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THE SHARING ECONOMY BUSINESS MODEL OF E-SCOOTERS IN THE CONTEXT OF SUSTAINABLE TRANSPORTATION*

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Abstract

The aim of this study is to examine the integration of electric scooters (e-scooters) into sustainable transportation systems within a conceptual framework from the perspective of the sharing economy business model by addressing sharing economy applications in the context of sustainability and Sustainable Development Goals (SDGs). The study also aims to examine and discuss the ecological footprint and environmental gains of these micro-mobility tools on a scientific basis, especially by addressing the environmental sustainability dimensions of shared e-scooters. In the study the systematic review method was adopted and the relevant literature on was searched using seven academic databases with high national and international recognition and reliability: Academic Search Elite (EBSCO), ScienceDirect, SAGE Journals Online, Taylor & Francis Online, Emerald Premier, ProQuest - Science Database (ProQuest) and Google Scholar. The search was conducted using the keywords "Sharing Economy", "Sustainability", "Sustainable Development Goals", "Sustainable Transportation" and "Shared Electric Scooters" and covered the years 2008-2025 without any language restrictions. All the studies obtained were subjected to title and abstract, and then full text review, and at the end of the process, 90 academic studies that were found suitable for inclusion in the study were interpreted and integrated into the study. The results indicate that the shared usage model promoted by the sharing economy can contribute to sustainability and sustainable development by enabling more efficient and effective resource utilization. Adopting an access-based model instead of ownership-oriented approaches has been found to have the potential to generate significant environmental benefits in the context of sustainable transportation, particularly by reducing traffic congestion, lowering carbon emissions, and minimizing air pollution through shared e-scooter use. Furthermore, it is emphasized that, with appropriate infrastructure improvements and the implementation of regulatory policies, shared e-scooters could play a significant role in helping cities achieve their sustainability goals.

Keywords: Sharing Economy, Sustainability, Sustainable Development Goals, Sustainable Transportation, Shared Electric Scooter.

Jel Codes: M31, Q51, Q56.

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SÜRDÜRÜLEBİLİR ULAŞIM BAĞLAMINDA E- SKUTERLERİN PAYLAŞIM EKONOMİSİ İŞ MODELİ

Öz

Bu çalışmanın amacı paylaşım ekonomisi uygulamalarını sürdürülebilirlik ve Sürdürülebilir Kalkınma Hedefleri (SKH) bağlamında ele alarak, elektrikli skuterlerin (e-skuter) sürdürülebilir ulaşım sistemlerine entegrasyonunu paylaşım ekonomisi iş modeli perspektifinden kavramsal bir çerçevede incelemektir. Paylaşımlı e-skuterlerin özellikle çevresel sürdürülebilirlik boyutları ele alınarak, bu mikro hareketlilik araçlarının ekolojik ayak izi ve çevresel kazanımlarının bilimsel bir temelde irdelenmesi ve tartışılması da çalışmanın amaçları arasındadır. Çalışmada sistematik derleme yöntemi benimsenmiş ve ilgili literatür ulusal ve uluslararası tanınırlığı yüksek ve güvenilir olan yedi akademik veri tabanı kullanılarak taranmıştır: Academic Search Elite (EBSCO), ScienceDirect, SAGE Journals Online, Taylor & Francis Online, Emerald Premier, ProQuest – Science Database (ProQuest) ve Google Scholar. Tarama "Paylaşım Ekonomisi", "Sürdürülebilirlik", "Sürdürülebilir Kalkınma Hedefleri", "Sürdürülebilir Ulaşım" ve "Paylaşımlı Elektrikli Skuter" anahtar kelimeleri kullanılarak yapılmış ve herhangi bir dil sınırlaması olmadan 2008-2025 yıllarını kapsayacak şekilde gerçekleştirilmiştir. Elde edilen tüm araştırmalar başlık ve özet, ardından da tam metin incelemesine tabi tutulmuş süreç sonunda çalışmaya dahil edilmeye uygun bulunan 90 akademik araştırma yorumlanmış ve çalışmaya entegre edilmiştir. Sonuçlar, paylaşım ekonomisinin teşvik ettiği ortak kullanım modelinin, kaynakların daha etkin ve verimli kullanımını sağlayarak sürdürülebilirlik ve sürdürülebilir kalkınmaya katkıda bulunabileceğini göstermektedir. Mülk sahipliği yerine erişim temelli bir modelin benimsenmesi sürdürülebilir ulaşım bağlamında paylaşımlı e-skuterlerin şehirlerdeki trafik tıkanıklığını azaltma, karbon salınımını ve hava kirliliğini minimize etme gibi çevresel açıdan önemli etkiler yaratma potansiyeline sahip olduğunu ortaya koymaktadır. Ayrıca, uygun altyapı iyileştirmeleri ve düzenleyici politikaların uygulanmasıyla paylaşımlı e-skuterlerin şehirlerin sürdürülebilirlik hedeflerine ulaşmasında önemli bir rol oynayabileceği vurgulanmaktadır.

Anahtar Kelimeler: Paylaşım Ekonomisi, Sürdürülebilirlik, Sürdürülebilir Kalkınma Hedefleri, Sürdürülebilir Ulaşım, Paylaşımlı Elektrikli Skuter.

Jel Kodları: M31, Q51, Q56.

1. INTRODUCTION

In recent years, factors such as the proliferation of internet applications and smartphones, accelerating globalization and urbanization, the effects of the global economic crisis, shifts in consumption habits, and growing interest in sustainable consumption have driven the development of the sharing economy (Ranjbari et al., 2018). The global sharing economy was valued at USD 149.94 billion in 2022 and is projected to grow at a compound annual growth rate (CAGR) of 32.01%, reaching USD 793.68 billion by 2028, reflecting a significant growth trend (Absolute Reports Pvt. Ltd., 2023).

Various studies in the literature (Shaheen & Cohen, 2019; Dias et al., 2021; Riggs et al., 2021; Mitropoulos et al., 2023) show that the sharing economy promotes energy savings, reduces waste generation, and has the potential to lower greenhouse gas emissions and carbon footprints. In this context, the sharing economy is regarded as an alternative economic model aimed at reducing waste and enhancing social benefits (Sung et al., 2018). Within the sharing economy framework, the sharing of various consumer goods (such as vehicles, housing, books, and toys) is considered an approach to improving resource efficiency. For instance, platforms

like Airbnb and Roomorama facilitate access to accommodation services, while Relay Rides and Wheelz enable vehicle and bicycle sharing, and applications like Uber and Lyft provide access to transportation services, supporting the expansion and impact of the sharing economy (Malhotra & Van Alstyne, 2014). Meanwhile, technological advancements in the transportation sector have heightened the interest of large corporations, encouraging investments in sustainable transportation solutions. These investments, particularly in smart mobility applications closely tied to the environmental benefits of the sharing economy, have gained prominence. Smart mobility is defined as an integrated network system that meets individuals' transportation needs through digital and physical connectivity, with the potential to optimize the environmental sustainability impacts of the sharing economy (Battarra et al., 2018). For instance, vehicle sharing has been found to reduce individual car ownership, contributing to an estimated annual reduction of around 482,170 tons of emissions (Feng & Xu, 2025).

A review of the national literature (Bölen & Çeliker, 2021; Polat et al., 2023; Ekici et al., 2023; Topçuoğlu et al., 2022; Bildirici et al., 2024; Özden & Kurtuluş Kün, 2025) shows that sustainable transportation systems have been addressed to a limited extent from the perspectives of the sharing economy model and sustainability. Accordingly, the primary objective of this study is to explore sharing economy practices within the context of sustainability and Sustainable Development Goals (SDGs), conceptually examining the integration of electric scooters (e-scooters) into sustainable transportation systems from a sharing economy business model perspective. The study also aims to scientifically assess and discuss the ecological footprint and environmental benefits of shared e-scooters, with a particular focus on their environmental sustainability dimensions. Additionally, it seeks to address challenges hindering the safe and effective use of shared e-scooter systems (such as parking irregularities and negative effects on pedestrians) while proposing solutions. The research questions identified within this framework are as follows:

1. What are the impacts of sharing economy practices on environmental sustainability?
2. What are the potential contributions and limiting factors of the sharing economy model in achieving SDGs?
3. What are the effects of the sharing economy model on reducing carbon dioxide (CO_2) emissions and enhancing energy efficiency?
4. What are the impacts of sustainable transportation systems, viewed from a sharing economy perspective, on urbanization processes and urban planning?

5. How can the effects of shared e-scooters and other transportation modes on urban mobility and traffic regulation be evaluated?
6. What are the impacts of e-scooter usage on urban traffic flow and air quality?
7. How can the parking behaviors of e-scooter users be assessed in terms of their effects on pedestrian mobility and safety?

The preparation of this study began with defining the research problem, followed by a systematic analysis of existing academic studies on the topic. Seven widely recognized and reliable academic databases were utilized: Academic Search Elite (EBSCO), ScienceDirect, SAGE Journals Online, Taylor & Francis Online, Emerald Premier, ProQuest – Science Database, and Google Scholar. The literature review employed key concepts such as the sharing economy, sustainability, sustainable development, sustainable transportation, and shared electric scooters. Given the centrality of the sharing economy in this research, it was included in all searches. However, while the literature includes related subcategories and synonyms (such as peer-to-peer rental markets, crowd-based capitalism, on-demand economy, access-based consumption, and collaborative consumption), their limited impact on search results led to their exclusion from this study.

The literature review spans academic studies published between 2008 and 2025, a period marked by significant growth and notable developments in the literature on the sharing economy and sustainable transportation systems. The year 2008 is considered a critical threshold due to the global financial crisis, which prompted individuals to reassess consumption patterns (Faraji et al., 2023), and the subsequent rise of sharing economy values in academic literature. The inclusion of 2025 ensures the incorporation of the most recent findings. The search initially targeted article titles and abstracts, expanding to full-text searches when results were insufficient. This systematic process identified 90 academic articles suitable for inclusion in the study.

The second section of the study summarizes key approaches in the relevant literature, presenting perspectives and findings from various researchers. Subsequently, the conceptual framework of the sharing economy is explored in detail from the perspectives of sustainability and SDGs. The third section evaluates shared e-scooter systems as a critical component of sustainable urban transportation from a sustainability perspective. The results and recommendations section summarizes the study's key findings, outlines its theoretical and practical contributions, and emphasizes the role of shared e-scooter systems in sustainable transportation. It also discusses

the importance of infrastructure improvements and regulatory policies to enhance the effectiveness of these systems, offering suggestions for future research.

2. LITERATURE REVIEW

Numerous studies on the sharing economy (Boar et al., 2020; Yin et al., 2021; Dabbous & Tarhini, 2021; Lai & Ho, 2020; Hu et al., 2019) have highlighted its potential contributions and limitations in terms of sustainability and SDGs. While some of the literature supports the positive environmental impacts of sharing practices, certain sharing economy applications have been found to fall short of improving environmental performance. For instance, Heinrichs (2013) examines the potential effects of the sharing economy on environmental, economic, and social sustainability, suggesting that it offers a new pathway for sustainability, with interdisciplinary sustainability science playing a role in supporting and shaping this process.

Hasan and Birgach (2016) argue that consumers' growing inclination toward the sharing economy and their interest in economically and environmentally viable alternatives are key drivers of success in business models, underscoring its potential as a sustainable economic model.

Gössling and Hall (2019) conceptualize the structure and evolution of the sharing economy, drawing attention to sustainability dimensions (such as ownership, participation, control, and profit distribution), and asserting its potential to contribute to SDGs.

Boar et al. (2020) emphasize the positive impacts of the sharing economy on sustainability and SDGs, arguing that it significantly contributes to the realization of all SDGs. In this context, the sharing economy is shown to benefit areas such as improving societal well-being, promoting economic growth, protecting the environment, conserving natural resources, reducing energy consumption, and lowering emissions. For instance, a 2014 environmental study found that Airbnb offers significant environmental advantages over traditional hotel stays (including up to an 89% reduction in greenhouse gas emissions, 48% in water use, 32% in waste production, and 78% in energy savings) (Dabija et al., 2023).

Yin et al. (2021) analyzing cross-sectional data from 165 countries, found a positive correlation between a high level of sharing economy activity and environmental performance, with reductions in CO_2 emissions and contributions to sustainability. They identified co-variables (such as broadband access, urbanization, and high education levels) as positively influencing the environmental performance of the sharing economy. In producer countries, high sharing economy levels, coupled with significant urbanization, were associated with lower CO_2

emissions and improved environmental performance, supporting the notion that the sharing economy generally contributes positively to sustainability.

Dabbous and Tarhini (2021) investigate the potential impacts of the sharing economy on sustainable economic development and energy efficiency, concluding that it has the capacity to enhance energy efficiency and promote sustainable development. Similarly, Karobliene and Pilinkiene (2021) explore the relationship between the sharing economy and SDGs, highlighting its positive impact on national economic sustainability.

Lin and Zhai (2023) examine the role of user adoption of the sharing economy in energy efficiency, demonstrating its potential to promote environmental sustainability, with energy efficiency being a key factor in users' behavioral intentions.

Pérez-Pérez et al. (2021) conclude that the sharing economy can contribute to SDG 11 (sustainable cities and communities) by enhancing mobility, reducing negative environmental impacts, and decreasing personal vehicle ownership.

Song and Hua (2024) analyze the role of carbon taxation in improving natural resource efficiency in BRICS countries from 1991 to 2022, finding that sustainability-focused strategic regulations strengthen stakeholder relationships and support the development of a green economy.

However, some studies indicate that certain sharing economy applications do not improve environmental performance. For instance, Czepkiewicz et al. (2018) found that while Airbnb reduces accommodation costs, it increases travelers' carbon footprints due to additional energy consumption and material use, highlighting the need for new regulatory frameworks as the sharing economy grows. Protecting users and businesses, ensuring fair competition, and supporting environmental sustainability are critical for its effective and healthy operation.

Lai and Ho (2020) explore the sharing economy's potential and limitations in combating environmental degradation and overconsumption from a social sciences perspective, noting that consumers unwilling to voluntarily adopt an eco-friendly culture limit its ability to reduce unnecessary consumption.

Hu et al. (2019) argue that the sharing economy system can yield effective green outcomes only when integrated with corporate social responsibility practices.

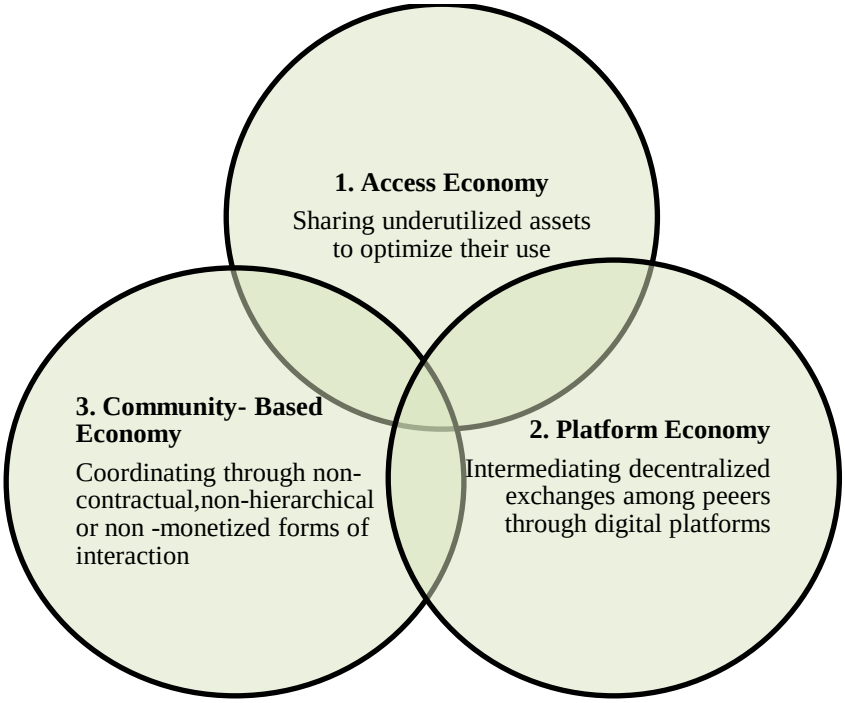
Tussyadiah and Pesonen (2016) suggest that the expansion of the accommodation and transportation sectors through the sharing economy offers affordable options but increases environmental pressure due to a significant rise in travel volume.

James et al. (2019) investigate the impacts of shared e-scooter use on pedestrians and parking behaviors, finding that 16% of e-scooters are improperly parked and 6% obstruct pedestrian rights-of-way.

2.1. Sharing Economy

Emerging in the 2000s, the sharing economy represents a convergence of economic models focusing on evolving production and consumption habits and interactions between producers and consumers (Pérez-Pérez et al., 2021). It encompasses a broad range of applications, activities, and industries, including both for-profit and non-profit initiatives (Laukkanen & Tura, 2020). While certain characteristics are commonly attributed to the sharing economy, no universally accepted definition exists (Mont et al., 2020). One definition describes it as an ecosystem that uses online platforms to provide temporary access to underutilized resources through trust-based peer-to-peer networks, reducing transaction costs (Boar et al., 2020). Some authors limit the sharing economy to activities providing temporary access (such as sharing, lending, borrowing, and renting), while others include permanent transactions like the exchange, donation, sale, and purchase of used goods (Encarnación et al., 2024). Hamari et al. (2016) define it as an activity aimed at sharing goods and services through community-based online platforms, overlapping significantly with concepts like collaborative economy, collaborative consumption, access economy, platform economy, and community-based economy (Hossain, 2020). Acquire et al. (2017) conceptualize the sharing economy through three core components: (1) access economy, (2) platform economy and (3) community-based economy (see Figure 1).

Figure 1. Three Organizing Cores of the Sharing Economy.



Source. Acquire et al. (2017)

1. Access Economy: This emerges as companies increasingly shift from offering products to providing services, shaped by concepts such as product-service systems, servitization, and functional business models (Mont, 2002). The nature of interactions between service providers and customers is a key determinant of the long-term success of service platforms. In the sharing economy, sustainable success hinges on balancing the acquisition, retention, and reacquisition of profitable service providers and customer bases (Kumar et al., 2018). Various consumer goods (such as cars, housing, luxury clothing, and household appliances) are now used through sharing-based models rather than purchased (Acquire et al., 2017). Leading platforms like Airbnb and Blablacar connect users with housing and vehicle owners, optimizing the use of durable goods and increasing access to high-cost assets, thereby contributing to the environmental and social goals of the access economy (Eckhardt & Bardhi, 2016).

2. Platform Economy: This constitutes the second component of the sharing economy. In contemporary applied research, the term "platform" is often linked to "ecosystem," establishing a strong connection between the two. Digital platforms are regarded as dominant structures organizing participants and creative processes within ecosystems (Gawer, 2014). The platform economy is defined as a set of initiatives facilitating decentralized peer-to-peer exchanges through digital platforms (Srnicek, 2016). Platforms externalize much of the production process to individuals via peer-to-peer interactions, leveraging digital technologies to secure and

monitor transactions remotely (Acquire et al., 2017). These technologies offer new opportunities for value creation, enabling systematic large-scale data collection and the formation of complex market organizations (Zander et al., 2025). By transforming market dynamics and fostering competition, platforms (supported by large-scale venture capital investments, scalability potential, and strong network effects) have paved the way for next-generation tech giants like Airbnb, Uber, and Blablacar (Srnicek, 2016).

3. Community-Based Economy: This constitutes the third component of the sharing economy. Conceptualizing community not as geographically based organizations but as institutional logics fostering meaningful and emotional relationships based on shared experiences and interests provides a useful framework for understanding modern virtual and technology-based communities. The rise of widespread, low-cost communication technologies like the internet and wireless networks has enabled group participation and frequent interaction within large networks sharing common goals or interests (Marquis et al., 2011). The primary aim of community-based economy initiatives is not to maximize economic value but to contribute to a community project, build social bonds, promote values, or achieve a social mission through collective efforts (Acquire et al., 2017).

While the concept of sharing is as old as human history, the “sharing economy” phenomenon has evolved as a significant part of digital transformation with the widespread adoption of the internet. The integration of information and communication technologies into daily life has transcended the boundaries of traditional sharing practices, enabling the emergence of scalable sharing economies. Individuals have shown increasing interest in the collaborative use of goods and services over purchasing and ownership (Pouri & Hilty, 2018). Particularly following the 2008 global financial crisis, people began reevaluating consumption patterns and redefining the value of sharing (Faraji et al., 2023). In this context, the sharing economy has emerged as a paradigm prioritizing access over ownership, facilitating more efficient resource use through the convergence of information, marketing, and technology (Zhu et al., 2023). It also promotes innovative business models, sustainable growth, and energy efficiency (Dabbous & Tarhini, 2021). The sharing economy aims to address societal issues such as overconsumption, environmental pollution, and poverty through collaborative consumption (Jung et al., 2021). It offers consumers greater choice and control, enabling them to sustain their lifestyles cost-effectively without ownership (Rakowska & Talouni, 2024). Alternatively, it provides a business model that facilitates sharing through online platforms based on supply and demand, offering opportunities to share idle resources (Chomachaei et al., 2024). For instance, platforms

like Uber and Airbnb have rapidly globalized the sharing economy business model (Zhu & Liu, 2021). These companies represent both business-to-consumer (B2C) and consumer-to-consumer (C2C) models, driving significant transformations in traditional hospitality and taxi industries. Airbnb's inception traces back to Joe Gebbia and Brian Chesky's idea of renting out unused space in their San Francisco home (Sung et al., 2018). The platform enables local residents to utilize idle housing resources more effectively and offer them to potential customers. Richardson (2015) identifies three key features of Airbnb as a leading sharing economy representative:

(i) Airbnb provides idle housing resources through an online platform, cost-effectively facilitating connections between potential hosts and guests via digital mediation

(ii) the platform offers a peer-to-peer service model, where Airbnb users can act as both guests and hosts, and in a broader sense, hosts can use the platform as guests when traveling

(iii) Airbnb provides access-focused services rather than ownership, granting users temporary access to specific housing resources or services for a defined period.

However, Airbnb's rapid growth and widespread adoption have raised various socioeconomic concerns. Its expansion has contributed to rising rental prices and reduced housing supply in major cities. Similarly, in Berlin, Airbnb's impact on the housing market has increased living costs for locals, negatively affecting their quality of life (Nieuwland & Van Melik, 2018). Thus, the economic and social dynamics created by Airbnb in cities extend beyond individual gains and tourist experiences, necessitating comprehensive evaluations in the contexts of housing markets, neighborhood transformation, and social sustainability.

2.2. Sustainability and Sustainable Development Goals (SDGs) from the Sharing Economy Framework

The rapidly growing global population is placing increasing pressure on natural resources, environmental systems, and economic activities. This situation lays the groundwork for various social and environmental challenges that threaten future quality of life and economic growth (Tu et al., 2023). The negative impacts of human activities on the planet and environment over centuries have led to severe consequences, including pollution, climate change, transportation issues, and resource scarcity (Meng et al., 2020). In response to this critical scenario, the United Nations (UN) 2030 Agenda and rising global awareness (amid increasing natural disasters and widespread poverty) underscore the urgent need for innovative approaches to build a sustainable future, both environmentally and socially. Among the concepts emerging as

potential solutions in this pursuit of sustainability is the sharing economy, initially defined as digital platforms facilitating exchanges between non-professional individuals (Öberg, 2024).

The sharing economy is increasingly evaluated in close relation to sustainability. This relationship is typically framed in three main ways: first, as an economic opportunity; second, as a means to promote more sustainable consumption; and third, as a pathway toward a fair and sustainable economy (Martin, 2016). This framework highlights that the sharing economy not only provides economic benefits but also contributes to environmental and social sustainability principles, suggesting it could play a significant role in achieving SDGs.

At a macro level, sustainability refers to the uninterrupted existence of all life forms, while at a micro level, it is examined by scientists considering various elements (Zhang et al., 2024). Broadly, sustainability is addressed across three core dimensions: environmental, social, and economic (Chavalittumrong & Speece, 2022). The environmental dimension aims to enhance resource efficiency, promote responsible resource use, reduce environmental harm and emissions, and improve ecological well-being. The social dimension focuses on protecting health and safety, ensuring legal compliance, respecting employee and stakeholder rights, adhering to ethical principles, mitigating negative impacts, and promoting social welfare. The economic dimension concentrates on increasing cost efficiency, boosting profit margins, ensuring operational stability, and fostering economic prosperity (Boar et al., 2020). These dimensions represent interconnected elements that must be balanced to achieve sustainability.

The complexity of defining sustainability is frequently emphasized by researchers. Nevertheless, the most widely accepted definition is based on the principle of meeting the needs of the present generation without compromising the ability of future generations to meet their own needs (Louis & Lombart, 2024). Introduced in 1987 by the World Commission on Environment and Development and known as the Brundtland definition, this concept marked a paradigm shift in thinking about sustainable development. In this context, sustainability is also regarded as a capability enabling the realization of sustainable development (Pouri & Hilty, 2018), which is seen as a reflection of ecological modernization (Gössling & Michael Hall, 2019). Accordingly, on September 27, 2015, the UN Sustainable Development Summit in New York unanimously adopted the SDGs. This comprehensive framework, which encompasses 17 key objectives such as sustainable cities, combating drought, protecting biodiversity, and combating climate change, is presented in detail in Figure 2 (Republic of Turkey Ministry of Foreign Affairs, 2022).

Figure 2. Sustainable Development Goals (SDGs)

Source. United Nations (UN), 2015, https://sdgs.un.org/ goals

Pérez-Pérez et al. (2021) confirm that the sharing economy model positively impacts the realization of the UN SDGs. Their study identifies positive effects in areas such as ending poverty, ending hunger, improving health and quality of life, achieving gender equality, promoting decent work and economic growth, advancing industry, infrastructure, and innovation, fostering sustainable cities and communities, encouraging responsible consumption and production, and supporting peace, justice, and strong institutions. However, no positive impact was observed on the goal of life on land.

Chang and Fang (2023) highlight the growing significance of the sharing economy in the literature, examining its impact on sustainable development in the Chinese context. Using a nonlinear autoregressive distributed lag (NARDL) model, their analysis shows that sharing economy users and its value positively influence China's sustainable development. Additionally, foreign direct investment (FDI), renewable energy production, and consumption are found to contribute positively to sustainability.

Tu et al. (2023) emphasize the global importance of the sharing economy's contribution to sustainable development. Studies in emerging economies, such as Brazil, China, India, Mexico, Indonesia, Russia, and Turkey, show that practices like corporate social responsibility, eco-design, supplier green management, internal green management, and customer green management enhance sustainable development through the sharing economy.

A comprehensive literature review by Akande et al. (2020) analyzing 22 quantitative studies, aims to identify the key drivers of the sharing economy. The findings affirm its persistence as a long-term social phenomenon, with cities and communities playing a crucial role in supporting sustainable development.

2.3. Sustainable Transportation

Transportation is a fundamental need for human societies, yet its significant expansion in recent years has encountered substantial environmental challenges (Heidari et al., 2023). With the global population exceeding 8 billion and projected to reach 9.7 billion by 2050—approximately 70% of whom are expected to live in urban areas—transportation demand is rising, exacerbating existing environmental concerns (García-Olivares et al., 2018). The transportation sector currently accounts for about 25% of global carbon dioxide emissions, with energy consumption and pollution levels increasing at a rate surpassing other sectors (Heidari et al., 2023). Consequently, it is recognized as a primary contributor to greenhouse gas emissions (Neves et al., 2024). Given the average private vehicle usage rate of 8% in North America and Western Europe, vehicle-sharing applications hold significant potential for reducing greenhouse gas emissions. Research in North America indicates that such applications could reduce per capita annual greenhouse gas emissions by an average of 0.84 tons (Zhu & Liu, 2021). Similarly, Eckelman and Kalmykova (2023) support this finding, examining the sharing economy's impacts on physical resource use and emissions while exploring transformations in the supply processes of goods and services. Their results suggest that, particularly in urban areas with widespread vehicle sharing, reductions in emissions and traffic density can yield indirect health benefits. This emissions reduction could lower ozone levels (a key component of vehicle emissions), improving urban air quality. Furthermore, alleviating traffic congestion could enhance pedestrian and cyclist safety, reduce urban noise levels, and decrease road maintenance costs.

However, vehicle-sharing systems alone are insufficient to form the foundation of a sustainable transportation system, necessitating long-term, comprehensive strategies (Zhao et al., 2020). The physical and mental health of urban residents is significantly affected by factors such as air and noise pollution, traffic accidents, congestion, and transportation-related stress (Chakhtoura & Pojani, 2016). Addressing these negative effects and improving urban quality of life require transportation planning grounded in sustainability principles (Zietsman, 2011).

Ultimately, sustainable transportation aims to meet current needs without jeopardizing future systems, enhancing energy efficiency, and minimizing waste production (Singh et al., 2020). These systems support environmental, social, and economic well-being, contributing to sustainability goals while promoting economic development through balanced, high-quality transportation options (Mahdinia et al., 2018; Kumar & Anbanandam, 2018). Micro-mobility solutions, particularly for short-distance travel, have the potential to reduce reliance on traditional transportation modes. A deeper understanding of demand dynamics, travel purposes, preferences among transportation types, and environmental impacts is critical for shaping future urban transportation policies (Wan & Bendavid, 2024). Implementing effective sustainable transportation policies is thus vital for reducing environmental degradation and enhancing urban quality of life.

2.3.1. The Role of Shared E-scooters in Sustainable Transportation

As cities strive to accommodate rapidly growing populations, the need for transportation systems to serve more people has become increasingly critical. Currently, over half the world's population resides in urban areas, a proportion expected to rise to two-thirds by 2050. In response to this growing mobility demand, various innovative transportation concepts have emerged (Zarif et al., 2019). One such development is shared mobility, a rapidly expanding sector encompassing services like car and bicycle sharing. Consequently, cities are reevaluating transportation systems, promoting cycling, e-scooters, and pedestrian travel to reduce traffic congestion and mitigate the negative effects of individual motorized vehicle use (Gössling, 2020). Technological advancements and growing interest from large-scale businesses in the transportation sector have prompted many cities to invest in smart mobility. While defined variably, smart mobility fundamentally refers to an integrated network system meeting individuals' transportation needs through digital and physical connectivity (Battarra et al., 2018). Its key attributes (flexibility, efficiency, integration, sustainability, safety, social benefits, automation, connectivity, accessibility, and user experience) closely align with shared e-scooter systems (Dias et al., 2021).

E-scooter sharing systems were first introduced in 2017 in the United States, with Bird launching the initial dockless service in Santa Monica, California. By 2018, e-scooters surpassed bicycles as the preferred vehicle for dockless users. In 2019, shared e-scooter trips doubled compared to 2018, accounting for two-thirds of all shared micro-mobility trips in the United States (Mitropoulos et al., 2023). Empirical data indicate that in many U.S. cities, a significant proportion of people prefer shared e-scooters over cars, suggesting that they could

be an effective strategy for reducing car dependency (Wang et al., 2023). In Turkey, the first e-scooter initiative began in 2019 with Martı entering Istanbul's traffic. Its expansion to other cities and popularity among youth have fueled growing interest in the e-scooter sector. The leading e-scooter brands in Turkey (Martı, Binbin, and Link) have collectively attracted 4.4 million users. The sector is projected to grow by 80% by 2025, reaching a value of USD 38.6 billion (Özeltürkay et al., 2023).

Today, e-scooters are regarded as a vital component of modern smart transportation applications within the sharing economy and sustainability frameworks. Largely technology-driven, these applications aim to make transportation more efficient, eco-friendly, and accessible (Bozkurt et al., 2021), offering potential positive impacts on the environment and transportation. Similarly, Shaheen and Cohen (2019) assert that shared e-scooter systems have beneficial effects on both the environment and transportation, including reduced greenhouse gas emissions, decreased car use, and economic development. Another key advantage of e-scooters is their minimal physical space requirement compared to cars, significantly reducing the need for storage and parking areas (Riggs et al., 2021).

However, the widespread adoption of e-scooters has also introduced challenges. Issues such as parking difficulties, obstruction of pedestrian movement, and the need to reorganize sidewalk spaces are frequently discussed in the literature (James et al., 2019; Wang et al., 2023; Polat et al., 2023). Critics argue that e-scooters left haphazardly in cities create an unsightly appearance and impede pedestrian access. Numerous news reports and social media posts support this claim with images of e-scooters abandoned on street corners, blocking building entrances, or overturned on sidewalks (Fang et al., 2018). Moreover, improperly parked e-scooters can restrict the movement of pedestrians, particularly those using wheelchairs, creating unexpected obstacles (Brown et al., 2020). Thus, effectively regulating e-scooter use in cities requires policies and practices prioritizing efficient parking management, infrastructure adjustments, safety measures, user behavior guidance, and regulatory compliance.

3. DISCUSSION AND CONCLUSION

This study has examined sharing economy practices within the framework of sustainability and SDGs, exploring the integration of e-scooters into sustainable transportation systems from the perspective of the sharing economy business model within a conceptual framework. To this end, a literature review encompassing academic studies from 2008 to 2025 was conducted across seven nationally and internationally recognized academic databases, with 90 relevant

studies systematically analyzed. The findings, along with the perspectives of various researchers, have been synthesized and presented in the study, subsequently subjected to in-depth analysis, interpreted, and integrated into the research.

The literature review provides the following insights and findings regarding the research questions addressed in this study:

Heinrichs (2013) and Hasan and Birgach (2016) suggest that the sharing economy has the potential to offer a new perspective on sustainability and can be regarded as a sustainable economic model. Similarly, Gössling and Hall (2019) emphasize its potential to significantly contribute to SDGs. Khachaturyan and Klicheva (2025) assert that the sharing economy positively impacts sustainable development across all economic segments, though its effect on energy efficiency is more pronounced in higher segments. These findings are significant for understanding the sharing economy's contribution to SDGs and indicate that its impacts may vary across economic segments.

Ahmad et al. (2024) show that growth in the sharing economy supports long-term sustainable development, with technological innovations playing a key role in advancing sustainability in both the short and long term. Zhang et al. (2023) find that an increase in sharing economy users, coupled with reduced technology use, enables more efficient energy resource utilization, enhancing energy efficiency. They also note that the economic value of the sharing economy correlates positively with energy efficiency as technology use decreases. Additionally, rising inflation, population growth, and employment rates increase financial resources; however, the use of efficient technologies and skilled human resources positively impacts energy efficiency. The study further shows a positive relationship between the growth in sharing economy users and economic value with sustainable economic development, promoting resource efficiency and economic activity to support sustainable development. Ye et al. (2023) identify a positive correlation between the sharing economy's economic value, population growth, urbanization, and industrialization with sustainable economic development (SED), concluding that these relationships enhance sustainable development by promoting efficient energy use. These perspectives and findings are supported by various studies in the literature across different contexts (Boar et al., 2020; Karobliene & Pilinkiene, 2021; Pérez-Pérez et al., 2021; Yin et al., 2021).

Guo and Zhang (2021) show that shared e-scooters can play a significant role in the sustainability of urban transportation. Their study offers recommendations for regulations and planning strategies to enhance the effectiveness of shared e-scooter programs, making them

more sustainable transportation solutions. The environmental benefits (particularly in reducing traffic congestion, noise, and emissions) are highlighted as critical. Fuady et al. (2025) argue that micro-mobility can significantly reduce energy consumption, CO_2 emissions, and individual vehicle use, achievable through effective integration into urban transportation systems. They suggest that investments in micro-mobility infrastructure (such as in Vienna) are strategically vital for achieving long-term sustainability goals. A comparative analysis by Zhang et al. (2024) in Binjiang, Wucheng, and Xiangshan, China, examines the carbon emission reduction potential of dockless shared bicycles and e-bikes, finding that over one week, shared bicycles reduced CO_2 emissions by 41.51 tons and e-bikes by 31.84 tons.

Alongside these positive impacts, the literature highlights challenges in implementing e-scooter systems (including barriers to safe and effective use, parking issues, and negative effects on pedestrians) (James et al., 2019; Polat et al., 2023). Considering parking problems, violations of pedestrian rights-of-way, and safety concerns, the following recommendations are proposed:

- Parking area regulation and enforcement: To address haphazard parking and pedestrian access issues, local governments could establish designated parking zones strategically placed in high-use areas, with penalties for parking outside these zones. Technological solutions (such as disabling unparked e-scooters) could also be developed.
- Enhanced safety standards: To alleviate user safety concerns, e-scooter providers could implement robust safety measures (such as speed limits, improved scooter stability and user-friendliness, and mandatory helmet use in busy areas). Adding mirrors to e-scooters could enhance driver safety, reducing accident risks for both users and other road users. Awareness campaigns promoting safe riding practices could further encourage responsible use.
- Infrastructure improvements: Dedicated e-scooter lanes or paths are critical for protecting pedestrian and vehicle safety in cities. Such investments would guide scooter use effectively and improve traffic flow. For instance, creating designated areas similar to bike lanes could ensure a safer riding experience.
- Regulating user behavior: Public awareness of e-scooter use should be raised, encouraging responsible behavior. Mobile apps could inform users about parking rules and safety tips, while incentives for safe riding (such as rewards for frequent or rule-abiding users) could be offered.

- Technology-driven monitoring and management: Advanced Global Positioning System (GPS) and artificial intelligence (AI) systems could track e-scooter movements and monitor parking area occupancy, facilitating proper parking and minimizing pedestrian disruptions.

From the perspective of e-scooter manufacturers, continuous improvements in the durability, environmental compatibility, and recyclability of materials and components are essential. Platform operators should ensure regular maintenance, promote responsible use, and, where appropriate, guide user behavior through penalties. Additionally, balanced integration of shared e-scooters into urban mobility systems requires adopting dynamic distribution models aligned with usage data. Establishing such regulatory frameworks would enhance not only e-scooter systems but also other sharing economy models from an environmental sustainability perspective. However, how these proposed principles will be implemented and managed effectively remains a critical area requiring further research. Integrating environmental sustainability goals into traditional regulatory approaches and developing flexible models suited to the sharing economy's dynamic nature also warrant deeper investigation.

This study offers both theoretical and practical implications. Theoretically, it provides an original perspective by examining the globally expanding sharing economy phenomenon within the contexts of sustainable transportation and micro-mobility, contributing to the literature. It analyzes the integration of shared e-scooters into sustainable transportation systems not merely as a technological innovation but as a conceptual framework intertwined with the sharing economy's core principles and SDGs. While existing literature often focuses on singular impacts, this study holistically evaluates the multifaceted effects of shared e-scooters on urban traffic, air pollution, carbon emissions, and quality of life, aiming to enrich discussions in sustainable transportation. Practically, the findings offer guiding insights for policymakers and practitioners.

In terms of practical implications, establishing appropriate regulatory frameworks to facilitate the sharing of goods and services is crucial for promoting sustainability and protecting consumers. Governments should support and incentivize sharing economy platforms to reduce waste and enhance resource efficiency. G7 countries, as leaders in the sharing economy's development, could serve as models for others, playing a strategic role in advancing global resource efficiency. Addressing global environmental challenges effectively requires strengthening international cooperation and partnerships. International agreements like the Paris Agreement should be implemented with active government participation and supported

by concrete steps toward SDGs. The United States, a G7 member, could lead in fostering international collaboration to combat climate change and environmental degradation. Urgent support mechanisms are needed to enable low-income countries to adopt sustainable practices and access eco-friendly technologies, with capacity-building and technical assistance programs from competent authorities being vital. Effective resource coordination could reduce economic and technological disparities between high- and low-income countries, accelerating the global sustainability transition.

Policymakers should develop short-term regulations to minimize the sharing economy's negative impacts and create long-term, comprehensive policies balancing innovation and sustainability. Strategies integrating incentives for sustainable practices and innovation, urban planning with sharing economy services, and green technology adoption could maximize its long-term contributions to economic growth, innovation, and sustainable development. Given the potential positive impacts of technological innovations on sustainable development, countries should promote sustainable sharing economy models to attract both domestic and foreign investments.

The study also offers implications for urban planners. In developing countries experiencing rapid urbanization and industrialization, planning and implementing sustainable urban infrastructure are critical necessities. This acceleration will inevitably require additional urban infrastructure investments, increasing energy demand. Managing this process in line with environmental sustainability principles requires prioritizing energy efficiency and establishing urban infrastructure systems that support long-term sustainability. Efficient energy use and the integration of sustainable transportation solutions offer significant opportunities to reduce cities' environmental impacts. Furthermore, policies promoting energy efficiency and accelerating the transition to low-carbon energy systems could decouple environmental impacts from economic growth, aiding long-term SDGs achievement.

The findings suggest that, in the long term, the sharing economy could significantly contribute to sustainable development by enhancing resource efficiency. Adopting an access-focused approach over ownership-based models could reduce consumption, supporting environmental sustainability. For instance, shared transportation services could minimize carbon emissions by reducing the need for individual vehicle ownership. As the sharing economy matures, developing new business models could enhance social inclusivity and optimize resource allocation more effectively. Regulatory bodies could seize opportunities to integrate these

innovative models into economic and social systems, ensuring fair competition and crafting effective policies for environmental challenges.

The study's findings and recommendations align with various SDGs, supporting a balance between sustainable economic growth and environmental responsibility:

- SDG 7 (Affordable and Clean Energy): Countries can contribute to this goal by developing strategies to enhance energy efficiency and promote renewable energy use.
- SDG 9 (Industry, Innovation and Infrastructure): Adopting eco-friendly technologies and promoting sustainable business models fosters an ecosystem supporting innovation and resilient infrastructure.
- SDG 11 (Sustainable Cities and Communities): Promoting inclusive, safe, and sustainable urban governance, particularly through smart city solutions, plays a critical role.
- SDG 12 (Responsible Consumption and Production): The sharing economy's expansion supports responsible production and consumption habits, enhancing resource efficiency and reducing waste.
- SDG 13 (Climate Action): Implementing policies to reduce carbon emissions and providing accessible, reliable, and cost-effective energy sources for all is a key step in combating climate change.

Thus, supporting the sharing economy and sustainable business models is among the core strategies for achieving SDGs.

Limitations and Future Recommendations

This literature review was conducted within certain limitations. First, it is restricted to studies within the examined databases containing the specified keywords. While these databases are nationally and internationally recognized and widely accepted, relevant studies in other databases may have been overlooked. Additionally, the review is limited to studies published between 2008 and 2025, excluding research published before 2008.

The existing literature on the sharing economy's environmental impacts remains limited. This study discusses the potential benefits and challenges of the sharing economy in terms of environmental sustainability, identifying key elements for evaluating shared e-scooter systems in this context. However, given the diverse applications of the sharing economy and the broad industrial sectors it integrates with, determining optimal conditions for environmental

sustainability requires more in-depth qualitative and quantitative research. Future studies could conduct comparative analyses across different geographic contexts to explore how e-scooter systems can be optimized based on local dynamics and cultural factors.

Declaration of Research and Publication Ethics

This study, which does not require ethics committee approval and/or legal/special permission, complies with research and publication ethics.

Researcher's Contribution Rate Statement

Authors contributed equally to the article.

Declaration of Researcher's Conflict of Interest

There are no potential conflicts of interest in this study.

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