cities aim to achieve goals such as the efficient use of natural resources, reducing greenhouse gas emissions, and conserving biodiversity.

The creation of sustainable cities is a complex and multi-dimensional process. This process requires the active participation of local governments, the private sector, non-governmental organizations, and citizens. Additionally, the successful implementation of sustainable cities necessitates an integrated approach and cooperation among different sectors. Therefore, the role of cities in achieving sustainable development goals should be addressed with a comprehensive and holistic perspective. Sustainable development is fundamentally evaluated under three main headings: economy, social life, and the environment.

The following sections of the study will first focus on the economic, social, and environmental pollution aspects, which are the fundamental components of sustainable development. Subsequently, the historical development of sustainable cities and an evaluation of Turkey and the EU will be provided. Later, a literature review will be conducted, and in the final section, indicators of sustainable cities will be graphically compared for Türkiye and the EU.

The aim of the study is to see the general situation of Turkey towards the European Union within the framework of the "2024-2030 smart cities action plan", sustainable development and sustainable cities, and to contribute to the identification of its deficiencies. The indicators to be revealed within this framework are basic indicators for sustainable cities. Improving the lagging areas in the determined indicators will be the main criteria in achieving Turkey's sustainable development goals and catching up with EU countries.

1.1 Sustainable Development and Economy

Sustainable development emphasizes the need to balance economic growth with social equity and environmental protection. In this context, the economic dimension emerges as one of the three fundamental components of sustainable development. Economic sustainability aims to use resources efficiently, ensure long-term economic growth, and guarantee the economic well-being of future generations (Pearce & Turner, 1990). Achieving economic sustainability requires that economic growth be conducted sustainably in both developed and developing countries. This can be accomplished through the efficient and renewable use of natural resources, waste reduction, and the promotion of green technologies. Additionally, economic sustainability aligns with social goals such as job creation and ensuring fairness in income distribution.

The green economy integrates environmental sustainability with economic growth within the framework of sustainable development. This economic model aims to reduce carbon emissions, increase energy efficiency, and promote the use of renewable energy sources (UNEP, 2011). Turkey is taking significant steps in this area and aligning its energy policies with the green economy. Furthermore, sustainable agricultural practices aim to ensure long-term food security by maintaining soil fertility and increasing biodiversity. Turkey seeks to minimize the environmental impacts of agricultural production by adopting sustainable agricultural policies (FAO, 2018).

Sustainable economic growth is possible by ensuring fairness in the labor market and including disadvantaged groups in the economy. Turkey supports sustainable development by developing policies for combating unemployment and promoting social inclusion in the labor market. Various programs are implemented to increase the participation of women and youth in the workforce (ILO, 2019). Industrial and innovation policies are also important for economic sustainability. Turkey is taking various measures to increase energy efficiency in industry and promote environmentally friendly technologies. Innovative approaches and R&D activities are the cornerstones of sustainable economic growth (TÜBİTAK, 2020).

For economic sustainability, Turkey needs to increase the share of renewable energy sources in the energy sector, expand sustainable agricultural practices, enhance social inclusion policies in the labor market, and improve energy efficiency in industry. Renewable energy projects such as solar, wind, and hydroelectric should be supported, and the use of fossil fuels should be reduced (Erdem, 2020). Sustainable agricultural practices are important for maintaining soil fertility and reducing environmental impacts in agricultural production. Innovative agricultural methods such as organic farming and biotechnology should be promoted (Çelik, 2019). Investments in education and skill development programs are necessary to reduce unemployment rates and increase social inclusion in the labor market. The participation of women and youth in the workforce should be encouraged (Yılmaz, 2021). Increasing energy efficiency in industry and investing in environmentally friendly technologies are key to sustainable economic growth. R&D activities and innovative projects should be supported (Kara, 2020).

1.2 Sustainable Development and Social Life

Sustainable development encompasses not only economic growth and environmental protection but also social equity and community welfare. In this context, social sustainability aims to meet the needs of all segments of society, enhance the quality of life, and ensure social justice. The social dimension of sustainable development increases the welfare of individuals and communities. Cities play a critical role in achieving social sustainability goals. Sustainable cities enhance community welfare by providing accessible and quality education, healthcare services, social services, and cultural activities for everyone. Additionally, social sustainability aims to ensure the integration of disadvantaged groups into economic and social life (Cuthill, 2010).

Social sustainability requires the integration of communities into urban planning and development processes. Policies and practices that promote community participation in social life and strengthen social capital need to be developed. To increase social welfare and ensure social equity, Turkey needs to take necessary measures to improve education and healthcare services, enhance community participation and solidarity, and increase the accessibility of social services and infrastructure (Demir, 2017).

1.3 Sustainable Development and Environment

The environmental dimension of sustainable development encompasses the conservation of natural resources, sustainable management of ecosystems, and prevention of environmental degradation. In this context, environmental sustainability, alongside economic and social sustainability, is one of the three fundamental components of sustainable development. Environmental sustainability aims to meet the needs of the current generation while ensuring that natural resources are preserved for future generations (Smith & Wilson, 2019).

Cities play a critical role in achieving environmental sustainability goals. The rapid growth and urbanization of cities put significant pressure on environmental resources. Therefore, the sustainable management of cities is an important factor in ensuring environmental sustainability. Sustainable cities aim to minimize environmental impacts by implementing innovative and sustainable solutions in areas such as energy efficiency, water management, waste management, and green spaces (Jim, 2004).

Energy efficiency is a crucial factor in environmental sustainability. Reducing energy consumption, using renewable energy sources, and implementing energy efficiency measures in cities are critical for reducing the carbon footprint. Turkey is taking significant steps in this area and conducting various projects to increase energy efficiency. Water management is another important factor in the sustainability of cities. Sustainable water management promotes the efficient use of water resources, reduces water pollution, and encourages water conservation.

Waste management is another important issue in environmental sustainability. Reducing the amount of waste, increasing recycling rates, and using environmentally friendly methods in waste management are essential characteristics of sustainable cities. In this context, municipalities have significant responsibilities.Another

important factor in ensuring environmental sustainability is green spaces and biodiversity. Green spaces improve air quality in cities, support ecosystem services, and increase community welfare. In this context, investments in green spaces and biodiversity by local governments are crucial.

2. History of Sustainable City Policies in Turkey and the EU

2.1 Sustainable Cities in Turkey

Turkey is taking significant steps towards creating sustainable cities. With its rapidly growing population and increasing urbanization rate, Turkey needs to develop innovative solutions for sustainable urban development. The policies regarding sustainable cities in Turkey are largely shaped by national development plans and strategic documents. The Eleventh Development Plan (2019-2023) is an important document that emphasizes the goals of creating sustainable cities and settlements. This plan includes key elements such as energy efficiency, environmental sustainability, and community participation (T.C. Ministry of Development, 2019).

One of the most important steps in the process of creating sustainable cities in Turkey is the integration of environmental sustainability principles into urban planning processes. In this context, various projects are being carried out in areas such as green infrastructure projects, waste management, and water management. For example, significant projects are being implemented in major cities such as Istanbul and Ankara to increase green spaces and reduce environmental pollution (Doğan, 2019).

One of the biggest challenges in creating sustainable cities in Turkey is the rapid growth and unplanned development in urban areas. This situation leads to problems such as infrastructure deficiencies and environmental pollution. Additionally, the lack of community participation and the capacity limitations of local governments make the process of creating sustainable cities more difficult (Karaman & Aksoy, 2020).

2.2 Sustainable Cities in the European Union

The European Union (EU) is a global leader in creating sustainable cities. The EU's policies on sustainable cities are shaped by the European Green Deal and the 2030 Sustainable Development Goals. The European Green Deal sets out the EU's goal of becoming a climate-neutral continent by 2050. In line with this goal, significant projects are being carried out in areas such as energy efficiency, the use of renewable energy, green transportation systems, and the circular economy (European Commission, 2019).

Successful implementations of sustainable cities in the EU include cities like Copenhagen, Amsterdam, and Stockholm. These cities serve as models with their sustainable urban development models and innovative environmental policies. For instance, Copenhagen has adopted the goal of becoming carbon-neutral by 2025 and is implementing a comprehensive climate action plan. This plan includes elements such as green energy projects, the expansion of bicycle lanes, and the construction of energy-efficient buildings (Bertoldi, 2017).

One of the most important elements in the process of creating sustainable cities in the EU is community participation and the role of local governments. In EU countries, local governments play a central role in the implementation of sustainable urban development policies. Additionally, various programs and funds managed by the European Commission support cities in achieving their sustainability goals. For example, funds like Horizon 2020 and the LIFE Program provide financial support for innovative projects (European Commission, 2020)..

3. Literature Review

There are many studies in the literature examining the economic, social, and environmental development of sustainable cities and their impact on the quality of life. One such study by Portney (2003) explores the concept of sustainable cities and their effects on economic development, the environment, and quality of life. This systematic comparison of sustainability initiatives in major U.S. cities analyzes whether cities take sustainability efforts seriously. Cities like Portland, San Francisco, and Seattle are noted for addressing economic development, the environment, and quality of life holistically. In contrast, cities such as Boston, Cleveland, and Orlando limit their sustainability efforts to specific issues like solid waste management and urban beautification. The study provides a theoretical foundation for developing sustainable cities, investigating whether sustainability initiatives are successful and why some cities emphasize these efforts more than others.

Portney (2005) examines the role of civic participation in sustainable city programs in the United States. The study states that at least 42 U.S. cities have initiated sustainable city programs over the past decade to enhance livability. Some of these programs are comprehensive, including smart growth efforts, while others focus on narrow goals such as promoting bicycle use and reducing pesticide use. The study highlights that the idea of sustainable cities emerged from grassroots organizations and relies on public participation for its existence. However, some cities

treat sustainability as an expert-driven effort, limiting public involvement. The research underscores that civic participation is crucial both in the development of sustainable city programs and as part of the programs' objectives.

Cohen (2006) examines urbanization trends in developing countries, future projections, and the main challenges for sustainability. The study notes that many urban areas have experienced dramatic growth over the past 20 years due to a combination of rapid population growth and technological-political changes. About half of the world's population lives in cities, and all population growth over the next 30 years will concentrate in urban areas. This rapid urban growth often exceeds the capacity of cities to provide adequate services to their citizens. The study emphasizes the scale of challenges for sustainable urban development, particularly in Africa.

Agudelo-Vera et al. (2011) explore the integration of resource management (RM) and urban planning (UP) for sustainable urban development (SD). The study analyzes the historical role of resource management in city development and how these two disciplines can be integrated. It highlights how energy and material management has historically shaped urban growth and how technological developments have influenced this process. The study concludes that integrating RM as a strategic element into UP is necessary for sustainable urban development. It emphasizes developing new approaches that integrate resource management and urban planning to achieve city sustainability.

Bayulken and Huisingh (2015) examine historical trends and emerging theoretical approaches for developing sustainable cities. The study discusses how spatial and urban development policies and trends have changed since the onset of industrialization in the 1800s and how these changes have led to environmental problems. Concepts such as sustainable development (SD) and ecological modernization (EM) are reviewed to respond positively to environmental concerns caused by growth policies and development strategies. The research evaluates how the evolutionary aspects and shortcomings of EM and SD concepts are used to improve urban development policies. The study concludes that creating sustainable cities requires social and environmental dimensions that do not naturally arise from technological designs and must be cultivated and sustained in specific locations.

Zhang et al. (2015) examine the concept of "regenerative sustainability" and its applicability in the construction sector. The study aims to reconceptualize the relationships between human-made and natural systems based on sustainable development and ecological modernization literature. It advocates for developing holistic and systematic approaches beyond green building practices to provide positive ecological and social benefits in the built environment. The study discusses theoretical frameworks, measurement and monitoring methods, practical implementation paths, and barriers to these approaches, proposing a new paradigm for sustainable cities.

Yigitcanlar and Dizdaroglu (2015) review the importance of ecological approaches in planning sustainable cities through a literature review. The study addresses the environmental, social, and economic challenges posed by rapid urbanization and discusses how to overcome these challenges in creating sustainable cities. The article establishes principles for the sustainable management of urban ecosystems and demonstrates how these approaches can be applied in urban planning. According to the study, ecological planning plays a fundamental role in creating sustainable cities, emphasizing the need to consider the interaction between the natural environment and human activities in this process.

De Jong et al. (2016) investigate the development of ecological cities in China and the challenges in policy implementation in this area. The study aims to explain the gap between high-level national policies and local practices using a policy network approach. Four stages of ecological city projects are developed based on the different levels of participation of various key actor groups. The analysis focuses on the relationships between local government and land developers within the national policy framework. It is noted that the central government tries to promote local government planning by collaborating with international architecture, engineering, and consultancy firms, often adopting a top-down approach. This situation makes it almost inevitable to encounter significant implementation gaps in ecological city practices. The research concludes that particular attention should be paid to the close dependency between the interests of local government actors and those of land and real estate developers.

Hu et al. (2016) compare the ecological city transformation processes of Penghu in Taiwan, Seoul in South Korea, and Tianjin in China. The study analyzes the impacts of national policies, local public authorities, citizen participation, and business activities on the development of ecological cities. The research emphasizes that Asian ecological cities aim to establish a new techno-social regime with sustainable solutions, highlighting the importance of national capacities in this process.

Bibri and Krogstie (2017) explore the social shaping dimensions of smart sustainable cities. The study analyzes the effects of the new wave of information and communication technologies (ICT) on urban sustainability, how these technologies become institutionalized, and how they intertwine with policy. The research highlights the transformative power of ICT in socio-technical and ecologically advanced societies and discusses the potential of

smart sustainable cities to achieve sustainable development goals. Bibri and Krogstie state that these cities are shaped by the integration of technological innovations and scientific knowledge into urban structures, as well as by shaping socio-cultural and political structures.

Saraç and Alptekin (2017) aim to rank Turkish provinces based on sustainable development indicators. The study evaluates the sustainable development performance of Turkish provinces between 2009 and 2013 using a set of 51 indicators encompassing economic, social, and environmental dimensions. The importance level of each variable in the indicator set is determined using the Entropy method, and the provinces' rankings are obtained using the Grey Relational Analysis technique. As a result, major cities like Istanbul, Ankara, and Izmir rank high in sustainable development, while provinces such as Bartın, Tunceli, and Bingöl rank low. The study emphasizes that these rankings can be an essential tool in formulating sustainable development policies.

Ahvenniemi et al. (2017) evaluate the similarities and differences between sustainable and smart city concepts. The study examines sixteen city assessment frameworks, including eight sustainable and eight smart city performance measurement systems. The research shows that smart city frameworks focus more on modern technologies and the concept of "smartness," while sustainable city frameworks include numerous indicators measuring environmental sustainability. It is noted that smart city frameworks lack environmental indicators and emphasize social and economic aspects more. The study suggests evaluating smart city performance using impact indicators that measure contributions to environmental, economic, and social sustainability goals, rather than just output indicators measuring the efficiency of smart solutions implementation.

Deakin and Reid (2018) examine the infrastructure of smart cities as energy-efficient and low-carbon regions for sustainable city-districts. The study analyzes smart city projects in cities such as Manchester, Amsterdam, Malmö, and Barcelona, evaluating how digital infrastructures, data management systems, and renewable energies are integrated into these regions. Focusing on the metrics of mass retrofit bids, the study highlights the performance of these city-districts in energy savings and CO2 reductions. The results show that smart cities' digital infrastructures and data management systems create sustainable growth strategies and emphasize their importance in terms of environmental, economic, and social sustainability. The study also stresses that sustainable city-districts should be evaluated as energy-efficient and low-carbon regions within the framework of social justice and that the wealth creation processes in these regions should be distributed equally.

Bibri (2018) aims to develop a theoretical, interdisciplinary, and multi-dimensional framework supporting the development of smart sustainable cities. The study explores how sustainable cities and smart cities can be better monitored, understood, analyzed, and planned as a combined model. In this context, the potential of information and communication technologies (ICT) to contribute to sustainable development goals is highlighted. Bibri emphasizes the importance of system thinking and complexity science approaches for the more effective management of complex urban systems and aims to develop a strategic planning model for future smart sustainable cities.

Machado Junior et al. (2018) analyze whether Brazilian cities want to be smart or sustainable. The study evaluates the economic, social, and environmental performance indicators of 150 Brazilian cities, revealing that city managers focus more on smart city approaches. The research examines the performance of small, medium, and large cities using a set of 21 indicators. The results show that large cities perform better overall, but small cities perform better in social indicators, which is thought to be due to citizens' closer proximity to managers in small cities.

Karvonen et al. (2019) examine the relationships between smart and sustainable cities, discussing how smart cities can make urban services and infrastructure more efficient with digital technologies but lack sufficient evidence on their ability to enhance social welfare, create fair communities, reduce resource consumption and waste production, improve environmental quality, or lower carbon emissions. The study analyzes how the social and environmental dimensions of smart cities are shaped and how these processes can be used to create fair and progressive cities. The conclusion highlights that social equity and environmental sustainability are not naturally inherent in technological designs and must be cultivated and maintained in specific places.

Ateş and Erinsel Önder (2019) discuss the evolving meaning of the 'smart city' concept and criticisms of this concept. The study emphasizes the need to produce sustainable urban solutions with the help of developing technologies in a world where urbanization rates are rapidly increasing, and resources are being rapidly depleted. The emergence of the 'smart city' concept, its shaping according to urban processes and different objectives, and the impact of components such as 'smart economy, smart people, smart governance, smart transportation, smart environment, smart living' on these processes are discussed. The study emphasizes the importance of the concept in creating sustainable cities and argues that 'smart city' approaches should be addressed with multi-dimensional and holistic strategies.

MacDonald et al. (2020) examine the job roles and competencies of municipal sustainability managers in building sustainable cities and communities. The study, based on semi-structured interviews with 26 sustainability professionals working in 25 different municipalities in Canada, investigates the qualifications, job responsibilities, and competencies used by these managers. The results show that sustainability managers take on strategic planning, change management, collaboration, and facilitative roles. Additionally, eleven critical competencies are identified, including communication, change management, multidisciplinary collaboration, interpersonal skills, sustainability knowledge, strategic thinking, information seeking, project management, future-oriented thinking, sustainability values, and systems thinking.

Çelikyay (2020) examines the role of intermediary cities in the context of sustainable development goals. The study notes that intermediary cities with populations between 50,000 and 1 million play a critical role in linking rural and urban areas. The research emphasizes that intermediary cities play important functions in many areas, such as economic development, employment, quality of life, environmental protection, and educational opportunities. The study reviews urban policies, legal regulations, and strategic documents developed for intermediary cities in Turkey in the context of sustainable development goals and aims to establish a roadmap and strategies for intermediary cities. The conclusion highlights that intermediary cities play essential roles and responsibilities in sustainable development.

Yeşildal (2020) examines the relationship between the 2030 Sustainable Development Agenda and urban development. The study notes that cities host half of the world's population and three-quarters of its economic output. Especially over the past twenty years, urban population growth has accelerated, and the environmental degradation that began in cities has reached serious levels. Therefore, the sustainable development goals set by the UN aim to control urban development and make cities more sustainable. The Sustainable Development Agenda consists of 17 main goals, and goal 11 aims to make cities and human settlements inclusive, safe, resilient, and sustainable. This goal responds to the claim that social development should start locally and indicates that urban development will be the main driver of overall development.

Dal and Özdemir (2020) examine the importance of the concept of sustainable smart cities in the 21st century. The study emphasizes the need for collecting and evaluating data in cities and producing digital solutions to problems in line with the requirements of the digital age. Sustainable smart cities aim to provide higher quality and more comfortable services by addressing macro and micro components. The authors argue that sustainable smart cities will play an essential role in improving the quality of life and that the participation of all city stakeholders is necessary for this process to succeed.

Yeşildal (2020) evaluates the relationship between Industry 4.0, innovation, and sustainable cities. The study predicts that the technical changes and socio-economic impacts of the fourth industrial revolution (Industry 4.0) and embedded technologies will grow rapidly. It is emphasized that local governments need an innovative and sustainable system solutions that incorporate a holistic approach to keep up with this transformation. The research reveals that Industry 4.0 can increase efficiency and citizen satisfaction in local governments through strategic planning, data analytics, and digital transformation. The conclusion states that local governments need to quickly adapt to the digitalization process.

Fell and Mattsson (2021) systematically review the potential of public-private partnerships (PPP) to contribute to sustainable cities in housing development projects. The study addresses the shortcomings and limitations of PPPs, particularly in terms of social justice and the exclusion of local actors. The analysis, using the Doughnut Economics (DE) model, emphasizes that PPPs should be more inclusive and equitable in the social and ecological context for sustainable cities. The research argues that PPPs need to promote the participation and inclusiveness of local actors to enhance their potential to achieve sustainable urban development.

Karabetça (2021) examines whether sustainable and resilient cities can be designed by drawing inspiration from functional solutions in nature. The study proposes that the symbiotic relationship in which every organism in nature supports one another can be applied to city designs. Using biomimicry as a research method, the study explores how the design principles of nature can be integrated into city designs. Forests' structural robustness, bioclimatic features, and functional morphologies are considered models for creating resilient cities. The conclusion scientifically proves that forests are natural and sustainable environments that can inspire city designs.

Doğaner (2022) examines the importance of creating resilient cities in Turkey for sustainable economic development. The study addresses the economic, social, and environmental dimensions of sustainable development and evaluates the impacts of natural disasters on cities. The research compares post-disaster costs with the costs of pre-disaster measures and analyzes the effects of natural disasters such as fires, floods, and earthquakes. The conclusion states that countries with high natural disaster risks, like Turkey, must make their cities resilient to achieve social and economic development and that efforts in this direction should be increased.

Gündoğdu and Aytekin (2022) examine the relationship between climate change and sustainable cities using a multi-criteria evaluation method. The study analyzes the connection between SDG 11 ("sustainable cities and communities") and SDG 13 ("climate action") using DEMATEL and PIV methods. The analysis shows that criteria such as carbon footprint, renewable energy use, and waste management play a significant role in ranking countries. The results reveal that Sweden, Uruguay, Colombia, Norway, and Brazil are leading countries. The study emphasizes the strong link between climate change and sustainable cities and suggests that this connection can guide future policy, program, and action recommendations.

Tunçay (2022) focuses on the goal of making cities and human settlements inclusive, safe, resilient, and sustainable within the framework of SDG 11. The study introduces the Sponge Cities approach developed in China and examines its applicability in Turkey. The Sponge Cities philosophy envisions integrating water into the city rather than channeling it away with canals, dams, and drains, allowing the city to absorb it. This approach involves nature-based solutions that consider the flow, quantity, and quality of water, biodiversity, and creating an aesthetic environment. Tunçay states that implementing nature-based sustainable drainage systems reduces flood risk, helps manage pollution, and creates aesthetic environments in cities. Furthermore, it is emphasized that the institutional environment in Turkey has the capacity to support this approach, although there are no examples of its implementation yet.

Partigöç (2022) examines the role of the smart city approach in sustainable urban planning processes. The study emphasizes that integrating information and communication technologies (ICT) with urban systems has become a necessity and highlights how these technologies enhance public services provided by local governments. The impact of smart city applications on urban planning processes in the context of technological innovations and the Society 5.0 concept is discussed. The results show that the smart city approach is not just about blindly advocating for the idea of creating a 'smart' city but is also a process that includes developing human capital.

4. Comparison of Sustainable City Performances between Turkey and the EU

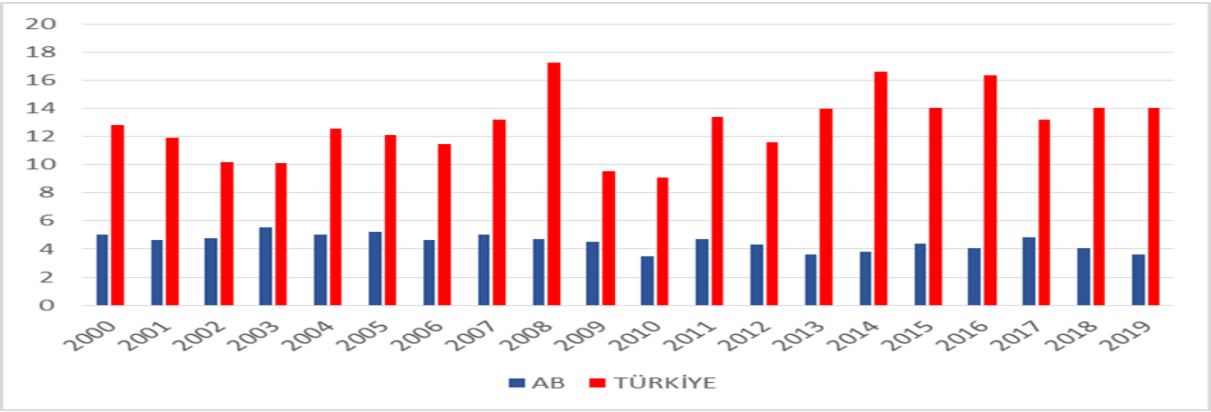
To compare the sustainable city performances of Turkey and the EU, indicators under the subheading of EU policies/Sustainable Development Indicators/Sustainable Cities and Communities from the Eurostat database were used. All data under the sustainable cities heading in the web-based data for the years 2000-2022 were utilized. To avoid inconsistencies and differences in the comparison, a single source was used, given the absence of similar indicators in different sources. While acknowledging the possibility of using different indicators for sustainable cities, indicators with quantitative data were preferred to ensure an objective comparison.

4.1 Water Usage Index

The water usage index is a significant indicator measuring how efficiently and sustainably cities use their water resources. This index evaluates various factors such as water consumption, water conservation, and water management. In sustainable cities, the water usage index plays a critical role in preserving and efficiently managing water resources. A high water usage index indicates that cities use water efficiently and achieve water conservation.

Graph 1 shows the water usage index of Turkey and the EU. According to the graph, Turkey uses water more efficiently and effectively compared to the EU. The graph covering the years 2000-2019 shows that Turkey's index score, despite fluctuations over the years, consistently remains above the EU country averages. These data indicate that Turkey's efficient and effective use of water is significantly higher than that of the EU.

Graph 1: Water Usage Index



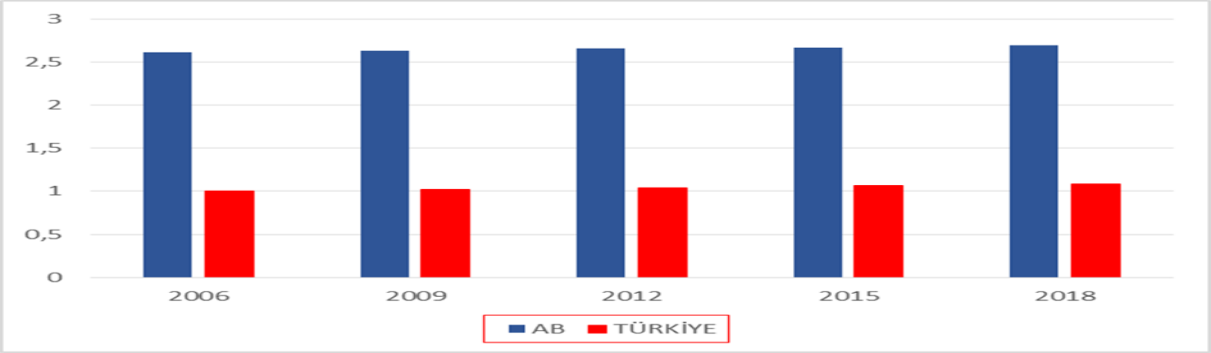
4.2 Soil Sealing Index

The soil sealing index is an indicator that shows the extent to which urban surfaces are rendered impermeable, covered by concrete, asphalt, or other hard surfaces. This index is used to assess the environmental impacts of urbanization and its effects on ecosystem services. Soil sealing disrupts the natural water cycle, lowers groundwater levels, and increases the risk of flooding. It also leads to a decrease in biodiversity and contributes to the urban heat island effect.

Sustainable cities aim to minimize soil sealing and increase green spaces. Practices such as green roofs, permeable surfaces, and green infrastructure are effective methods for reducing soil sealing. In both Turkey and the European Union, attention is paid to soil sealing in urbanization processes, and various policies and practices have been developed in this regard. Especially in major cities, urban planning policies are implemented to preserve and increase green spaces (Erdem, 2020).

Graph 2 shows the soil sealing index values. According to the data covering the years 2006-2018, Turkey's index value is significantly lower than the EU average. Although it is thought to be higher in urbanized areas, our index value is quite good compared to EU countries. Over the 12-year period, a slight increase in the index value is observed in both Turkey and EU countries. Increased urbanization, new buildings, concrete pavements, and asphalt roads continuously increase the index value. Especially with the rise of green space projects by local governments and the use of more permeable materials, this rate will further decrease.

Graph 2: Soil Sealing Index



4.3 Municipal Waste Recycling Rate

The municipal waste recycling rate is a crucial indicator for cities aiming to achieve environmental sustainability goals. This rate indicates the proportion of waste produced in cities that is recycled and reused. High recycling rates are essential for reducing waste quantities and conserving natural resources. In sustainable cities, recycling programs and waste management systems are vital for minimizing environmental impacts and efficiently using resources.

In Turkey and the European Union, various policies and practices are developed to increase the recycling rates of municipal waste. These policies include establishing waste separation systems, increasing the number of recycling facilities, and raising public awareness about recycling. Turkey is implementing several projects to increase recycling rates. Particularly in major cities, waste separation systems and recycling facilities are being expanded, and waste management processes are being improved through collaboration between municipalities and the private sector. Additionally, public awareness and education on recycling play a significant role in increasing recycling rates (Erdem, 2020).

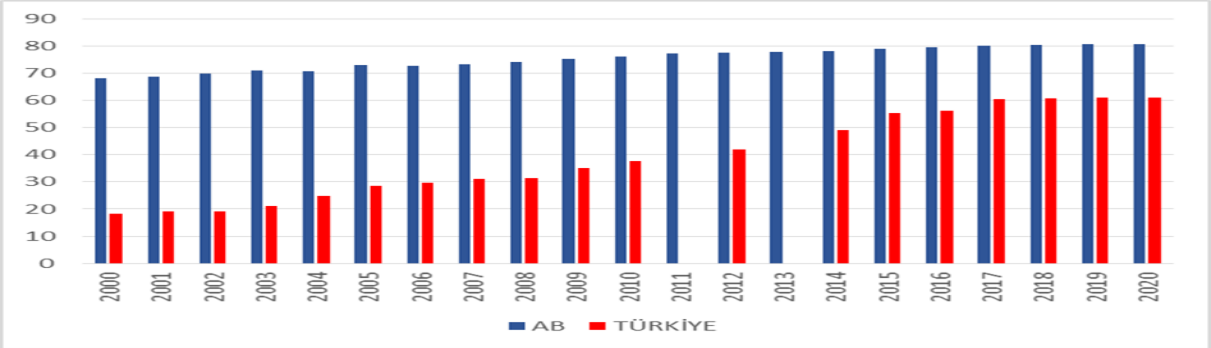
Increasing recycling rates contribute to conserving natural resources, saving energy, and reducing environmental pollution. In Turkey, recycling practices and policies are seen as a crucial step in creating sustainable cities. In this context, strengthening Turkey's recycling infrastructure and making waste management systems more efficient are key goals (Yılmaz, 2019).

Graph 3, which shows the municipal waste recycling rate, indicates how far behind Turkey is compared to EU countries. According to data from 2016-2021, while this rate continuously increases between 40-50% in EU countries, it varies between 9-12% in Turkey. Although there is an upward trend in the rate, it is still at much lower levels compared to EU countries. In this regard, it is important to conduct efforts to raise awareness among the public in addition to the efforts of local governments.

4.4 Population Connected to at Least Secondary Wastewater Treatment Systems

The population connected to at least secondary wastewater treatment systems is an important indicator for cities aiming to achieve sustainable water management and environmental protection goals. Secondary wastewater treatment uses biological processes to remove organic matter and other pollutants from water. This process is crucial for ensuring that water is cleansed of contaminants before being returned to the environment. In sustainable cities, secondary wastewater treatment systems contribute to environmental sustainability by reducing water pollution and conserving water resources.

Graph 4: Population Connected to at Least Secondary Wastewater Treatment Systems



In both Turkey and the European Union, increasing the population connected to secondary wastewater treatment systems is a key goal. To achieve this objective, various projects and policies are being implemented to strengthen and expand wastewater treatment infrastructure. In Turkey, the widespread adoption of secondary and advanced wastewater treatment systems is crucial for reducing water pollution and conserving water resources (Yılmaz, 2019). Particularly in major cities, it is necessary to increase the capacity of wastewater treatment facilities and plan these facilities to serve a larger population.

According to Graph 4, which shows the population connected to secondary wastewater treatment systems, there has been an increase in Turkey since 2010. Although the growth rate has slowed in recent years, it has approached the EU average. The data covering the period from 2000 to 2020 indicate that while Turkey's rate was about one-third of the EU average at the beginning of the period, significant progress has been made over the 20-year period, approaching the EU average in recent years. However, it is important to note that Turkey is still below the EU average, and to ensure a sustainable environment, this rate needs to exceed 80%.

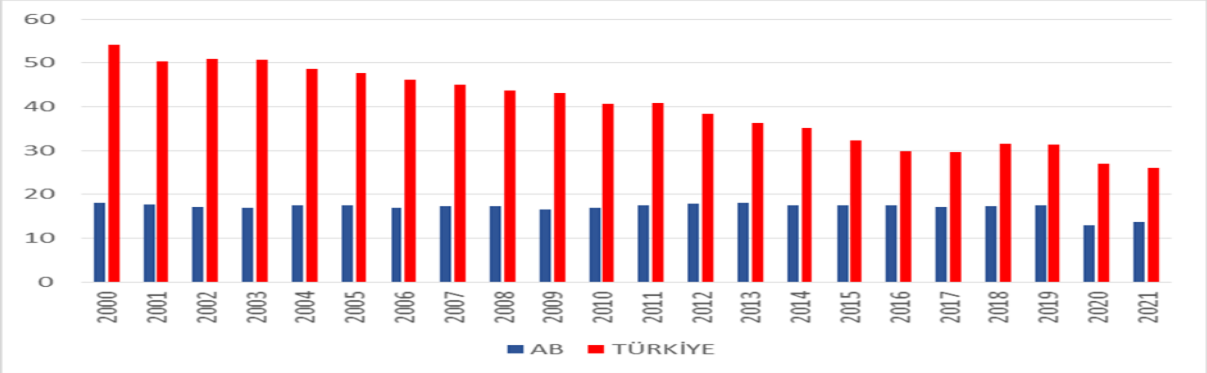
4.5 Share of Buses and Trains in Domestic Passenger Transport

Domestic passenger transport is a significant component of the transportation infrastructure of sustainable cities. The share of buses and trains plays a critical role in determining the efficiency and environmental sustainability of transportation systems. In Turkey, buses are widely used for passenger transport and hold a significant share in this sector. Bus transportation provides service to many regions with flexible route options and an extensive transportation network. Train transportation, on the other hand, is particularly preferred for long-distance travel and offers an important transportation option in regions where railway infrastructure is developed (Erkan, 2018).

In both Turkey and the European Union, sustainable transportation policies aim to integrate bus and train transportation and increase the share of these modes. Particularly, the development of railway infrastructure and the increase in train services are crucial for reducing carbon emissions and alleviating traffic congestion. In this context, Turkey aims to increase the share of railway transportation through projects such as high-speed train projects and the expansion of the railway network. High-speed train projects make rail transportation more attractive by reducing travel times between major cities. At the same time, the development of integrated transportation systems with bus transportation enhances the efficiency and accessibility of the transportation network (Yılmaz, 2019).

For sustainable cities, increasing the share of bus and train transportation supports environmental sustainability and enhances the efficiency of public transport systems. The more widespread use of buses and trains reduces individual car usage, thereby decreasing traffic congestion and air pollution. Turkey aims to create a sustainable and efficient transportation system by supporting bus and train transportation in its transportation policies (Erdem, 2020).

Graph 5: Share of Buses and Trains in Domestic Passenger Transport



Graph 5 shows the density ratio of public transportation vehicles in domestic transportation in Turkey and EU countries between 2000 and 2021. According to the graph, while the average in EU countries remained between 18-20%, it dropped to approximately 15% in the last two years. In Turkey, the density, which was around 50%, continuously decreased over the 21-year period, reaching 27%. Although this indicator was in a very good position compared to the EU countries at the beginning of the period, it approached the EU average in recent years. The rapid population growth and especially the increase in transportation by private vehicles have caused Turkey to perform worse in this indicator over the years. Although the use of rail networks, especially metros, in public transportation has increased parallel to the population growth, the significant increase in private vehicle usage has greatly complicated urban transportation. The lack of sufficient public awareness on this issue is seen as the most important factor for Turkey.

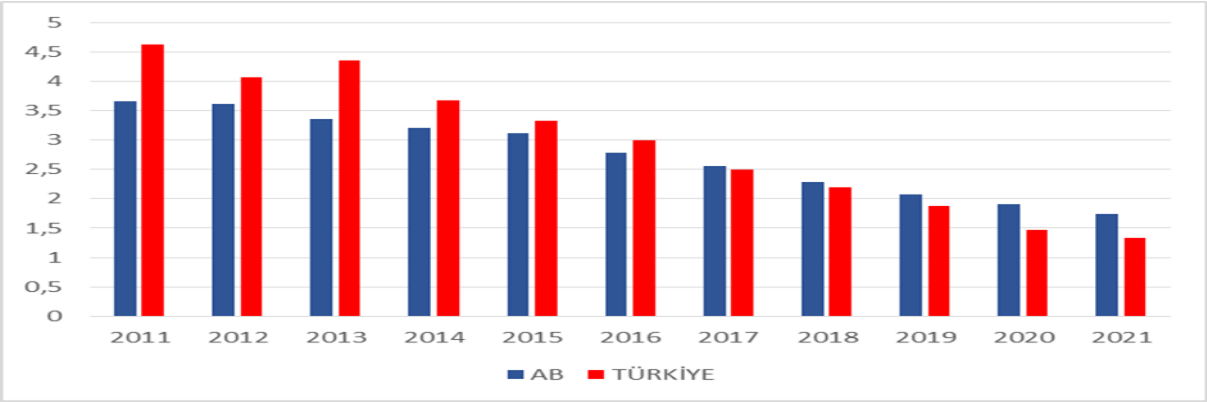
4.6 Standard Mortality Rate for Tuberculosis, HIV, and Hepatitis by Disease Type

Among the health indicators of sustainable cities, the mortality rates due to specific diseases hold significant importance. Infectious diseases such as tuberculosis, HIV, and hepatitis pose serious threats to public health, and the mortality rates associated with these diseases reflect the effectiveness of health systems and the overall health level of the community. The standard mortality rates due to tuberculosis, HIV, and hepatitis provide information on the prevalence of these diseases and the level of control achieved (Erkan, 2018).

In Turkey and the European Union, various health policies and programs are implemented to combat diseases such as tuberculosis, HIV, and hepatitis. These policies include measures for early diagnosis, access to treatment, and preventing the spread of these diseases. Particularly in the fight against HIV/AIDS, expanding testing and treatment services for risk groups and raising public awareness are among the important steps (Yılmaz, 2019).

In sustainable cities, controlling such infectious diseases and increasing access to treatment services are crucial for improving public health levels. The accessibility of healthcare services, disease management, and public health programs play a significant role in preventing the spread of these diseases.

Graph 6: Mortality Rate Due to Tuberculosis, HIV and Hepatitis

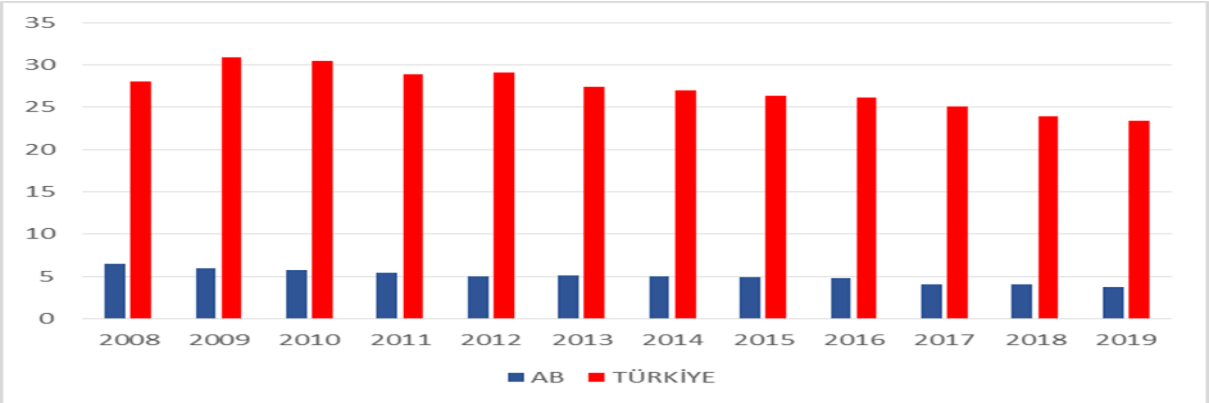


Graph 6 shows the mortality rates due to significant infectious diseases, namely tuberculosis, HIV, and hepatitis, for the period between 2011 and 2021, comparing Turkey and the EU average. It can be observed that until 2016, the mortality rates in Turkey were above the EU average, but after this year, they fell below the EU average. The indicator, which follows a negative trend throughout the period, suggests that advancements in healthcare and

increased public awareness are the primary reasons for the decrease in deaths from infectious diseases year by year. The reduction of the mortality rate from over 4.5% at the beginning of the period to below 1.5% by the end of the 10-year period indicates that significant measures were taken in this short span. However, it is also important to note that, despite these improvements, the mortality rate from infectious diseases remains high in the 21st century, indicating that further measures are still needed.

The rate of severe housing deprivation reflects the inadequacies in access to livable housing for people in urban areas based on poverty levels. This rate typically indicates that low-income groups cannot achieve adequate housing conditions and highlights the deficiencies in meeting their shelter needs. For sustainable cities, reducing severe housing deprivation and providing livable housing for everyone is of great importance. In Turkey and the European Union, housing policies and social assistance programs aim to meet the housing needs of impoverished segments of the population. Policies such as social housing projects and housing support for low-income groups are significant steps towards reducing housing deprivation. Turkey is developing various projects and implementing social housing policies to reduce housing deprivation (Yılmaz, 2019).4.7 Severe Housing Deprivation by Poverty Status

Graph 7: Rate of Severe Housing Deprivation



According to Graph 7, which shows severe housing deprivation, it can be said that the poverty situation in Turkey is at much more severe levels compared to EU countries. Although there is a downward trend in housing deprivation, there is still a significant difference when compared to the EU average. In 2009, the rate was 32%, and it decreased to 23% in 2019. However, during the same periods, the EU average fell from 6% to 4%. Severe housing deprivation, an important indicator of poverty, is likely to remain a significant issue for Turkey in the near future.

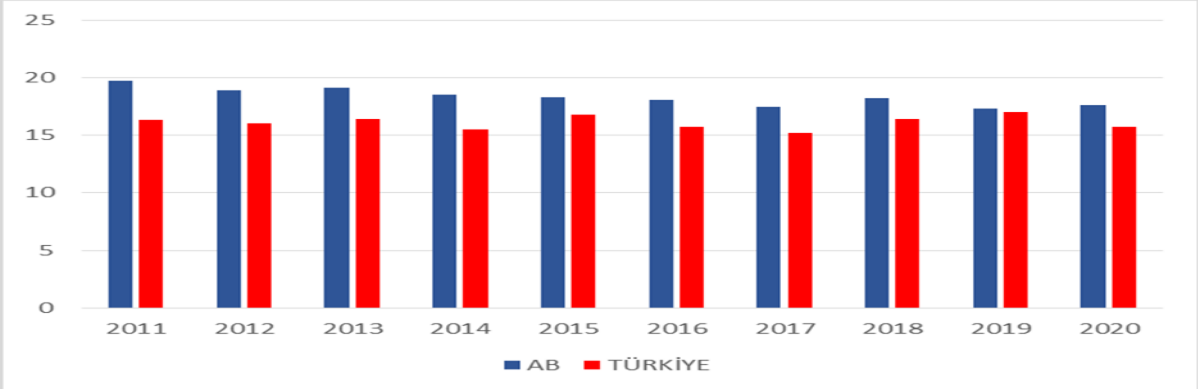
4.7 Population Living in Households and Considering Themselves Harmed by Noise, by Poverty Status

The population living in households and considering themselves harmed by noise, classified by poverty status, is one of the important social indicators of sustainable cities. Noise pollution negatively impacts individuals living in low-income and impoverished households. These populations often reside in areas with heavy traffic, industrial zones, or other high-noise sources. Noise pollution can lead to health problems, increased stress levels, and a general decrease in quality of life. Reducing noise pollution and providing quiet living spaces is crucial for sustainable cities.

In Turkey and the European Union, policies and practices have been developed to combat noise pollution. Various projects and regulations have been implemented to reduce noise pollution, particularly affecting populations living in low-income areas. Turkey collaborates with local governments to implement various noise management plans and projects to reduce the effects of noise pollution and protect public health (Yılmaz, 2019).

Graph 8 compares the rate of the population considering themselves harmed by noise for the period from 2011 to 2020 between Turkey and EU countries. According to the graph, there has been no significant change over the past 10 years; however, the rate in Turkey has remained below the EU average every year during the period. It is important to note that this rate has consistently remained above 15%, indicating a high level. The proximity of traffic and noisy production facilities to residential areas can be seen as a significant factor contributing to this issue.

Graph 8: Rate of Population Considering Themselves Harmed by Noise



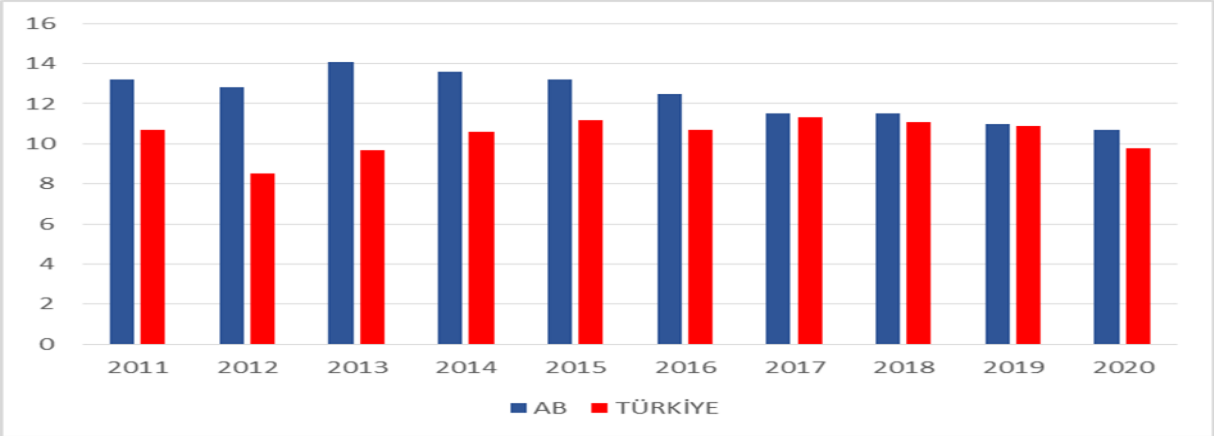
4.8 Population Reporting Crime, Violence, or Vandalism in Their Area, by Poverty Status

The population reporting crime, violence, or vandalism in their area, classified by poverty status, is a critical indicator of social sustainability and security in cities. Individuals living in low-income and impoverished areas often face higher crime rates, violence, and vandalism. This situation lowers the quality of life for residents in these areas and increases social inequalities.

For sustainable cities, reducing crime and violence rates and creating safe and livable spaces is of great importance. In Turkey and the European Union, various policies and projects have been developed to combat crime and violence. These policies aim to increase the effectiveness of security forces, encourage community participation, and implement social programs targeting the root causes of crime (Yılmaz, 2019).

Creating safe cities is also closely related to improving education, employment, and social services. Increasing educational and employment opportunities, ensuring the accessibility of social services, and strengthening community solidarity contribute to reducing crime and violence rates. In this context, Turkey aims to create social programs and employment opportunities for disadvantaged groups (Erdem, 2020).

Graph 9: Rate of Population Reporting Crime, Violence, or Vandalism in Their Area



According to Graph 9, which shows the rate of individuals reporting crime, violence, or vandalism, there was an increase in Turkey after 2012, followed by a slight decrease in recent years. In contrast, the EU average has shown a consistent downward trend since 2012. Although the rate in Turkey remained consistently above 8% throughout the period and showed some decrease in recent years, the decline rate in EU countries was higher. Throughout the period, Turkey's rate of the population reporting crime and violence has remained below the EU average. It is important to note that with appropriate legal sanctions and adjustments in the education system, these high rates of crime and violence should be significantly reduced.

5. Conclusion

This study compared the sustainable city performances of Turkey and the European Union from the perspective of sustainable development, considering economic, social, and environmental dimensions. The findings reveal that both regions face various successes and challenges in creating sustainable cities.

Turkey has performed above the EU average in water usage index and soil permeability, achieving positive results in these areas. Advanced water management and efficient water use highlight Turkey's proficiency in this field, while high soil permeability offers a significant advantage for environmental sustainability. However, Turkey lags behind the EU averages in municipal waste recycling rates and the population connected to secondary wastewater treatment systems, indicating the need to further develop its recycling infrastructure and wastewater treatment systems.

From a social sustainability perspective, issues such as severe housing deprivation and noise pollution remain significant barriers in Turkey. Housing deprivation highlights the housing problems experienced by the impoverished population, while noise pollution adversely affects the quality of life. Additionally, high crime and violence rates pose challenges to efforts in creating safe and livable cities. In this context, Turkey needs to strengthen its social policies and urban planning to address these issues.

The EU generally performs better in terms of sustainable cities, yet it shares similar challenges with Turkey in some areas. Rapid population growth and the pressures of urbanization are common problems for both regions. The EU exhibits higher performance in environmental sustainability indicators such as recycling rates and wastewater treatment systems. However, improvements are needed in soil sealing and energy efficiency.

In conclusion, while both Turkey and the EU have taken significant steps towards creating sustainable cities, more comprehensive and integrated policies are required to overcome the challenges encountered. To achieve sustainable development goals, both regions must continuously improve in economic, social, and environmental sustainability dimensions and encourage the participation of all sectors of society, alongside local governments.

As a policy recommendation, in the perspective of 2030 sustainable cities and sustainable development, Turkey is lagging behind in many areas compared to EU countries. First of all, the society needs to be educated about sustainable cities and informed about the policies to be implemented. In the next stages, local governments must first develop new policies in the fields of environmental health and transportation, and the residents must be both aware of and adapt to these policies. Another suggestion is that the central government should spread sustainability throughout the country by providing both education and financial resources to smaller-scale cities that do not have enough economic power for sustainable cities.

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