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Erasmus+ 2024-3-TR01-KA154-YOU000279592

Resilient Cities and Sustainable Future: Youngsters Discuss Future of the Cities

Extended Abstract

📅 **11 Temmuz 2025**

📍 **Sakarya Üniversitesi**

SAKARYA GOVERNORSHIP

Resilient Cities and Sustainable Future
Youngsters Discuss Future of the Cities Symposium

11 July 2025 / SAKARYA

EXTENDED ABSTRACT BOOK

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Frames of Childhood, Faces of the Brand: An Analysis of Instagram Pages of Turkish Children' Universities

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ABSTRACT

This study investigates how children's universities in Türkiye use Instagram to construct institutional brand identity, represent children visually and symbolically, and engage digital audiences. While higher education institutions increasingly leverage social media for strategic communication, limited research has examined how sub-institutions targeting children employ branding and representation practices in digital spaces. Focusing on seven EUCU-recognized children's universities with active Instagram accounts, this study employs a mixed-methods research design that combines qualitative content analysis with quantitative engagement metrics. A total of 1,876 posts selected through purposive sampling were collected from Instagram via web scraping tools. Brand identity was analyzed using Aaker's Brand Equity Model and Kapferer's Brand Identity Prism, while child representation was examined through Sprokholt's visual analysis framework. MAXQDA 2020 was used for coding, and SPSS v23 for statistical analysis. Findings reveal that institutions using consistent visual branding and portraying children as active individuals achieved higher engagement. Dynamic formats like reels and the use of call to action also increased user interaction. However, cultural specificity and diverse representation remained limited. This research contributes to the literature on institutional branding and digital childhood representation, offering insights on building authentic and engaging communication strategies on social media for branding.

Key words: Branding, Children's Universities, Social Media, Children Representation, Mixed-Methods.

Introduction

In an increasingly digital communication landscape, social media platforms such as Instagram have become essential tools for educational institutions to build brand visibility, shape public perception, and engage with target audiences (1,2). Particularly for institutions addressing younger demographics and their families, platforms rich in visual storytelling offer strategic advantages in communicating identity and values (3). Children's universities, specialized initiatives aimed at introducing children to academic environments and stimulating early learning enthusiasm, represent a unique case of institutional branding where both pedagogical vision and public image intersect.

Brand identity construction on social media is well-documented in marketing literature. Aaker's (4) Brand Equity Model highlights key components such as brand awareness, perceived quality, brand associations, and brand loyalty, all of which can be influenced by strategic communication practices. Kapferer's (5) Brand Identity Prism further expands the framework by identifying six dimensions of brand identity: physique, personality, culture, relationship, reflection, and self-image. These frameworks have been effectively adapted to analyze higher education institutions, where brand strength correlates with recruitment, reputation, and stakeholder engagement (6). Within this scope, Instagram serves as a visual stage where brand identity can be actively constructed through recurring elements such as logos, taglines, color schemes, and the tone of textual captions. Research shows that visual consistency, authenticity, and emotional resonance significantly enhance audience trust and engagement on Instagram (7,8).

Equally important is the representation of children within institutional media. Hall et al.'s (9) theory of representation asserts that media images do not merely reflect reality but actively construct it. Similarly, Buckingham (10)argues that childhood is a cultural construct shaped by media, often oscillating between depictions of innocence and empowerment. In the context of educational branding, how children are portrayed – whether as curious learners, passive participants, or active agents – carries implications for how institutions position themselves ideologically and socially.

This study draws on a multi-theoretical framework to explore how children's universities in Türkiye construct their brand identity and represent children through Instagram posts. Brand identity is examined through Aaker's (4) Brand Equity Model and Kapferer's (5) Brand Identity Prism, which provide analytical lenses for assessing visual and textual elements such as logos, tone of messaging, color consistency, and value propositions (6,7). Meanwhile, the representation of children is analyzed using Sprokholt's (11) framework for analyzing child images on institutional social media, since this framework enables a layered analysis of visual and symbolic cues, particularly regarding how children's agency, emotion, and cultural identity are constructed or constrained.

Past research in media and childhood studies has pointed out that children are frequently underrepresented or stereotyped in institutional communication (12,13). When they are visible, they are often framed within idealized, adult-centered narratives that overlook diversity, agency, and playfulness (14). This reinforces the need to critically assess how children's universities, while educationally inclusive by design, visually enact or subvert dominant tropes of childhood through their social media presence. Another dimension of analysis is audience engagement. Likes, comments, and shares are not merely quantitative indicators of popularity, but also signals of relational engagement between institutions and their audiences (15,16). Studies have shown that posts featuring children, particularly those conveying joy, curiosity, or success, tend to perform better on engagement metrics compared to generic institutional content (17).

Despite the growing use of Instagram by universities, the strategic branding and representational practices of children's universities remain underexplored. Most existing studies focus either on university-level branding (18) or on media portrayals of childhood in non-educational contexts (19). There is a distinct gap in understanding how institutions operating at the intersection of childhood and academia use visual and textual narratives to build their identity and connect with stakeholders. This study addresses this gap by examining the Instagram accounts of seven EUCU-recognized children's universities in Türkiye. It investigates three core dimensions: [1] the use of brand identity elements; [2] the visual and symbolic representation of children; and [3] the levels and patterns of audience engagement as reflected by likes and comments. By combining content analysis with engagement metrics, this research not only contributes to the literature on educational branding and child representation but also offers practical insights for the enhancement of digital visibility and relational credibility in child-focused education sectors.

Based on literature on institutional branding, social media marketing, and child representation, the study

proposed the following hypotheses:

H1: Posts that contain brand identity elements exhibit higher engagement rates.

H2: Posts that depict children in active roles generate more engagement.

H3: Posts that include direct calls to action attract higher levels of user interaction.

H4: Posts featuring dynamic media formats achieve higher engagement rates due to their immersive and interactive appeal.

In line with its main purpose, this study adopts a mixed-methods research design, combining qualitative content analysis with quantitative engagement metrics, as this design provides both interpretive depth and empirical breadth, enabling a more comprehensive understanding of digital communication practices (20,21). The qualitative component explores symbolic representations and visual strategies, while the quantitative strand assesses audience interactions via likes and comments, enabling triangulation across data types (22). A purposive sampling method was employed to ensure analytical relevance and conceptual consistency (23). From a national list of 53 children's universities, only those affiliated with the European Children's Universities Network (EUCU) were considered. EUCU recognition signifies an institutional commitment to pedagogical quality and international engagement (24). Among 11 eligible institutions, two were inactive and two had no Instagram presence, resulting in a final sample of seven institutions with active and public Instagram accounts.

Instagram posts were collected from the official accounts of the seven selected institutions via web scraping tools. A total of 1,876 posts were sampled. Both visual and textual data were archived, including images, videos, captions, likes, comments, and follower counts. Stories were excluded due to their ephemeral nature. The collected data were analyzed via qualitative content analysis using MAXQDA 2020, and the coding scheme was developed deductively, grounded in Aaker's (4) and Kapferer's (5) models. For the representation of children, the study used Sprokholt's (11) framework. Furthermore, the quantitative engagement was measured using standard social media metrics: number of likes and comments per post. To ensure comparability across accounts, an engagement rate was calculated by normalizing interactions with follower counts using the following formula:

Descriptive statistics and cross-tabulations were generated to examine how engagement varies by post type, brand marker presence, and child representation strategy. Thus, data were analyzed using SPSS v23 (8,15).

Main Results

The dataset comprises 1,876 posts in total, collected from the following Instagram accounts: @egecocukuniversitesi (n=137), @harrancocukuniversitesi (n=56), @cocukuniversitesinonu (N=59), @iytecocukuniversitesiofficial (n=183), @ozaygunselcocukuniversitesi (n=809), @informelegitim_cocukistanbul (n=307), and @iau_cocukuni (n=325). The disparity in posting frequency among these accounts reflects varying levels of strategic communication effort and may influence overall engagement metrics. On average, posts that included children's faces, showed active participation, and used call to action had significantly higher engagement rates. Reels and video content generated more user interaction, confirming H4. For example, posts with dynamic content averaged an engagement rate 1.6 times higher than static visuals. @egecocukuniversitesi and @iytecocukuniversitesiofficial demonstrated the most consistent use of brand identity elements such as logos and institutional colors, aligning with H1. These posts also tended to receive above-average likes and comments. Conversely, accounts with inconsistent branding (e.g., @cocukuniversitesinonu) showed weaker engagement patterns.

In alignment with Sprokholt's (11) framework, most posts represented children as joyful, curious, and

engaged in structured educational settings. However, variation was observed in the degree of agency attributed to children. While @informelegitim_cocukistanbul and @iau_cocukuni frequently portrayed children in active roles, others like @harrancocukuniversitesi more often presented children as passive participants in ceremonies or group photos. Visual diversity was limited across most accounts, with underrepresentation of children with disabilities or from visibly diverse cultural backgrounds. Cultural specificity was most evident in @harrancocukuniversitesi, while other accounts displayed a more universal or sanitized aesthetic.

Accounts affiliated directly with public universities (e.g., Ege, IYTE, Inonu) displayed stronger alignment with strategic branding frameworks, integrating both visual consistency and thematic diversity. In contrast, non-university-based accounts like @ozaygunselcocukuniversitesi, despite high output, lacked clear visual coherence or identity messaging. These findings support H1, H2, H3, and H4.

Conclusion

Institutions that maintained strong visual identity elements – such as logos, brand colors, and slogans – not only demonstrated higher aesthetic coherence but also achieved greater audience engagement, supporting the idea that strategic branding contributes to digital visibility and credibility. Posts that portrayed children as active, expressive participants (rather than passive or symbolic figures) were more likely to receive likes and comments, reaffirming the communicative power of dynamic and emotionally resonant visuals. While some universities, particularly Ege and IYTE, exemplified consistent and purposeful use of Instagram for public engagement, others showed fragmented or underdeveloped strategies. Non-university-affiliated institutions with high posting volume lacked a clear branding framework, indicating a quantity-over-strategy approach.

This study underscores the importance of combining visual storytelling, ethical child representation, and coherent branding in institutional social media. Future research may expand the scope to include audience perceptions, longitudinal data tracking, and cross-cultural comparisons. Ultimately, children's universities have significant untapped potential to not only showcase their educational mission but also build a distinctive digital identity that affirms the value of inclusive, playful, and culturally grounded learning.

REFERENCES

1. Gensler S, Völckner F, Liu-Thompkins Y, Wiertz C. Managing Brands in the Social Media Environment. Journal of Interactive Marketing. 2013 Nov 1;27(4):242–56.
2. Popp B, Woratschek H. Consumer–brand identification revisited: An integrative framework of brand identification, customer satisfaction, and price image and their role for brand loyalty and word of mouth. Journal of Brand Management. 2017 May 28;24(3):250–70.
3. Ashley C, Tuten T. Creative Strategies in Social Media Marketing: An Exploratory Study of Branded Social Content and Consumer Engagement. Psychol Mark. 2015 Jan 11;32(1):15–27.
4. Aaker D. Building Strong Brands. New York, NY, USA: Free Press; 1996.
5. Kapferer JN. The New Strategic Brand Management: Creating and Sustaining Brand Equity Long Term. 4th ed. London: Kogan Page; 2008.
6. Hemsley-Brown J, Goonawardana S. Brand harmonization in the international higher education market. J Bus Res. 2007 Sep;60(9):942–8.
7. Schivinski B, Dabrowski D. The impact of brand communication on brand equity through Facebook. Journal

of Research in Interactive Marketing. 2015 Mar 9;9(1):31–53.

8. De Veirman M, Cauberghe V, Hudders L. Marketing through Instagram influencers: the impact of number of followers and product divergence on brand attitude. Int J Advert. 2017 Sep 3;36(5):798–828.

9. Hall S, Evans J, Nixon S. Representation: Cultural Representations and Signifying Practices. London: SAGE; 1997.

10. Buckingham D. Childhood in the Age of Global Media. In: Aitken S, editor. Global Childhoods: Globalization, Development and Young People. London: Routledge; 2008. p. 43–54.

11. Sprokholt FV. UNICEF and the Image of Children A Qualitative Content Analysis on the Portrayal of Children by UNICEF on Instagram [MA]. [Utrecht]: Utrecht University; 2020.

12. Giroux HA. Stealing Innocence: Youth, Corporate Power, and the Politics of Culture. New York, NY, USA: Palgrave-Macmillan; 2000.

13. Kline S. Out of the Garden: Toys, TV, and Children's Culture in the Age of Marketing. London: Verso; 1993.

14. Livingstone S, Third A. Children and young people's rights in the digital age: An emerging agenda. New Media Soc. 2017 May 10;19(5):657–70.

15. Dessart L, Veloutsou C, Morgan-Thomas A. Consumer engagement in online brand communities: a social media perspective. Journal of Product & Brand Management. 2015 Mar 16;24(1):28–42.

16. Hudson S, Huang L, Roth MS, Madden TJ. The influence of social media interactions on consumer–brand relationships: A three-country study of brand perceptions and marketing behaviors. International Journal of Research in Marketing. 2016 Mar;33(1):27–41.

17. Chang M, Yi T, Hong S, Yan Lai P, Jun JY, Lee JH. Identifying Museum Visitors via Social Network Analysis of Instagram. Journal on Computing and Cultural Heritage. 2022 Sep 30;15(3):1–19.

18. Chapleo C. What defines "successful" university brands? International Journal of Public Sector Management. 2010 Mar 2;23(2):169–83.

19. Buckingham D. The Material Child: Growing Up in Consumer Culture. Cambridge, UK: Polity Press; 2011.

20. Creswell JW, Plano Clark VL. Designing and Conducting Mixed Methods Research. 3rd ed. SAGE Publications; 2017.

21. Kuckartz U. Qualitative Text Analysis: A Guide to Methods, Practice & Using Software. London: SAGE; 2014.

22. Fetters MD, Curry LA, Creswell JW. Achieving Integration in Mixed Methods Designs—Principles and Practices. Health Serv Res. 2013 Dec 23;48(6pt2):2134–56.

23. Patton MQ. Qualitative Research and Evaluation Methods. 3rd ed. Thousand Oaks, CA, USA: SAGE; 2002.

24. Gary C, Dworsky C. Children's Universities — a "leading the way" approach to support the engagement of higher education institutions with and for children. Journal of Science Communication. 2013 Dec 11;12(03):C03.

International Student Mobility and Social Inclusion in Cities:
A Case-Based Evaluation within the Erasmus+ Framework

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ABSTRACT

Global migration has led to increasingly diverse urban populations, making social inclusion a central concern for modern cities (UN-Habitat, 2020). Within this dynamic, international student mobility emerges as a significant component of cultural diversity and cross-border engagement (Favell, 2011). The Erasmus+ programme, facilitating study and internship mobility, enables young people to interact with different urban and social environments, thereby contributing to the shaping of inclusive and resilient cities (European Commission, 2023).

This paper explores the role of international student mobility in promoting social inclusion in urban settings. Drawing on the author's personal experiences as an Erasmus+ participant in Poland and Finland, and professional observations as an Erasmus office administrator in Turkey, the study examines intercultural interaction, accessibility to social life, and sense of belonging among mobile youth in host cities. The dual perspective—of being both a participant and a facilitator—offers an in-depth view of how cities respond to international student presence and how institutions contribute to their integration (Gümüş & Gök, 2018).

The study provides recommendations for aligning EU mobility programmes with local inclusion strategies, highlighting the mutual benefits for both cities and young people in fostering more inclusive, participatory urban spaces (Council of Europe, 2018).

Key words: International Student Mobility, Social Inclusion, Urban Diversity, Erasmus+, Youth Participation

Introduction

Urban environments are increasingly shaped by global migration patterns. One subset of this phenomenon, international student mobility—has gained prominence as part of Erasmus+ and other exchange programmes (Cairns, 2017). These young individuals do not only pursue academic goals but also interact with local cultures and institutions, creating a living laboratory for social inclusion. This paper aims to bridge academic and practical perspectives on how mobile youth affect and are affected by the social fabric of cities (Favell, 2011).

Main Results

The findings of this study indicate that international student mobility serves as a catalyst for intercultural exchange and contributes positively to the social fabric of host cities. Students who participate in Erasmus+ programmes are not only temporary visitors but active social agents who bring diverse perspectives and stimulate cultural interaction in their environments (Gök & Gümüş, 2018). Despite facing initial challenges such as housing, language barriers, and unfamiliarity with local systems, many students gradually develop adaptive strategies that foster their inclusion into urban life (Cairns, 2017). Moreover, local institutions—especially universities and municipalities—play a pivotal role in facilitating integration by offering orientation programmes, language courses, and intercultural events (Council of Europe, 2018). However, personal observations also reveal a gap between institutional efforts and the actual lived experiences of students. While policy frameworks emphasize inclusion, the implementation often lacks the depth and continuity needed for sustainable social integration. This contrast highlights the need for more localized and youth-informed inclusion strategies that align with the objectives of EU mobility programmes (European Commission, 2023).

Conclusion

International student mobility contributes positively to the development of socially inclusive urban environments. Programmes like Erasmus+ should be better integrated with municipal and university-level inclusion policies. Future strategies should address the specific needs of mobile youth to foster equitable participation in urban life (European Commission, 2023).

REFERENCES

1. Cairns, D. (2017). The Erasmus undergraduate exchange programme: A highly qualified success? Children's Geographies, 15(6), 728–740. **(Journal Article)**
2. Gök, E., & Gümüş, S. (2018). International student recruitment efforts of Turkish universities: Rationales and strategies. In A. W. Wiseman (Ed.), Annual review of comparative and international education 2017 (Vol. 34, pp. 231–255). Emerald Publishing Limited. **(Journal Article)**
3. European Commission. (2023). Erasmus+ Programme Guide 2023. https://erasmus-plus.ec.europa.eu. **(Corporate Reports)**
4. Favell, A. (2011). Eurostars and Eurocities: Free movement and mobility in an integrating Europe. Wiley-Blackwell. **(Book)**
5. Council of Europe. (2018). Social inclusion of young people: Call for action. https://rm.coe.int/social-inclusion-call-for-action/16808f9a0c **(Corporate Reports)**
6. UN-Habitat. (2020). World Cities Report 2020: The value of sustainable urbanization. https://unhabitat.org/wcr **(Corporate Reports)**

Youth-led Urban Agriculture: From Soil to Sale for a Resilient Future

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ABSTRACT

Urban agriculture offers innovative opportunities for empowering youth while fostering resilience in cities. This paper proposes a youth-led model that enables young people to actively engage in sustainable food production, from planting to selling. The model envisions practical applications such as school-based greenhouses, neighborhood gardens, and youth-operated local markets. These activities contribute not only to ecological awareness but also to entrepreneurship and social inclusion. The initiative highlights the importance of youth participation in local food systems, especially in response to climate challenges and food insecurity. By integrating community involvement with environmental action, the model creates a circular ecosystem where young people are both producers and change-makers. The proposed concept is designed to be implemented in cooperation with municipalities, youth NGOs, and educational institutions, enhancing its adaptability to diverse urban contexts. It aims to plant the seeds of self-sufficiency, responsibility, and collective ownership among the new generation. This is not just a project; it is a platform to help youth take root in their communities while addressing global sustainability goals.

This is not just my idea; it is a seed I hope will grow with your hands.

Key words: Youth empowerment, Urban agriculture, Sustainability, Local food systems, Social entrepreneurship

Introduction

According to the OECD's sustainability indicators, development must be addressed through economic, social, and environmental dimensions simultaneously [1]. In this context, many countries have adopted multidimensional strategies involving the expansion of agriculture without chemical inputs, reducing carbon emissions, and supporting the education and economic participation of women and youth. Local development through youth and agricultural policies has increasingly become a central objective in sustainable urban planning.

As of 2022, over 20 countries have integrated youth engagement in agriculture into their national strategies. For instance, Germany promotes school-based agricultural education through the "Grüne Berufe" (Green Professions) program, while the Netherlands offers urban gardening and funding opportunities for

young farmers [2]. In Asia, South Korea's "Youth Return to Farming" initiative supports rural reintegration, and Japan emphasizes youth as carriers of agricultural heritage [3]. In Africa, Kenya's "Ajira Youth Agripreneurs" program fosters youth-led digital agriculture, and Nigeria offers state-supported agricultural loans and advisory services to young farmers [4]. In the Americas, the U.S. 4-H Youth Development Program involves over 6 million young people in agricultural learning, while Brazil's "Escola Ativa" integrates agriculture into rural education [5]; [6]. In Türkiye, more than 40,000 young individuals have benefited from the Ministry of Agriculture's Young Farmer Program, and school garden farming projects have been implemented in over 300 schools across 81 provinces [7].

Agriculture must be redefined for youth not merely as a means of livelihood but as a process of productivity, responsibility, and civic contribution. Zimmerman's Empowerment Theory (1995) underlines the importance of enabling individuals to participate effectively in decision-making processes and develop the skills required to contribute meaningfully to society [8]. In this context, agriculture can serve as a space for both personal development and community engagement.

Additionally, Kolb's Experiential Learning Theory (1984) emphasizes the value of learning through direct involvement [9]. Participating in the agricultural cycle from seed to harvest activates not only cognitive, but also emotional and behavioral learning domains. It fosters young people's connection with nature and internalization of core values such as patience, labor, and sustainability.

This paper proposes involving primary and secondary school students in agricultural activities, supporting them in developing marketing strategies for their own produce, and empowering them to participate in local economies. Long-term, the model envisions supportive structures such as school-based greenhouses, neighborhood gardens, and youth-led local markets. The goal is to empower youth not only as consumers but as producers, entrepreneurs, and active societal contributors. This model is inspired not only by global practices but also by Türkiye's own historical experience the Village Institutes. These institutions integrated agriculture, production, and education, and offer a valuable legacy for reconnecting young generations with nature and community through sustainability-centered learning.

Main Results

This study does not present empirical research findings but proposes a conceptual model based on Türkiye's national experience and global inspirations in youth-led urban agriculture. The model aims to be implemented through cooperative efforts among schools, municipalities, and non-governmental organizations.

In Türkiye, school garden agriculture projects have already been introduced in over 300 schools, and the Young Farmer Support Program has reached more than 40,000 participants. Building upon this foundation, the proposed model envisions the following components:

- *School-Based Greenhouses and Gardens:* Hands-on production activities integrated into curricula and values-based education.

- *Youth-Managed Community Gardens:* Vacant urban spaces are transformed into food-growing hubs that also foster teamwork and ecological responsibility.

- *Youth Farmers' Markets:* Students sell their produce in local settings, learning entrepreneurship, communication, and resource management.

- *Training and Mentorship:* In collaboration with local experts and producers.
- *Digital Documentation and Sharing:* Students record their progress and share their experiences via digital platforms to encourage broader engagement.

While rooted in Türkiye's educational and agricultural context, the model presents a flexible and scalable framework for diverse urban settings worldwide. Its goal is to reconnect youth with nature, strengthen civic participation, and promote long-term sustainability through meaningful empowerment.

Table 1. Comparison between existing school-based agricultural programs and the proposed youth-driven model

Existing School Programs	Proposed Model
Focused on basic gardening and planting activities	Includes full-cycle process: production, marketing, and circular sustainability
Students as observers or passive participants	Students as producers, marketers, and decision-makers
No economic or entrepreneurial dimension	Emphasizes entrepreneurial skills and economic participation
One-time or seasonal activities	Integrated into long-term educational processes
Teacher-centered approach	Youth-centered, participatory learning model
Minimal or no digital tools or storytelling	Includes digital documentation, media sharing, and community engagement

This table highlights the pedagogical, economic, and participatory distinctions that make the proposed model more holistic and empowering.

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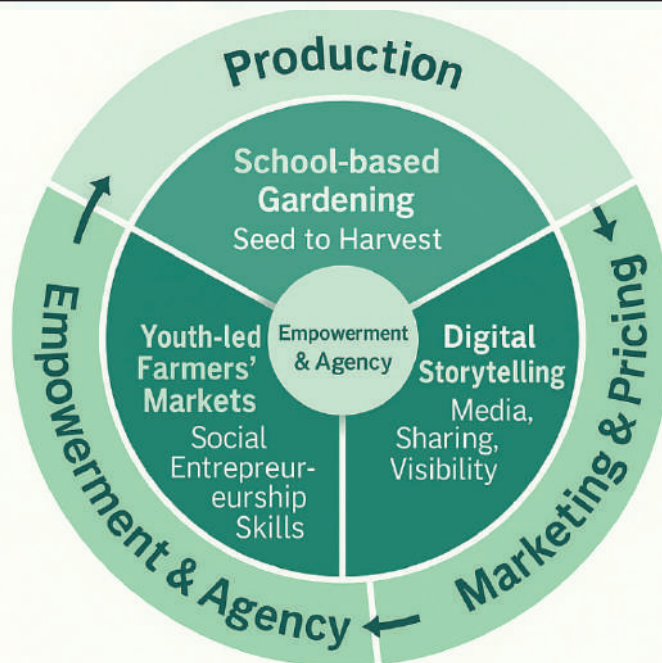
Figure 1. Youth-driven circular agriculture model

This circular diagram illustrates the interconnected components of the proposed model production, marketing, storytelling, and empowerment designed to foster youth participation, skill development, and social impact.

Conclusion

The proposed model addresses several interrelated global challenges: food insecurity, youth unemployment, climate disconnection, and declining civic participation among younger generations. While urban agriculture initiatives have gained attention in recent years, most remain limited to localized gardening activities without broader pedagogical or economic integration.

By combining experiential learning (Kolb, 1984) [8] with empowerment theory (Zimmerman, 1995) [9], the model moves beyond passive engagement to cultivate youth agency and self-efficacy. Unlike traditional school garden projects, it embeds entrepreneurship, digital storytelling, and community visibility into the learning process. These components are essential for 21st-century youth development and are aligned with OECD's multidimensional approach to sustainability (OECD, 2022) .

Although rooted in the Turkish context, the model is inherently adaptable. In lower-income urban areas, for example, community gardens can be supported by local governments or NGOs. In technologically advanced settings, digital storytelling and virtual markets may become the core. The flexibility of the model allows for integration into different educational systems, climate zones, and cultural norms.

Potential limitations include institutional resistance, lack of teacher training in sustainability pedagogy, or insufficient local support. Nevertheless, pilot implementations in partnership with municipalities or Erasmus+ school collaborations could test feasibility while creating scalable blueprints.

Ultimately, the model envisions youth not as recipients of environmental education, but as designers of resilient futures.

REFERENCES

1. OECD. Youth Engagement in Agriculture. Paris: OECD Publishing; 2022.
2. FAO. Youth and Agriculture: Key Challenges and Concrete Solutions. Rome: FAO; 2021.
3. UNDP. Youth as Agents of Rural Transformation in Asia. Bangkok: United Nations Development Programme; 2020.
4. IFAD. Rural Youth Action Plan 2019–2021. Rome: International Fund for Agricultural Development; 2021.
5. USDA. 4-H Youth Development Annual Report. Washington DC: National Institute of Food and Agriculture; 2022.
6. UNESCO. Education for Sustainable Development in Latin America. Paris: UNESCO; 2021.
7. Ministry of Agriculture and Forestry (MAF). (2023). Young Farmer Support Program Activity Report. Ankara: MAF.
8. Zimmerman MA. Empowerment theory: Psychological, organizational and community levels of analysis. In: Rappaport J, Seidman E, editors. Handbook of Community Psychology. Boston: Springer; 2000. p. 43–63.
9. Kolb DA. Experiential learning: Experience as the source of learning and development. Englewood Cliffs, NJ: Prentice-Hall; 1984.

Urban Sustainability Through Education: The Strategic Role of Educators in the Perspective of Child-Friendly Cities

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ABSTRACT

This study investigates the contributions of educators in Turkey to child-friendly city strategies and examines how these efforts impact urban sustainability. The aim is to evaluate the integration of children's rights and urban awareness themes into the national curriculum, analyze teachers' pedagogical approaches, and reveal the structural status of collaboration between local governments and educational institutions. The research was conducted using qualitative methods, including policy document analysis, case studies, and semi-structured interviews. Findings indicate that although teachers individually strive to prepare children for active citizenship, curriculum limitations and administrative constraints hinder these efforts. Cooperation with local governments was found to be limited and lacking in sustainability, while platforms such as children's councils were largely symbolic in function. The study concludes that in order to sustain the vision of child-friendly cities, educators must be systematically supported, curricula need to be restructured, and school-municipality partnerships must be strengthened. It is recommended that modules on urban participation and children's rights be integrated into teacher training programs.

Key words: Urban Sustainability; Child-Friendly Cities; Participatory Citizenship; Educational Policy; Children's Rights

1. Introduction

The increasing rate of global urbanization today brings numerous social, environmental, and administrative challenges, especially in environments where children live. According to data from the United Nations, it is projected that 68% of the world's population will reside in urban areas by 2050 (UN DESA, 2022). In this context, sustainable urban living and social inclusion have become central priorities of contemporary urban

policies. The Child-Friendly Cities Initiative (CFCI), launched by UNICEF, aims to place children's rights at the heart of city governance and to develop policies that reflect their needs and voices. However, achieving this goal requires not only the physical design of cities but also support from educational processes that shape children's lived experiences.

This study analyzes the contribution of educators in Turkey to the vision of child-friendly cities. Using a qualitative research approach, data were collected through policy document analysis, case studies, and semi-structured interviews with teachers. The findings indicate that teachers, through their personal efforts, enhance children's urban awareness. However, the process is restricted by the limitations of the existing curriculum, legal constraints, and weak cooperation with local administrations. The study highlights the necessity of developing educational models that support children's active participation in city life.

2. Aim of the Study

The main objective of this research is to examine the contributions of educators in Turkey to the vision of child-friendly cities and to evaluate the impact of these contributions on urban sustainability. The Child-Friendly Cities Initiative (CFCI), launched by UNICEF in 1996, aims to enable children to play active roles in urban life and to ensure their rights are recognized at the local level (UNICEF, 2018). However, in Turkey, this initiative is often limited to physical infrastructure projects implemented by municipalities, with its educational dimension largely overlooked. As emphasized by educational philosophers such as Dewey (1916) and Freire (1970), education plays a critical role in fostering children's social awareness.

The potential of educators to support children's urban participation has not been adequately explored in the existing literature. To fill this gap, the present study aims to provide a framework to understand the strategic role of teachers within the child-friendly cities approach. Specifically, the study seeks to analyze how teachers integrate themes such as children's rights, environmental awareness, and participatory citizenship into educational settings; identify the structural limitations they face; and examine the extent of their collaboration with local administrations. The study also aims to propose strategies for integrating educational policies with local governance approaches. The sub-objectives are as follows: To explore the educational dimension of CFCI practices in Turkey. To analyze the presence of children's rights, urban awareness, and sustainability themes in the curriculum. To present pedagogical models that encourage children's participation in local governance. To evaluate the legal framework and effectiveness of cooperation between local administrations and educational institutions. To offer policy suggestions in light of national and international documents.

2. Findings

2.1 Insufficient Inclusion of Urban Themes in the Curriculum

Although Article 2 of the Turkish Basic Law of National Education (Law No. 1739) emphasizes "social responsibility" in education, the current curriculum offers limited direct content on children's rights and urban

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life (MoNE, 2024). For instance, in the 4th-grade social studies course, while environmental protection is mentioned, concepts such as participation in local governance, spatial justice, or urban infrastructure are absent.

2.2 Teacher Initiatives and Pedagogical Strategies

Some teachers have independently organized activities such as "urban observation," "problem identification," and "proposal development." For example, one teacher collaborated with students to assess the safety of sidewalks around their school and submitted a report to the municipality. Such practices have been shown to increase students' sense of responsibility and self-confidence (Interview-5, 2024).

2.3 Collaboration with Local Governments

According to the Union of Municipalities of Turkey (TBB, 2020), only 23 municipalities in Turkey have active children's councils, and only 11 of these collaborate regularly with educational institutions. Interviewed teachers reported that schools are often excluded from the selection process for council representatives and that student participation is largely symbolic.

2.4 Institutional and Time Constraints

Seventy-five percent of the teachers indicated that they conduct these projects outside of class time due to curriculum overload. Moreover, bureaucratic processes—such as requiring parental consent and obtaining official permissions—have hindered the continuity of these initiatives in most schools

3. Conclusion and Recommendations

This study demonstrates that sustainable urban development cannot be achieved solely through physical infrastructure but must also be supported by inclusive educational systems that prioritize children's participation. Teachers hold a transformative role in encouraging children to participate actively in urban life as engaged citizens. However, due to the limitations of the current curriculum, lack of institutional support, and insufficient collaboration with local governments, this role cannot be sustained effectively in the long term.

The findings reveal that while teachers are developing innovative classroom practices, the lack of institutional structures to support these efforts hinders their long-term impact. There is a need to establish stronger connections between educational policies and local government strategies. Therefore, it is recommended that urban sustainability and participatory citizenship themes be integrated into the national curriculum, and that teacher training programs include modules on children's rights and urban awareness.

Future research should focus on developing tools to measure the effectiveness of school-municipality partnerships and analyze children's contributions to local decision-making processes.

4. Policy Suggestions

A new course titled "City and Citizenship" should be added to the national curriculum by the Ministry of National Education (MoNE). Municipalities should implement "educator support programs" aimed at promoting urban participation. Children's councils should be restructured as school-based representative systems. Teacher training programs should include certified training on UNICEF's Child-Friendly Cities Initiative (CFCI). The

Turkish Statistical Institute (TÜİK) should regularly publish indicators on children's participation in urban life.

5. REFERENCES

1. Ministry of Family and Social Services. Turkey's Child Rights Strategy Document. 2021.

2. Braun V, Clarke V. Using thematic analysis in psychology. Qual Res Psychol. 2006;3(2):77–101. doi:10.1191/1478088706qp063oa

3. Dewey J. Democracy and Education. New York: Macmillan; 1916.

4. Freire P. Pedagogy of the Oppressed. New York: Herder and Herder; 1970.

5. Karsten L. Urban children and the importance of the city. Child Youth Environ. 2015;25(2):1–18.

6. Ministry of National Education. Basic Law of National Education No. 1739. 1973.

7. Ministry of National Education. Century of Türkiye National Curriculum. 2024.

8. Republic of Türkiye Ministry of Environment, Urbanization and Climate Change. Urban Sustainability Strategy Document. 2022.

9. Union of Municipalities of Türkiye. Child Participation in Local Governments Report. 2020.

10. UN DESA. World Urbanization Prospects 2022. United Nations Department of Economic and Social Affairs. Available from: https://population.un.org/wup/

11. UNICEF. Child-Friendly Cities and Communities Handbook. 2018. Available from: https://childfriendlycities.org

12. UN-Habitat. Participatory Urban Governance Framework. Nairobi: United Nations Human Settlements Programme; 2020.

Renewable Energy Use in Eskişehir

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ABSTRACT

Eskişehir, a rapidly developing city in the center of Turkey, has achieved significant steps to integrate renewable energy sources into urban energy policy for the city. As concerns about climate change and environmental sustainability rise, the mid-sized cities like Eskişehir are emerging as key locations to switch to low-carbon energy systems. The current scenario with regard to the use of renewable energy in Eskişehir is addressed in the article in regard to solar energy, geothermal energy, and energy efficiency initiatives. The strengths of the location, education system, and open mindset of the population facilitate making the most of the geographic location of the city. Community-based and decentralized energy systems are exemplified in initiatives undertaken by Eskişehir Metropolitan Municipality, universities, and private entities. Financing, policy support, and technology infrastructure remain challenges but are being addressed through public-private partnerships. Based on a study of the development of Eskişehir's renewable energy, the paper provides practical lessons in urban energy transition for Turkey and provides a model for replication in other similarly sized cities.

Key words: Renewable Energy, Urban Energy Transition, Solar Power, Geothermal Energy

Introduction

Eskişehir, famous for its dynamic student population and progressive social mindset, is fast emerging as a model of green urbanization for Turkey. It has a population in excess of 870,000 and two of the best universities in the country. Eskişehir has become an incubator of innovation and a focus of environmental consciousness. As part of efforts to reduce the environmental impact of fossil fuels and promote energy independence, local authorities and institutions in Eskişehir have initiated projects that incorporate renewable energy into daily life. This article discusses the intended and actual use of renewable power in the city and how it fits into the national energy plans and climate goals of Turkey.

Main Results

1. Solar Energy Projects

High annuasolar irradiation rates in Eskişehir make the location suitable for solar power generation. Photovoltaic panels have been installed on government offices, municipal buildings such as schools, and bus terminals. Programs like the "Smart City Solar Energy Program" aim at reducing municipality energy costs and promoting green energy.

2. Geothermal Potential

The area and the city surrounding it possess huge geothermal reserves, of which utilization is mainly for heating houses in nearby towns like Sarıcakaya. It is planned to utilize deeper geothermal resources for the production of power as well as for long-term heating systems.

3. University-led Research and Pilot Projects

Anadolu University and Eskişehir Technical University are conducting applied research on smart grid systems, energy storage, and renewable technology. Joint effort with the municipality has led to pilot installations of wind and solar power systems in university buildings.

4. Energy Efficiency Programs

Besides renewable energy projects, Eskişehir has also conducted building insulation projects and LED street lighting projects that have contributed significantly to saving huge amounts of energy.

5. Community Education and Involvement

There have been campaigns of public awareness and education towards increasing the participation of the citizens in the renewable transition. Eskişehir has conducted different green energy expos and sustainability festivals aimed at educating the citizens and stimulating the use of renewable technologies.

Conclusion

The experiences of Eskişehir depict the growing role of mid-sized cities as drivers of the energy transition in their respective regions. Through joining public investment, academic research, and public involvement, the city has made major steps towards adopting renewable energy technologies. While issues remain, especially in expanding grid infrastructure and securing investment, the foundation for a sustainable energy future has been laid. The integration of local government, university engagement, and public engagement employed in Eskişehir provides a beneficial example for other Turkish cities and comparable cities worldwide.

Acknowledgment: I would like to thank my family and my English teacher, Neslihan Akkaya,

REFERENCES

1. Eskisehir Metropolitan Municipality. (2023). Solar Energy Projects Report.

2. Turkey Electricity Transmission Company (TEİAŞ). (2022). Renewable Energy Capacity by Regions.

3. Anadolu University Renewable Energy Center. (2023). Annual Research Report.

4. Turkey Ministry of Energy and Natural Resources. (2021). National Energy Efficiency Action Plan.

5. Sarıcakaya Municipality. (2022). Geothermal Heating System Assessment Report.

6. REN21. (2022). Renewable Energy 2022 Global Status Report.

Erasmus+ 2024-3-TR01-KA154-YOU-000279592
Resilient Cities and Sustainable Future: Youngsters Discuss Future of the Cities

Climate-Resilient Cities Through Children's Eyes: An Early Intervention Model with Ecological School Gardens

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ABSTRACT

This study is based on the idea that children are not merely passive individuals in urban life but can be active partners in sustainable urban transformation. Conducted in a preschool in Türkiye in collaboration with a university, this practice-based research involved the co-creation of an "ecological school garden" model with five-year-old children. The nature-based, participatory learning process offers micro-scale solutions to urban ecology, climate adaptation, biodiversity, renewable energy, and circular economy.

During the implementation, children contributed to the development of rainwater harvesting systems, raised garden beds irrigated through drip systems, urban farming plots, compost units, and bird observation areas. Harvested rainwater was used through drip irrigation in garden beds where vegetables and plants were grown. The study followed a qualitative design; children's environmental awareness, critical thinking, and social participation were assessed through observation and analysis of their products. Data were analyzed thematically using descriptive methods.

Findings show that children became not only learners but also environmentally aware individuals influencing their communities. The model presents a holistic contribution to the "children and cities" theme, integrating urban sustainability and ecology. It highlights the transformative role of early childhood education in fostering resilient, eco-conscious urban citizens.

Key words: Children and cities, Sustainable cities, Early childhood, Nature-based learning, Urban ecology

Introduction Today's cities face significant environmental crises such as climate change, biodiversity loss, increasing resource consumption, and environmental pollution [1]. These challenges make it essential to involve children as active participants in sustainable urban planning. As future decision-makers and long-term

residents of cities, children are among the most important stakeholders in shaping urban futures. Gaining environmental awareness at an early age is critically important for achieving long-term sustainability goals [2]. Increasing children's participation not only empowers them as active agents within urban ecological systems but also promotes environmental consciousness across all segments of society [3].

This study aims to examine preschool children's contributions to urban ecology through the development of an ecological school garden model. Implemented in collaboration with a university, this hands-on initiative allows children to engage with and experience key sustainability concepts such as urban sustainability, climate change adaptation, and biodiversity in a meaningful and age-appropriate way.

Implementation

Children designed and constructed rainwater harvesting systems using recycled materials (plastic bottles, old buckets, faucet attachments) in the school garden. Through this hands-on activity, they experientially learned about the natural water cycle, the importance of rainwater conservation, and its role in drought mitigation [6]. In the vegetable beds created in the garden, the children actively participated in all stages from seedling planting to harvest. They observed plant growth cycles and practiced watering and soil cultivation techniques. The use of harvested rainwater in drip irrigation systems provided practical knowledge about water efficiency and eco-friendly agricultural practices.

During compost production activities, children sorted organic waste (fruit/vegetable peels, leaves) and created compost piles. This allowed them to observe organic matter cycles and microorganisms' roles firsthand, facilitating early understanding of circular economy principles [7].

Through the biodiversity theme involving bird observation stations and nature walks, children gained opportunities to understand and develop conservation awareness for local ecosystems. These activities were observed to increase environmental awareness among families as well, contributing to the adoption of sustainable practices in households [8].

Findings and Discussion

The findings of the study clearly demonstrate that preschool-aged children developed meaningful awareness of environmental issues and acquired basic critical thinking skills. Especially through hands-on activities involving direct interaction with nature, children were observed to perceive the environment not merely as an object of observation but as a living space in which they actively participate.

Teacher journals and child observation forms indicated that children engaged in inquiry using their own words on issues such as environmental pollution, water waste, energy conservation, recycling, and the protection of living beings. They offered simple yet thoughtful solutions and showed emotional responses to these concerns [9]. For instance, some children reportedly began using water more carefully at home and reminded their families to sort plastic packaging into recycling bins instead of throwing them in the trash.

Observational data and the creative outputs produced by children during the activities revealed a tangible development in their understanding of environmental concepts. Behaviors such as sorting waste during play, conserving water, and expressing empathy for nature demonstrated that children not only gained knowledge but also internalized it and reflected it in their behavior [2]. Children's drawings, constructions, and material-based productions showed that they expressed environmental themes in unique and creative ways. These findings indicate that young children can develop an environmentally conscious perspective and comprehend basic ecological concepts from an early age [5].

Therefore, children's environmental learning experiences contributed not only to their cognitive development

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but also to their emotional and behavioral growth in a holistic manner [11]. The data show that even in early childhood, children are capable of making sense of abstract concepts such as sustainability, urban resilience, and ecological responsibility through tangible, practice-based learning environments.

In this context, the *ecological school garden model* provided children with an experience beyond that of passive learners—it positioned them as active agents in urban life and environmental engagement. Throughout the implementation process, children were observed not only acquiring knowledge but also planning, questioning, and transforming their own environmental actions [12].

As such, the model presents a unique and applicable approach to commonly discussed themes in the literature, including "children and the city," "urban sustainability," and "urban ecology." It supports the idea that urban spaces can and should be designed with children's developmental needs in mind, that children's perspectives must be integrated into urban planning processes, and that child-centered participation is crucial not only in education but also in shaping environmental and spatial policies [13].

This approach invites a reimagining of cities not just as spaces for adults but as inclusive environments shared by all age groups, enabling the development of more inclusive, resilient, and sustainable urban visions.

Conclusion and Recommendations

This study has demonstrated that preschool-aged children can meaningfully engage with concepts such as environmental awareness and urban sustainability through experiential learning and active participation. The developed ecological school garden model revealed that children are not merely passive learners but active individuals who can play a role in shaping the environments in which they live. Through nature-based activities, children's skills in critical thinking, observation, collaboration, and responsibility were strengthened, while families and the broader school community also showed positive shifts in their attitudes toward the environment.

The findings underscore the importance of integrating child-centered approaches into urban ecological policies. In this context, the following recommendations are proposed:

Transform school gardens into living learning environments: Micro-scale ecological areas should be planned where children can interact directly with nature, observe environmental systems, and experience sustainable living practices. These gardens should not be viewed solely as play areas, but rather as experimental spaces where science, art, and environmental education intersect.

Support child participation in urban design processes: Local governments and planning authorities should develop participatory models that incorporate children's perspectives and needs. Children should be actively involved in the design of public spaces such as parks, gardens, and playgrounds.

Encourage university-school partnerships: Collaborative projects with academic institutions can provide children with early exposure to scientific processes while grounding sustainability practices in research-based foundations. These partnerships also promote interdisciplinary and community-based approaches in education.

Expand ecological awareness through family and community engagement: The learning process initiated at school should continue at home and be reinforced through community-level activities that raise environmental consciousness. Initiatives such as family workshops, community gardens, and neighborhood ecology days can support this goal.

In conclusion, this study illustrates that children can serve as conscious and active stakeholders in shaping the cities of the future. Environmental learning models introduced during early childhood education offer a strong foundation for building more resilient and sustainable urban environments.

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REFERENCES

1. United Nations. Transforming our world: The 2030 agenda for sustainable development. New York: United Nations; 2015.
2. Chawla L. Childhood experiences associated with care for the natural world: A theoretical framework for empirical results. Children's Environments Quarterly. 1999;16(1):1-12.
3. Malone K, Tranter P. Children's environmental learning and the role of participatory design in urban green spaces. Journal of Environmental Education. 2003;34(4):16-25.
4. Creswell JW. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. 4th ed. Thousand Oaks: Sage Publications; 2014.
5. Sobel D. Place-based education: Connecting classrooms & communities. Great Barrington: The Orion Society; 2004.
6. Liu J, Daily GC, Ehrlich PR, Luck GW. Effects of household dynamics on resource use and biodiversity. Science. 2003;302(5650):1915-1918.
7. Sovacool BK. Renewable energy: A global review of technologies, policies, and markets. Annual Review of Environment and Resources. 2009; 34:275-305.
8. Girardet H. The Gaia Atlas of Cities: New directions for sustainable urban living. London: Gaia Books; 1999.
9. Louv R. Last child in the woods: Saving our children from nature-deficit disorder. Chapel Hill: Algonquin Books; 2005.
10. Hart R. Children's participation: The theory and practice of involving young citizens in community development and environmental care. New York: UNICEF; 1997.
11. Tilbury D. Environmental education for sustainability: defining the new focus of environmental education in the 1990s. Environ Educ Res. 1994;1(2):195-212.
12. Newman J, Jennings C. Cities as sustainable ecosystems: Principles and practices. Washington: Island Press; 2008.
13. Agyeman J, Bullard RD, Evans B. Just sustainabilities: Development in an unequal world. London: Earthscan; 2003.

Think, Feel, Act for a Resilient Kayseri: A Learning Journey for Sustainable Cities with Specially Gifted Students

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ABSTRACT

This study presents a student-centered educational workshop focusing on sustainability, conducted at Murat Kantarcı Science and Art Center in Kayseri, Türkiye, as part of the World Cities Day celebrated on 31 October 2024 under the theme "Climate and Youth Leadership for Local Action in Cities." Implemented during the 2024–2025 academic year within the school's Entrepreneurship Workshop for the Sustainable Development Goals, the workshop was structured around a three-phase model—**"Think – Feel – Act"**—grounded in cognitive, social-emotional, and behavioral learning domains. The workshop aimed to guide students in understanding the challenges of their city, recognizing their values and emotions, and producing creative solutions for a more livable Kayseri. In line with SDG 11 (Sustainable Cities and Communities), the experience sought to raise students' awareness on urban sustainability and climate resilience, while enhancing their capacity to develop local, actionable solutions.

Keywords: Gifted students, Urban sustainability, Climate education

Introduction

Today, more than half of the world's population lives in urban areas. This fact makes it not only necessary but imperative to create inclusive, resilient, and sustainable urban environments. Achieving this goal requires equipping younger generations with the awareness, skills, and competencies needed to understand and respond to urban challenges and climate-related issues.

In this context, Murat Kantarcı Science and Art Center, which provides education to gifted students in Kayseri, Türkiye, organized a thematic educational workshop in alignment with the UNESCO Greening Education Partnership, the Climate Change Action Plan of the Turkish Ministry of National Education, Sustainable Development Goal 11 (Sustainable Cities and Communities), and the National Framework Curriculum for Science and Art Centers.

The educational process was structured around a three-phase model called **"Think – Feel – Act"**, which integrates cognitive, social-emotional, and behavioral learning domains:

- **Think (Cognitive Domain):** Students analyzed the causes and consequences of urban problems such as

unplanned development, air pollution, and traffic. They explored concepts like smart cities, sustainable transportation, water management, and recycling systems. Inquiry-based discussions were held in the local context of Kayseri.

- **Feel (Social-Emotional Domain):** Through sensory and reflective exercises, students identified the most frequent colors, sounds, smells, and tastes they encounter in their city. They then imagined a sustainable urban environment they would like to live in and created emotionally-driven city visions.

- **Act (Behavioral Domain):** In the final phase, students worked in teams to design and build scale models of a smart, inclusive, and eco-friendly neighborhood in Kayseri. These models incorporated green infrastructure, zero-waste zones, safe routes to school, and cultural heritage preservation elements.

Main Results

The findings obtained during the workshop process indicate significant learning gains among students, both cognitively and behaviorally. Specifically:

- Students developed an understanding of the importance of community involvement in sustainable urban planning.

- Concrete solution proposals were developed, including smart lighting systems, sensor-based irrigation, and inclusive transportation networks.

- The physical city models created by students reflected their awareness of concepts such as environmental justice, circular economy, and intergenerational responsibility.

Notably, students exhibited measurable growth in critical thinking, environmental literacy, creative problem-solving, empathy, and collaboration. This multidimensional learning approach contributed to students' ability to connect abstract concepts like sustainability with their lived experiences and immediate environment.

Conclusion

Empowering young people through inclusive, action-based learning models is a critical step toward building sustainable and livable cities. The **"Think – Feel – Act"** model implemented in this study offers a replicable and practical educational framework that enables gifted students to actively engage in local climate action.

Such practices, when implemented in flexible and creative learning environments like Science and Art Centers, support the development of key 21st-century skills in young learners—such as leadership, civic responsibility, and environmental awareness. In doing so, students not only imagine better cities but also gain the will and capacity to help build them.

REFERENCES

1. Birleşmiş Milletler. Dünya Şehirler Günü 2025 – Tema: "Genç İklim Eylemi Öncüleri." [Internet]. [cited 2025 Jun 12]. Available from: https://urbanoctober.unhabitat.org

2. Türkiye Cumhuriyeti Millî Eğitim Bakanlığı. İklim Değişikliği Eylem Planı. Ankara: MEB; 2023.

3. Türkiye Cumhuriyeti Millî Eğitim Bakanlığı. Bilim ve Sanat Merkezleri Destek Eğitim Çerçeve Programı. Ankara: MEB; 2024.

4. United Nations. World Cities Day – Official UN Observance. [Internet]. [cited 2025 Jun 12]. Available from: https://www.un.org/en/observances/cities-day

5. UNESCO. Greening Education Partnership – Education for Sustainable Development. [Internet]. [cited 2025 Jun 12]. Available from: https://www.unesco.org/en/sustainable-development/education/greening-future

6. Sürdürülebilir Kalkınma Amaçları – Amaç 11: Sürdürülebilir Şehirler ve Topluluklar. [Internet]. [cited 2025 Jun 12]. Available from: https://www.kureselamaclar.org/amaclar/surdurulebilir-sehirler-ve-topluluklar/

Youth Participation in Urban Governance: Constraints and Opportunities in the Context of Local Decision-Making

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ABSTRACT

This study addresses the importance of ensuring the effective participation of young people in decision-making processes and examines the shortcomings observed in current practices. In this context, local governance practices in Turkey are analyzed, and participation processes realized through youth councils, digital participation methods, and civil society organizations are evaluated. Local decision-making mechanisms represent an important step in including young people, who will shape and build the future of society, in governance processes. Considering various factors frequently observed among today's youth—such as social disengagement, lack of purpose, identity confusion, and low self-esteem—integrating young people into urban decision-making mechanisms can help them achieve self-actualization, promote social integration, and contribute to society as active citizens. In general, the needs, demands, and ideas of the youth population are overlooked in urban governance; as a result, inclusive and sustainable urban policies fail to be developed. In this regard, it is crucial to accurately identify the barriers to youth participation in decision-making processes and to disseminate good practices. Ultimately, young people should not be seen merely as a target audience but as active stakeholders in decision-making processes, and participation channels should be expanded accordingly.

Key words: Youth participation, Urban governance, Local governments, Decision-making processes, Participatory democracy

Introduction

Achieving social development is possible through the active involvement of not only the adult population but also young individuals in governance processes. As a social group, youth can both perceive political, social, and economic dynamics and possess the potential to influence changes within these domains [1]. Youth participation in decision-making processes is crucial for the spread of democracy, the enhancement of transparency in governance, and the establishment of intergenerational justice [2]. However, due to various structural, cultural, and political barriers, youth participation in administrative processes in Turkey remains limited [3].

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The main objective of this study is to examine the extent to which young individuals are involved in local-level decision-making processes, evaluate the effectiveness of current practices, and develop recommendations to enhance youth participation. Within this framework, youth participation models in Turkey—particularly those carried out through youth councils, digital participation platforms, and civil society organizations—are explored. The impact of local governments on youth policies, young people's perspectives on urban life, and their level of participation in these processes are assessed.

In terms of methodology, both document analysis [4] and qualitative content analysis [5] were employed. In this context, youth council practices of various municipalities in Turkey, relevant regulations, activity reports of youth NGOs, and data from the Turkish Statistical Institute (TÜİK) were examined. The findings reveal that youth participation in decision-making processes generally remains at a symbolic level and that youth councils play a limited role in terms of both effectiveness and representation [6].

Main Results

It has been determined that the opinions of young people are not sufficiently taken into account by decision-makers, and that despite their potential, digital participation tools are not being used in a systematic and effective manner. However, it is understood that some municipalities and civil society organizations at the local level offer good practice examples, although these practices have not been widely adopted.

Comprehensive evaluations emphasize once again the importance of viewing youth not only as a "target group" but also as "partners in decision-making." Actively involving youth in governance processes contributes not only to their social and psychological development but also makes it possible to create participatory, inclusive, and sustainable urban policies [7].

Conclusion

Efforts to increase the representation of the youth population in decision-making processes should be expanded. In this regard, practices such as establishing youth quotas within decision-making bodies can be adopted. To encourage youth participation, educational and instructional programs that foster a culture of participation at all levels of education could help instill such culture from an early age. Lastly, providing financial support to participation platforms that include young people may further enhance youth engagement. In this context, the findings of the study suggest that youth policies in Turkey should be revisited and that youth participation should be strengthened not only in terms of quantity but also in terms of the quality and impact of their involvement in decision-making processes.

REFERENCES

1. Checkoway B. What is youth participation? Children and Youth Services Review. 2011 Feb; 33(2): 340-345.
2. Hart R A. Children's participation: From tokenism to citizenship. Florence: UNICEF International Child Development Centre; 1992.
3. Bal H. Katılımcı demokrasi ve gençlik katılımı: Türkiye'de gençliğin siyasal entegrasyonu. Akademik İncelemeler Dergisi. 2021; 16(1): 145-168.
4. Bowen G A. Document analysis as a qualitative research method. Qualitative Research Journal. 2009; 9(2): 27–40.

5. Forman J, Damschroder L. Qualitative content analysis. In: Jacoby L, Siminoff L A, editors. Empirical methods for bioethics: A primer. Vol. 11. Leeds: Emerald Group Publishing; 2007. 39–62.

6. Korkmaz A, Akdemir S. Gençlerin yerel yönetimlere katılımı: Gençlik meclisleri üzerinden bir değerlendirme. Sosyal Politika Çalışmaları Dergisi. 2020; 20(44): 185–212.

7. Öztürk M, Kaymakçı S. Yerel yönetimlerde gençlik katılımının önündeki engeller ve çözüm önerileri. Yerel Yönetim ve Denetim Dergisi. 2022; 7(1): 45–66.

Sustainable Smart-Green Campuses in the Context of Resilience: The Cases of ITU Ayazağa and Manisa Celal Bayar Central Campuses

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ABSTRACT

University campuses play a significant role in the holistic integration of sustainability, resilience, and smart city concepts. Universities must prioritize not only achieving sustainability goals but also preparing for the future with resilient structures, robust technological infrastructures, and flexible governance models. Establishing smart, green, and resilient campuses is of vital importance, particularly for countries located in regions with high disaster risk. This study questions to what extent the widely used UI Green Metric system for evaluating sustainable campuses reflects the concept of "resilience" in campuses located in earthquake-prone areas. Taking Istanbul Technical University's Ayazağa Campus—one of Turkey's leading technical universities—and the developing Central Campus of Manisa Celal Bayar University as case studies, the performance of these campuses is comparatively analyzed within the context of resilience. Furthermore, the importance of integrating smart systems into campus infrastructures is emphasized. As a result, increasing interest in green campus practices holds strategic importance not only for environmental and economic benefits but also for enhancing social resilience. The proliferation of such campuses constitutes an effective tool in both combating climate change and building resilient cities and communities against disaster risks.

Key words: sustainable smart-green campus, resilience, UI GreenMetric

Introduction

Today, university campuses are not only centers for knowledge production and dissemination but also serve as spaces where globally critical concepts such as sustainability, technological innovation, and disaster resilience are tested and embodied. The global climate crisis, the increasing risk of natural disasters, and the environmental pressures generated by urbanization necessitate a rethinking of traditional campus planning approaches, urging a restructuring of campuses through green, smart, and resilient systems [1]. While campuses are planned with the goal of ensuring environmental sustainability through energy efficiency, water management, and waste reduction, various disasters experienced in recent years

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in Turkey have brought the concept of "resilience" to the forefront [2]. Resilience refers to the capacity to withstand natural disasters, climate change, and other potential crises. Strengthening infrastructure, establishing emergency plans, and preparing communities for such situations are all addressed within the scope of resilience [3]. Moreover, in countries exposed to disasters such as earthquakes, floods, and fires, not only sustainability but also rapid recovery and infrastructural robustness during crises are of critical importance.

Although resilience is not directly included among the ranking criteria of systems that evaluate campus sustainability performance, it can be indirectly assessed through sustainability themes such as energy and climate change, waste management, water management, and transportation. In the 21st century, with the advancement of the internet and technology, smart applications have come to the forefront to address current problems and make settlements more livable. Regardless of scale, the concept of smart buildings or campuses is defined as self-sufficient entities that use energy efficiently, are sensitive to disasters and the environment, ensure security, prioritize comfort, and adapt to user needs. Smart, green, and resilient campuses can be described as innovative settlements that integrate technology with environmental, economic, and social sustainability, as well as disaster resilience. These campuses should ensure sustainability through renewable energy resources, smart buildings, and automation systems, while also possessing the capacity to recover rapidly in times of crisis.

This study re-centers the often-overlooked concept of "resilience" in sustainable campus evaluation approaches, taking as examples two campuses in Turkey that differ in scale and context: Istanbul Technical University's Ayazağa Campus and Manisa Celal Bayar University's Central Campus. In the study, the UI Green Metric performances of these two campuses [4], as well as their physical infrastructures, governance models, and technological capacities, are evaluated from the perspective of resilience. Furthermore, the integration level of smart systems into these structures is examined, and suggestions are developed for a campus model that is prepared for disasters, sustainable, and technologically equipped. In this context, the aim of the study is to reassess the concept of sustainable campuses through the lens of resilience; to question the adequacy of current systems in this regard; and to reveal the contribution of smart-green campus practices to the overall resilience level of society. The significance of the study stems not only from offering an academic analysis, but also from providing concrete findings that can guide policymakers, local administrators, and campus planners—particularly in a country like Turkey that is situated in a high-risk disaster zone. Accordingly, the study aims to present a comprehensive perspective on how environmental sustainability and social resilience can be integrated on the campus scale. Sustainable settlements or green campuses stand out as university campuses designed to promote environmentally friendly infrastructure and sustainable lifestyles.

In disaster-prone countries such as Turkey, the concepts of sustainability and resilience must be considered together. The relationship between resilience and sustainability should also be emphasized in systems that assess the sustainability performance of universities, such as the UI GreenMetric, and in the future, resilience indicators should be incorporated into the ranking criteria. An examination of campuses in Turkey reveals an increasing number of green campus projects, while the aspect of resilience is often overlooked. However, in the face of disaster risks, it is not sufficient for green campuses to be sustainable alone; resilient infrastructures and effective disaster management systems must also be integrated. In this regard, collaboration among universities, ministries, public institutions, and local governments is essential to ensure that campuses are both environmentally sensitive and disaster resilient.

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Main Results

1. **UI GreenMetric Performance Analysis**

When the data from the 2023–2024 period of the UI GreenMetric are analyzed, a notable difference is observed between the two universities in terms of ranking and scores. ITU ranks first in Turkey and is among the top 40 universities globally (Total Score: 8800), demonstrating international success in the field of sustainability. When examined categorically, ITU received near-maximum scores in the high-weighted categories (Table 1). These scores validate the university's well-established and successful practices in areas such as energy efficiency, the use of renewable energy, waste recycling programs, sustainable transportation policies, and academic activities focused on sustainability. On the other hand, Manisa Celal Bayar University has made significant progress in recent years, reaching 49th place in Turkey and 509th place globally (Total Score: 6675). MCBU's scores indicate a strong potential for further development.

Table 1. Comparison of UI GreenMetric Scores: ITU vs. MCBU [5]

2024 Ranking	Istanbul Technical University	Celal Bayar University
	#38	#509
Setting & Infrastructure	1175	1075
Energy & Climate Change	1700	1500
Waste	1650	1050
Water	900	500
Transportation	1650	1275
Education & Research	1725	1275
Total Score	8800	6675

2. Sustainability and Resilience

While sustainability focuses on future-oriented goals through the efficient use of resources, resilience centers on maintaining existing assets and functionality in the face of sudden and disruptive events. For a country like Turkey, located on active fault lines, this distinction is a vital necessity. A review of the six main categories of the UI GreenMetric system clearly reveals the absence of resilience-related metrics.

- *Setting & Infrastructure:*
  This category evaluates elements such as the proportion of green space, the campus budget allocated to sustainability investments, and accessibility for disabled individuals. However, it lacks indicators that directly assess resilience, such as the seismic performance of buildings, compliance of the existing building stock with earthquake regulations, structural safety of critical infrastructure (e.g., data centers, laboratories, power plants), or the adequacy of designated emergency assembly areas. Al-

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though ITU Ayazağa Campus, with its strong engineering background, likely possesses structurally sound buildings, its score does not provide data to support this assumption.

- *Energy & Climate Change:*
  This category measures energy efficiency and the use of renewable energy sources. However, it omits resilience-focused metrics such as redundant energy systems capable of off-grid operation after a potential earthquake, microgrids, or the capacity of uninterruptible power supplies to sustain vital units during emergencies. A high UI GreenMetric score in Energy & Climate Change does not guarantee that a campus could maintain essential functions (shelter, communication, first aid) for hours or days following a major power outage.

- *Waste:*
  This category assesses environmental performance in daily operations through recycling rates, organic waste processing, and hazardous waste disposal. ITU's high score in this area indicates the presence of a well-established system. However, it completely overlooks disaster scenarios. Questions remain unanswered, such as how tons of debris generated by a potential earthquake would be managed, whether there is temporary on-campus waste storage capacity if regular collection services are disrupted, or whether an emergency protocol exists for an anticipated increase in medical waste. A resilient campus should have a dedicated "Disaster Waste Management Plan."

- *Water:*
  While this category focuses on water conservation and reuse, it does not assess critical resilience components such as access to clean water after a disaster, emergency water storage capacity, or the availability of alternative water sources.

- *Transportation:*
  This category evaluates efforts to reduce motorized vehicle use on campus, promote cycling and pedestrian pathways, and support zero-emission vehicles. ITU's high Transportation score reflects its success in reducing its carbon footprint. However, these metrics do not measure emergency logistics or evacuation capacity. Can pedestrian walkways and narrowed vehicle roads allow tens of thousands of people to evacuate the campus quickly and safely during a panic situation? Are there designated corridors that remain unobstructed under all conditions to ensure unrestricted access of emergency vehicles (e.g., fire trucks, ambulances) to every point on campus? The UI GreenMetric score overlooks the potential contradiction between transportation efficiency during normal times and evacuation effectiveness during crises.

- *Education and Research:*
  This category measures the number of courses and publications related to sustainability. However, it fails to adequately emphasize practical metrics such as disaster awareness training, regular earthquake drills, the existence and effectiveness of campus emergency response plans, or resilience-focused R&D projects.

Conclusion

In the process of integrating the concepts of sustainable, resilient, and smart cities through a holistic approach, university campuses play a crucial role. In this context, university campuses should not only aim to achieve sustainability goals but also prioritize preparedness for the future through resilient structures, robust technological infrastructures, and flexible governance models. The omission of smart and resilient campus criteria from widely adopted international evaluation systems poses a significant risk. Universities with high UI GreenMetric scores are often labeled as "fully sustainable," yet they may, in fact, be structurally and functionally "fragile." Given

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the high seismic risk of Istanbul, where ITU is located, the university's operational success in sustainability does not guarantee its physical or functional resilience during a disaster. Similarly, considering the earthquake risk in Manisa and its surroundings, integrating a resilience perspective into MCBU's sustainability efforts is not merely a choice but a strategic necessity. True and holistic sustainability must encompass not only environmental performance under normal conditions but also the capacity to withstand shocks, adapt to disruptions, and maintain core functions in times of crisis. Therefore, evaluation systems such as UI GreenMetric should retain their current metrics while also developing new indicators that focus on resilience and smart systems, especially for institutions located in risk-prone geographies. These indicators should address areas such as structural reinforcement, emergency management, community preparedness, and the development of technological infrastructure. Otherwise, the prestigious "green campus" titles awarded may risk losing their significance in the face of inevitable natural disasters.

REFERENCES

1. Erdem N. Dirençli kent ve kompakt kent modellerinin sürdürülebilirlik çerçevesinde değerlendirmesi. Eurasian J For Sci. 2022;10(3):183–206.
2. Doğaner A. Sürdürülebilir ekonomik kalkınma için Türkiye'de dirençli şehirler. Çevre Şehir ve İklim Dergisi. 2022;1(2):59–80.
3. Parizi SM, Taleai M, Sharifi A. A spatial evaluation framework of urban physical resilience considering different phases of disaster risk management. Nat Hazards. 2024:1–36.
4. Atici KB, Yasayacak G, Yildiz Y, Ulucan A. Green University and academic performance: An empirical study on UI GreenMetric and World University Rankings. J Clean Prod. 2020; 291:125289.
5. UI GreenMetric Methodology. GreenMetric World University Rankings Methodology [Internet]. 2024 [cited 2025 Jun 17]. Available from: https://greenmetric.ui.ac.id/rankings/overall-rankings-2024/

Prediction of Ömerli Dam Water Level Using Artificial Neural Networks

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ABSTRACT

Using the precipitation and evaporation values of the Ömerli Dam basin in Istanbul, which affect the dam's water level, along with the dam's water level measurements from 2000 to 2023, the aim was to predict the water level in the dam reservoir for the first 15 days of March 2023 using artificial neural networks. In the models created with artificial neural networks, monthly datasets obtained from daily data were used with the multilayer artificial neural network model LSTM. It was determined that the predicted data closely matched the actual water level, with an RMSE value of 62.33 Based on these results, it can be stated that the ANN model provides successful outcomes in predicting the water level of the Ömerli Dam.

Keywords: Artificial Neural Networks, Dam Water Level, Prediction, Precipitation, Evaporation.

Introduction

In recent decades, the accurate prediction of reservoir water levels has become increasingly critical due to the escalating effects of climate change, irregular precipitation patterns, and rising water demands in urban environments. Effective forecasting of reservoir levels is essential not only for optimizing water resource management and infrastructure planning, but also for mitigating risks associated with extreme hydrological events such as droughts and floods. Conventional statistical methods often fall short in addressing the nonlinear and dynamic behavior of hydrological systems. In contrast, data-driven approaches, particularly deep learning models, have shown significant promise in capturing the complex temporal dependencies inherent in such systems.

Long Short-Term Memory (LSTM) networks, a type of recurrent neural network, have emerged as a powerful tool for time series forecasting owing to their ability to learn long-range dependencies and retain memory over sequential data. Recent studies have demonstrated the superiority of LSTM models over traditional methods in water level forecasting tasks. For instance, Vizi et al. applied the LSTM model to the Tisza River in Central Europe, reporting high accuracy in both low (≤ 239 cm) and flood (≥ 650 cm) water levels, although with moderate reliability at intermediate levels (1). Their findings underscore LSTM's strength in dealing with extreme hydrological conditions.

Similarly, Özer et al. compared LSTM with other machine learning models for predicting water levels in Ma

masin Reservoir. The LSTM model achieved outstanding performance, with $R^2 = 0.9515$ and RMSE = 3.49, indicating its robustness and reliability (2). A hybrid LSTM–GRU model was proposed by Cho et al., incorporating meteorological inputs and achieving high accuracy metrics (MSE = 3.92, NSE = 0.942, MAE = 2.22), particularly in flood prediction scenarios (3). These findings suggest that combining LSTM with other deep learning architectures can further enhance model performance.

Expanding on this trend, Li et al. evaluated several LSTM-based hybrid models including BiLSTM, CNN–LSTM, and CNN–Attention–LSTM for the Three Gorges Reservoir. Their results highlighted the CNN–Attention–LSTM model's superior ability to capture both seasonal variations and short-term fluctuations, emphasizing the potential of hybrid deep learning models for improving forecast accuracy in complex hydrological environments(4).

Building upon these advancements, this study presents a data-driven approach to forecast the monthly water level of the Ömerli Reservoir using an LSTM neural network. The model leverages LSTM's temporal learning capabilities to process daily reservoir data and generate multi-step ahead predictions. The workflow includes comprehensive data preprocessing, model training and evaluation, and visualization of forecast results. Model performance is assessed using Root Mean Square Error (RMSE), providing a quantitative measure of prediction accuracy. This research not only contributes to the growing body of literature on deep learning applications in hydrology but also offers practical insights for sustainable reservoir operation and water resource management.

Main Results

The training and testing correlation values of the artificial neural network are close to each other and close to zero.

In Figure 1. it can be seen that the values predicted by the ANN overlap with the observed values in some parts of the graph, while in other parts they fall slightly below or above the actual values. This indicates that the model has a low error margin.
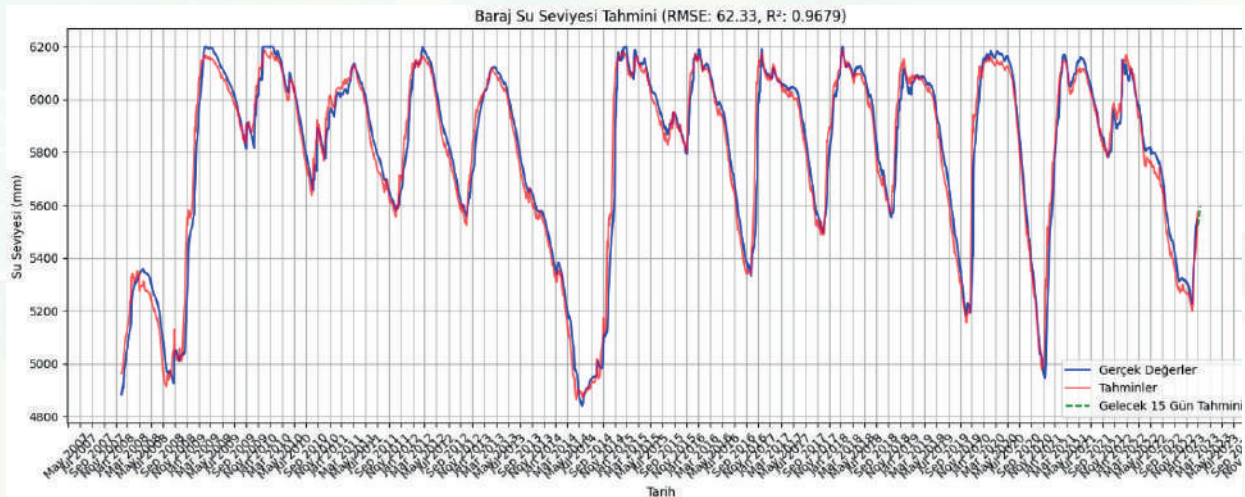
Figure 1. Graph of the distribution of and actual values by month.

Conclusion

In this study, an LSTM-based deep learning model was developed to forecast daily reservoir water levels using meteorological and hydrological variables such as rainfall and evaporation. The dataset, compiled from three different sources, was preprocessed by interpolating missing values, applying logarithmic transformation to reduce skewness, and standardizing features using a StandardScaler.

The model architecture consists of a three-layer LSTM with 64 hidden units per layer and a fully connected output layer, trained to predict water levels for the next 15 days. A sliding window approach was used to create sequences with a 30-day look-back period. The model was trained using the Adam optimizer and mean squared error (MSE) as the loss function, with early stopping implemented to prevent overfitting.

Evaluation on the validation dataset showed a good match between predicted and actual values, with a final RMSE that reflects strong forecasting performance. Additionally, visualizations of past predictions and future projections illustrate the model's ability to capture temporal trends and provide actionable insights. In this study, the obtained R^2 score of 0.9679 indicates that the model performs with high accuracy in predicting reservoir water levels. R^2 was used during both the training and validation processes, and it was also calculated to evaluate how accurately the model predicts based on historical data. This value shows that the model successfully explains approximately 96.79% of the variations in water levels and is capable of generating reliable forecasts.

This LSTM-based forecasting framework can serve as a valuable decision-support tool for water resource management, enabling proactive planning against potential shortages or overflows.

REFERENCES

1. Vizi Z, Batki B, Rátki L, Anda A. Water level prediction using long shortterm memory neural network model for a lowland river: A case study on the Tisza River, Central Europe. Environ Sci Eur. 2023;35(1):91. doi:10.1186/s12302-023-00878-w
2. Özer M, Yoon S, Kim K. Water level prediction model applying an LSTM–GRU-based water level prediction model using water level data and meteorological data. Water. 2024;16(6):1089. doi:10.3390/w16061089
3. Cho Y, Kim H, Lee S, Park J. Flood forecasting using hybrid LSTM and GRU models with lag time preprocessing. Water. 2022;14(18):2871. doi:10.3390/w14182871
4. Li Y, Zhang H, Wang R, Liu Q. Water-level prediction analysis for the Three Gorges Reservoir area based on a hybrid model of LSTM and its variants. Water. 2024;16(9):1352. doi:10.3390/w16091352

Typo-morphological Reflections of New Generation Urban Living Spaces in Rural Contexts: The Case of Kalabak

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ABSTRACT

With the increasing impact of urbanization on rural areas in Turkey, new legal regulations have been required for the governance and planning of these areas. In this context, Law No. 6360, which came into force in 2012, reclassified villages and towns within the administrative boundaries of metropolitan municipalities as neighborhoods (Official Gazette, 2012)[1]. Although this regulation aimed to sustain rural life, hybrid transitional zones have emerged where spatial structures are transformed, everyday life practices shift, and cultural disintegration deepens in peri-urban areas. The lack of systematic data on housing typologies and spatial patterns, along with the limited academic literature on the rural neighborhoods of Aliağa—a district of İzmir province—prompted the selection of Kalabak Neighborhood as the case study. The analysis was conducted based on categories and sub-parameters defined within the tipo-morphological approach to investigate the physical-spatial structure of Kalabak Neighborhood. The parameters used were derived from fundamental approaches commonly applied in the urban morphology literature. This research constitutes an initial step in the documentation and interpretation of rural morphological typologies in Aliağa, contributing to the understanding of how spatial identity in rural areas evolves under administrative and socio-economic influences.

Key words: typo-morphology, rural settlements, housing typology, spatial analysis

Introduction

In this context, the study first examines key analysis parameters frequently employed in urban morphology literature, classifying the typological and morphological criteria proposed by Caniggia and Maffei (2001)[2] and Conzen (1960)[3] within a shared theoretical framework. Based on this framework, the field research conducted in Kalabak Neighborhood documents and analyzes housing typologies, parcel configurations, and street patterns. The findings indicate that while the spatial structures of rural settlements largely retain their traditional characteristics, they also exhibit formal divergence due to recent building trends. These insights provide valuable guidance for the development of planning and design policies aimed at preserving rural identity.

This study adopts a typo-morphological approach to identify and interpret the spatial characteristics of rural settlements in the Aliağa district. The primary aim of this study is to identify the morphological patterns and document the elements of rural spatial identity by examining the spatial and housing typologies of Kalabak Neighborhood. Kalabak was selected due to its representational significance and the lack of prior academic research on the area. The study seeks to develop a detailed morphological profile through qualitative field observations and spatial data modeling.

The geographical scope is limited solely to Kalabak Neighborhood, located within the district of Aliağa. The absence of current and systematic datasets detailing the spatial layout and housing typologies of this neighborhood, along with the lack of original academic studies on Aliağa's rural settlement structure, have been decisive in selecting this area as the focus of the research. Accordingly, the study aims to fill a gap in the literature and provide an original contribution.

Drawing from the typological theories of Caniggia and Conzen, the study employs a typo-morphological approach to decode the spatial identity of Kalabak Neighborhood.

Main Results and Discussion

Aliağa, a district of İzmir province, comprises a total of 32 neighborhoods, 19 of which are classified as rural. Kalabak Neighborhood is a rural settlement located in the northeastern part of the district. There are two distinct settlement units within Kalabak Neighborhood: "Eski Kalabak" and "Yeni Kalabak," the latter of which emerged in 2020 through a formal parceling process. These two areas are connected by a 7.7 km stretch.

Table 1 highlights the typological differences in the building stock of both settlement units. In terms of architectural style, traditional structures are predominant in Eski Kalabak, whereas modern buildings dominate in Yeni Kalabak. This contrast reflects the more recent development of Yeni Kalabak and is also evident in the choice of construction materials.

In Eski Kalabak, local and natural materials such as stone and brick are commonly used, while in Yeni Kalabak, prefabricated construction systems have also become prominent. This shift indicates evolving preferences in the building production process, driven by considerations of cost-efficiency and time-saving.

Regarding openings such as doors and windows, Eski Kalabak maintains its traditional architectural character through the use of iron and wood, while Yeni Kalabak features more modern materials like steel and PVC. This trend suggests a prioritization of durability and affordability over aesthetic continuity.

When roof typology is examined, tiled roofs are prevalent in Eski Kalabak, whereas Yeni Kalabak exhibits a more diverse typology, including not only tiles but also terrace and metal sheet roofs. This variation points to a growing emphasis on functionality and contemporary construction trends rather than spatial aesthetics.

Table 1. Comparative Morphological Parameters of Sample Areas A1 and A2

Morphological Parameter	Eski Kalabak (A1)	Yeni Kalabak (A2)
Settlement Pattern	Organic	Gridded
Transportation Network	Includes cul-de-sacs	Fluid, planned
Number of Floors	1–2 storeys	1–2–3 storeys
Architectural Style	Traditional	Modern
Building Materials	Stone, brick	Brick, prefabricated
Door/Window Materials	Iron, wood	Steel, PVC
Roof Typology	Predominantly tiled	Tiles, terraces, metal sheets
Social Infrastructure	Limited	Developed
Occupancy Status	19% abandoned	100% in use

The comparative table above highlights the fundamental morphological contrasts between Eski Kalabak and Yeni Kalabak. While Eski Kalabak retains the organic and traditional features typical of historical rural settlements, Yeni Kalabak exhibits a more modern and planned urban form. These differences underline the dual nature of spatial transformation in peri-rural areas, shaped by administrative restructuring, socio-economic trends, and evolving construction practices.

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Conclusion

The research indicates that the disregard of traditional typological features—such as façades, materials, and roof types—in new developments leads to a loss of spatial identity and the disruption of morphological integrity. In this context, it is recommended that typo-morphological analyses be utilized as guiding tools in planning and construction processes in rural contexts.

For future studies and practical implementations, attention should be given to the following aspects to ensure the preservation and continued vitality of rural heritage:

- Development of building guides that reference local architectural identity,
- Formulation of construction principles compatible with the traditional fabric,
- Integration of typo-morphological analysis into zoning and development plans,
- Establishment of incentive mechanisms for the preservation and restoration of existing buildings,
- Adaptation of architectural control mechanisms to the specific characteristics of rural contexts,
- Regulation of new developments in ways that do not disrupt morphological continuity,
- Incorporation of formal coherence alongside functional considerations in planning decisions,
- Definition of licensing procedures sensitive to traditional construction techniques,
- Avoidance of physical interventions that exclude local lifestyles and cultural context.

REFERENCES

1. Law No. 6360 on the Establishment of Metropolitan Municipalities in Fourteen Provinces and the Formation of Twenty-Seven Districts, and on Amendments to Certain Laws and Decree Laws (6360 sayılı On Dört İlde Büyükşehir Belediyesi ve Yirmi Yedi İlçe Kurulması ile Bazı Kanun ve Kanun Hükmünde Kararnamelerde Değişiklik Yapılmasına Dair Kanun). T.C. Resmî Gazete [Official Gazette of the Republic of Turkey], No. 28489, Date: 06.12.2012. Accessed: 02.07.2025. Available at: https://www.mevzuat.gov.tr/mevzuat?Mevzuat-No=6360&MevzuatTur=1&MevzuatTertip=5

2. Conzen MRG. Alnwick, Northumberland: A study in town-plan analysis. 2nd ed. London: Institute of British Geographers; 1969.

3. Caniggia G, Maffei GL. *Architectural composition and building typology: Interpreting basic building.* Siena: Alinea Editrice; 2001.

4. Moudon AV. Urban morphology as an emerging interdisciplinary field. Urban Morphol. 1997;1(1):3–10.

5. Turkish Statistical Institute (TÜİK). [Internet]. Accessed: 2024 Sep 15. Available from: https://www.tuik.gov.tr/

6. Aliağa Municipality. [Internet]. Accessed: 2025 Jul 2. Available from: https://www.aliaga.bel.tr/

7. General Directorate of National Property. [Internet]. Accessed: 2025 Jul 3. Available from: https://milliemlak.csb.gov.tr/

8. General Directorate of Land Registry and Cadastre. Parcel Inquiry [internet]. Accessed 05 July 2024. Available from: https://parselsorgu.tkgm.gov.tr

Rejuvenating City Residents with Gerontechnology in Aging Cities

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ABSTRACT

Cities that are growing with their population, volume and problems are also evolving towards becoming aging cities, both in terms of their physical structures and their residents. Just as cities that are constantly being physically renewed in this process are rejuvenated with technological equipment, their elderly residents are also integrating with young technologies for a longer and healthier life with the use of gerontechnological products (technology for elderly use). The constantly evolving and updated structure of technology ensures that it is the main determinant of the lifestyles of young people. On the other hand, with increasing life expectancy, the elderly also need to integrate with technology, turn to wearable technologies, use health technologies more intensively and especially increase their technological health literacy. As the most recent example, during the Covid 19 pandemic, it was understood how much they needed all kinds of technology use, the importance of monitoring health monitoring programs and other public institutions reaching out to the elderly through these means. All these elements show that the age-friendly city and youth/child-friendly city approaches are integrated in the focus of technology. This study addresses the importance of the technological perspective in the cities of the future for both the physical structure of the city and the elderly city dwellers, and aims to draw attention to the importance of the gerontechnological perspective articulated in smart city-smart building approaches. In the study based on literature review, examples of the increasing use of technology in the elderly policies of city administrations are compiled as social innovative models.

Key Words: Gerontechnology, Smart city, aging, social innovation, wearable technology

Introduction

Aging is a natural and inevitable process that continues from birth to death (1). The basic needs of older individuals include access to healthcare, housing, nutrition, rehabilitation, independence in daily life, self-care, and social communication. The use of digital technologies provides convenience and support for older adults in meeting these basic needs (2). In this process, in addition to physiological and psychological changes, the cumulative effects of social changes such as prolonged exposure to external factors, isolation, and the loss of loved ones also come into play (3).

According to data from the Turkish Statistical Institute (TurkStat), the proportion of the elderly population in the total population was 7% in 2008, 8% in 2013, and 10.2% in 2023 (4). This situation has made it essential to provide a safe home environment and prevent time loss in emergencies, as the care workforce is insufficient to meet the increasing demands for elderly care (5). Digital technologies used to ensure this security are also prioritized in approaches developed for the smart cities in which today's youth will live in the future (6).

In this context, it is clear that services provided to the elderly require up-to-date approaches, along with the simultaneous development of health information technologies (7). Supporting the elderly with technology and increasing their technological literacy is crucial for a shared intergenerational perspective in urban life.

Key Findings

Technologies used to improve the quality of life and meet the care needs of older adults include applications such as home health monitoring devices, emergency buttons, and smart home systems. These technologies help older adults maintain their independence and receive rapid intervention in emergencies. These technologies increase the effectiveness of elder care services and alleviate the burden on caregivers.

Gerontechnology is an approach conceptually derived from the words gerontology and technology, and is the name given to the entirety of aging and technology studies to improve the daily activities of the elderly (8). Studies in the field of gerontechnology are organized within the framework of five basic support areas for the elderly to live a healthier and more active life. This framework is called the Five Methods of Gerontechnology and consists of the following categories: prevention, development, compensation, care support and research (9).

Despite the positive attitudes towards the use of technology among the elderly in Turkey, it has been found that only 8.3% of the elderly population recognizes the term gerontechnology (10). Studies have examined the use of digital health services by elderly individuals and have stated that they should be supported in terms of access to these services, information and education (11). The importance of digital technologies used in health services is increasing and studies have revealed how these technologies facilitate the access of elderly individuals to health services (12,13).

In Turkey, the Ministry of Health launched the e-health project in 2003 as part of the Health Transformation Project, aiming to establish a health information system encompassing all aspects of healthcare. This project aims to consolidate health data nationwide, provide citizens with access to their own health information, and create a database containing lifelong health records (14).

The ability of today's elderly to speak the same technological language as younger people and to monitor their health status in digital environments depends on their digital literacy. The skills individuals develop to adapt to constantly changing and advancing information technologies are defined as "digital literacy." Digital literacy encompasses not only technical knowledge but also cognitive, social, and cultural skills, enabling individuals to integrate into today's world (15).

An examination of the healthcare systems of developed countries reveals the widespread use of technological applications such as e-Health, telemedicine, mobile health, digital hospitals, wearable technology, and robotic surgery. These technological advancements are changing the delivery and accessibility of healthcare services

(16, 17). Undoubtedly, this process is related to policies regarding the vocational training of young people as well as new space-use decisions. For example, developed countries are shifting their healthcare investments toward e-Health systems and related technologies rather than large hospital construction. This not only differentiates healthcare institution construction policies but also expands the scope of healthcare services, making them more accessible through telemedicine and mobile applications. Therefore, similar developments in urban space-use decisions are inevitable in educational settings. The principle of working with robot colleagues will also be important in young people's future career decisions. Japan, a pioneer in healthcare technology, has robot nurses and toilet robots equipped with artificial intelligence. These robot nurses play an active role in blood sample collection, education, and nursing services; they can perform urine tests in 20 seconds and print or email the results to a doctor (18). This will change time and space requirements such as collecting materials, delivering them to laboratories, and setting time limits for storing test results. This service, which is used more frequently by the elderly population, will become a more significant factor in the future of young people's healthcare.

The use of technology in healthcare has come to the forefront in almost all its dimensions during the Covid-19 period. There has been a great explosion in both institutional and personal digital application use (19, 20, 21). Telemedicine robots providing remote care to Covid-19 patients have been used in hospitals in Boston. The US "Cody" robot assists in bed bathing, dressing, and rehabilitation of stroke patients. In Belgium, "Pepper" robots greet and guide visitors in hospitals (22). Again, the awareness and expectation that other epidemics will spread in the future of the world also show that technological regulations in this regard will maintain their importance.

Conclusion

In conclusion, while the use of digital technologies of the future, with the dimensions mentioned above, in all areas such as urban planning, settlement, transportation, etc., opens new perspectives for young people, a visionary perspective is also required for the healthier aging—and, in a sense, rejuvenation—of the aging population. The proficiency of older individuals in using new technologies should be increased not only for their physical health but also for their mental well-being. The trend toward digitalization and robotization in healthcare delivery and health data monitoring should be evaluated from a technical, ethical, and legal perspective in all areas of management policies.

In many parts of the world, critical health information such as heart rhythm and body temperature of individuals can be monitored by health centers with the help of devices used through wearable technologies (e.g. watches, rings, shoes, glasses, phones, etc.). These technological developments allow for continuous and more effective health monitoring. This trend should be supported, and "monitoring and surveillance" policies should be planned sensitively on the axis of freedom/security. All these processes will affect urban health policies and space usage decisions. Especially the elderly care sector and local social service policies to be implemented should be shaped accordingly.

REFERENCES
1. Kalınkara, V. Temel Gerontoloji Yaşlılık Bilimi Ankara: Nobel Yayınları. 2016. 7-8.
2. Karasoy, G., ve Yıldırım, B. Yaşlılara Yönelik Dijital Teknolojiler ve Sosyal Hizmet Uygulamaları Geronteknolojik Sosyal Hizmet Uygulamasını Doğurabilir mi? Toplum ve Sosyal Hizmet. 2023. 34(3). 727–742.
3. Sönmez, S., ve Çevik, C. Yaşlılık ve Sağlıkta Eşitsizlikler. Humanistic Perspective. 2021. 3(2). 496-511.

4. Türkiye İstatistik Kurumu. İstatistiklerle Yaşlılar 2023. https://data.tuik.gov.tr/Bulten/Index?p=Istatistikler-le-Yaslilar-202249667#:~:text=T%C3%9C%C4%B0K%20Kurumsal&text=Ya%C5%9Fl%C4%B1%20n %C3% BCfus%20olarak%20kabul%20edilen,9%2C9'a%20y%C3%Bckseldi

5. Oğlak, S. Türkiye'de yaşlı bireylerin bakım gereksinimlerine yönelik yaşadığı ortamda sunulacak bakım modelleri. "İş, Güç" Endüstri İlişkileri ve İnsan Kaynakları Dergisi. 2011. 13 (4), 115-130.

6. Tunçer, A.S. Yerel Yönetimlerde Teknoloji ve Bilgi Yönetimi (Akıllı Kent Felsefesi ve Uygulamaları Bağlamında Bir Değerlendirme). İçinde Ed. Yalçınkaya, B., Altay Ünal, M., Yılmaz, B., Özdemirci, F. (Eds). Bilgi Yönetimi ve Bilgi Güvenliği. Ankara: Ankara Üniversitesi Yayını. 2019. 349-379.

7. Aksu, T., & Fadıloğlu, Ç. Yaşlılıkta evde bakıma güncel yaklaşımlar: "Telefon zinciri yöntemi ve kurtarıcı servisler teknolojisi". Maltepe Üniversitesi Hemşirelik Bilim ve Sanatı Dergisi. 2010. 2 (3).119-125.

8. Fukuda, Ryoko Gerontechnology for a Super-Aged Society. in F. Kohlbacher and C. Herstatt (eds.). The Silver Market Phenomenon. Berlin, Heidelberg. Springer-Verlag. 2011. 79.

9. Graafmans, J. A., Taipale, V. ve Charness, N. (Eds.). Gerontechnology: A sustainable investment in the future (Vol. 48). IOS Press. 1998.

10. Hazer, O., ve Ateşoğlu, U. L. Yaşam Kalitesine Geronteknolojik Bakış1. The Journal of Academic Social Science Studies. 2017. 63.

11. İlgar, Y., ve Bilgili, N. Yaşlı Bireylerde E-Sağlık Okuryazarlık Düzeyi ve Dijital Sağlık Hizmetlerinin Altuntaş, E. Y. Sağlık hizmetleri uygulamalarında dijital dönüşüm. 1.Baskı. Konya: Eğitim Kitabevi. 2019.

12. Ülke, R. ve Atilla, E.A. Sağlık Hizmetlerinde Bilişim Sistemleri ve E-Sağlık: Ankara İli Örneği. Gazi İktisat ve İşletme Dergisi. 2020. 6(1). 86-100.

13. Kılıç, T. E-Sağlık, İyi Uygulama Örneği; Hollanda. Gümüşhane Üniversitesi Sağlık Bilimleri Dergisi. 2017. 6(3). 203-217.

14. Çoban, M. Türkiye'de E-Sağlık Uygulamalarında Mevcut Durum. Bingöl Üniversitesi Sağlık Dergisi. 2023. 4(1). 197-204.

15. Yıldırım, B. ve Kılıç, C. Dijital okuryazarlık odağında eleştirel bir bakış (düşünme) ve değerlendirme. İçinde: S. Yıldırım, D. Çakmak Karapınar ve L. Bayındır (Eds). Dijital Okuryazarlık (ss. 198-211). Erzurum: Atatürk Üniversitesi Yayınları. 2021.

16. Tunçer, A.S. Geleceğin Kentlerinde Sağlık ve Katılım Politikaları. III. Kent Konseyleri Sempozyumu. Türkiye Kent Konseyleri Birliği. Balıkesir. 2021. 309-324.

17. Tunçer, A.S. The Effects of Artificial Intelligence Studies in Health as a Biopolitics Tool. International Cumhuriyet Artificial Intelligence Applications Conference (CAIAC'22). 8-9 December 2022. Sivas: Sivas Cumhuriyet Üniversitesi Yayını. 2022. 110-112.

18. Terkeş, N., ve Bektaş, H. Yaşlı sağlığı ve teknoloji kullanımı. Dokuz Eylül Üniversitesi Hemşirelik Fakültesi Elektronik Dergisi. 2016. 9(4). 153-159.

19. Tunçer, A.S. Coronavirüs Döneminde Dijital Devlet Uygulamaları. Kamu Yönetimi ve Teknoloji Dergisi (KAY-TEK). 2020. 2(2). 34-56.

20. Tunçer, A.S. Salgın Sürecinde Dünyada ve Türkiye'de Belediye Uygulamaları, Ankara: TBB Yayını. 2021.

21. Tunçer, A.S. Salgına Dirençli Kent Modeli: Çankırı. Ankara: Astana. 2022. 116-121.

22. Bacaksız, F. E., Yılmaz, M., Ezizi, K., ve Alan, H. Sağlık hizmetlerinde robotları yönetmek. Sağlık ve Hemşirelik Yönetimi Dergisi. 2020. 3(7). 458-465.

Biogas and Organic Fertilizer Production from Urban Organic Waste: Contributions to Urban Circular Economy

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ABSTRACT

Urban organic waste management is a crucial element of sustainable cities within the circular economy framework. This study investigates the economic and environmental contributions of producing biogas and organic fertilizer from municipal organic waste. The research emphasizes the use of generated biogas in city gas networks and as compressed natural gas (CNG) fuel for municipal fleets. By integrating biogas into local energy systems and using the digestate as organic fertilizer, cities can reduce landfill dependency, lower greenhouse gas emissions, and enhance local resource cycles. The paper presents key case studies and provides an impact analysis on urban sustainability indicators. The findings demonstrate that such practices not only support waste valorization but also contribute to energy security and municipal cost savings.

Key words: Circular Economy, Biogas, Organic Waste.

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Introduction

The increasing urban population and consumption patterns generate vast quantities of organic waste, causing significant environmental and economic challenges for cities. Traditional disposal methods, particularly landfilling, are unsustainable and contribute heavily to methane emissions and soil degradation(1). Within the circular economy paradigm, the valorization of organic waste via anaerobic digestion to produce biogas and organic fertilizer presents an effective solution to close resource loops(2). Biogas, a renewable energy source rich in methane, can be injected into urban gas grids or upgraded as compressed natural gas (CNG) for use in municipal vehicles(3). Such integration not only mitigates fossil fuel dependence but also provides cities with localized energy alternatives. Moreover, the digestate, a by-product of the anaerobic digestion process, can be utilized as a valuable organic fertilizer, reducing the need for chemical inputs in urban agriculture and green spaces(4). This study aims to evaluate the economic and environmental benefits of implementing biogas and organic fertilizer systems in urban settings, with a specific focus on the potential for biogas utilization in municipal gas networks and vehicle fleets.

Main Results

The study is based on a comparative analysis of urban biogas facilities in Europe and Türkiye, supported by life cycle assessment (LCA) and cost-benefit analysis (CBA) methodologies. Key findings are summarized as follows: Urban organic waste streams (kitchen, market, and park wastes) have a high biogas yield potential, with an average of 100-150 m³ of biogas per ton of waste(5). Upgrading biogas to biomethane enables direct injection into existing gas infrastructure, enhancing city-wide energy circularity(6). Cities utilizing biogas-derived CNG for public transport and waste collection fleets reported annual greenhouse gas emission reductions of up to 30% and significant operational cost savings(7). Investment in biogas plants becomes economically viable within 7-10 years when municipal solid waste is used as a primary input, particularly when gate fees and carbon credits are incorporated(8). The digestate can replace approximately 50-70% of chemical fertilizers in urban green spaces and peri-urban agriculture, promoting soil health and reducing import dependency(9).

A table of performance indicators from selected urban biogas plants can be found below.

Table 1. Performance indicators of urban biogas plants

Indicator	Performance
Biogas Yield (m³/ton)	100-150
Fleet Fuel Cost Reduction	20-30% annually
GHG Reduction	Up to 30%
Fertilizer Substitution	50-70%

Conclusion

The valorization of organic waste via biogas and organic fertilizer production offers cities a strategic pathway toward circular economy objectives. Integrating biogas into municipal gas networks and utilizing CNG as fuel for city fleets significantly contributes to emission reduction targets and economic resilience. Furthermore, replacing chemical fertilizers with digestate supports urban ecological sustainability. It is recommended that cities develop policies to incentivize such integrated systems, particularly by creating synergies between waste management, energy, and transportation departments. Future research should focus on optimizing the logistics of organic waste collection to maximize system efficiency.

REFERENCES

1. European Environment Agency. Municipal waste management across European countries. EEA Report No 18/2013. 2013.
2. Ellen MacArthur Foundation. Towards the circular economy: Accelerating the scale-up across global supply chains. 2014.

3. IEA Bioenergy. Biogas upgrading technologies - developments and innovations. Task 37. 2019.
4. Möller K, Müller T. Effects of anaerobic digestion on digestate nutrient availability and crop growth: A review. Engineering in Life Sciences. 2012;12(3):242-257.
5. Mata-Alvarez J, Dosta J, Macé S, Astals S. Codigestion of solid wastes: A review of its uses and perspectives including modeling. Critical Reviews in Biotechnology. 2011;31(2):99-111.
6. Scarlat N, Dallemand JF, Fahl F. Biogas: Developments and perspectives in Europe. Renewable Energy. 2018;129:457-472.
7. Fischedick M, Schmid C. The role of compressed natural gas in municipal transport: Case studies from European cities. Renewable and Sustainable Energy Reviews. 2015;51:851-859.
8. De Clercq D, Wen Z, Fan F, Caicedo L. Biomethane as a sustainable transport fuel in Europe: Analysis of benefits and barriers. Journal of Cleaner Production. 2017;165:1025-1035.
9. Tambone F, Genevini P, D'Imporzano G, Adani F. Assessing amendment and fertilizing properties of digestates from anaerobic digestion through a comparative study with digested sludge and compost. Chemosphere. 2009;75(6):844-850.

Navigating Socio-Economic Conditions, Governance Structures and Cultural Values for Adopting Smart City Technologies in the Global South: Evidence from Youths in Kampala, Uganda

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ABSTRACT

The adoption of smart city technologies in the Global South presents unique opportunities and challenges shaped by diverse socio-economic conditions, governance structures, and cultural values. In this study, the contextual factors that influence the participation of youth in the adaptation of smart city technologies in Kampala, Uganda, were examined. The research survey data highlights that youth in Kampala face key barriers such as digital illiteracy, high costs of devices and internet access, institutional exclusion, and the cultural misalignment of technologies. The finding further indicates that though Kampala being the most connected demographic, youth in Kampala are not engaged in smart city planning and decision-making processes. The study thus recommends an urgent need for inclusive policies and investments that target digital infrastructure, education, and youth-centered governance. Services such as affordable internet, digital learning platforms, and job-matching apps are top priorities for youth's desire for smart technologies that directly address employment, education, and connectivity needs. This research contributes to a deeper understanding of how smart city initiatives can be made more equitable and locally relevant by centering the voices and needs of youth in urban innovation agendas.

Key words: Smart City Adoption, Youth Participation, Global South, Socio-Economic Challenges, Governance and Technology.

Introduction

Today's urban planning, development and management is increasingly adopting the use of emerging technologies such as the Internet of Things (IoT), Big Data analytics and Artificial Intelligence (AI) to improve not only infrastructure, and governance but also public services as a way of enhancing the quality of urban life (1). These technologies are also termed as smart city technologies. In the Global South,

however, adopting these technologies is still facing unique challenges and opportunities mainly because of socio-economic conditions, governance structures, and cultural values. These technologies offer great benefits such as better service delivery, increased citizen engagement, and economic growth, however if they are not well adapted to local needs in the Global South, they risk widening inequalities (2). From a socio-economic perspective, the Global South is further characterised by prevalence of poverty, inadequate infrastructure and informal economies which are major limitations to the effectiveness of smart technologies' adoption (3). It is common that many residents in urban centres in the Global South lack devices and do not have internet access, this creates a digital divide, which remains a significant barrier (4) to smart city adoption. Policy development and technology integration in the Global South is complicated by fragmented governance systems and structures because government agencies, private sectors, and civil society operate with varying coordination (5). This is further worsened by corruption, lack of transparency, and limited institutional capacity (6). Thus, there is a need for collaborative governance that engages diverse stakeholders to ensure effective smart city implementation. The cultural values and social norms in the Global South significantly shape how smart technologies are perceived. The influence of informal social networks amongst communities cannot be overlooked therefore design of smart city technologies should be aligned with these structures to be effective (7). Some residents in the Global South have varying culturally contextualized perceptions of technology, for example, some view smart systems with scepticism due to surveillance concerns (8). Therefore, a culturally sensitive engagement is crucial to build trust and ensure technology acceptance. Smart city planning, development and implementation in the Global South requires a holistic approach that goes beyond one-size-fits-all solutions implemented in the Global North. Smart city solutions for the Global South require a participatory design that should involve local communities in technology development to enhance relevance and acceptance (9). Leveraging local knowledge can lead to sustainable, context-specific solutions to ensure that smart cities address the unique needs of each urban setting. 60% of the Global South's urban population is expected to be under 18 by 2030 (10). As primary internet users, they engage in education, job searches, and civic activities, aligning with smart city goals (11). Thus, the youth are key stakeholders, and are often making sustainable choices, for example 83% are knowledgeable about waste management, 74% prioritize energy reduction, and 71% favour sustainable shopping (12). However, exclusion from planning, lack of trust in governments, and limited education hinders their involvement and engagement (13). Engaging youth in smart city planning taps into their creativity and commitment to sustainability, ensuring urban development meets current and future needs (14). The future of urban living in the Global South hinges on integrating innovation with inclusivity, particularly by empowering youth to shape their cities. This study seeks to investigate the adaptation of smart city technologies in the Global South by addressing both opportunities and challenges for inclusive participation of youth in urban development. The fundamental research question the study sought to answer was: "How do socio-economic conditions, governance structures, and cultural values influence the adoption and use of smart city technologies among youths in Kampala, Uganda?"

Main Results

The study revealed many interrelated challenges that youth in Kampala face in adapting to smart city technologies. The major challenge is lack of awareness of smart city technologies and digital literacy. This greatly limits not only their understanding but also engagement with smart city technologies. The high cost of smart devices and internet services was cited to further restrict access, especially for low-income youth. A number

of institutional constraints such as poor governance, limited coordination, and exclusion of youth from policy-making processes were also cited as hinderances to the development of inclusive digital strategies. On the cultural side, many technologies are not contextually adapted, making them less accessible or relevant to local users and this further marginalizes the youth in the smart city transformation. Addressing these challenges requires multi-stakeholder collaboration focused on affordability, digital literacy, inclusive governance, and culturally contextualizing technology design.
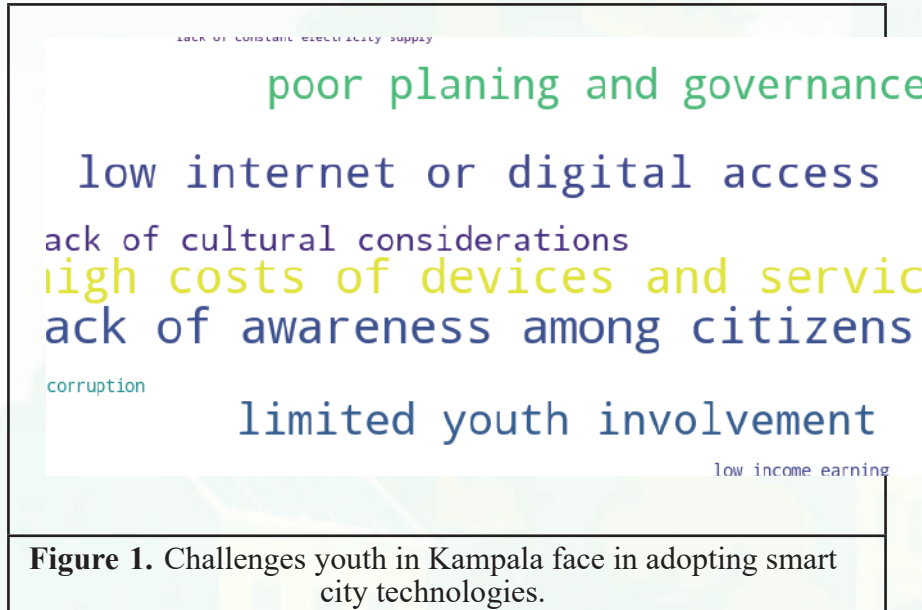
Figure 1. Challenges youth in Kampala face in adopting smart city technologies.

Table 1. The services that should be prioritized for smart city

Services that should be prioritized	% respondents
Affordable internet access	79.2
Digital learning platforms	68.3
Smart transportation and traffic management	41.5
Jobs and skill matching mobile apps	68.9
Online access to government services	45.9
Public safety technologies	40.4
Digital health care services	48.1
Renewable energy solutions	32.2

The survey results indicate that affordable internet access is the top priority for youth in Kampala, with 79.2% of respondents identifying it as essential for inclusive participation in smart city initiatives. This is followed by strong support for job and skill-matching mobile applications (68.9%) and digital learning platforms (68.3%), highlighting the urgent demand for technology-driven solutions to address youth unemployment and education gaps. Online access to government services (45.9%) and digital health care services (48.1%) also emerged as important, pointing to the need for efficient, accessible public service delivery. While smart transportation and traffic management (41.5%) and public safety technologies (40.4%) were moderately prioritized, renewable energy solutions (32.2%) received the lowest emphasis, possibly reflecting more imme-

diate concerns around connectivity, employment, and education over long-term environmental technologies.

Conclusion

This study underscores the importance of contextual sensitivity in the development and implementation of smart city technologies in the Global South. For youth in Kampala, significant barriers such as limited digital literacy, high costs of connectivity and devices, and exclusion from governance structures inhibit meaningful participation in smart urban initiatives. The lack of culturally adapted technologies further alienates youth, despite their potential as drivers of digital transformation. However, the findings also point to clear areas of opportunity: young people prioritize services that enhance access to education, employment, public services, and digital infrastructure. These priorities reflect an appetite for technologies that deliver tangible socio-economic benefits and bridge existing inequalities. The future success of smart cities in contexts like Kampala hinges on multi-stakeholder collaboration to design inclusive, affordable, and culturally resonant solutions. By engaging youth not just as beneficiaries but as co-creators of urban innovation, policymakers can ensure that smart city agendas are sustainable, equitable, and future-ready.

REFERENCES

1. Zheng C, Yuan J, Zhu L, Zhang Y, Shao Q. From digital to sustainable: A scientometric review of smart city literature between 1990 and 2019. J Clean Prod. 2020;258:120689. doi:10.1016/j.jclepro.2020.120689
2. Ghosh B, Arora S. Smart city imaginaries in Kolkata: A socio-economic analysis. Environ Plan C Polit Space. 2022;40(2):318-339. doi:10.1177/23996544211027583
3. Korah PI. Socio-economic strategies in Accra's City Extension Project. In: Smart Cities for Technological and Social Innovation. Elsevier; 2020:157-180. doi:10.1016/B978-0-12-818886-6.00009-5
4. Mahendra A, et al. Seven transformations for more equitable and sustainable cities. World Resources Report. 2021. doi:10.46830/wrirpt.19.00124
5. Medaglia R, et al. Artificial intelligence in government: A systematic literature review. Soc Sci Comput Rev. 2023;41(1):123-140. doi:10.1177/08944393211034087
6. Sameer N, et al. Digital participatory planning in Oman: A case study of smart city initiatives. Proc Inst Civ Eng Urban Des Plan. 2022;175(2):72-90. doi:10.1680/jurdp.21.00040
7. Mutambik I. Culturally informed technology for smart sustainable cities. Sustainability. 2024;16(10):4075. doi:10.3390/su16104075
8. Mutambik I. Culturally informed technology for smart sustainable cities. Sustainability. 2024;16(10):4075. doi:10.3390/su16104075
9. Sameer N, et al. Digital participatory planning in Oman: A case study of smart city initiatives. Proc Inst Civ Eng Urban Des Plan. 2022;175(2):72-90. doi:10.1680/jurdp.21.00040
10. UN Habitat. World Cities Report 2022. Nairobi: United Nations Human Settlements Programme; 2022.
11. International Telecommunication Union. Youth and the Internet: Statistics and Trends. Geneva: ITU; 2021.
12. Pew Research Center. Gen Z, Millennials Stand Out for Climate Change Activism, Social Media Engagement with Issue. Washington, D.C.: Pew Research Center; 2021.
13. Education International. Who's Making the Grade on Climate Change Education Ambition? Brussels: Education International; 2023.
14. Earth.Org. Why Youth Should Be Involved in the Planning of Smart Sustainable Cities. [Internet]. 2023 [cited 2025 Jun 11]. Available from: https://earth.org/youth-smart-sustainable-cities

Citizens' Perceptions and Expectations on Participatory Budgeting towards Sustainable Sakarya City: A Study by Youth Researchers

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ABSTRACT

Participatory budgeting, which supports democratic participation, transparency, accountability, and social trust at local levels, is an approach that enables citizens to be directly involved in decisions about allocating public resources. This study, conducted by young researchers, aimed to explore the perceptions and expectations of citizens in Sakarya about participatory budgeting practices in supporting sustainable cities. In the research, a scale was developed to measure the perceptions and expectations of Sakarya residents about this budgeting approach, and data were collected through online and face-to-face surveys. Then, the data were analysed using the SPSS software programme, and policy recommendations were proposed for local administrations in Sakarya based on the findings. The findings revealed the level of acceptance, interest, and expectations of Sakarya residents regarding participatory budgeting. According to the primary findings, the citizens did not know about participatory budgeting. However, the participants stated that the local governments in Sakarya needed to implement it. This study is also unique as it is the first to focus on participatory budgeting in Sakarya, providing insights into its applicability and potential benefits. The results would contribute to developing more inclusive and effective budgeting processes in local governance while offering valuable references for future studies.

Keywords: Local Governance, Participatory Budgeting, Sakarya

Introduction

Participation refers to a governance approach that involves the direct or indirect inclusion of individuals and communities in public decision-making processes. The participatory approach goes beyond merely voting in elections and emphasizes the active involvement of citizens in all stages of administrative processes, including planning, implementation, and oversight [1]. The participatory management approach has recently become one of the cornerstones of modern public administration. It is closely associated with the principles of efficiency, transparency, and accountability, particularly with the rise of the concept of governance [2]. Participatory budgeting (PB) is also a democratic budgeting approach that emphasizes the direct involvement of citizens in public budget processes, aiming to enhance transparency, accountability, and social inclusivity [3]. It was first implemented in 1989 in Porto Alegre, Brazil, and has since gained global prominence. Primarily,

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it advocates for citizens to have a direct say in the allocation of public resources, while practically, it seeks to achieve outcomes such as equitable resource distribution, increased trust in public services, and the strengthening of social capital [4]. PB process consists of several stages: preparation and information dissemination, neighbourhood meetings, representative selection, prioritization, budget approval and monitoring [5]. Implementing PB in local administrations contributes directly to the United Nations Sustainable Development Goal (SDG) 16: Peace, Justice, and Strong Institutions. SDG 16 emphasizes building accountable, transparent, and inclusive institutions and ensuring participatory decision-making at all levels [6]. Additionally, the 12th Development Plan (2024–2028) adopts a holistic approach based on participation, inclusivity, accountability, and transparency, aiming to foster social cohesion, address societal issues, and implement sustainable projects through PB[7]. However, in Turkiye, PB is implemented in the limited central cities, İstanbul, Çanakkale, İzmir, Uşak, Eskişehir, Ankara, and Trabzon. On the other hand, the cities identified as not yet implementing PB but currently in the preparation phase are Tekirdağ, Kocaeli, Manisa, Konya, Adana, Samsun, Diyarbakır and Sakarya.

From this perspective, in the study, we explored the perceptions and expectations of citizens about PB in supporting sustainable Sakarya City. The preparation process of PB in Sakarya has gained momentum through its inclusion in the Eastern Marmara Regional Plan. These efforts were shaped around sustainability, participation, and applicability, with participatory planning activities like consultation meetings, district visits, and surveys conducted. Its 2025–2029 Strategic Plan has also emphasized participatory methods and sought input from internal and external stakeholders to shape the plan's goals and objectives [8]. However, while participation has been embraced in Sakarya, PB practices have not yet been implemented. Studies on PB have lately increased significantly. [9] also focused on e-PB processes, while [10] examined PB models. [11] evaluated participation in democracy and transparency. In Türkiye,[12] performed a study on municipalities,[13] explored citizen budget practices and [14] adopted a critical approach. The contribution of our study to the literature lies in being the first to investigate perceptions of PB, specifically in the province of Sakarya.

Main Results

To achieve the research aim, we developed a survey titled "Determination of Citizens' Perceptions and Expectations Regarding Participatory Budgeting: A Field Study in Sakarya", comprising 20 items. The first 12 items were designed to assess the perceptions of citizens living in Sakarya regarding PB. The remaining 8 items aimed to uncover their expectations concerning this budgeting approach and a total of 400 individuals aged 18 and above responded the survey. Primarily, the scale demonstrated excellent internal consistency, with a Cronbach's Alpha (α) value of 0.89, indicating a high degree of reliability and validity. The sample demonstrates a high educational attainment, with most participants (57.1%) holding a license degree, while an additional 15.5% possess postgraduate qualifications, indicating a well-educated cohort. The age distribution shows a pronounced skew toward younger participants, with nearly half (44.8%) falling within the 18-29 age range, and an additional 23.1% in the 30-39 bracket, suggesting the sample predominantly represents younger to middle-aged adults. Gender representation exhibits a moderate female majority (59.8% female vs. 40.3% male), while occupational diversity is evident with educators comprising the largest professional group (28.2%), followed by farmers (20.0%) and officers (14.0%), indicating a mix of public sector professionals and agricultural workers. The combination of high educational levels, younger age demographics, and diverse occupational backgrounds suggests a sample that may be particularly relevant for studies examining contemporary perspectives among educated, working-age populations. Table 1 provides the frequency distribution of each item, respectively.

Table 1. Frequency Distribution of Each Item

		Never Disagree	Disagree	Unsure	Agree	Totally Agree
1	I have sufficient knowledge about participatory budgeting.	21,0	26,8	26,6	17,3	8,5
2	I have sufficient knowledge about the municipal budgets in Sakarya.	31,0	33,8	22,5	9,3	3,5
3	I think that municipalities in Sakarya sufficiently involve citizens in their decision-making processes.	28,5	31,3	25,5	9,3	5,5
4	I think that citizens should have a say in the budget expenditures of municipalities in Sakarya.	4,0	4,3	11,8	33,3	46,8
5	I think that citizens' opinions should be taken into account when prioritizing municipal services in Sakarya	2,5	3,8	7,8	31,6	54,5
6	I think that with the implementation of participatory budgeting in Sakarya, municipal revenues will be used more fairly.	3,5	5,0	18,8	35,3	37,5
7	I think that with the implementation of participatory budgeting in Sakarya, municipal revenues will be used more transparently.	3,0	6,5	15,5	32,3	42,8
8	I think that participatory budgeting practices in Sakarya will increase my trust in municipal governance	2,0	5,3	17,5	34,3	41,0
9	I think that citizen participation in municipal budget processes in Sakarya will improve the quality of public services.	3,8	3,3	13,0	39,1	41,0
10	I think that if a participatory budgeting process is initiated in Sakarya, I will actively take part in this process.	7,0	11,5	29,6	29,5	22,5
11	I think that my willingness to vote for a municipal administration that implements participatory budgeting will increase in the next elections.	3,8	6,0	23,1	33,5	33,8
12	I consider that participatory budgeting in Sakarya as a tool that strengthens the relationship between citizens and the municipality.	1,8	4,3	16,0	42,1	36,0

13	I request participatory budgeting practices to be initiated in Sakarya.	2,8	3,8	12,3	36,8	44,5
14	I expect the municipalities in Sakarya to inform me about participatory budgeting.	1,3	5,0	10,8	40,0	43,0
15	I expect the municipalities in Sakarya to gather citizens' opinions through various methods (surveys, meetings, etc.) in their budget planning processes.	2,3	3,0	9,8	36,5	48,5
16	I request digital platforms (websites) to be created in Sakarya where citizens can make suggestions about the municipal budget.	1,8	3,3	9,5	32,1	53,5
17	I expect citizen voting to be conducted when determining municipal projects in Sakarya.	2,8	3,8	11,5	34,3	47,8
18	I expect the implementation of participatory budgeting to provide services more suited to local needs in Sakarya.	1,8	2,5	12,8	37,3	45,8
19	I expect the implementation of participatory budgeting to improve the quality of life in public spaces in Sakarya.	0,8	3,0	14,8	36,8	44,8
20	I expect the citizens living in Sakarya to be included in the municipal budget processes.	2,3	3,3	14,2	35,8	44,5

According to Table 1, a significant portion of participants believe that the implementation of PB will provide services better suited to local needs (45.8% "Totally Agree") and improve the quality of life in public spaces (44.8% "Totally Agree"). Additionally, there is strong support for including citizens in budget processes (44.5% "Totally agree"). However, a notable percentage of participants feel that citizens are not sufficiently involved in the current municipal processes in Sakarya (31.3% "Disagree"). These results suggest that PB practices could strengthen the relationship between citizens and municipal governance while promoting more transparent and fair management. Based on the average scores of citizens' perceptions and expectations regarding PB, it is evident that their expectations (mean: 4.22) are significantly higher than their current perceptions (mean: 3.61). This highlights a considerable gap between what citizens aspire to achieve from the budgeting process and how they currently perceive its implementation and effectiveness.

Conclusion

The study explored the significant potential of PB in fostering sustainable urban development in Sakarya. Findings revealed that while citizens had limited knowledge about PB, there was a strong demand for its implementation. Participants believed that PB could enhance transparency, fairness, and inclusivity in municipal

governance, with many expecting it to improve the quality of public services and better address local needs. The results also indicated a gap between citizens' expectations and their current perceptions of municipal processes, emphasizing the need for more inclusive and participatory practices.

In conclusion, the research addressed the importance of integrating PB into Sakarya's local governance framework. By actively involving citizens in budget planning and decision-making, municipalities could strengthen public trust, improve service delivery, and align projects with community priorities. The study provided valuable insights for policymakers and serves as a foundation for future research on participatory governance in Türkiye.

REFERENCES

1   Eryilmaz, B. Participation and Public Administration. Ankara: Seçkin Publishing; 2010.

2   Güler, B. A. Governance: All Power to Capital. Praksis. 2003; 2: 93-116.

3   Wampler, B. A Guide to Participatory Budgeting. In: Shah, A., editor. Participatory Budgeting. The World Bank; 2007. 21-54.

4   Goldfrank, B. The World Bank and the Globalization of Participatory Budgeting. Journal of Public Deliberation. 2012; 8(2): 7. Available from: http://www.publicdeliberation.net/jpd/vol8/iss2/art7.

5   Yildiz, F., Alkan, F. A Study on Higher Education Students' Perception of Budgeting from the Perspective of Participatory Budgeting: The Case of Dumlupinar University. Journal of Finance Studies. 2017; 3(2): 129-145.

6   United Nations. Paris Agreement. United Nations; 2015. Available from: https://unfccc.int/sites/default/files/english_paris_agreement.pdf. Retrieved June 08, 2025.

7   Presidency of the Republic of Turkiye, Directorate of Strategy and Budget. Twelfth Development Plan (2024-2028). Ankara: Directorate of Strategy and Budget; 2023. Available from https://www.sbb.gov.tr/wp-content/uploads/2023/12/On-Ikinci-Kalkinma-Plani_2024-2028_11122023.pdf Retrieved June 08, 2025.

8   Sakarya Metropolitan Municipality. 2025-2029 Strategic Plan. Sakarya: Sakarya Metropolitan Municipality; 2024. Available from: https://www.sakarya.bel.tr/uploads/stratejik/NaNCU6FUbK.pdf. Retrieved June 08, 2025.

9   Mærøe, A., Norta, A., Tsap, V. and Papel, I. Increasing Citizen Participation in E-Participatory Budgeting Processes. In: Copeland, L., Towner, T., editors. Journal of Information Technology & Politics. 2021. 125-147.

10 Aziz, H., Shah, N. Participatory Budgeting: Models and Approaches. In: Rudas, T., Peli, G., editors. Pathways between Social Science and Computational Social Science. Springer; 2020. 215-236.

11 Laruelle, A. Voting to Select Projects in Participatory Budgeting. European Journal of Operational Research. 2021; 288(2): 598-604.

12 Zarplı, S. A. Participatory Budgeting as a New Approach in Public Budgeting: A Study on Municipalities in Turkiye. Karamanoğlu Mehmetbey University Journal of Social and Economic Research. 2022; 24(43): 1069-1088.

13 Geyik, O., Özbay, F. Citizen Budget as a Tool for Participatory Budgeting and Its Implementation in Turkiye. Artuklu Kaime International Journal of Economic and Administrative Research. 2023; 6(1): 44-62.

14 Ataer, M. Y. Participatory Budgeting: A Critical Approach. Istanbul Journal of Economics. 2022; 72(1): 361-384.

Food Security: Strategies for Sustainable and Resilient Agriculture in Africa

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ABSTRACT

The effects and consequences of climate change are now real and visible throughout the world. Africa is currently the continent most affected by global warming. Climate hazards are increasing and becoming more intense on this continent, which is home to the poorest and least developed people on the planet. The objective of this work is to show the strategies that Africa must adopt for resilient agriculture. Every year, in several regions of the continent, millions of hectares of arable soil are flooded and/or eroded, losing their fertility and productivity. On the other hand, particularly in the countries of the Horn of Africa, soils are losing their productivity due to unprecedented drought caused by scarce or irregular rainfall. As a result of all this, we are witnessing a decline and shortage of agricultural products, leading to and exacerbating food insecurity and malnutrition on the continent. Every year, millions of Africans desperately migrate within the continent in search of food and water. For this reason, Africa must urgently adopt sustainable agricultural development systems that will mitigate food insecurity and build climate resilience. These systems must be based on agroecology, agroforestry, greenhouse farming and hydroponics.

Key words: Climate change, Food security, agroecology, greenhouse farming, hydroponics.

Introduction

For several decades, the entire world has been experiencing an unprecedented phenomenon that continues to rage and intensify its effects: global warming. Climate change is, at its core, Climate change is a natural phenomenon. But today, it is accentuated by human activities which emit enormous quantities of greenhouse gases [1]. The most important of these gases are carbon dioxide, methane, nitrous oxide and fluorinated gases [2], [3]. The effects and consequences of climate change are now real and visible throughout the world. Several initiatives have been taken and several approaches adopted to reduce, mitigate, and adapt to its effects.

Africa, although the continent emits the least carbon in the world (less than 4%) [4], [5] is today the most affected by the phenomena of global warming [6]. This continent faces several environmental challenges linked to deforestation, the use of dirty energy, inadequate agricultural system, lack of waste management system, the destruction of marine ecosystems, inadequate mining process, uncontrolled urbanization, etc.

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[7], [8]. The implications of climate hazards are increasing and becoming more intense on this continent. This is particularly important given the human cost associated with the continent and the ugly economic realities of Africa home to the poorest and least developed people on the planet [9]. These hazards include, among others, extreme drought in the Horn of Africa owing to the scarcity or insufficiency of precipitation, and major floods which often affect the West and Center of the continent. These manifestations of climate extremities deeply affect millions of hectares of arable land which are gradually losing their productivity and fertility [10], [11]. The outcome of which leads to a significant drop in agricultural yields, threatening the food security of millions of people [12]. Currently, 58% of Africans are food insecure, which is double the global average [13]. For this reason, Africa urgently needs to adopt new resilient agricultural development systems to guarantee sustainable food security on the continent.

The objective of this work is to demonstrate, through a literature review, the new strategies that Africa must adopt for sustainable and resilient agriculture.

Main Results

In order to combat food insecurity and face multiple climatic hazards, such as floods and droughts, which degrade soils, Africa must adopt new agricultural strategies that are both sustainable and resilient. As the continent is made up of different agroecological zones (humid and forested on the one hand, and arid on the other), the choice of strategy should depend on the nature and conditions of the environment. These agricultural systems are as follows:

- Agroecology: A holistic approach to agriculture that considers the interactions between plants, animals, humans and the environment. It focuses on the sustainable use of natural resources, the protection of biodiversity, the promotion of soil health and the reduction of negative impacts on the environment [14]. Faced with the challenges of global food security, climate change, biodiversity restoration and resource depletion, agroecology offers a promising framework for reflection and innovation. It proposes several levers to ensure agricultural production while reducing the use of inputs and preserving soil and water [15].

Among the agroecological techniques is **agroforestry**. This is an agricultural technique that involves combining trees and hedges with crops or livestock [16]. Trees can thus provide numerous ecological services, such as climatic regulation and erosion control. It thus makes it possible to produce food while preserving forest ecosystems [17]. Applicable in wetlands and forest areas, agroecology makes it possible to produce diversified and financially affordable food. It also gives small-scale producers, especially women and young people, the means to build sustainable food systems [18].

- Greenhouse: greenhouse farming allows plants to be grown under shelter in completely controlled and suitable conditions. Above all, the greenhouse provides a barrier to climatic hazards and crop aggressors. Greenhouses create more favorable climatic conditions that allow plants to grow better. Furthermore, growing plants in a closed environment contributes to better control of insect attacks and therefore limits the use of pesticides—which also affects the environment. Greenhouse cultivation shows undeniable advantages for quality and environmentally friendly production. With less watering and fewer insects, greenhouse farming represents a promising new solution for African arid zones. This alternative aims to combat climate risks to produce better harvests [19], [20], [21].

- Hydroponics: This method of growing plants in a substrate rather than in soil is a soilless technique that is simple to implement and offers many advantages [22]. In the face of global challenges such as climate change, soil degradation and water scarcity, hydroponics has emerged as a sustainable alternative

to traditional agriculture. This soilless planting method uses a nutrient-rich substrate, enabling efficient food production in controlled environments. It offers higher yields, year-round cultivation and reduced land and water use, making it ideal for all urban and arid regions [23].

Conclusion

The effects of climate change are leading to unprecedented consequences in Africa, particularly soil degradation, thus causing a gradual reduction in agricultural yields. Reduction in agricultural yields, if unabated, will increase food insecurity on the continent, putting the lives of millions of people at risk. Faced with this situation, Africa needs to focus on new, sustainable and resilient agricultural techniques. Agroecology, greenhouse and soilless farming are among the best techniques to implement. With its renewable energy advantages, implementing these systems in Africa is easy and requires political and community will.

REFERENCES

1. Evseeva, O., Evseeva, S., & Dudarenko, T. The impact of human activity on the global warming. In *E3S Web of Conferences*. 2021; Vol. 284, p. 11017). EDP Sciences.
2. Hopwood, N., & Cohen, J. Greenhouse gases and society. *Retrieved April*, *8*, 2008.
3. Anonymous, Quels sont les principaux gaz à effet de serre et leurs principales sources d'émissions ?, Connaissance des Energie, 2024. https://www.connaissancedesenergies.org/questions-et-reponses-energies/quels-sont-les-principaux-gaz-effet-de-serre (Access date: 24/07/2025).
4. GIEC. Climate Change and Land, An IPCC Special Report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. Summary for Policymakers. Electronic copies of this Summary for Policymakers are available from the IPCC website www.ipcc.ch. 2020; ISBN 978-92-9169-154-8.
5. Kohnert, D. L'impact des émissions de CO2 des pays industrialisés sur le changement climatique en Afrique subsaharienne: Études de cas d'Afrique du Sud, du Nigeria et de la RD Congo. Econstor. 2024; https://www.econstor.eu/handle/10419/300879 (Access date: 20/07/2025).
6. UN Economic Commission for Africa (ECA). 17 out of the 20 countries most threatened by climate change are in Africa, but there are still solutions to this crisis. 2023; https://www.uneca.org/stories/17-out-of-the-20-countries-most-threatened-by-climate-change-are-in-africa%2C-but-there-are (Access date: 24/07/2025).
7. Mwebaza, R. Le Gef en Afrique. 2024; https://www.thegef.org/sites/default/files/documents/2024-04/GEF_in_Africa_2024_FR.pdf (Access date: 20/07/2025).
8. Mérino, M. Les défis environnementaux en Afrique, quels enjeux pour le continent ?. Forum International de Dakar. 2021; https://dakarforum.org/wp-content/uploads/2021/12/forum-de-dakar-2021-Defis-environnementaux-en-Afrique-MERINO.pdf (Access date: 19/07/2025).
9. Banque Mondiale, Pauvreté. 2024; https://www.banquemondiale.org/fr/topic/poverty/overview#:~:text=Aujourd'hui%2C%20quelque%20700%20millions,et%20dans%20les%20zones%20rurales (Access date: 24/07/2025).
10. Nsikani, M. M. Dégradation de près de 25 % des terres en Afrique : en voici les causes et les solutions. The Conversation. 2024; https://theconversation.com/degradation-de-pres-de-25-des-terres-en-afrique-en-voici-les-causes-et-les-solutions-231684 (Access date: 21/07/2025).
11. Gnacadja, L., & Wiese, L. Land degradation neutrality: will Africa achieve it?. Institutional solutions to land degradation and restoration in Africa. In *Climate change and multi-dimensional sustainability in African agriculture: Climate change and sustainability in agriculture*. Cham: Springer International Publishing.

2016; pp. 61-95.

12. FAO. Stimuler les sols africains, De la Déclaration d'Abuja sur les engrais au cadre de gestion durable des sols 3 pour la sécurité alimentaire et nutritionnelle en Afrique à l'horizon 2030, Partenariat mondial sur les sols. 2023; Rome.

13. World Bank. The Road to Food Security: How Targeted Transport Investments Can Reduce Waste and Food Prices. 2025; https://www.worldbank.org/en/news/feature/2025/05/20/the-road-to-food-security-how-targeted-transport-investments-can-reduce-waste-and-food-prices (Access date: 21/07/2025).

14. Barberger, E. Qu'est-ce que l'agroécologie ?. Agoterra. 2025; https://www.agoterra.com/articles/cultiver-un-avenir-durable-les-bienfaits-de-lagroecologie (Access date: 20/07/2025).

15. Kerr, R. B., Postigo, J. C., Smith, P., Cowie, A., Singh, P. K., Rivera-Ferre, M., ... & Neufeldt, H. Agroecology as a transformative approach to tackle climatic, food, and ecosystemic crises. *Current Opinion in Environmental Sustainability*, 2023; *62*, 101275.

16. Nair, P. R., Kumar, B. M., & Nair, V. D. Definition and concepts of agroforestry. *An introduction to agroforestry: Four decades of scientific developments*, 2022; 21-28.

17. Fahad, S., Chavan, S. B., Chichaghare, A. R., Uthappa, A. R., Kumar, M., Kakade, V., ... & Poczai, P. Agroforestry systems for soil health improvement and maintenance. *Sustainability*, 2022; *14*(22), 14877.

18. Bogale, G. A., & Bekele, S. E. Sustainability of agroforestry practices and their resilience to climate change adaptation and mitigation in Sub-Saharan Africa: A review. *Ekológia*, 2023; *42*(2), 179-192.

19. Anonymous. La culture sous serre: une production de qualité sous abri, Richel Groupe, 2022; https://richel-group.fr/la-culture-sous-serre-une-production-de-qualite-sous-abri/ (Access date: 19/07/2025).

20. Nakashima, K., Yanagihara, S., Muranaka, S., & Oya, T. Development of sustainable technologies to increase agricultural productivity and improve food security in Africa. *Japan Agricultural Research Quarterly: JARQ*, 2022; *56*(1), 7-18.

21. Forkuor, G., Amponsah, W., Oteng-Darko, P., & Osei, G. Safeguarding food security through large-scale adoption of agricultural production technologies: The case of greenhouse farming in Ghana. *Cleaner Engineering and Technology*, 2022; *6*, 100384.

22. Kannan, M., Elavarasan, G., Balamurugan, A., Dhanusiya, B., & Freedon, D. Hydroponic farming–A state of art for the future agriculture. *Materials today: proceedings*, 2022; *68*, 2163-2166.

23. Al Meselmani, M. A.. Hydroponics: The future of sustainable farming. In *Hydroponics: The future of sustainable farming*. New York. 2024; pp. 101-122., NY: Springer US.

Youth's Transformative Role in Resilient Cities and Post-Disaster Reconstruction Processes

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ABSTRACT

This study highlights the transformative role of youth in the reconstruction processes of cities after disasters. The increasing risk of disasters and the impact of the climate crisis necessitate not only the resilience of physical structures in cities but also the strengthening of their social and cultural fabrics. In this context, youth contributions in sustainable architectural solutions, digital resilience, social entrepreneurship, and community solidarity are deeply examined. Supported by the Sakarya model, this framework emphasizes that post-disaster transformation is not merely restorative but also innovative and inclusive. As a result, youth are shown to evolve from passive participants to strategic and implementing transformative actors in disaster management processes.

Key words: youth participation, resilient cities, disaster recovery, digital resilience, social entrepreneurship

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1. Introduction

The acceleration of the climate crisis and the increasing frequency and intensity of natural disasters are raising the vulnerability levels of cities. Disasters such as earthquakes, floods, and fires not only destroy physical structures but also damage social fabrics, disrupt economic systems, and negatively affect individuals' psychosocial health. In this context, the concept of a "resilient city" reflects a multidimensional approach that includes not only technical infrastructure improvements but also social participation, cultural continuity, and sustainable development. Youth are among the most dynamic and innovative actors at the center of this transformation. Their energy, creativity, and proficiency in digital technologies enable more effective and inclusive management of post-disaster processes.

2. Main Results

2.1 Resilient cities and structural/non-structural measures
To increase cities' resilience against disasters, two main types of measures exist:
Structural Measures
These include earthquake-resistant building designs, robust infrastructure projects, and the creation of safe residential areas. Such measures are essential to minimize physical damage and are supported by innova-

tions in engineering and architecture. Planning infrastructure to ensure uninterrupted access to electricity, water, and transportation is also critical.

Non-structural Measures
These involve community-based risk awareness, disaster education, and inclusion of local residents and youth through participatory planning mechanisms. Strengthening social bonds, developing a culture of solidarity during crises, and providing psychosocial support are also vital. Non-structural measures complement physical resilience by enhancing social resilience.

Post-disaster reconstruction is not merely a return to previous conditions but an opportunity to build stronger, more flexible, and sustainable cities. Active youth participation is critical to developing innovative solutions during this process.

2.2 Youth Participation: Gaps and Potential
Literature reveals that youth participation in disaster management and urban planning is often symbolic or limited. Their voices are insufficiently heard in decision-making mechanisms. However, youth bring creative perspectives, digital literacy, and social sensitivity—qualities that are vital for making cities more resilient.

Youth can accelerate crisis communication through social media and digital platforms, develop AI-supported early risk detection applications, and pioneer social enterprises that support local economies. To enhance youth participation, structures such as youth urban councils, youth-disaster coordination boards, and participatory budgeting programs should be established.
The Sakarya-based scenario in this study demonstrates how youth participation gaps and potential can be evaluated with concrete examples.

2.3 Transformative Contributions of Youth

Creative design and sustainable architecture

Youth develop durable model structures using low-cost and eco-friendly materials, enhancing both their technical skills and sustainability awareness. The creative use of concrete, rope, and basic materials provides solutions that can inspire real urban planning processes.

Social Entrepreneurship and Economic Revival

In post-disaster economic recovery, youth play a significant role by establishing micro-enterprises, digital cooperatives, and conducting social media campaigns. These efforts are vital to supporting local production and generating employment.

Technological Competence and Digital Resilience

Youth can develop AI-supported risk mapping systems, manage information flow via open data platforms during disasters, and effectively facilitate crisis communication through social media. Digital resilience is a crucial component of modern cities' adaptation to disasters.

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2.4 Youth's Active Role in Urban Planning

Youth need to be structurally represented in decision-making processes, not just symbolically. This is essential for enabling them to shape the future of cities directly. Proposed structures include:

- **Youth Urban Councils:** Platforms where youth directly contribute to urban policies and planning.
- **Youth-Disaster Coordination Boards:** Organized bodies involving youth before, during, and after disasters.
- **Participatory Budgeting Programs:** Democratic practices enabling youth to manage and prioritize specific portions of municipal budgets.

These mechanisms ensure youth actively participate in building sustainable, inclusive, and resilient cities.

2.5 Psychosocial Recovery and Cultural Memory

Disasters deeply impact the mental health of communities. Youth can develop community-based support programs through creative activities such as art, theater, music, and storytelling. These initiatives assist individuals in trauma recovery and support the healthy integration of disasters into collective memory. As "restorative actors," youth not only provide aid but also become unifying forces that reconnect communities.

2.6 International Connections and Global Youth Impact

To strengthen global youth representation, participation in international platforms such as the UN Youth Forum and Erasmus+ should be encouraged. This enriches local experiences through global knowledge exchange. Youth's international networks facilitate increased global cooperation in building resilient cities and enable the widespread adoption of innovative practices.

3. Conclusion

This study reveals that youth are not merely volunteers in post-disaster reconstruction but strategic, implementing, and transformative actors in urban transformation. Transitioning youth from passive participants to active decision-makers in disaster management is crucial for urban sustainability and resilience.

Recommendations

- Youth representation should be increased in national disaster plans.
- Incubation and innovation programs focused on youth-disaster themes should be established in universities.
- Incentive programs in architecture, entrepreneurship, and technology should be designed for youth.
- Local governments should strengthen participatory mechanisms through youth councils and coordination boards.
- Youth leadership should be prioritized in psychosocial support and cultural memory projects.

REFERENCES

1. United Nations Office for Disaster Risk Reduction (UNDRR). Youth engagement and resilience building. Geneva: UNDRR; 2022.
2. World Bank. Urban resilience principles. Washington, DC: World Bank; 2021.
3. International Federation of Red Cross and Red Crescent Societies (IFRC). Youth in disaster risk reduction. Geneva: IFRC; 2020.
4. T.C. İçişleri Bakanlığı Afet ve Acil Durum Yönetimi Başkanlığı (AFAD). Türkiye Afet Müdahale Planı (TAMP): Gençlik ve afet yönetimi rehberi. Ankara: AFAD; 2023.
5. Cities4Youth.org. Youth participation in urban planning and disaster resilience. [Internet]. 2025 [cited 2025 Jul 25]. Available from: https://cities4youth.org/resources/youth-participation

Economic investigation for rainwater harvesting and greywater reuse in decentralized-scale residential areas: a case study from Bursa

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ABSTRACT

Unplanned urbanization, climate change, scarcity, and pressure on water resources necessitate sustainable urban water management practices to ensure water security. In this study, a sustainable solution for addressing the increasing urban water demand was presented, focusing on the recycling potential of greywater and rainwater for a residential site. The project included an evaluation of the economic dimensions of the components (piping, treatment, storage, etc.). Greywater includes domestic wastewater originating from sinks, showers, baths, and washing machines. Rainwater is collected from roofs, stored, and can be used in various areas, such as irrigation and cleaning. In the study, the amount of greywater and rainwater that can be recycled from a sample site consisting of 6 blocks and 96 apartments was evaluated with system design and economic feasibility. Daily greywater production in the project area was calculated as approximately 55,296 liters. Rainwater collected from roofs can be used in landscape irrigation, thus reducing drinking water consumption and wastewater volume. The study presented an economically applicable and environmentally compatible solution proposal for cities that are compatible and resilient to climate change.

Keywords: Greywater, rainwater, recycling, economic analysis, adaptation to climate change

Introduction

With the increasing population and urbanization, the demand for clean water resources is increasing. Therefore, recycling alternative water resources is important for sustainable water management [1]. To minimize the effects of urbanization and climate change, it is recommended to treat and reuse greywater, increase rainwater harvesting practices instead of traditional rainwater drainage systems, and search for alternatives that can restore the water cycle in cities. Greywater is a low-polluted wastewater from domestic sources and can be treated and reused. Rainwater can be collected from roofs with surface runoff and used with simple filtration and storage methods [2]. This study aims to evaluate the technical and economic recovery of greywater and rainwater in a residential area in Bursa.

Main Results

In this study, a residential area consisting of 96 flats was evaluated. There are 6 blocks with 4 floors in the area, and there are 16 flats per block, with 4 flats on each floor. Assuming that each flat is approximately 100

m² in size and that an average population of 4 people lives per flat, a total residential area of 384 people is envisaged. In the residential area, water usage habits were calculated by considering literature data in the calculation of daily water consumption per person, and a daily greywater production of 144 L per person and a total greywater potential of 55,296 L/d were calculated [3-5]. This potential is an important source in terms of recycling alternative water resources. In addition, based on the annual average rainfall on the block roof areas, approximately 1875 m³/year of rainwater was calculated for the entire site; plans were made to use this water, especially for the irrigation of landscape areas. In the study, greywater and rainwater infrastructure line calculations were made, and it was based on directing greywater to a central treatment unit and collecting and storing rainwater. In the layout plan shown in Figure 1, the system in question is integrated in a holistic manner between the blocks. While the treated greywater is reused in the system to be used in toilet tanks after filtration and disinfection processes, rainwater is integrated with drip irrigation systems and used in the irrigation of green areas. In this study, the equipment and labor requirements to be used for greywater and rainwater infrastructure systems to be implemented in a residential area consisting of 96 flats were evaluated. Table 1 includes the equipment to be used for greywater and rainwater recovery line and the components that will create costs, and the data in Table 1 includes the lateral and vertical pipes to be used for the collection and transportation of raw greywater, the system where the collected greywater is treated, tanks and pumps [6]. Data on the pipes, connection equipment, and equipment to be used for rainwater collection and storage are also presented in the table. The design of both systems was made by considering the material selection and application needs; all hydraulic calculations and cost analyses were carried out by conducting detailed market research [7-10]. The systems were planned with a holistic approach to contribute to sustainable water management. Thanks to this system, mains water consumption is significantly reduced, direct discharge of wastewater into the sewer system is prevented, and environmental impacts are reduced. It has been calculated that up to 56% of water savings can be achieved in the applications carried out, which reveals both the ecological and economic efficiency of the system.

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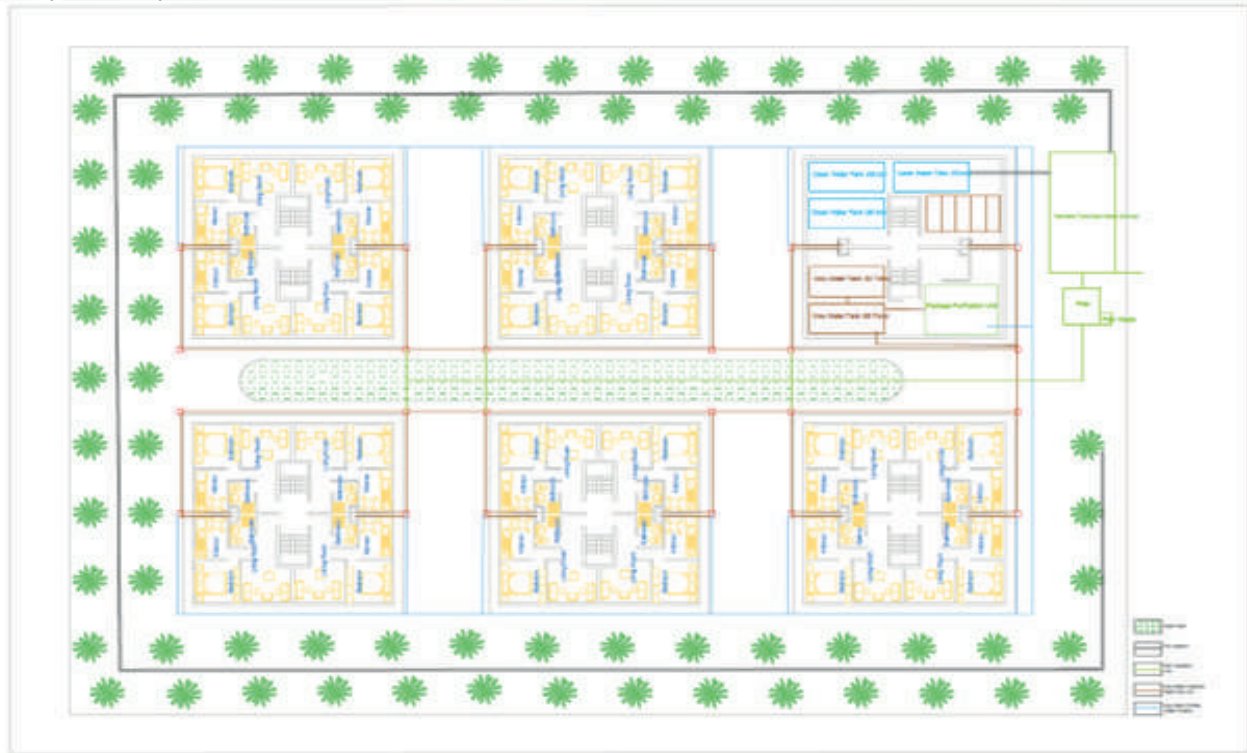
Figure 1. Greywater and Rainwater Recycling Systems in the Residential Area

Table 1. Greywater and Rainwater System Costs

Component	Costs (₺)
Greywater	
Piping	379.000
Labor	615.000
Equipment (Tank, Pump)	805.000
Treatment (MBR)	900.000
Additional Expenses	36.000
Total	**2.735.000**
Rainwater	
Piping	151.500
Labor	120.000
Equipment (Tank, Pump, Filter)	125.000
Additional Expenses	18.500
Total	**415.000**

Initial investment costs vary according to the size of the system, and as the system grows, the costs per apartment decrease and the amortization periods decrease. It is stated in the literature that the installation of the system in buildings with 15-20 apartments requires a cost of approximately 600 Euros per apartment, and that the costs decrease to 200 Euros in sites with more than 500 apartments [11]. Considering the current Euro exchange rate (46 ₺) for the project, an approximate cost of 625 Euros per apartment was calculated and the obtained value is consistent with the literature data.

Conclusion

In this study, the sustainability and economic efficiency of greywater and rainwater management in a 96-flat residential complex in Bursa were evaluated. In this context, the installation costs for collecting greywater and rainwater that may occur were calculated, and the suitability of the recycled water for reuse in areas such as toilet tanks and landscape irrigation was evaluated. The Membrane Bioreactor (MBR) system was preferred for greywater treatment due to its low energy requirement and high treatment performance. 56% water saving was achieved with this system. The collected rainwater supported the natural water cycle and contributed to minimizing the risk of flooding and water saving by reducing surface runoff. The integration of greywater treatment and rainwater harvesting at different scales enables the efficient use of alternative water sources in urban infrastructure systems. The applied systems reduce the water supply load by reducing the consumption of network water; at the same time, they minimize environmental loads by reducing the amount of wastewater discharge. The application results reveal that the system efficiency varies depending on the field conditions, climatic data, and user habits. To make such applications widespread in Türkiye, systems with low energy consumption and modular design should be encouraged; technical standards and regulations should also be developed. Urban sustainability initiatives, such as rainwater harvesting and greywater recycling, provide environmental solutions to help adapt to climate change by alleviating pressure on water supply and treatment systems.

REFERENCES

1. Daigger GT. Evolving urban water and residuals management paradigms: Water reclamation and re-use, decentralization, and resource recovery. Water environment research. 2009 Aug;81(8):809-23.

2. Abbasi T, Abbasi SA. Sources of pollution in rooftop rainwater harvesting systems and their control. Critical Reviews in Environmental Science and Technology. 2011 Dec 1;41(23):2097-167.

3. Kutlu S, Şentürk İ, Büyükgüngör H. Alanya ilçesinde seçilen pilot bölge için gri su potansiyelinin belirlenmesi. Afyon Kocatepe Üniversitesi Fen ve Mühendislik Bilimleri Dergisi. 2017;17(2):580-9.

4. Üstün G, Tırpancı A. Gri suyun arıtımı ve yeniden kullanımı. Uludağ Üniversitesi Mühendislik Fakültesi Dergisi. 2015;20(2):119-39.

5. Doğan M, Akten M, Seçme D. Çevre dostu binalar ve yeşil bina sertifika sistemleri. Akademia Disiplinlerarası Bilimsel Araştırmalar Dergisi. 2018;4(1):19-27.

6. Helmi NR, Verbeiren B, Mijic A, van Griensven A, Bauwens W. Developing a modeling tool to allocate Low Impact Development practices in a cost-optimized method. Journal of Hydrology. 2019 Jun 1;573:98-108.

7. Sevimli A. *Sürdürülebilir Yağmur suyu Yönetimi Uygulamaları: Bursa Uludağ Üniversitesi Görükle Kampüsü Orneği* (Master's thesis, Bursa Uludag University (Turkey)).

8. Hamidi MN, Hamidi N. Gri Suyun Arıtılması ve Yeniden Kullanımı: Faydaları ve Riskleri. Çevre İklim ve Sürdürülebilirlik.;25(2):59-74.

9. Kantaroğlu Ö. Yağmur Suyu Hasadi Plan Ve Hesaplama Prensipleri. IX. Ulusal Tesisat Mühendisliği Kongresi. 2009:6-9.

10. Selimoğlu P, Yamaçlı R. Sürdürülebilir Yağmur Suyu Hasadı Üzerine Yapısal Bir İnceleme. Sürdürülebilir Mühendislik Uygulamaları Ve Teknolojik Gelişmeler Dergisi. 2022;5(2):210-31.

11. Karahan A. Gri suyun değerlendirilmesi. IX. Ulusal Tesisat Mühendisliği Kongresi. 2011:1155-64.

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Youth-Centered AI Urban Labs: Co-Creating Data-Driven Mobility Policies in Secondary European Cities

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ABSTRACT

This paper examines the role of Youth-Centered AI Urban Labs as participatory frameworks for developing inclusive and data-informed mobility policies in secondary European cities. While artificial intelligence (AI) increasingly influences how cities approach mobility planning, the perspectives of young people, despite their centrality as users of public transport, remain underrepresented in decision-making processes. Secondary cities face structural limitations such as limited institutional capacity and fewer formal avenues for youth engagement in smart city innovation. Adopting a qualitative abductive approach, this study reviews practitioner literature, policy reports, and urban innovation cases from Aveiro (Portugal) and Wrocław (Poland). Documents were purposively selected for their relevance to AI in urban planning, youth participation, and local governance. Findings reveal that Youth-Centered AI Urban Labs serve as platforms where youth can build digital skills, collaborate with local governments, and contribute to mobility policy. Despite challenges like digital inequality and limited policy uptake, these labs offer a scalable model aligned with EU priorities on digital inclusion and participatory governance. They also contribute to the realization of key Sustainable Development Goals, particularly sustainable cities (SDG 11), innovation (SDG 9), quality education (SDG 4), reduced inequalities (SDG 10), and inclusive governance (SDG 16).

Key words: Youth-Centered AI urban labs, Secondary cities, Smart city, Urban mobility, Youth participation

Introduction

Cities are complex, evolving systems shaped by ongoing social, economic, and technological transformations. According to the United Nations, by 2050, nearly 68% of the global population will live in urban areas, intensifying the need for innovative, sustainable urban planning (1). Secondary cities in Europe are key regional hubs facing unique challenges in adopting smart city technologies (2).

According to the European Commission, A smart city is a place where traditional networks and services are made more efficient with the use of digital solutions for the benefit of its inhabitants and business. A smart city goes beyond the use of digital technologies for better resource use and less emissions. It means smarter urban transport networks, upgraded water supply and waste disposal facilities and more efficient ways to light and heat buildings. It also means a more interactive and responsive

city administration, safer public spaces and meeting the needs of an ageing population (3).

Artificial intelligence (AI) is reshaping the future of urban mobility (4) cities are facing escalating challenges in traffic management, public transportation efficiency, and environmental sustainability. Leveraging case studies from cities globally, including Singapore, London, and Helsinki, the paper explores how AI technologies are revolutionizing urban transportation systems. The study delves into key components of AI integration such as adaptive traffic management, personalized mobility solutions, and the implementation of autonomous vehicles. It highlights how AI algorithms analyze real-time data from diverse sources to optimize traffic flow, enhance public transportation services, and predict future mobility patterns. The research underscores the significance of AI in creating responsive and intelligent urban environments, adapting dynamically to the evolving needs of urban dwellers. Furthermore, the paper addresses challenges associated with AI-driven urban mobility, including privacy concerns, ethical considerations, and the need for equitable access to technological benefits. The findings emphasize the importance of responsible governance and a balanced approach to technology deployment in urban planning. In conclusion, this research contributes essential insights for policymakers, urban planners, and researchers navigating the integration of AI into urban mobility. The envisioned outcome is a future where AI-driven adaptive infrastructure fosters sustainable, efficient, and user-centric urban mobility ecosystems.","container-title":"International Journal of Development Research","DOI":"10.37118/ijdr.27837.12.2023","ISSN":"2230-9926","journalAbbreviation":"IJDR","language":"en","page":"64509-64513","source":"DOI.org (Crossref. This is through data-driven innovations designed to enhance efficiency, accessibility, and sustainability, which are key pillars of smart city development (5). Community engagement, which includes involving residents in the planning, development, and implementation of smart city initiatives is a vital element of governance (6)focusing on the Silesian and Lesser Poland Voivodships in Poland. This research addresses a notable gap in the analysis of regional AI strategies within urban management, providing a comparative analysis of AI implementation in these two distinct regions. The Silesian Voivodship, with its emphasis on traditional industries such as manufacturing and energy, contrasts with the broader approach of the Lesser Poland Voivodship, which includes applications in life sciences and ICT. The paper explores how AI technologies enhance urban efficiency, sustainability, and livability through practical applications in traffic management, healthcare, energy efficiency, and environmental management. It highlights the importance of a human-centric approach in smart city development, emphasizing inclusivity, transparency, and ethical considerations. The paper also delves into the socio-technical dynamics of AI deployment, illustrating how these technologies can transform urban environments while ensuring that the benefits are equitably distributed and that urban developments are sustainable and resilient. By analyzing specific case studies, the authors aim to provide empirical evidence and insights that contribute to the academic and practical understanding of AI's role in smart cities, ultimately advocating for the design of AI applications that prioritize human well-being and environmental health.","container-title":"Sustainability","DOI":"10.3390/su161 88279","ISSN":"2071-1050","issue":"18","journalAbbreviation":"Sustainability","language":"en","license":"https://creativecommons.org/licenses/by/4.0/","page":"8279","source":"DOI.org (Crossref. Citizens play a central role in the smart city concept. Analyzing their needs enables the development of advanced services and solutions specifically designed for them. Children and the youth are equally vital members of the community. Despite their frequent and dependent use of public transport systems, young people are often excluded from the policy processes that govern them. Secondary cities, while rich in local knowledge and potential, often lack the institutional and technical infrastructure necessary to implement inclusive, AI-supported solutions (7).

Youth-Centered AI Urban Labs represent a transformative approach to integrating the youth into urban

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governance processes. These labs engage youth in AI-supported data analysis, participatory planning, and collaboration with municipal institutions. By incorporating real-time data from Internet of Things (IoT) systems, these platforms become more responsive to actual urban conditions. Rather than positioning youth as passive stakeholders, these platforms empower them as co-creators of urban futures (8). This paper aims to explore how these labs function in practice and their contribution to inclusive, evidence-based policymaking.

The study therefore adopts an abductive qualitative framework, drawing from practitioner and academic literature and urban innovation case studies. Wrocław and Aveiro were purposively selected based on their engagement in EU smart city initiatives and youth participation practices. The analysis identifies patterns in digital skill-building, institutional support, and how youth-generated insights are integrated into local mobility policies through AI Urban Labs.

Main Results

Youth-Centered AI Urban Labs contribute significantly to fostering youth agency, technological literacy, and inclusive policymaking. Aveiro's Tech City Living Lab enable young citizens to participate in real-time data monitoring and AI-supported analysis through digital infrastructures mounted on public transport. Youth organizations partner with city authorities to interpret data trends and offer solutions to local transport inefficiencies (9)Portugal. This platform comprises a large number of Internet-of-Things devices with communication, sensing and computing capabilities. The communication infrastructure, built on fiber and Millimeter-wave (mmWave. On the other hand, in Wrocław, youth are engaged through participatory budgeting and ICT platforms that allow them to propose and prioritize mobility initiatives. These efforts are integrated into broader smart city strategies, providing youth with formal tools to influence planning outcomes (10)taking into account national and international conditions, on the basis of Wroclaw's practices in 1998–2018. Many researchers have emphasized the necessity of including residents' participation in both the smart city concept and the sustainable city development concept, but they do not focus on a coherent linking of these activities during evolution toward a sustainable smart city (SSC.

Persistent challenges include digital exclusion, particularly among marginalized youth groups, and the lack of formal mechanisms to sustain youth participation. In some cases, youth contributions were acknowledged but not integrated meaningfully, reflecting risks of symbolic engagement or tokenism. However, cities employ various strategies to address these barriers. Aveiro developed open-source platforms that facilitated transparency and iterative engagement between youth participants and public officials (9,11) Portugal. This platform comprises a large number of Internet-of-Things devices with communication, sensing and computing capabilities. The communication infrastructure, built on fiber and Millimeter-wave (mmWave. Despite mixed outcomes, these efforts reflect emerging local strategies to counter exclusion. Wrocław, on the other hand, invested in community-level digital inclusion programs and strengthened institutional links between youth groups and municipal departments (12)taking into account national and international conditions, on the basis of Wroclaw's practices in 1998–2018. Many researchers have emphasized the necessity of including residents' participation in both the smart city concept and the sustainable city development concept, but they do not focus on a coherent linking of these activities during evolution toward a sustainable smart city (SSC.

Youth-Centered AI Urban Labs enrich participatory governance by embedding youth perspectives directly into smart city planning. Through multi-stakeholder collaboration, these labs move beyond symbolic youth involvement, empowering young people as co-creators of urban futures. These labs provide a participatory model that advances both technological innovation and democratic accountability in secondary

cities while aligning with EU priorities such as digital empowerment, youth inclusion, and smart mobility, reflecting the principles of co-production and civic innovation by bridging the gap between local governments and young citizens.

The varied experiences across Aveiro and Wrocław underscore the importance of local governance cultures, existing youth engagement ecosystems, and infrastructural readiness. While digital literacy training and open data access are instrumental to lab success, institutional commitment to integrating youth insights into planning processes remains equally critical. Future efforts should focus on establishing durable participation mechanisms, ensuring digital equity, and fostering sustained youth-municipality collaboration.

Table 1. Overview of Youth-Centered AI Urban Labs in Selected Cities

City	Youth Participation Model	AI Application Area	Institutional Support Level	Key Outcome
Aveiro	Living Lab + Youth-Tech partnerships	Real-time transport data analysis	Moderate- High	Youth used data to inform city traffic solutions
Wrocław	Participatory budgeting + ICT tools	Smart mobility planning	High	Youth-led proposals adopted into transport plans

Conclusion

Youth-Centered AI Urban Labs represent an emerging best practice in fostering inclusive, data-informed mobility planning in secondary European cities. These labs empower youth as knowledge producers and civic actors while enriching the smart city agenda with diverse perspectives and localized insights. Integrating such labs into governance structures and addressing barriers to digital access can significantly strengthen democratic urban planning and sustainable mobility strategies.

As climate change, demographic pressures, and digital transformation reshape urban futures, these Labs offer a scalable blueprint for building resilient, equitable, and youth-driven smart cities. To fully realize their potential, stronger institutional support is needed at both local and EU levels. Addressing digital exclusion, ensuring follow-through on youth input, and embedding participation mechanisms into planning cycles will be essential. The EU's overarching frameworks, such as the European Youth Strategy and Digital Education Action Plan, provide limited guidance on implementation at the municipal level. Future EU programs should prioritize not only innovation but also offer structured pathways for marginalized youth to actively shape the urban environments they reside in.

Having Youth-Centered AI Urban Labs as the main technical thematic cluster in city planning not only enhances youth inclusion but also fosters long-term civic innovation and trust in local governance by integrating participatory mechanisms with formal planning cycles, investing in digital literacy for marginalized groups, and enabling transparent, data-driven collaboration between young citizens, municipalities, and civic tech stakeholders.

REFERENCES

1. Vieira T, Moita G, Ribeiro R, Meireles M. Urban Transportation Planning, Sustainable Cities, Big Data, Intelligent Transport Systems [Internet]. SSRN; 2024 [cited 2025 Jun 18]. Available from: https://www.ssrn.com/abstract=4849643

2. Caragliu A, Del Bo C, Nijkamp P. Smart Cities in Europe. Journal of Urban Technology. 2011 Apr;18(2):65–82.

3. https://commission.europa.eu/eu-regional-and-urban-development/topics/cities-and-urban-development/city-initiatives/smart-cities_en.

4. Naveen Vemuri, Naresh Thaneeru, Venkata Manoj Tatikonda. Artificial intelligence -driven adaptive infrastructure for urban mobility. IJDR. 2023 Dec 30;64509–13.

5. Farzan Tahir, Muskan Rasool. The Role of Artificial Intelligence in Urban Transportation for Smart City Development and Sustainable Transportation Planning [Internet]. Unpublished; 2025 [cited 2025 Jun 18]. Available from: https://rgdoi.net/10.13140/RG.2.2.33756.09607

6. Skubis I, Wolniak R, Grebski WW. AI and Human-Centric Approach in Smart Cities Management: Case Studies from Silesian and Lesser Poland Voivodships. Sustainability. 2024 Sep 23;16(18):8279.

7. Skelton T, Gough KV. Introduction: Young People's Im/Mobile Urban Geographies. Urban Studies. 2013 Feb;50(3):455–66.

8. Faculty of Economics, University of Gdańsk, Poland, Brzeziecka DH, Piziak B, Institute of Urban and Regional Development, Kraków, Poland, Thel K, 'University of Malta, Centre for Environmental Education & Research, Msida, Malta; University of Warsaw, Faculty of Sociology, Warsaw, Poland; Academy of Fine Arts in Warsaw, Faculty of Artistic Research and Curatorial Studies, Warsaw, Poland'. Urban Living Labs as an innovative tool for achieving the Sustainable Development Goals? Evidence from Poland. CEJGSD. 2024 Dec 16;6(2):37–49.

9. Rito P, Almeida A, Figueiredo A, Gomes C, Teixeira P, Rosmaninho R, et al. Aveiro Tech City Living Lab: A Communication, Sensing and Computing Platform for City Environments [Internet]. arXiv; 2022 [cited 2025 Jun 18]. Available from: https://arxiv.org/abs/2207.12200

10. Bednarska-Olejniczak D, Olejniczak J, Svobodová L. Towards a Smart and Sustainable City with the Involvement of Public Participation—The Case of Wroclaw. Sustainability. 2019 Jan 10;11(2):332.

11. Correia D, Teixeira L, Marques JL. Reviewing the State-of-the-Art of Smart Cities in Portugal: Evidence Based on Content Analysis of a Portuguese Magazine. Publications. 2021 Oct 23;9(4):49.

12. Bednarska-Olejniczak D, Olejniczak J, Svobodová L. Towards a Smart and Sustainable City with the Involvement of Public Participation—The Case of Wroclaw. Sustainability. 2019 Jan 10;11(2):332.

Evaluation of the YeS-TR Settlement Certification System within the Scope of Sustainable Development Goals

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ABSTRACT

This study evaluates the direct relationship between Turkey's national green settlement certification system, the Green Certificate Settlement (YeS-TR Settlement), and the United Nations Sustainable Development Goals (UN SDGs). Through a qualitative content analysis based on the most recent version of the YeS-TR Settlement Evaluation Guide and official UN SDG documents, the study identifies direct conceptual linkages between certification criteria and SDGs. Indirect or potential associations were intentionally excluded to ensure analytical clarity. The results reveal that YeS-TR Settlement is most strongly aligned with "SDG 11: Sustainable Cities and Communities," "SDG 13: Climate Action," and "SDG 3: Good Health and Well-being." In contrast, limited connections were found with "SDG 5: Gender Equality," "SDG 4: Quality Education," and "SDG 14: Life Below Water." The study argues that YeS-TR Settlement, as a context-specific, cost-effective, and accessible tool tailored to Turkey's socio-economic and environmental conditions, holds significant strategic potential to contribute to national and global sustainability agendas. It integrates environmental, social, and economic dimensions of sustainability at the settlement scale. The findings aim to support the broader implementation of YeS-TR Settlement, encourage further research on national certification systems' alignment with global sustainability frameworks, and raise awareness about sustainable settlement practices in Turkey.

Keywords: Sustainable Development Goals (SDGs), YeS-TR Settlement, National Green Certification Settlement, Urban sustainability, Green settlements

Introduction

The concept of sustainable development, which encompasses economic, environmental, and social dimensions, was first defined in 1987 in the report known as the Brundtland Report, Our Common Future. According to this definition, sustainable development is described as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [1]. Economic sustainability aims at the efficient use of resources and supporting economic growth. Environmental sustainability covers issues such as reducing negative environmental impacts and efficient use of natural resources. Social sustainability involves ensuring social equity and enhancing social welfare [2].

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Today, increasing population and urbanization lead to escalating environmental problems, threatening natural resources. In this context, the concept of sustainable urbanization gains importance as a holistic approach that aims to reduce environmental impacts, increase economic efficiency, and support social welfare [3,4]. Sustainable cities aim to provide a livable environment for both current and future generations through energy-efficient buildings, integrated transportation systems, public green spaces, and environmentally friendly infrastructures. Green building and settlement certification systems developed in line with this goal are important tools to assess and improve the sustainability performance of cities. Through these systems, urban areas are designed and managed more sustainably according to criteria such as energy consumption, water efficiency, material selection, healthy living conditions, and ecological compatibility [5,6]. Therefore, there is a strong and strategic relationship between green certification systems and sustainable urbanization goals.

The Sustainable Development Goals (SDGs), announced by the United Nations in 2015, consist of 17 global targets to be achieved by 2030, addressing multidimensional aims such as poverty eradication, reduction of inequalities, environmental protection, and enhancement of global well-being [7]. These global goals emphasize that development cannot be reduced solely to economic growth, but must also holistically address areas such as environmental sustainability and social inclusion [8]. The goals primarily lead the development of sustainable policies and practices in areas like urbanization, infrastructure, climate change, and resource management.

Turkey's national green building and settlement certification system, YeS-TR (Green Certification–Turkey), was developed under the coordination of the Ministry of Environment, Urbanization, and Climate Change and with technical support from Istanbul Technical University (ITU) and various other universities. This system is an evaluation framework applicable at building and settlement scales, designed to suit local conditions [9,10]. Unlike international systems, YeS-TR considers climatic, cultural, and geographical specificities and offers an adaptable structure for local governments and practitioners. YeS-TR Settlement aims to guide the planning, design, and implementation processes of urban settlements in line with sustainable urbanization principles. The system consists of six main modules: Regional and Nearby Environment Profile (BOL), Sustainable Land Use, Ecology and Disaster Management (AKE), Transportation and Mobility (UHA), Urban Design (KET), Social and Economic Sustainability (SES), and Innovation Settlement (INO). These modules holistically evaluate issues such as sustainability, disaster resilience, climate adaptation, social equity, and user comfort [11]. The YeS-TR Settlement Certificate is positioned as a strategic tool supporting sustainable urban policies at the national level.

This study aims to conceptually evaluate the alignment between the YeS-TR Settlement certification criteria and the SDGs. The primary objective is to understand this relationship and emphasize the importance of YeS-TR Settlement in building resilient and sustainable cities. Raising awareness and supporting the widespread adoption of the system are secondary aims. The YeS-TR Settlement Evaluation Guide and the UN SDG official documents were used as data sources in the study. The methodology is based on qualitative content analysis. The findings obtained through conceptual matching have been visualized in tables. The objectives, scopes, and requirements of the criteria and global goals form the boundaries of the study. Understanding this relationship will contribute to the development of more globally coherent sustainability practices in urban planning.

Main Results

In this study, a qualitative content analysis method (document analysis) was applied to systematically examine the updated YeS-TR Settlement Evaluation Guide and the United Nations 2030 Agenda for Sustainable Development Goals in detail. Conceptual relationships were established between the certification criteria and the global goals, and all criteria were associated with one or more SDGs. These relationships between the global goals and certification criteria are presented through tables. With these tables, it is possible to identify which global goal(s) each module is associated with and/or most intensively linked to. Additionally, qualitative data have been visualized through tables to enhance comparability.

This study was conducted in accordance with scientific research and publication ethics. While establishing the conceptual links, the official definitions of the criteria and goals were taken as the basis, and subjective judgments were avoided. Through this study, the YeS-TR Settlement certification system is evaluated in terms of the Sustainable Development Goals, aiming to contribute to the literature, promote Turkey's national green settlement certification system, and raise awareness regarding its significance.

According to the findings of the content analysis, the YeS-TR Settlement certification system is closely associated with "SDG 3: Good Health and Well-being" due to its emphasis on improving air quality, ensuring walkable, accessible, and safe pedestrian axes, and promoting active living. It is also linked to "SDG 11: Sustainable Cities and Communities" because of its focus on inclusive and safe urban design, support for urban sustainability, climate adaptation, and community well-being. Additionally, it is associated with "SDG 13: Climate Action", as it promotes climate-resilient planning and carbon emissions management. However, based on the evaluation, the following interpretations can be made for the modules:

- The Regional and Nearby Environment Profile (BOL) module addresses the relationship between the settlement and its surrounding region within the framework of ecological integrity, focusing on natural thresholds, environmental sensitivities, ecosystem-compatible planning, flood risks, and the protection of sensitive areas. This module provides stronger support for "SDG 11: Sustainable Cities and Communities" and "SDG 16: Peace, Justice and Strong Institutions.
- The Sustainable Land Use, Ecology and Disaster Management (AKE) module aims at the efficient use of natural resources, water management, the preservation of ecological balance, disaster resilience, and risk reduction. In this respect, it establishes stronger linkages with "SDG 11: Sustainable Cities and Communities" and "SDG 13: Climate Action."
- The Transportation and Mobility (UHA) module promotes sustainable modes of transportation, and aims to enhance accessibility and mobility. Accordingly, it aligns with "SDG 3: Good Health and Well-being", "SDG 11: Sustainable Cities and Communities", and "SDG 13: Climate Action".
- The Urban Design (KET) module involves spatial organization of settlements, density, mixed land use, and open space systems. It is directly linked to "SDG 11: Sustainable Cities and Communities". By promoting pedestrian-oriented, healthy, and accessible spatial layouts, it supports the creation of more livable areas, thereby relating to "SDG 3: Good Health and Well-being". Its support for climate-adaptive settlement patterns also aligns with "SDG 13: Climate Action".
- The Social and Economic Sustainability (SES) module relates more to the social and economic dimensions of sustainability, including participatory processes, economic vitality and employment generation, accessible services, compliance with demographic needs and priorities, and

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social inclusion. Therefore, it contributes more significantly to "SDG 8: Decent Work and Economic Growth," "SDG 10: Reduced Inequalities," and "SDG 11: Sustainable Cities and Communities."

- The Innovation in Settlement (INO) module covers features such as data-driven planning, the use of digital tools, smart infrastructure, support for sustainable technologies, and the development of engineering and design solutions that improve quality of life. In this regard, it is particularly associated with "SDG 9: Industry, Innovation and Infrastructure" and "SDG 11: Sustainable Cities and Communities."

Conclusion

In this study, it was identified that the criteria of the YeS-TR Settlement certification system are directly related to various SDGs. The analysis reveals that, except for "SDG 5: Gender Equality," all other goals are associated with at least one criterion. These results demonstrate YeS-TR Settlement's support for the three pillars of sustainability: social, economic, and environmental. The system notably aligns with issues such as urban resilience, climate action, and public health. Accordingly, "SDG 11: Sustainable Cities and Communities," "SDG 13: Climate Action," and "SDG 3: Good Health and Well-being" are the most frequently associated goals. Among them, SDG 11 is linked to all certification modules, indicating the strongest alignment. In contrast, fewer linkages were found with goals such as "SDG 5: Gender Equality," "SDG 4: Quality Education," and "SDG 14: Life Below Water," pointing to the need for stronger engagement with the social dimension. The findings indicate that the certification system can serve as an effective tool for advancing the SDGs. To enhance its contribution and take concrete action on climate change, promoting the broader adoption of YeS-TR Settlement and increasing public awareness are essential.

The results align with existing literature on settlement-scale certification systems and their relevance to the SDGs. YeS-TR Settlement is considered more effective for transforming Turkey's construction sector due to its local adaptability, accessibility, and cost-efficiency. Its alignment with SDG 11 in particular underscores its potential to support sustainable urban development and create more livable communities. Further studies and case-based research are recommended to better understand its impact. Direct linkages in this study were identified through qualitative content analysis (document analysis technique) and conceptual matching, and visualized through tables. While this qualitative approach emphasizes the importance of aligning local sustainability tools with global agendas, future research using quantitative methods may provide deeper insights. Ultimately, the study aims to support sustainable settlement policies in Turkey and to encourage the inclusion of national green certification systems in global sustainability discussions. Engaging green building experts and climate activists can further raise awareness among planners and users nationwide.

REFERENCES

1. World Commission on Environment and Development (WCED). Our common future [report]. Oxford: Oxford University Press; 1987. Available from: https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf
2. Purvis B, Mao Y, Robinson D. Three pillars of sustainability: in search of conceptual origins. Sustainability Science. 2019; 14(3): 681–95. doi:10.1007/s11625-018-0627-5

3. UN-Habitat. World cities report 2020: the value of sustainable urbanization [report]. Nairobi: United Nations Human Settlements Programme (UN-Habitat); 2020. Available from: https://unhabitat.org/world-cities-report-2020-the-value-of-sustainable-urbanization

4. Aksoy F, Bayram Arlı N. Evaluation of sustainable happiness with sustainable development goals: structural equation model approach. Sustainable Development. 2020; 28(1): 385–92.

5. Kibert CJ. Sustainable construction: green building design and delivery. Fourth edition. Hoboken, NJ: John Wiley & Sons; 2016. 583p.

6. Ding GKC. Sustainable construction: the role of environmental assessment tools. Journal of Environmental Management. 2008; 86(3): 451–464.

7. United Nations. Transforming our world: the 2030 Agenda for Sustainable Development [Internet]. New York: United Nations; 2015 [cited 2025 Jun 10]. Available from: https://sdgs.un.org/2030agenda

8. Griggs D, Stafford-Smith M, Gaffney O, Rockström J, Öhman MC, Shyamsundar P, et al. Sustainable development goals for people and planet. Nature. 2013; 495 (7441): 305–7. doi:10.1038/495305a

9. **Özçevik** Ö, Ertekin Ö, Eyüboğlu E, Oğuz M, Akbulut A, Çelik Ö, et al. Sürdürülebilirlik, kentsel form, kentsel dönüşüm ve yeşil sertifika sistemleri ilişkisi **üzerine** bir değerlendirme: Ulusal Yeşil Sertifika YeS_TR deneyimi [An assessment of the relationship between sustainability, urban form, urban transformation, and green certification systems: The national Green Certificate YeS_TR experience]. 2nd Urban Morphology Symposium of the Turkish Network of Urban Morphology; 2018 Oct 31 – Nov 2; Istanbul, Turkey. Istanbul: Marmara Municipalities Union Cultural Publications; 2018. p.797–809.

10. Republic of Turkey Ministry of Environment, Urbanization and Climate Change. The number of "Green Buildings" will increase with the domestic Green Certificate System YeS-TR [Internet]. 2020 Jan 23 [cited 2024 Jun 14]. Available from: https://csb.gov.tr/yerli-yesil-sertifika-sistemi-yes-tr-ile-yesil-bina-sayisi-artacak-bakanlik-faaliyetleri-29700

11. Republic of Turkey Ministry of Environment, Urbanization and Climate Change. Green Certificate Settlement Evaluation Guide (V1). Amended: Official Gazette 2024 Oct 21–No. 32699, Annex-2. Ankara.

Contribution of Legal Structures of Actors in Supply Chains to Risk Resistance: Comparison of Companies and Co-Operatives

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ABSTRACT

With globalization, supply chains have become longer, but with technology, time has become shorter. This has made supply chains weaker against risks (1). In this study, the contribution of their legal structures of the actors to risk resistance will be investigated, while the comparison of selected company and cooperative structures will be investigated. In the first stage, in order to determine the importance of risks, the managers of 2 sample businesses will be contacted by face-to-face interview method, the risk type will be asked as an expression, and the relationship between demographic factors and risk perceptions will be examined with T test and ANOVA. In the second stage of the research, an attempt will be made to measure the effects of the actors' roles and legal structures in the supply chain on supply chain risk factors with a new scale developed as a result of the ranking of the risks obtained from the first stage. Studies related to the thesis topic in the last 20 years will be examined, according to the year of publication, type of publication, sector in which the publication was made, the method used in the publication and the structural characteristics of the publication.

 Key words: Supply Chain Management, Risk Factors, Legal Structure.

Literature Review

The research was carried out with the steps of literature review, determination of hypotheses in line with literature, collection of data related to hypotheses and analysis of these data.

Formation of Hypotheses

In this study, the comparison of selected company and cooperative structures will be investigated while investigating the contribution of the legal structures of the actors in the supply chains to risk resistance.
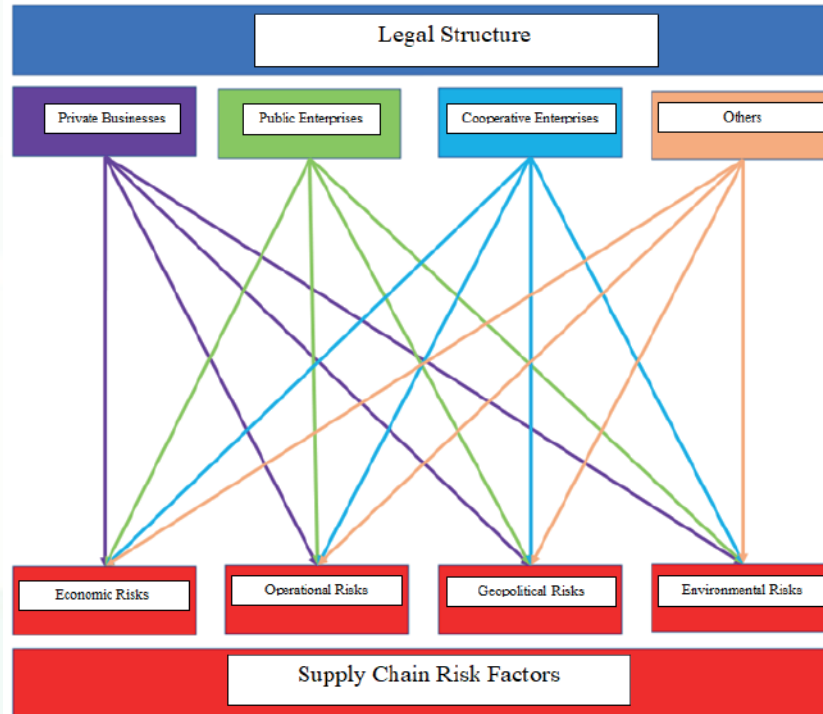
In this context, the research consists of two stages. As a result of the ranking of risk factors according to the scores they receive as a result of the first stage, a new scale will be developed that determines the effects of the actors' legal structures on supply chain risk factors.

Method Used in Obtaining Data

In the first stage, in order to determine the importance of risks, managers of 2 sample businesses will be reached through face-to-face interviews, the type of risk will be asked as an expression, and the relationship between demographic factors and risk perceptions will be examined with T-test and ANOVA.

As a result of the first stage, risk factors will be ranked according to the scores they receive. Within the framework of this purpose, the managers of 1 selected company and 1 cooperative will be asked about the risks affecting them in the supply chain, which risk type has been previously determined from the literature. The questions to be prepared to determine risk perceptions will be directed to all managers of the businesses, especially the managers related to the supply chain, and according to the results obtained, the risks will be ranked according to the scores they receive. In the second stage of the study, after the risks are determined, it will be evaluated how and to what extent the legal structures of the actors affect the supply chain risk factors.

In the research, data will be collected through face-to-face interviews through surveys. In the light of the obtained data, the effect of the actors' legal structures on supply chain risk factors will be examined and analyzed with structural equation modeling. The relationship between demographic factors and the effect of the actors' legal structures on supply chain risk factors will be examined with T test and MANOVA.

Method Used in Analyzing Data

The research model will be analyzed with the structural equation modeling path analysis method. It is thought

that the data obtained as a result of the analyses will help businesses to take the necessary precautions and take more controlled and useful steps by considering the effect of the actors' legal structures on supply chain risk factors. In addition, one of the features that distinguishes this research from other studies is that the risks were not directly taken from the ready-made risks in the literature and were created by asking companies directly. When the literature is examined, it is seen that all the studies conducted within a similar framework were conducted using previously determined risks. The fact that the study was applied to the legal structure of a company or cooperative also makes the study unique. In the literature review conducted during the development process of the data collection tool for the purpose of measuring the effect of the actors' legal structures on supply chain risk factors in supply chain management, it was seen that no study was conducted that addressed the research topic as a whole.

The draft conceptual model developed with the data obtained from the literature review conducted before the research is shown below. The research model was examined under a total of 8 variables, including 4 factors for legal structure and 4 factors for supply chain risks. The model basically shows that the legal structures of the actors in the supply chain affect risk resistance. In this context, while it is claimed in the first stage of the research that demographic factors may have an effect on the determination of risks in the supply chain, in the second stage, it is claimed that demographic factors will affect the variables in the model in the same way.

Conducting Statistical Analyses

In recent years, the importance and frequency of use of SEM applications in social and behavioral sciences have increased and they have become an integral part of a large number of scientific studies. SEM is a powerful statistical analysis method that allows testing many interdependent relationships at the same time. Unlike other multivariate analyses, in SEM, separate but interdependent multiple regression equations can be tested simultaneously within a structural model framework. As in multiple regression analysis, SEM allows testing the direct and indirect effects of the variables in the model(11). In this context, SEM will be used as the research method.

While conducting the research, studies conducted in the last 20 years related to the thesis topic will be examined and in the literature review section, chi-square analyzes of the distributions according to the publication year, publication type, sector where the publication was made, the method used in the publication and the structural features of the publication will be performed. In addition, a conceptual research model will be created in the light of the data obtained from the literature.

The survey technique, one of the quantitative research methods, was used in the research. The reason for using the survey technique is that the main purpose in quantitative research methods is to produce information that is as impartial, non-subjective, explains the cause-effect relationship as possible and can be generalized from the sample to the universe. In the research, the "Risks that may be encountered in the supply chain" scale will be used in the first stage, and in the second stage, the "Risks in the supply chain" scales of the "legal structure of the actors" will be used. The "Risks that may be encountered in the supply chain" scale used in the first stage was created by knowing which type of risk it belongs to from the risks found in the literature. In the development of the "Risks in the supply chain" scale used in the second stage, face-to-face interviews and surveys conducted with the managers of the companies participating in the research in the first stage of the research will be used.

Evaluation of Results

In order to determine the risks in the supply chain, the survey conducted for the first stage of the research was conducted to the managers of the companies participating in the research on the …. will be asked as a

risk expression and they will be asked to give a score out of 10 for each risk. A new ranking will be made as a result of the scoring. With the data obtained as a result of the ranking, it will be measured (inversely) how much the first 20 risks in four factors, each with five risks, will affect the businesses. Thus, a new scale will be developed in the second stage of the research, which will be used as the first scale. Again, for the second stage of the research, the second In the first scale, the level of supply chain integration of the companies participating in the research and in the third scale, the level of supply chain performance of the same companies will be measured. A seven-point Likert-type scale will be used, which includes the following statements: (1) Strongly Disagree (2) Disagree (3) Somewhat Disagree (4) Undecided (5) Somewhat Agree (6) Largely Agree (7) Strongly Agree. After the collected data is transferred to the computer environment, all analyses of the first survey conducted in order to determine the risks in the supply chain in the first stage will be conducted using the statistical analysis program SPSS package program. In the second stage, the analyses of the second survey with three scales will be conducted using the statistical analysis program SPSS and the AMOS program for YEM analyses.

REFERENCES

1. Yurttaş, A. (2020). Tedarik zinciri yönetiminde risk faktörlerinin, tedarik zinciri bütünleşmesine ve performansına etkisi: Yapısal eşitlik modellemesi ile İTOB OSB örneği (Yayınlanmış, Doktora Tezi). İnönü Üniversitesi Sosyal Bilimler Enstitüsü İşletme Ana Bilim Dalı. Malatya.
2. Bayramoğlu, Z., Cufadar, Y., Karakayacı, Z., Ağızan, K., Bozdemir, M., Ağızan, S. ve Yeşil, D. (2019). Niğde ilinde süt piyasasının ve uluslararası rekabet gücünün araştırılması. Atlas Akademi (1. Baskı). Konya.
3. Köksoy, N. (2018). Konya yöresi süt ve süt ürünleri üretim işletmeleri arasındaki rekabet analizi "Porter Elmas Modeli". (Yayınlanmamış Yüksek Lisans Tezi). Necmettin Erbakan Üniversitesi Sosyal Bilimler Enstitüsü İşletme Anabilim Dalı. Konya.
4. Köksoy, N., & Arıcıoğlu, M. A. (2018). Konya Süt Ürünleri Sektörü Rekabetçiliğinin Porter Analizi İle Ölçülmesi. Medeniyet Ve Toplum Dergisi, 2(2), 7-39.
5. WMO (World Meteorological Organization). 2022. Provisional State of the Global Climate in 2022.
6. World Bank. 2019. 2022. Pakistan: Flood Damages and Economic Losses over USD 30 Billion and Reconstruction Needs over USD 16 Billion: New Assessment. Press release. 28 October.
7. Asya Kalkınma Bankası. (2023). Net Sıfıra Küresel Geçişte Asya Asya Kalkınma Görünümü 2023 Tematik Raporu. Asya Kalkınma Bankası. https://www.adb.org/sites/default/files/publication/876891/ado-2023-thematic-report.pdf.
8. Waters, C., D., J., (2007), Supply Chain Risk Management: Vulnerability and Resilience in Logistics, Kogan Page Limited, London. (Google-Kitaplarım-Favoriler) https://books.google.com.tr/books?id=-L9us3-Nu2UC&printsec=frontcover&hl=tr#v=onepage&q&f=false
9. Hair, J., F., G., T., M., Hult, vd. …, (2017), A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM), (Second Edition), Sage Publications Inc., Thousand Oaks, CA.
10. Acker, V., V., F., Witlox, vd. …, "The Effects of the Land Use System on Travel Behavior: A Structural Equation Modeling Approach", Transportation Planning ve Technology, 2007/30(4), ss. 342.
11. Bayramoğlu, Z., Ağızan, K., Ağızan, S., Bozdemir Akçil, M., (2022). Explanation Of The Reasons For Price Changes In The Supply Chain Of Selected Agricultural Products. XIII International Scientific Agriculture Symposium "AGROSYM 2022". 1294- 1299, Sarajevo.
12. Warman M, Kennedy TL. 1998. Understanding cooperatives: agricultural marketing cooperatives. Working paper, US Dept of Agriculture.

13. Hailu G, Royer JS, Goddard EW. 2007. Efficiency, economic performance and financial leverage of agribusiness marketing co-operatives in Canada. In Cooperative Firms in Global Markets, Advances in the Economic Analysis of Participatory and Labor-Managed Firms, Volume 10, Novkovic S, Sena V (eds). Emerald Group Publishing Limited: Bingley; 47–77.

14. Galdeano Gómez E. 2006. Productivity and efficiency analysis of horticultural co-operatives. Spanish Journal of Agricultural Research 4(3): 191–201.

15. Du Y. 1998. Discussing the modern enterprise system in agriculture. Management World 5: 180–196.

16. Huang, Z., Fu, Y., Liang, Q., Song, Y., & Xu, X. (2013). The Efficiency of Agricultural Marketing Co-operatives in China's Zhejiang Province. Managerial and Decision Economics, 34(3/5), 272–282. http://www.jstor.org/stable/23464306

17. Jüttner U, Peck H, Christopher M. "Supply chain risk management: outlining an agenda for future research". International Journal of Logistics: Research and Applications, 6(4), 197-210, 2003.

18. Christopher M, Peck H. "Building The Resilient Supply chain". The International Journal of Logistics Management, 15(2), 1-29, 2004.

19. Maclean-Bristol C. "Business Continuity's Role In Supply Chain Resilience". http://www.continuity-central.com/feature0558.htm (10.07.2017).

20. Ho W, Zheng T, Yildiz H, Talluri S. "Supply chain risk management: a literature review". International Journal of Production Research, 53(16), 5031-5069, 2015.

21. Tang CS. "Perspectives in supply chain risk management". International Journal of Production Economics, 103(2), 451-488, 2006a.

22. Ambulkar S, Blackhurst J, Grawe S. "Firm's resilience to supply chain disruptions: scale development and empirical examination". Journal of Operations Management, 33, 111-122, 2015.

Smart Cities and Digital Divide: A Social Equity Discussion

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ABSTRACT

This paper examines how smart city projects address the digital divide while integrating citizens into their systems. Smart city initiatives escalated with the significant adoption of Internet of Things (IoT), information and communication technologies (ICTs), and artificial intelligence (AI) in urban systems. Although these technologies are optimized as an innovative response to increasing urbanization, these solutions have both benefits and challenges to urban life, depending on their planning objectives and the societal structures. The purpose of the study is to put emphasis on the social inclusion of diverse groups in the context of the smart city projects. This study adopts a qualitative and exploratory research approach to understand the digital divide in smart cities. The data is collected through a literature review based on keyword research on the Scopus database, and it is supported by relevant academic literature to shape the conceptual framework. A thematic analysis was conducted on the digital divide in smart cities to explore the academic debates and gaps in the literature. Accordingly, smart cities have sociotechnical aspects, and their implementations raise questions about social justice concerns by considering the social differentiations within the urban fabrics, rather than depending only on technological implementation processes and business-oriented appraisals. In this sense, this study focuses on the digital divide issues in smart cities by limiting its scope to the social equity discussions.

Keywords: smart cities, digital divide, social equity, sociotechnical perspective

Introduction

Smart cities are envisioned at the intersection of developing technologies and the urban fabric. Over time, the challenges and opportunities of smart cities have become prominent in environmental sustainability and governance discussions, moving beyond the focus on technological adaptation [14]. The concept of smart cities refers to the sociotechnical systems proposed as one of the responses to the rising demands of cities

with the aim of enhancing life quality, especially to support intelligent urban development and sustainable socio-economic growth for the citizens [12]. The evolution of cities is mediated by digital infrastructures, and ICTs are embedded into the urban fabric as new modes of urban governance that rely on big data [6]. The term smart city appeared as an urban infrastructure system charged with enabling energy, transportation, housing, and communication provisions while responding to escalating urbanization and population growth, and is synonymously regarded as "digital city" or "intelligent city" [3]. For instance, the "green city" is another concept that overlaps with the notion of smart cities in supporting economic processes and managing environmental resources [5]. Citizens, governments, and private companies are three stakeholders of social infrastructure in the smart cities. Accordingly, human capital appears as one of the crucial components of smart cities, since urban fabric comprises a diverse range of individuals from various socio-demographic backgrounds, and citizens are the end-users of the introduced smart technologies [12].

Social Equity in Smart Cities

The interconnected sociotechnical structure of the smart city design creates challenges for social equity in implementing and developing services to users [9]. Social equity is defined as a key factor for development in smart cities; further related policies are significant in terms of being a bridge between the technological and economic gap in the urban demographic relations. Accordingly, the term digital gap refers to the difference between who can afford technologies and who cannot afford them among citizens [5]. In relation to this, the concept of the "digital divide" pertains to societal differences in access to and knowledge of technology among various social groups. These potential digital gaps within societies can be addressed through adequate digital infrastructure and effective policy implementations in smart city initiatives [1]. Especially concentrating benefits around the smart city implementations, such as advanced infrastructure services and providing sociotechnical solutions in specific areas while excluding others, brings 'digital marginalization' concerns [3].

Furthermore, concerns over reproduction of social inequalities during the transition to a smart society increased with smart cities through 'the smartness-induced inaccess' to services, since the integration of ICT-based smart systems is celebrated in the governmental agenda for optimizing resource allocation and public service provisions [15]. Also, private companies, government bodies, and citizens might dissociate according to their different group interests; further, each smart city projects differ from others in accordance with their unique target groups [9]. In other words, social concerns vary depending on the idiosyncratic social dynamics. It is pointed out that limited dissemination of service, specifically the internet, could bring a "digital divide" while hindering the collective achievement of mass smart information services [12]. To detail, the digital divide has location context to dissociate advantageous and disadvantageous groups depending on the neighborhood-specific accessibility and usability of the digital infrastructures and other services [11]. It is suggested that smart cities contribute to the reproduction of urban inequities. Similarly, the condition of youth in Philadelphia proves that wealthy neighborhoods and their new economy become 'smart' while other parts of the cities are outcasted by digital investments and technology-driven urban change [8].

Mitigating the Digital Divide for the Future of Cities

The deployment of institutionally connected smart technologies in smart cities would bring several problems, not solely the technological challenges, but also the organizational challenges for the policymakers and other related stakeholders [9]. The digital divide is one of the challenges of smart city implementations among developing countries. Concomitantly, every citizen deserves to be equally treated in quality access

to ICTs, reaching available telecommunication services and the information and knowledge, regardless of their race, gender, income, and social group positions [5]. It is claimed that the digital divide appears as a significant notion for enacting accessible and inclusive city planning for everyone, and they put emphasis on the digital literacy and digital accessibility of vulnerable groups [12]. Private-public partnerships have prominent role as service providers, in transforming social dynamics of urban places into digitally-inclusive places. Therefore, holistic viewpoint for smart city implementations are suggested to be considered for environmental sustainability, societal wellbeing, and financial sustainability in accordance with the technological integrity [2].

Moreover, Caragliu and Del Bo conduct an empirical analysis on European cities, they analyze whether there is a relation between urban smartness and digital divide, and they state that the enhancing role of smart cities and the digital divide issue, which is not often referred to in the literature on European smart cities [4]. Their findings demonstrate that medium-upper level smartness has a negative effect on the digital divide, whereas higher level smartness is not associated with inequalities. Therefore, they conclude that ICTs actually have the potential to bring democratic planning if smart technologies are used efficiently in future policy implementations. The concept of digital divide needs to be extended and re-conceptualized from individual level access to public and community-based organizations to fully understand who owns and manages 'big data' in a comprehensive way [10]. Moreover, smart city innovations need to embrace diverse social groups and maintain long-term legitimacy and sustainability planning through social engagements. To highlight, the digital divide emerges in relation to digital society, and it can be mitigated through policy directions since these disparities within society arise and revolve in accordance with the continuous development of new technologies [13].

Methodology

During the paper selection process, a literature review is conducted through keyword research on the Scopus database to gather relevant articles. This study adopts a qualitative and exploratory research approach to understand the digital divide in smart cities. The data is collected through a literature review based on keyword research on the Scopus database, and it is supported by relevant academic literature to shape the conceptual framework. A thematic analysis was conducted on the digital divide in smart cities to explore the academic debates and gaps in the literature. The research question, "In what ways do smart city implementations mitigate the digital divide for social equity?" is defined to guide literature review and keyword selection within the sociotechnical imaginaries framework. Research topics are reduced to social sciences publications in the English language. Articles are selected from query results based on the thematic keywords searches, such as ("smart cit*" AND "digital divide"), by prioritizing their relevance to the study.

Main Results and Discussion

Especially, sociotechnical shifts have been expanding to various spheres of life with different applications around the globe. Herewith, diverse implementations in cities indicate the need for attention on both sociotechnical and environmental aspects of these technological shifts. Since sustainability and life quality have to be holistically considered through navigating the societal consensus in order to attain the effectiveness and efficient design of the smart solutions. Thinking about the smart city implementations brings discussions on improving the life quality of their audiences, whether implementations reach the whole society or partially. Social, in other words, soft infrastructure is an indispensable part of the smart cities, considering the intellectual capital and social capital, these components make smart cities a learning city and a knowledge city for en-

hancing local knowledge. Otherwise, they overlook the fact that people interpret technological developments in accordance with their backgrounds regarding specific sociocultural, political, and spatial locations. In fact, integration of the various groups regarding both expert and non-expert users into the sociotechnical city life matters for the social equity objectives for everyday life practices. Since a holistic viewpoint not only considers the three main stakeholders, referring to governments, companies, and citizens, but also the various social groups that citizens belong to, based on their different positions in their societies. The digital divide has to be accounted for by referring to its impact on the public life of citizens to participate in urban activities. Smart city initiatives have to implement policies that address the various socio-demographic groups and needs of citizens for an effective and equitable future in accordance with the project objectives.

Conclusion

The objective of this study is to acknowledge human infrastructure within smart city discussions. Smart cities appear as one of the sociotechnical implementations in order to support communities and their development in urban settings. The notion of smart cities brings the social, environmental, and technological dimensions together into the discussion. This paper intends to gather information about the future of smart cities while emphasizing the digital divide in smart cities to recognize various citizen groups and their conditions in being integrated into the new urban systems. Through this approach, smart cities are envisioned with their influence on the societal sphere, while academic literature mainly considers the technological innovations and innovative implementations. In a nutshell, this study aimed to provide a focus on the sociotechnical aspect of smart cities to highlight the significance of social equity for socially inclusive smart urbanism. Since smart city projects rely on the collective dynamics of several stakeholders. Citizen groups are diverse based on their social backgrounds and in-group relations, which are shaped by social, economic, cultural, gender-based, and disability factors. In other words, the group dynamics of citizens should be contemplated within smart city projects, such as socioeconomic status differences in access and digital literacy levels in technology usage. This paper has provided some initial points to the digital divide discussions in smart cities, but wider, in-depth studies are required to examine the topic in academic literature.

REFERENCES

1. Aditya T, Ningrum S, Nurasa H, Irawati I. Community needs for the digital divide on the smart city policy. Heliyon. 2023 Aug 4;9(8):e18932. doi:10.1016/j.heliyon.2023.e18932. PMID: 37588606; PMCID: PMC10425902.

2. Ahvenniemi H, Huovila A, Pinto-Seppä I, Airaksinen M. What are the differences between sustainable and smart cities? Cities. 2017;60:234–245. doi:10.1016/j.cities.2016.09.009.

3. Buttazzoni A, Veenhof M, Minaker L. Smart city and high-tech urban interventions targeting human health: an equity-focused systematic review. Int J Environ Res Public Health. 2020;17:2325. doi:10.3390/ijerph17072325.

4. Caragliu A, Del Bo CF. Smart cities and the urban digital divide. NPJ Urban Sustain. 2023;3:43. doi:10.1038/s42949-023-00117-w.

5. Collins Okafor C, Aigbavboa C, Thwala W. A bibliometric evaluation and critical review of the smart city concept – making a case for social equity. J Sci Technol Policy Manag. 2022. doi:10.1108/JSTPM-06-2020-0098.

6. Kitchin R. The real-time city? Big data and smart urbanism. GeoJournal. 2014;79(1):1–14. doi:10.1007/s10708-013-9516-8.

7. Kolotouchkina O, Barroso C, Sánchez J. Smart cities, the digital divide, and people with disabilities. Cities. 2022;123:103613. doi:10.1016/j.cities.2022.103613.

8. Masucci M, Pearsall H, Wiig A. The smart city conundrum for social justice: Youth perspectives on digital technologies and urban transformations. Ann Am Assoc Geogr. 2019;110(2):476–484. doi:10.1080/24694452.2019.1617101.

9. Mondschein J, Clark-Ginsberg A, Kuehn A. Smart cities as large technological systems: overcoming organizational challenges in smart cities through collective action. Sustain Cities Soc. 2021;67:102730. doi:10.1016/j.scs.2021.102730.

10. Mouton M, Ducey A, Green J, Hardcastle L, Hoffman S, Leslie M, Rock M. Towards 'smart cities' as 'healthy cities': health equity in a digital age. Can J Public Health. 2019 Jun;110(3):331–334. doi:10.17269/s41997-019-00177-5. PMID: 30701413; PMCID: PMC6964412.

11. Nam T, Pardo TA. Smart city as urban innovation: Focusing on management, policy, and context. In: Proceedings of the 5th International Conference on Theory and Practice of Electronic Governance (ICEGOV '11); 2011 Sep 26–28; Tallinn, Estonia. New York: ACM; 2011. p. 185–94. doi:10.1145/2072069.2072100.

12. Neirotti P, De Marco A, Cagliano AC, Mangano G, Scorrano F. Current trends in Smart City initiatives: some stylised facts. Cities. 2014;38:25–36. doi:10.1016/j.cities.2013.12.010.

13. Shin S-Y, Kim D, Chun SA. Digital divide in advanced smart city innovations. Sustainability. 2021;13:4076. doi:10.3390/su13074076.

14. Spicer Z, Goodman N, Olmstead N. The frontier of digital opportunity: Smart city implementation in small, rural and remote communities in Canada. Urban Stud. 2019;58. doi:10.1177/0042098019863666.

15. Zhang M, Zhao P, Qiao S. Smartness-induced transport inequality: Privacy concern, lacking knowledge of smartphone use and unequal access to transport information. Transp Policy. 2020;99. doi:10.1016/j.tranpol.2020.08.016.

Youth and Urban Sports Culture: A Perspective on Accessibility, Participation and Sustainibility

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Introduction

With increasing urbanization, young people's opportunities for physical activity and engagement in sports are often limited. Participation in urban sports culture is essential not only for individual health but also for social cohesion and a sense of community. Having spent my university years in Sakarya, I observed both the opportunities and the barriers that young people face in accessing sports. My personal journey includes early childhood involvement in swimming and kickboxing, which helped me develop discipline and resilience. At the university level, I became part of a Traditional Turkish Archery Community, where we organized events to introduce both the history and practice of archery to students. These experiences demonstrate the positive impact that accessible and community-driven sports activities can have on youth development.

Key words: Youth, Urban Sports, Accessibility, Social Participation, Sport Policy

Main Results

There are several major challenges that limit youth participation in urban sports culture:

1. Economic Barriers: Gym memberships, sportswear, and equipment can be prohibitively expensive for students.

2. Infrastructure Deficiencies: In smaller cities, there is often a lack of sports facilities like open spaces, gyms, or courts.

3. Lack of Awareness and Programming: Many youth are unaware of municipal programs or they find them inconsistent.

4. Limited Inclusion in Decision-Making: Youth are often excluded from decisions about urban sports planning.

One promising solution to the awareness and participation gap is the integration of a youth-oriented mobile application. Such a platform can centralize information about local sports facilities, ongoing events, free training opportunities, and equipment-sharing programs. With GPS functionality and personalized notifications, young users can discover nearby activities and connect with municipal programs more easily. The app also allows feedback from youth to city planners, creating a two-way communication channel. As shown in

Figure 1, a mobile interface can help young users easily navigate city-wide sports opportunities.
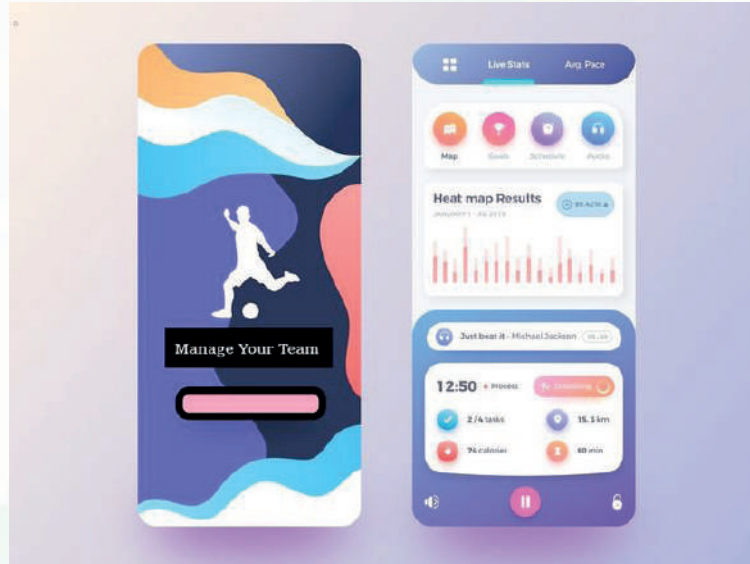
Figure 1. Sample user interface of a youth-oriented sports mobile application.

Table 1. Common Barriers Affecting Youth Sports Participation

Barrier	Description
Economic Barriers	Costs of gym memberships, equipment, and uniforms
Infrastructure Gaps	Lack of accessible sports spaces or safe environments
Awareness Issues	Lack of promotion of youth programs or events
Youth Exclusion	Minimal youth involvement in urban sports planning

Some successful examples include municipal initiatives in major cities like Istanbul and Izmir, where open-air sports parks, free youth clubs, and mobile sports units have been launched (2). Additionally, circular economy approaches—such as equipment-sharing platforms or recycled gear programs—have proven useful in reducing the cost barrier for low-income youth (3).

Conclusion

Youth participation in urban sports should be considered a public good, not a privilege. Increasing accessibility through affordable programs, improving infrastructure, and fostering inclusive policy-making are essential steps. Cities that support youth-driven sports initiatives and prioritize open, safe spaces for physical activity will be better equipped to build resilient, connected, and healthier communities (1-4). Integrating technology, such as youth-focused mobile applications, can further strengthen participation by keeping young citizens informed and engaged in city-wide sports opportunities.

REFERENCES

1. World Health Organization. Global action plan on physical activity 2018–2030: More active people for a healthier world. Geneva: WHO; 2018.

2. Istanbul Metropolitan Municipality Sports Directorate. Available from: https://www.spor.istanbul

3. Union of Municipalities of Türkiye. Youth and Sports Services Report. Ankara: UMT Publications; 2022.

4. Gokalp N. Urban Factors in Youth Participation in Sports Culture. Youth Research Journal. 2021;3(2): 45–58.

Assessing Wind Farm Potential Using GIS and Fuzzy AHP: A Case Study of the Lower Sakarya Basin

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ABSTRACT

The transition to renewable energy sources is a central tenet of sustainable development goals in the context of the global effort to combat climate change. In this context, wind energy is of strategic importance due to its low carbon footprint, use of local resources, and contribution to energy security. In this study, a Geographic Information System (GIS)-based model was developed to identify suitable locations for the construction of wind energy plants. The model was employed to conduct a suitability analysis of the Lower Sakarya Basin as a case study. The analysis process incorporated technical, environmental, and socio-economic criteria, including topographic slope, wind potential, environmental constraints, distance to residential areas, and infrastructure access. Following the evaluation, an area of 17,259 hectares, corresponding to 47.64% of the basin, was classified as 'suitable' and 'highly suitable'. These areas offer both high energy efficiency and investment opportunities that are compatible with sustainable urbanisation policies. The study emphasises that wind energy investments are not merely a technical process, but also represent an investment in social justice, environmental sustainability and the future of young people. The findings of this study contribute to decision-support mechanisms for local governments in energy planning and serve as a guide for policymakers.

Key words: Wind energy, GIS, renewable energy, spatial suitability analysis, youth and sustainability

Introduction

Energy is considered to be one of the fundamental building blocks of the universe and it has been demonstrated that it plays a decisive role in the rise and fall of civilisations (1). Beyond its physical manifestation, energy is recognised as a driving force behind social and economic development (2). The exponential increase in global energy consumption is driven by population growth and continuous technological innovation (3). The pressures engendered by population growth and contemporary lifestyles have increased demand for energy resources, thereby rendering the necessity for sustainable energy solutions all the more pressing.

In this context, the importance of renewable energy sources for achieving sustainable development goals cannot be overstated. It is evident that wind energy has been identified as a source with considerable potential and consistent availability (4–6). A substantial body of research has indicated that the implementation of wind energy could potentially contribute to a reduction in global CO_2 emissions by 1.5 billion tonnes by the year 2050 (7). However, in order to increase the share of wind energy in total energy production, it is first necessary

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to accurately assess the existing potential, select suitable sites, and conduct comprehensive feasibility studies. This process necessitates expertise and meticulous analysis due to its intricate nature. Furthermore, it should be noted that areas with the highest wind energy potential may not always be the most suitable locations for the establishment of wind farms (8).

A plethora of studies have been conducted to investigate the feasibility of utilising wind energy in various geographical regions. Voivontas et al. (9) in Crete; Baban and Parry (10)especially coal and oil-fired power stations, on the environment has created a demand for developing and using environmentally friendly renewable energy. Wind power is a popular and safe form of renewable energy. It can be economically viable, does not produce any physical pollution and can contribute radically to the reduction in air pollution. In the UK, the demand for wind energy is mounting. However, achieving the goal set by the EU will require a substantial expansion. Planning and environmental restrictions and conflicts would inevitably accompany this growth. A questionnaire targeting relevant public and private sectors in the UK has revealed the lack of coherent national criteria for locating wind farms. Using information from the questionnaire and the available published literature, simple Geographical Information System (GIS in England; Ramachandra and Shruthi (11) in India; Rodman and Meentemeyer (12)this technique can assist in forecasting the acceptance level of wind farms by the public. The analysis was used to evaluate the nine-county region of the Greater San Francisco Bay Area. The model accurately depicts areas where large-scale wind farms have been developed or proposed. It also shows that there are many locations available in the Bay Area for the placement of smaller-scale wind turbines. The framework has application to other regions where future wind farm development is proposed. This information can be used by energy planners to predict the extent that wind energy can be developed based on land availability and public perception.","container-title":"Energy Policy","DOI":"10.1016/j.enpol.2005.03.004" ,"ISSN":"0301-4215","issue":"15","journalAbbreviation":"Energy Policy","page":"2137-2149","source":"-ScienceDirect","title":"A geographic analysis of wind turbine placement in Northern California","volume":"34","author":[{"family":"Rodman","given":"Laura C."},{"family":"Meentemeyer","given":"Ross K."}],"issued":{"date-parts":[["2006",10,1]]}},"label":"page","suppress-author":true}],"schema":"https://github.com/citation-style-language/schema/raw/master/csl-citation.json"} in Northern California; Fueyo et al. (13) and Sánchez-Lozano, Garcia-Cascales, and Lamata (14) in Spain; and Van Haaren and Fthenakis (8) in New York State. In the present studies, the use of CBS was employed for the purpose of evaluating wind energy resources and potential. In recent studies, Adedeji et al. (15) employed a multidisciplinary approach integrating GIS, CCMV, and hybrid neuro-fuzzy modelling tools to assess the suitability of a wind farm site and predict wind resource variability in the Eastern Cape Province of South Africa. Asadi et al. (16) developed a mapping of decision criteria to site scores and used a multiple linear regression model employing GIS and AHP methods to identify the most suitable locations for wind and solar power plants. In their seminal study, Sotiropoulou, Vavatsikos, and Botsaris (17) proposed a hybrid GIS-based framework combining AHP, PROMETHEE II, and machine learning algorithms with a view to determining the most suitable onshore wind farm locations in Northeast Greece. In a study conducted in Burundi by Placide and Lollchund (18), the feasibility of establishing wind farms was assessed using FAHP and GIS.

Research studies have also been conducted in Turkey. Bilgili, Şahin, and Kahraman created a wind atlas using hourly wind data collected between 1997 and 2001 in the Antakya and İskenderun regions. The atlas was then employed to assess the wind energy potential in the region. Özerdem, Özer, and Tosun (19) utilised GIS to evaluate the technical and economic viability of wind energy facilities in Izmir, concluding that increased installed capacity results in enhanced internal rate of return (IRR) and diminished production costs. Uzar and Şener (20) utilised remote sensing and GIS analysis to identify suitable areas for wind energy projects in the rural regions of the Evrencik district in Kırklareli. In their study conducted in the Kozlu district of Zonguldak, Arca and Keskin Çıtıroğlu (21) employed ArcGIS software and GIS-MCDA methodology to identify potential

sites for the construction of wind energy plants and to determine suitable sites with low to medium sensitivity levels. Yaman (22)yet the finite nature of rapidly depleting fossil fuel reserves poses environmental challenges. To address this, numerous nations are shifting toward sustainable energy sources to foster environmental well-being while satisfying their energy requirements. Among these alternatives, wind energy emerges as a particularly efficient option. This study focuses on identifying optimal sites for installing wind power plants in Adana province through the integration of the analytic hierarchy process (AHP utilised a combination of Geographic Information System (GIS) and Analytic Hierarchy Process (AHP) methodologies to ascertain the most suitable locations for wind power plants in the province of Adana.

In this study, the criterion weights determined by the Fuzzy AHP method will be integrated using the ArcGIS Pro Model Builder tool, and a systematic workflow model will be developed. The objective of the present model is to determine the most suitable areas for wind energy power plants in the Lower Sakarya Basin.

Main Results

The districts of Kaynarca, Kandıra, İzmit, Gümüşova, Mudurnu, Karasu, Kocaali Söğütlü, Geyve and Pamukova, located in the Lower Sakarya Basin, have been identified as areas with significant potential for the development of wind energy resources. These areas meet key criteria, including strong wind conditions, advantageous topographical features, and proximity to existing infrastructure. In the extant literature, the argument is frequently made that regions characterised by discontinuous topographical features, such as mountain slopes and valleys, possess advanced potential for energy production. This is due to their capacity to effectively direct wind flow (23). For instance, the northern and southern slopes of Oflak Mountain along the Adapazarı-Karasu corridor demonstrate considerable potential for wind energy production. The intensification of wind currents as they pass over or around mountain ridges renders such terrains ideal for wind energy production. The Geyve Strait and its environs have the potential to direct wind flows and increase wind speeds at turbine level. Regions with complex terrain offer high wind energy potential, highlighting the importance of selecting such areas. Sakarya's varied topography, encompassing mountains and valleys, aligns with global research that underscores the significance of geographical diversity in wind farm location selection (24)which should consider not only economic and technical factors including manufacturing and raw materials, but also issues pertaining to the environment. In the present study, a novel methodology is proposed to determine the suitable locations for wind turbine farms by analyzing from the environmental perspective. In the methodology, the life cycle assessment (LCA.
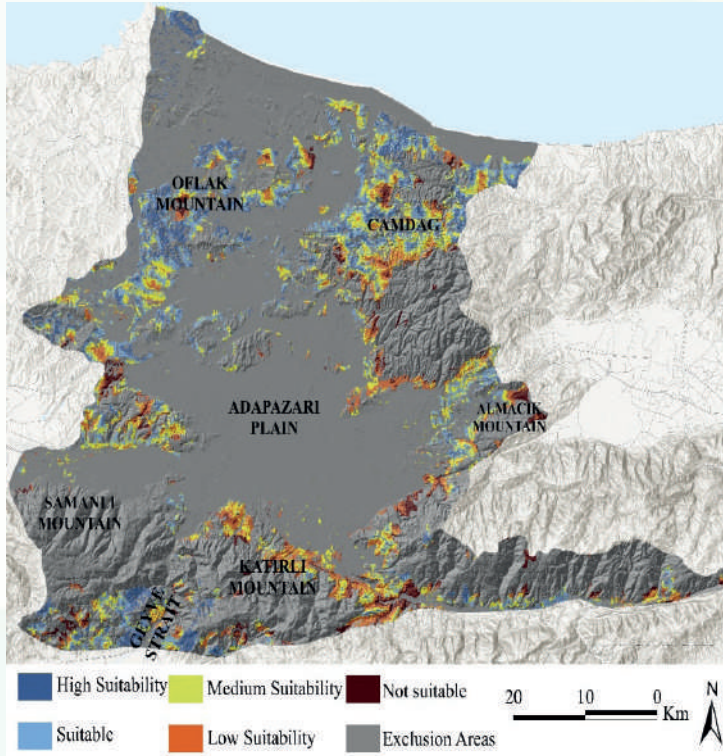
Figure 1. WPP Suitability Levels Results Map.

The suitability analysis conducted in the Lower Sakarya Basin reveals that the region has significant potential for wind energy investments. The total share of 47.64% of areas classified as suitable and highly suitable emphasises the region's significant potential for wind energy investments. The 26% of areas classified as moderately suitable could be developed with appropriate infrastructure and additional investments. This analysis demonstrates that the basin offers a strategic opportunity for wind energy projects in terms of economic and sustainable energy production.

Conclusion

The present study has demonstrated that the implementation of criteria weights, as determined by the Fuzzy AHP method, in GIS-based analyses has resulted in enhanced accuracy and reliability in the selection of WPP sites. The utilisation of fuzzy AHP provides a superior level of accuracy in results when compared with traditional MCDM methods, due to the consideration of uncertainties. The utilisation of ArcGIS Model Builder to formulate a workflow engenders a systematic and repeatable analysis. This configuration is intended to guarantee the adaptability of the method to different regions and sets of criteria.

REFERENCES

1. Smil V. Energy in world history. Vols 0-8133-1901–3. Birleşik Krallık: Westview Press; 1994. 1–300 p.

2. Raza MA, Yousif M, Hassan M, Numan M, Abbas Kazmi SA. Site suitability for solar and wind energy in developing

countries using combination of GIS- AHP; a case study of Pakistan. Renew Energy. 2023 Apr 1;206:180–91.

3. Edenhofer O, Madruga RP, Sokona Y. Renewable Energy Sources and Climate Change Mitigation [Internet]. New York: Cambridge University Press; 2012 p. 1–1088. Available from: https://www.ipcc.ch/site/assets/uploads/2018/03/SRREN_Full_Report-1.pdf

4. Asadi M, Pourhossein K, Mohammadi-Ivatloo B. GIS-assisted modeling of wind farm site selection based on support vector regression. J Clean Prod. 2023 Mar 1;390:135993.

5. Ekiz S, Şirin A, Erener A. En uygun rüzgâr enerji santrali yerlerinin coğrafi bilgi sistemleri ile belirlenmesi: Kocaeli ili örneği. Jeodezi Ve Jeoinformasyon Derg. 2022 May 1;9(1):59–79.

6. Latinopoulos D, Kechagia K. A GIS-based multi-criteria evaluation for wind farm site selection. A regional scale application in Greece. Renew Energy. 2015 Jun 1;78:550–60.

7. Hoang TN, Ly TTB, Do HTT. A hybrid approach of wind farm site selection using Group Best-Worst Method and GIS-Based Fuzzy Logic Relations. A case study in Vietnam. Environ Qual Manag. 2022;32(2):251–67.

8. Van Haaren R, Fthenakis V. GIS-based wind farm site selection using spatial multi-criteria analysis (SMCA): Evaluating the case for New York State. Renew Sustain Energy Rev. 2011 Sep;15(7):3332–40.

9. Voivontas D, Assimacopoulos D, Mourelatos A, Corominas J. Evaluation of Renewable Energy potential using a GIS decision support system. Renew Energy. 1998;13:333–44.

10. Baban SMJ, Parry T. Developing and applying a GIS-assisted approach to locating wind farms in the UK. Renew Energy. 2001 Sep 1;24(1):59–71.

11. Ramachandra TV, Shruthi BV. Wind energy potential mapping in Karnataka, India, using GIS. Energy Convers Manag. 2005 Jun 1;46(9):c.

12. Rodman LC, Meentemeyer RK. A geographic analysis of wind turbine placement in Northern California. Energy Policy. 2006 Oct 1;34(15):2137–49.

13. Fueyo N, Sanz Y, Rodrigues M, Montañés C, Dopazo C. High resolution modelling of the on-shore technical wind energy potential in Spain. Wind Energy. 2010;13(8):717–26.

14. Sánchez-Lozano JM, García-Cascales MS, Lamata MT. Identification and selection of potential sites for onshore wind farms development in Region of Murcia, Spain. Energy. 2014 Aug 14;73:311–24.

15. Adedeji PA, Akinlabi SA, Madushele N, Olatunji OO. Hybrid neurofuzzy investigation of short-term variability of wind resource in site suitability analysis: a case study in South Africa. Neural Comput Appl. 2021 Oct 1;33(19):13049–74.

16. Asadi M, Pourhossein K, Mohammadi-Ivatloo B. GIS-assisted modeling of wind farm site selection based on support vector regression. J Clean Prod. 2023 Mar 1;390:135993.

17. Sotiropoulou KF, Vavatsikos AP, Botsaris PN. A hybrid AHP-PROMETHEE II onshore wind farms multicriteria suitability analysis using kNN and SVM regression models in northeastern Greece. Renew Energy. 2024 Feb 1;221:119795.

18. Placide G, Lollchund MR. Wind farm site selection using GIS-based mathematical modeling and fuzzy logic tools: a case study of Burundi. Front Energy Res [Internet]. 2024 Apr 29 [cited 2024 Aug 16];12. Available from: https://www.frontiersin.org/journals/energy-research/articles/10.3389/fenrg.2024.1353388/full

19. Ozerdem B, Ozer S, Tosun M. Feasibility study of wind farms: A case study for Izmir, Turkey. J Wind Eng Ind Aerodyn. 2006;94:725–43.

20. Uzar M, Şener Z. Suitable map analysis for wind energy projects using remote sensing and GIS: a case study in Turkey. Environ Monit Assess [Internet]. 2019 [cited 2024 Aug 16];191. Available from: https://consensus.app/papers/analysis-wind-energy-projects-using-sensing-case-study-uzar/209d90af8da259ec98814c1f791e192f/

21. Arca D, Çıtıroğlu HK. Güneş enerjisi santral (GES) yapım yerlerinin CBS dayalı çok kriterli karar analizi ile belirlenmesi: Karabük örneği. Geomatik. 2022 Apr 15;7(1):17–25.

22. Yaman A. A GIS-based multi-criteria decision-making approach (GIS-MCDM) for determination of the most appropriate site selection of onshore wind farm in Adana, Turkey. Clean Technol Environ Policy [Internet]. 2024 May 17 [cited 2024 Aug 16]; Available from: https://doi.org/10.1007/s10098-024-02866-3

23. Ifkirne M, El Bouhi H, Acharki S, Pham QB, Farah A, Linh NTT. Multi-Criteria GIS-Based Analysis for Mapping Suitable Sites for Onshore Wind Farms in Southeast France. Land. 2022 Oct;11(10):1839.

24. Demir A, Dinçer AE, Çiftçi C, Gülçimen S, Uzal N, Yılmaz K. Wind farm site selection using GIS-based multicriteria analysis with Life cycle assessment integration. Earth Sci Inform. 2024 Apr 1;17(2):1591–608.

Green Infrastructure and Smart Cities: Yıldız Technical University Davutpaşa Smart Green Campus Applications

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ABSTRACT

Along with industrialization and technological development in cities, horizontal and vertical construction is increasing. With this construction, impermeable surface area increases, urban heat island effect is seen, and negative effects of climate change are felt more. One of the focal issues for those seeking solutions against all these effects is green infrastructures. Green infrastructures are an important issue for smart and sustainable cities with their multifunctional features such as ecological, economic, social and health. University campuses resemble cities with their buildings, roads and green areas. Campuses are important areas for sustainability with their area sizes, amount of energy and water used, waste, transportation and open green areas. The aim of the study is to indicate the importance of green infrastructure applications for the smart city approach. Within the framework of examining the concepts of smart city, green infrastructure and sustainable campus in the literature, Yıldız Technical University Davutpaşa Campus smart green campus applications are evaluated. The campus stands out with its water and energy management, biodiversity, waste, transportation and increasing green areas for reducing impermeable surfaces. With these physical features, there are smart applications for campus residents. Campuses are small residential areas that can serve as examples for smart cities.

Key words: Smart City, Green Infrastructure, Sustainable Campus

Introduction

Campuses are seen as important settlement areas in terms of urban sustainability due to dense population, excessive use of energy and water, and active transportation. Today, universities have to produce greener, more ecological and smart campus solutions in order to compete among universities in the sustainability ranking. Movements such as Smart Cities, Green Infrastructures, Sustainable Campus aim to plan campuses in a holistic manner and implement them on the basis of sustainability with a participatory approach. Especially in mega cities with a population of 16 million and high building density such as Istanbul, the protection and development of campus areas plays an important role in ensuring sustainability by both protecting public spaces and contributing to the reduction of the effects of climate change.

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Smart Cities are urban ecosystems that employs advanced digital technologies and data analytics to optimize infrastructure, governance, and services while fostering environmental sustainability. When closely integrated with green infrastructure, smart cities leverage nature-based systems such as urban forests, bioswales, green roofs, and permeable surfaces—to mitigate urban heat islands, enhance biodiversity, and improve water and air quality (12,13). This fusion of ecological planning with smart technology enables more resilient and adaptive cities, where natural processes are supported by digital monitoring and feedback systems (14,15). The approach not only enhances climate adaptation but also improves liveability, equity, and energy efficiency in urban settings (13,16).

Green infrastructure is defined as 'a developed network system where ecologically and biologically important natural areas, protected areas and other open green areas are connected by ecological corridors' (2), the continuity of abiotic, biotic and cultural functions of landscape ecology (1)environmental and socially-equitable sustainability. This chapter focuses on the environmental area, with theories, models, and applica- tions illustrating possible spatial configurations of a green infrastructure to support ecological and physical processes in the built environment including: hydrology, bio- diversity, and cultural/human activities. Green infrastructure is an emerging planning and design concept that is principally structured by a hybrid hydrological/drainage network, complementing and linking relict green areas with built infrastructure that provides ecological functions. Green infrastructure plans apply key principles of landscape ecology to urban environments, specifically: a multi-scale approach with explicit attention to pattern:process relationships, and an emphasis on connectivity. The chapter provides theoretical models and guidelines for understanding and com- paring green infrastructure approaches. International examples at multiple scales are discussed to illustrate the concepts and principles introduced.","author":[{"-dropping-particle":"","family":"Ahern","given":"J","non-dropping-particle":"","parse-names":false,"-suffix":""}],"container-title":"Cities of the Future:Towards Integrated Sustainable Water and Landscape Management","id":"ITEM-1","issued":{"date-parts":[["2007"]]},"page":"267–283","publisher":"IWA Publishing: London, UK; Citeseer: Princeton, NJ, USA","title":"Green infrastructure for cities: the spatial dimension","type":"chapter"},"uris":["http://www.mendeley.com/documents/?uuid=aee58592-3390-4579-9b96-94d568c1d374"]}],"mendeley":{"formattedCitation":"(Ahern, 2007 ,the multi-functionality of green areas with the concept of 'green', the effective role of connectivity combined with the concept of 'infrastructure', accessibility, spatial variance, multi-functionality, benefits to nature and humans, the creation of biodiversity and connectivity (9),an integrated network of natural and semi-natural areas that provide various benefits to people (10).Green infrastructure provides the ecological, economic, social, cultural and health functions provided by green areas. By increasing permeable surface areas, biological infiltration and filtration of water into the soil, natural drainage system, urban surface water control and urban microclimate and water balance are protect (6,8), since the city is a sponge area, flow control, water reservoir, overflow and flood prevention (2). Preventing drought by regulating the precipitation regime depending on the surface temperature, storing carbon in the main source of soil, plants and water areas, creating carbon sink areas, reducing energy use, reducing temperature effect, reducing urban heat island effect, provides adaptation to climate change (3,4,5,7,11).

This study aims to emphasize the importance of green infrastructures for smart cities. The study area is Yıldız Technical University Davutpaşa campus. The green infrastructure obtained from the literature study, the functions of green infrastructure, smart city, smart city principles within the framework of the applications on the campus were examined and evaluated. As a result, it was tried to determine how green infra-

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structure affects sustainable smart cities.

Main Results

In the creation of sustainable campuses, the development of green infrastructure and smart applications are becoming more and more important today. For this purpose, the protection of existing natural areas of campuses and the increase and improvement of open green areas will be sustainable strategies. In this context, the protection of existing green areas in Davutpasa campus areas, the transformation of areas such as parking lots into green areas in order to increase open green areas will contribute to the reduction of impermeable surfaces. Improving campus green spaces and developing campus forest areas will provide a sustainable and aesthetic urban drainage system for the campus. These areas provide active recreational areas for campus residents, providing them with social and cultural interaction. Energy consumption will be reduced with the climatic comfort provided by green areas. The increase or improvement of walking and bicycle paths in transportation and the use of permeable materials on these paths are important.

Another key aspect of green infrastructure is improving water management. The campus focuses on water management by collecting rainwater from roof gutters in a rain harvesting tank and using it for irrigation, implementing smart irrigation systems with wind and rain sensors, and selecting drought-tolerant species to reduce irrigation needs.

Identifying, protecting, and enhancing biodiversity is crucial for the quality of green spaces. Focus is on identifying plant and animal species on campus, protecting them, introducing new plant taxa, and selecting the right plant species. Additionally, trees on campus will be identifiable through a smart tag system. QR code tags have been created for trees. Residents will scan the QR code and access the plant's name, habitat, and physical characteristics. This will further enhance their understanding of the campus's biological assets and raise awareness.

Yıldız Technical University green infrastructure applications are given in Figure 1.
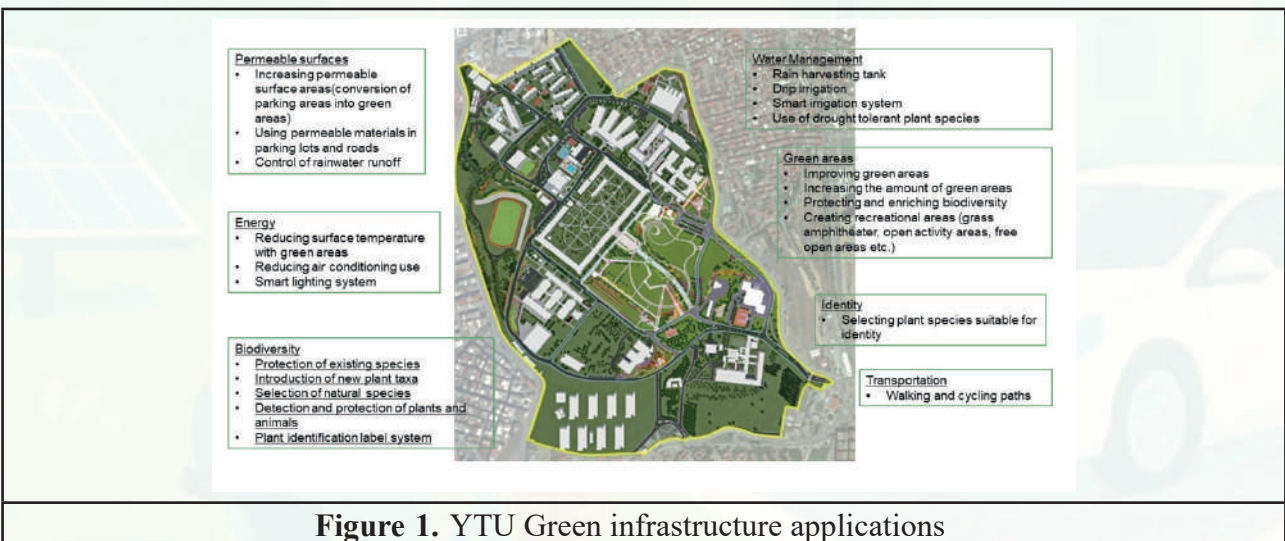
Figure 1. YTU Green infrastructure applications

In addition to green infrastructure applications, introducing smart devices increases awareness and provides ease of use.

Conclusion

Green infrastructure practices support the smart city concept through the functions they provide. They mitigate the effects of climate change through multifunctional features such as increasing green spaces, a sustainable drainage system, water management, protecting biodiversity, and reducing energy consumption. These features ensure the sustainable and smart use of the campus.

The Davutpaşa campus, with its existing and developing green infrastructure features, forms a crucial part of the region's green infrastructure system. Green infrastructure draws its strength from connectivity. Connecting the campus to other green spaces in the region through green corridors will strengthen the campus's infrastructure and provide a holistic approach.

The green infrastructure applications implemented on the Davutpaşa campus serve as a key contributor to the smart city concept by enhancing the integration of nature-based solutions within urban systems. Through initiatives such as smart water management systems, biodiversity preservation, and sustainable transportation networks, the campus provides a model for how urban spaces can leverage green infrastructure to improve environmental quality, reduce energy consumption, and foster resilience against climate change. These applications not only optimize resource management but also promote the sustainable use of urban areas, ensuring a balance between technological advancement and ecological preservation. As part of a smart city framework, the campus's green infrastructure supports improved urban livability, making it a vital component in achieving the goals of environmental sustainability and climate adaptation.

In addition to these applications, smart governance with multi-stakeholder, participatory management style, effective use of the campus-by-campus residents and smart human features will gain the feature of a smart green campus.

REFERENCES

1. Ahern J. Green infrastructure for cities: The spatial dimension. In: Novotny V, Brown P, editors. Cities of the future: Towards integrated sustainable water and landscape management. London: IWA Publishing; 2007. p. 267–283.
2. Benedict MA, McMahon ET. Green infrastructure: Linking landscapes and communities. Washington, DC: Island Press; 2006.
3. Davies ZG, Edmondson JL, Heinemeyer A, Leake JR, Gaston KJ. Mapping an urban ecosystem service: Quantifying above-ground carbon storage at a city-wide scale. J Appl Ecol. 2011;48(5):1125–34.
4. Demuzere M, Orru K, Heidrich O, Olazabal E, Geneletti D, Orru H, et al. Mitigating and adapting to climate change: Multi-functional and multi-scale assessment of green urban infrastructure. J Environ Manage. 2014;146:107–15.
5. Depietri Y, McPhearson T. Integrating the grey, green, and blue in cities: Nature-based solutions for climate change adaptation and risk reduction. In: Kabisch N, Korn H, Stadler J, Bonn A, editors. Nature-based solutions to climate change adaptation in urban areas: Theory and practice of urban sustainability transitions. Cham: Springer; 2017. p. 91–109.
6. Ellis JB. Sustainable surface water management and green infrastructure in UK urban catchment planning. J Environ Plan Manag. 2013;56(1):24–41.

7. Gill SE, Handley JF, Ennos AR, Pauleit S. Adapting cities for climate change: The role of the green infrastructure. Built Environ. 2007;33(1):115–33.

8. Liu L, Jensen MB. Green infrastructure for sustainable urban water management: Practices of five forerunner cities. Cities. 2018;74:126–33.

9. Mell IC. Green infrastructure: Concepts, perceptions and its use in spatial planning [PhD thesis]. Newcastle upon Tyne: Newcastle University; 2010.

10. Naumann S, McKenna D, Kaphengst T, Pieterse M, Rayment M, Davis M. Design, implementation and cost elements of green infrastructure projects. Brussels: European Commission; 2011.

11. Tiwari A, Kumar P, Kalaiarasan G, Ottosen TB. The impacts of existing and hypothetical green infrastructure scenarios on urban heat island formation. Environ Pollut. 2020;265:114875.

12. Alizadeh T, Bosman C, O'Connor K. Planning for smart cities: Will the smart city evolve into the sustainable city? Urban Policy Res. 2020;38(1):77-93. doi:10.1080/08111146.2019.1672667

13. Maimunah A, Leh OLF, Akmal MF, Arshad R. Green Infrastructure and the Smart City: A Review of the Literature. IOP Conf Ser Earth Environ Sci. 2021;767(1):012006. doi:10.1088/1755-1315/767/1/012006

14. Sharifi A. A critical review of selected smart city assessment tools and indicator sets. J Clean Prod. 2020;253:119982. doi:10.1016/j.jclepro.2019.119982

15. Kabisch N, Korn H, Stadler J, Bonn A, editors. Nature-based solutions to climate change adaptation in urban areas: Linkages between science, policy and practice. Cham: Springer; 2017.

16. Pauleit S, Zölch T, Hansen R, Randrup TB, Konijnendijk van den Bosch C. Nature-based solutions and climate change – four shades of green. In: Kabisch N, et al., editors. Nature-Based Solutions to Climate Change Adaptation in Urban Areas. Cham: Springer; 2017. p. 29–49.

The Impact of the Deposit Return System on Urban Waste Management in Sakarya

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ABSTRACT

This study seeks to assess the contribution of the Deposit Return System (DRS), recently implemented in the province of Sakarya, to urban waste management efforts. As part of a national strategy to roll out the DRS across all 81 provinces of Türkiye by the end of 2025, Sakarya was designated as a pilot region, with the system being introduced in early 2025. The initiative has rapidly gained traction among both local authorities and residents. Drawing on field observations and survey data, the study evaluates the system's effectiveness in practice. The findings reveal that, although public awareness of the system is relatively high, several infrastructural and technical challenges hinder its optimal performance. Key limitations include the suboptimal spatial distribution of reverse vending machines, the limited appeal of the current refund incentives, and restricted access in rural areas. Despite these challenges, the Sakarya case provides critical insights for the potential nationwide expansion of the DRS. To ensure the long-term sustainability and effectiveness of the system, the study recommends the implementation of targeted awareness campaigns, investment in infrastructure, and integration with digital platforms.

Key words: Deposit Return System, Zero Waste, Urban Waste Management, Recycling

Introduction

With the growing consumption patterns and urbanization dynamics of today, solid waste management has become one of the fundamental components of environmental sustainability. Effective management of solid waste is regarded as a critical necessity for the preservation of natural resources, the reduction of greenhouse gas emissions, and the transition toward a circular economy (1,2). According to data from the World Bank, approximately 2 billion tons of municipal solid waste are generated annually on a global scale, a significant portion of which is not disposed of through environmentally sound methods (3). This situation has necessitated the development of new and sustainable approaches to waste management.

Deposit Return Systems (DRS), which are widely implemented across the European Union and other developed countries, enable high recycling rates by ensuring the source-separation of beverage containers

(4). The improper disposal of recyclable packaging waste not only poses a threat to ecosystems but also imposes considerable financial burdens on local governments. Therefore, various policy tools are being developed to promote the efficient use of resources, reduce waste generation, and increase recycling rates (5). Among these tools, DRS aims to reduce waste volumes and increase reuse rates by encouraging consumers to return packaging materials.

In Türkiye, the first implementation of DRS took place in 2022 on a pilot scale in the Kızılcahamam district of Ankara under the coordination of the Ministry of Environment, Urbanization, and Climate Change. As of 2025, the system was expanded to the province of Sakarya and made available for public use. The DRS model in Sakarya involves the collection of glass, plastic, and metal beverage containers within the scope of the "Deposit-Labelled Packaging" (DLP) initiative through specially positioned reverse vending machines. Consumers return these containers at designated locations and receive their deposit refunds via mobile wallets, thereby promoting voluntary participation. Supported by the Sakarya Metropolitan Municipality, this initiative serves as a model in terms of both local governmental environmental commitment and citizens' willingness to participate.

This study aims to evaluate the technical infrastructure, public acceptance level, and contribution to recycling processes of the DRS model implemented in Sakarya in 2025. In addition, in order to assess the initial outcomes of the implementation, a semi-structured interview study was conducted, supported by both qualitative and quantitative data. Within this framework, the study seeks to examine the local applicability and effectiveness of the DRS, its environmental benefits in terms of solid waste transformation, and its potential to influence consumer behavior.

Main Results

This research was conducted using a mixed-methods approach that combines both qualitative and quantitative data collection techniques. In the qualitative phase of the study, field observations were carried out at three different Deposit Return Points located in the city center of Sakarya. These observations aimed to examine user behavior, technical malfunctions, and general performance aspects related to the operation of the system.

In the quantitative phase, semi-structured interviews were conducted—both online and face-to-face—with a total of forty participants residing in Sakarya who were familiar with the system and had used it at least once. Data were collected regarding users' levels of knowledge about the system, frequency of use, evaluations of functionality, and the challenges they encountered.

As of 2025, the Deposit Return System (DRS) in Sakarya was implemented on a pilot scale, primarily in the city center and major districts. In the distribution of reverse vending machines, priority was given to central urban areas, while access to the system remained limited in rural and peripheral neighborhoods. This disparity necessitates an assessment of the system's accessibility at the local level.
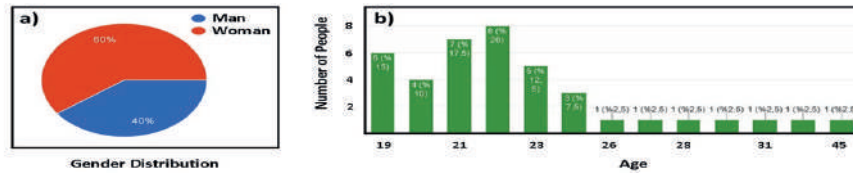
Figure 1. Graphs Showing the a) Gender Distribution and b) Age Distribution of the Participants

The demographic distribution of the participant profile is presented in Figure 1. Among the participants, 60% were female and 40% were male. According to the findings, 95% of respondents reported having used a Deposit-Labelled Packaging (DLP) return machine at least once, while only 5% stated that although they were aware of the system, they had never used it. These results indicate a high level of adoption of the system within a short period.

However, the channels through which participants obtained information about the system appear largely unstructured. Only 25% of participants became aware of the system through organized communication tools such as social media, posters, or promotional events. The majority, on the other hand, gained information from informal sources such as word of mouth or incidental observations. This suggests the need for more comprehensive, targeted, and sustainable communication strategies to support public outreach.

While 35% of participants expressed a positive evaluation of the system—particularly appreciating its environmental benefits, ease of use, and support for next-generation recycling habits—10% reported problems such as equipment malfunctions, software errors, frequent "out of service" messages on the mobile application, and inappropriate or unhygienic use of the machines. These issues point to a clear need for strengthening the technical infrastructure of the system and improving user guidance mechanisms.

Opinions on the refund amount varied among participants. While 35% considered the current incentive adequate, 23% found it insufficient. The remaining 42% did not express a clear opinion on the matter. This distribution suggests that the economic incentive does not equally motivate all user groups and has not yet reached a level that drives behavioral change. Indeed, some participants indicated that the refund may be more encouraging for younger users but also emphasized that the sustainability of the system should not rely solely on monetary rewards.

Another key finding frequently highlighted by participants is the system's contribution to environmental sustainability. During the interviews, respondents emphasized the functionality of the system in reducing

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waste generation, protecting the environment, and raising awareness about recycling. There was a strong consensus among participants that environmental education should begin at an early age to ensure the long-term success of the system. It was also underscored that more intensive information dissemination and incentive strategies are needed to transform recycling behavior from an individual action into a widespread social habit.

In the open-ended response section, participants offered various suggestions regarding the sustainability of the system. These included minimizing technical malfunctions in the machines, developing instructional materials (such as educational videos) for proper use, preventing misuse, and enhancing public education on the importance of recycling. These recommendations indicate that the Deposit Return System (DRS) should not be seen merely as a technical infrastructure, but rather as a multifaceted initiative that must be supported by an effective public communication strategy.

Overall, although the system is still in the early stages of implementation, the findings demonstrate that the DRS in Sakarya contributes significantly at both environmental and societal levels. In particular, the high level of awareness among young individuals is considered a promising indicator of the system's potential for broader adoption. Nonetheless, the long-term success of the system is directly linked to strengthening its technical infrastructure, restructuring economic incentives, ensuring spatial equity in machine distribution, and developing a systematic communication strategy.

Conclusion

As of 2025, the implementation of the Deposit Return System (DRS) in Sakarya marks the beginning of a significant transformation in sustainable waste management and environmental policy at the urban scale. With the active support of local authorities and the rapid development of public awareness, the system was quickly accepted and has generated notable environmental benefits by promoting source-separation of packaging waste. This underscores that recycling is not merely a technical operation, but also a domain of behavioral transformation. However, findings from the initial phase of implementation also point to several structural and operational challenges that limit the system's performance. Key weaknesses include the limited number of reverse vending machines, frequent technical malfunctions, functionality issues in the mobile application, and refund amounts that are perceived as insufficiently motivating by users. Additionally, the limited accessibility of DRS points in rural and peripheral neighborhoods raises questions about the system's compliance with the principle of spatial equity and hinders the widespread adoption of recycling behavior across the city. Nevertheless, considering the system is still in its early stages, such limitations may be regarded as part of a normal adaptation process.

The Sakarya case provides valuable experiential insights and policy implications for the nationwide expansion of the DRS in Türkiye. The research findings indicate that the long-term success of the system depends on several critical factors, including the enhancement of technical infrastructure, equitable distribution of collection devices across all residential areas, and the systematic strengthening of public awareness. Furthermore, designing more comprehensive and targeted promotion, education, and incentive mechanisms emerges as a crucial element for increasing user engagement. In conclusion, the DRS should not be viewed solely as a technical tool for waste reduction, but rather as an integrated policy instrument that promotes social transformation and environmental responsibility. The implementation

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in Sakarya demonstrates the system's potential not only at the local level but also as a scalable model capable of contributing to national circular economy goals. In this regard, it serves as a guiding example for similar systems to be implemented across Türkiye.

REFERENCES

1. EEA 2016 Solid waste [Internet]. Available from: https://www.eea.europa.eu/en
2. EPA 2022 Recycling in the United States [Internet]. Available from: https://www.epa.gov/
3. Worldbank: Trends in Solid Waste Management [Internet]. Available from: https://datatopics.worldbank.org/what-a-waste/trends_in_solid_waste_management.html
4. Eren Z, Taşarsu N. Katı atıkların geri dönüşümü için depozito iade sisteminin önemi: Kızılcahamam pilot uygulaması örneği. Çevre İklim Ve Sürdürülebilirlik. 2023;24(2):65-74.
5. Korucu MK. Ulusal atık yönetimi eylem planlarında kullanılan belediye atığı yönetimi için yöntem seçimi yaklaşımının bir eleştirisi. Ulusal Çevre Bilimleri Araştırma Dergisi. 2019;2(4):169-176.

Digital Space and Participation in the European Union: The Role of Youth in Participatory Democracy Practices

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ABSTRACT

This article investigates the role of youth in the European Union's (EU) participatory democracy practices, with a specific focus on the digital public sphere. It examines how the EU integrates young people into democratic governance through digital means. The study is based on a qualitative analysis of key EU policy documents, including the EU Youth Strategy (2019–2027), the EU Youth Dialogue, and Digital Compass 2030. It also evaluates findings from Eurobarometer surveys.

The analysis reveals that the EU's approach to youth participation is increasingly structured around digital citizenship and multilevel governance frameworks. While institutional mechanisms such as the EU Youth Dialogue and digital platforms have improved formal access to participatory processes, they often reproduce limitations related to proceduralism, representation, and digital exclusion. The participatory spaces created tend to emphasize consultation over co-decision, limiting young people's agency in shaping policy outcomes. Additionally, structural disparities across member states hinder the equal realization of participatory ideals.

The EU has advanced an ambitious normative agenda linking youth, digitalization, and participatory democracy. However, its implementation remains constrained by asymmetries in digital access, uneven policy integration, and limited deliberative depth. For participatory democracy to evolve meaningfully, future efforts must prioritize not only access and visibility but also substantive influence, reflexivity, and democratic responsiveness in youth engagement structures.

Key words: European Union, Digitalization, Democracy, Participation, Urban Governance

Introduction

In recent years, the European Union (EU) has placed increasing emphasis on participatory democracy as both a normative commitment and a policy imperative. Amid widespread concerns over democratic legitimacy, political disengagement, and institutional distance, particularly among younger generations, the EU has sought to reimagine civic participation through digitally mediated mechanisms. The emergence of digital public spheres—enabled by networked communication technologies—has opened new avenues for political expression and engagement, offering the potential to reshape traditional models of democratic participation. In this context, the inclusion of youth in EU-level democratic practices is no longer a peripheral concern but a central issue linked to the future of European governance (European Commission, 2018; Banaji and Buckingham, 2013).

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Young people in Europe are both subjects and agents of digital transformation. As digital natives, they are among the most active users of online platforms, yet they also face structural barriers that limit their influence in formal political processes. This paradox has led EU institutions to promote youth participation through a variety of frameworks and tools, including the EU Youth Strategy (2019–2027), the European Youth Goals, and initiatives such as the EU Youth Dialogue and Erasmus+. These programs frame youth as key stakeholders in the co-creation of European democratic futures, emphasizing values such as inclusion, dialogue, and empowerment (European Commission, 2022).

However, the relationship between digitalization, youth participation, and democratic deepening remains contested. While the EU has made significant efforts to institutionalize youth engagement, questions persist regarding the substantive quality of this participation. Much of the existing scholarship has problematized the gap between access and influence, highlighting the risk of symbolic inclusion in participatory spaces that are constrained by proceduralism, weak accountability, or technocratic mediation (Sloam, 2016; Fung, 2006; Boussaguet, 2016). Moreover, disparities in digital infrastructure and civic education across member states produce uneven conditions for participation, undermining the EU's integrative aims (Council of Europe, 2020; Livingstone and Third, 2017).

This study examines the extent to which EU participatory democracy practices have succeeded in empowering youth as active and equal agents in the digital public sphere. By focusing on EU-level frameworks rather than local or national case studies, the article aims to assess the coherence, reach, and limitations of the EU's normative and institutional approach to youth engagement. Drawing on a critical review of official policy documents, Eurobarometer surveys, and youth-targeted initiatives, the analysis explores how digital tools are being mobilized to structure participation and how these efforts intersect with broader concerns about legitimacy, representation, and democratic renewal in Europe (Flash Eurobarometer 502, 2022; Youth Forum, 2021; Boucher, 2020).

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Main Results

The 2024 European Parliament Eurobarometer Youth Survey confirms a nuanced portrait of young Europeans' democratic outlook and civic engagement. Nearly 39% reported voting in elections, while 26% engaged in petitioning and 20% in volunteering, with approximately 19% leveraging social media or boycotts to express political views (European Parliament, 2024). These figures align with data from the Flash Eurobarometer 502, which indicates that 64% intend to vote in upcoming elections and 49% have participated in societal actions such as petitions or rallies (European Commission, 2024; European Youth Portal, 2024). The convergence in findings across these surveys suggests evolving patterns of hybrid civic participation—combining formal electoral acts with digital activism.

Despite rising activity, trust and representation gaps persist. The European Youth Dialogue (EYD) has succeeded in institutionalizing youth input at the EU level, yet only around 38% of participants feel genuinely heard, with broader public awareness of the initiative remaining low (Council of Europe, 2023; European Commission, 2022). Moreover, although approximately 61–65% of youth express satisfaction with EU democracy and recognize its societal impact (European Commission, 2025), under-25 turnout fell short at 36% in 2024 compared to 42% in 2019 (Dressler, 2024). This dichotomy—between positive attitudes and lower turnout—raises questions about the depth of engagement and the ability of institutions to convert sentiment into action.

Comparatively, while the EU Youth Strategy and Youth Dialogue frameworks aim to foster inclusion, disparities in digital access and education undermine equitable participation. Eurobarometer data highlights that 42% of youth rely on social media for political information (European Parliament, 2024), yet heterogeneous digital infrastructure across member states limits some groups' engagement. Furthermore, survey data reveals salient policy concerns—environmental protection, economic pressures, and human rights—that motivate youth participation, suggesting that issue-based engagement holds promise if accompanied by responsive institutional pathways (European Commission, 2024).

In sum, EU-level youth initiatives reflect a normative commitment to participatory democracy, buttressed by hybrid modes of civic engagement. Yet translating such engagement into sustained and meaningful influence requires addressing structural limitations, improving awareness, and building more deliberative and accessible engagement platforms across the Union.

Conclusion

This study has examined the European Union's participatory democracy practices in relation to youth engagement within the evolving digital public sphere. Through a review of policy instruments such as the EU Youth Strategy, the EU Youth Dialogue, and Eurobarometer surveys, it becomes evident that the EU has made meaningful normative and institutional commitments to embed youth participation within its democratic architecture. The institutionalization of participatory mechanisms—particularly those enabling digital modes of expression and consultation—demonstrates the EU's recognition of youth as not only beneficiaries of democratic governance but as agents of democratic renewal.

Nevertheless, the findings point to persistent challenges that hinder the translation of formal access into substantive influence. While young Europeans demonstrate relatively high levels of democratic aspiration and a willingness to engage through both conventional and non-conventional channels, there remains a gap between their participatory potential and their perceived and actual impact on policy processes. The limited visibility of instruments such as the EU Youth Dialogue among the broader youth population, coupled with uneven digital infrastructures and disparities in civic education across member states, weakens the democratic inclusivity of these mechanisms. Furthermore, although digital platforms have expanded the reach and diversity of participation, they often do so within constrained institutional logics that emphasize consultation over co-decision or accountability.

Considering these dynamics, the EU's participatory democracy agenda requires both deepening and recalibration. Strengthening youth engagement in the EU context demands moving beyond symbolic gestures and toward more deliberative, reflexive, and responsive forms of governance. This includes reinforcing feedback mechanisms, enhancing transparency in how youth input influences policymaking, and addressing the structural inequalities that inhibit equal access to participatory processes. The convergence of digital innovation and youth political engagement presents an opportunity not only to renew democratic practices but to reimagine them in ways that are more inclusive, equitable, and future-oriented. The extent to which the EU can institutionalize these transformations will be a defining test of its democratic legitimacy in the years ahead.

REFERENCES

1. Banaji, S. and Buckingham, D. *The Civic Web: Young People, the Internet and Civic Participation.* MIT Press; 2013.

2. Boucher, S. (2020). Youth Political Participation in Europe: What Role for the EU? European Policy Centre.

3. Boussaguet, L. Participatory Democracy within the European Union: Institutional and policy innovations. Comparative European Politics. 2016; 14(1), 20–35.

4. Council of Europe. (2020). Digital Citizenship Education Handbook. Council of Europe Publishing.

5. Council of Europe. (2023). Review of the Nine Cycles of the EU Youth Dialogue (2010–2022).

6. Dressler, M. (2024). Youth Turnout in the 2024 European Elections: A Closer Look at the Under25 Vote. Foundation for European Progressive Studies.

7. European Commission. (2018). Engaging, Connecting and Empowering Young People: A New EU Youth Strategy.

8. European Commission. (2022). EU Youth Strategy 2019–2027: Mid-Term Review and Future Outlook.

9. European Commission. (2024). Flash Eurobarometer 502: Youth and Democracy in the European Year of Youth.

10. European Commission. (2025). Commission Expands Youth Participation with New Youth Report, Eurobarometer Survey and Online Debate. European Commission Representation in Cyprus.

11. European Parliament. (2024, February 19). Results of the 2024 EU Youth Survey. EU Children's Platform.

12. European Youth Portal. (2024, May 13). Eurobarometer Survey Shows Young People's Active Participation in Civic and Democratic Life Ahead of the Upcoming European Elections.

13. Fung, A. Varieties of Participation in Complex Governance. Public Administration Review. (2006); 66(1): 66–75.

14. Livingstone, S. and Third, A. Children and Young People's Rights in the Digital Age: An Emerging Agenda. New Media & Society. (2017); 19(5), 657–670.

15. Sloam, J. Diversity and Voice: The Political Participation of Young People in the European Union. The British Journal of Politics and International Relations. (2016). 18(3), 521–537.

AI-Supported Smart Irrigation Systems Against Graywater Microplastics

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ABSTRACT

This study focuses on microplastic pollution in graywater, which comprises a large portion of domestic wastewater—excluding blackwater as defined by Water Pollution Control Regulation. It examines the impact of microplastics on aquatic organisms and the risks of using graywater for agricultural irrigation. A review of the literature reveals a rapid increase in microplastic pollution in recent years due to changing consumer habits, and that a significant portion of microplastics in urban wastewater originates from graywater. In the light of the global threat of water scarcity, reducing microplastic pollution at its sourceis crucial for the effective use of graywater. This is of importance for preserving water resources and protecting the health of living organisms.The proposed method involves an AI-supported irrigation system equipped with microplastic sensors. These sensors continuously monitor microplastic levels in irrigation pipelines. If levels exceed a set threshold, the system stops irrigation and diverts the water to a separate tank for non-agricultural use. Preventive measures like using cotton clothing and installing washing machine filters help reduce microplastics at the source. Literature and experimental data show this integrated approach effectively limits microplastic entry into soil and crops, enabling safer, more efficient graywater reuse amid growing water scarcity.

Keywords: Microplastics, Graywater, Wastewater, Purification, AI-Supported Smart Irrigation Systems.

Introduction

Our natural resources are not unlimited. As the world's population and consumption increase, these resources are quickly decreasing. If we don't use them carefully, they may run out one day. That's why it's very important to reduce waste at the source and to protect our natural resources from pollution.Environmental pollution is one of the biggest problems in the world. Plastic pollution, in particular, harms the air, water, and soil. Plastics used in daily life break down into small pieces called microplastics when they enter the environment, and they spread into ecosystems like water sources. In Turkey, more than 80% of the solid waste causing water pollution is made up of plastic pieces.

Wastewater is usually divided into four types: Domestic, industrial, agricultural and rainwater. Domestic wastewater has two main types: graywater and blackwater. Graywater can also be grouped into slightly dirty and very dirty graywater. According to the Water Pollution Control Regulation (4) graywater means all household wastewater except for toilet water (which is blackwater). The main sources of graywater are kitchen sinks, bathroom water, washbasins, and laundry. Graywater makes up about 75% of all domestic wastewater (4). It

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usually doesn't have many harmful germs and is not very rich in nutrients.
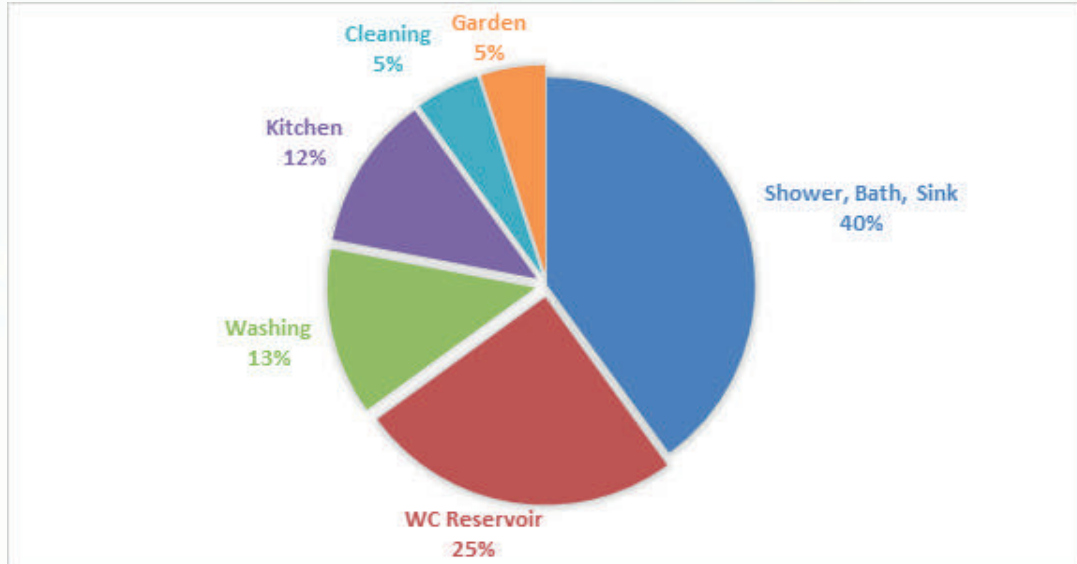
Graphic 1. Daily Domestic Water Consumption Amounts (4)

The first synthetic plastic (2) was made by Leo Hendrik Baekeland in 1907. Plastics are grouped by their size. These groups are: Macroplastics, mesoplastics, microplastics, mini-microplastics and nanoplastics.Microplastics were first used in the 1970s, mainly in personal care products like face scrubs. In the 1990s, microplastic pollution started to grow and became a bigger environmental problem (7).

Microplastics are divided into two types based on where they come from: primary microplastics and secondary microplastics (7).*"Microbeads in personal care, cleaning, hygiene, and cosmetic products, and plastic materials or waste released into soil or water during production, are examples of primary microplastics"* (1).

Main Results

If small plastic particles are not removed properly after use, they can directly enter rivers, seas, and other water environments.Large plastic materials thrown into land or sea break down over time due to biological, chemical, and physical factors. This breakdown damages their structure and causes them to fragment. The microscopic plastic pieces formed in this way are called secondary microplastics (3).

In a study, Kiessling(5) found that secondary microplastics enter the food chain of marine organisms.Wastewater generated from laundry activities is considered part of graywater and makes up its more polluted portion. The first study showing the presence of microplastics in wastewater from laundry was published by Browne in 2007 (3).

Following this study, several experiments have shown that a standard 6 kg household washing machine can release around 700,000 fibers per wash (6), and a single piece of clothing can shed about 1,900 fibers in just one wash.

Conclusion

Research has also shown that using a filter at the washing machine outlet can capture about 80% of microplastics (6), significantly reducing their release into water systems.In the UK, it has been reported that wearing cotton-based clothes is more effective in reducing microplastic pollution than adding filters to washing machines.Many studies have shown that graywater from laundry contains a large amount of microplastics. If this water is used on soil without proper treatment, it can lead to microplastic build-up in the soil, which may be very harmful.Using graywater efficiently is very important for protecting natural water sources. However, to stop microplastics in graywater from entering the human body through the food chain, steps must be taken to reduce microplastics in this water.

In addition to these steps, using microplastic sensors in water pipes can help lower the risk if there is a leak and graywater reaches the soil. In this AI-supported system, the sensors will measure microplastic levels often. A safe range will be set for the system. If the microplastic level goes above this range, the AI will redirect the water to a storage tank. If the microplastic level returns to normal, the water will be allowed to flow to the fields again. However, if microplastic levels continue to remain high, a system that redirects the water to treatment facilities is proposed, and it is anticipated that this system could help solve the microplastic problem.

Microplastics in graywater, especially from laundry, are a growing environmental problem. Although graywater can help reduce water use, it must be treated carefully to avoid harm. This study shows that using washing machine filters and choosing cotton clothes can help reduce microplastic pollution at the source. It also suggests an AI-supported smart irrigation system with sensors that stop water flow when microplastic levels are too high. This system protects soil, crops, and water resources. Overall, combining green solutions with smart technologies can make cities more sustainable and safer.If more efforts are made to prevent microplastic pollution, it is expected that people can be protected from microplastics.

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REFERENCES

1. Aslan,R.Mikroplastikler: HayatıKuşatan Yeni Tehlike. Ayrıntı Dergisi;2018. Cilt: 6, Sayı: 66, ss. 61 - 67.

2. BakeliteFirst Synthetic Plastic - National Historic Chemical Landmark [Internet]. American Chemical Society. [cited 2025 Jun 22]. Available from: https://www.acs.org/education/whatischemistry/landmarks/bakelite.html

3. Browne M, Galloway T, Thompson R. Microplastic - An Emerging Contaminant of Potential Concern? Integrated Environmental Assessment and Management. [cited 2025 Jun 22]. Available from: http://dx.doi.org/10.1897/ieam_2007-048

4. Karahan A. Gri Suyun Değerlendirilmesi. IX. UlusalTesisatMühendisliğiKongresi, 2011; ss. 1154 - 1164.

5. Kiessling T, Gutow L, Thiel M. Marine Litter as Habitat and Dispersal Vector. In: Marine Anthropogenic Litter. Cham: Springer International Publishing; 2015. pp. 141 - 81.

6. Napper I. E., Thompson R. C. Release of Synthetic Microplastic Plastic Fibres from Domestic Washing Machines: Effects of Fabric Type and Washing Conditions. Marine Pollution Bulletin; 2016. 112 (1- 2): pp. 39 - 45.

7. YılmazY. T. Mikroplastik Nedir? Canlılara ve Çevreye Nasıl Zarar Verir? [İnternet]. Evrim Ağacı. [cited 2025 Jun 22]. Available from: https://evrimagaci.org/mikroplastik-nedir-canlilara-ve-cevreye-nasil-zarar-verir-15353

Integrating Green Infrastructure into Smart Cities: The Case of Freiburg

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ABSTRACT

This study examines how green infrastructure can be integrated into smart cities by using content analysis method, taking the example of Freiburg. Green infrastructure refers to a network that provides the "components" to solve urban and climatic challenges by building together with nature. Therefore; it's the best way to build a sustainable city and also, it creates a great collaboration with smart cities. Because smart cities are not only the technology-focused cities, but also, they are the cities that provide a more sustainable, more livable and more inclusive life for people. Considering that we aim a sustainable and livable life, green infrastructure is the best way to provide this. This study explains the most suitable ways for integrating the green infrastructure systems into the smart cities. Freiburg is one of the unique cities which have both smart city and green infrastructure qualification and also, it's an excellent example of integrating green infrastructure into smart cities, as it places emphasis on sustainability in transport, the protection of green areas, renewable energy and water management, makes it one of the best options to use in this study.

Key words: Green infrastructure, Smart Cities, Freiburg, Renewable Energy, Water Management.

Introduction

In today's world, the importance of integrating green infrastructure into smart cities is steadily increasing. Therefore, this study examines ways to integrate green infrastructure into smart cities. It basically contains researches of how to build most livable cities that have both sustainable and technological character. It's a significant topic because urbanization and global warming are driving people to seek sustainable, eco-friendly alternatives, which are often difficult to find due to the lack of attention or importance people give to these issues. The concept of the term, "green infrastructure", simply refers to "a strategically planned network of natural and semi-natural areas with other environmental features, designed and managed to deliver a wide range of ecosystem services, while also enhancing biodiversity" (1). As can be understood from this definition, green infrastructure possesses all the qualities necessary for supporting a sustainable lifestyle. And also, a smart city is "the use of digital and communication technologies and, in this context, it is aimed at high quality resource management and service delivery" (3). These two terms are pretty compatible with each other for sustainability of cities. That's why the study offers useful research

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for sustainability by using the example of Freiburg, one of the smart cities that has green infrastructure.

Main Results

Freiburg is the perfect example to use in this study because it's defined as "a shining example of the success of Germany's energiewende" (2). It's known for its renewable energy, alternative mobility, solar power and hydro-power projects. The city has long been active in implementing important factors for sustainability, such as renewable energy, public transport, green space and participatory urban development. Also, Freiburg remains at the forefront of the implementation of green building technologies (2). The table below shows some of the programs in Freiburg and also, their aims and effects.

Table 1. Aims and Effects of Green City Programs in Freiburg

Program	Aim	Effects
Usage of Solar Energy	Achieving 100% renewable energy and carbon neutrality for the city	Freiburg maintains very low carbon emissions, with the majority of its energy production based on renewable sources.
Encouragement of Walking and Cycling Instead of Car Usage	Preventing energy waste and promoting sustainable, alternative urban mobility	Freiburg effectively reduces carbon emissions and prevents air pollution by decreasing dependence on motor vehicles.
Usage of Bio-Energy	Utilizing the city's organic waste as an eco-friendly energy source	This program helps reduce environmental pollution from organic waste while simultaneously increasing energy production for the city.
Usage of Wind Energy	Generating electricity from the kinetic energy of wind	The use of wind power, a renewable source, helps prevent various environmental problems and contributes to a sustainable energy generation.
Usage of Hydro-Energy	Generating electricity from the kinetic energy of water	Like wind energy, hydro-energy is a renewable source that helps mitigate environmental issues associated with conventional energy production.

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Green Urban Planning	Preserving large portions of the city as green spaces	This program not only promotes walking and cycling but also makes Freiburg an attractive place for students and environmentally conscious citizens.

This table gives us a lot of information about green city programs in Freiburg. Each program has significant aims and effects for the sustainability in the city. Usage of solar energy in the city aims achieving 100% renewable energy and carbon neutrality for the city and provides benefits like low carbon emission. Encouragement of walking and cycling aims decreasing energy waste and promoting sustainable urban mobility which provides low carbon emission and precaution against air pollution. Usage of bio-energy utilizes the city's wastes as a bio friendly energy source, which benefits city's policies about reducing environmental pollution while producing energy. Usage of wind and hydro-energy generates energy from bio-friendly sources, which mitigates environmental issues. And lastly, green urban planning preserves large portions of the city as green spaces, so people prefer walking and cycling. Also, this program makes Freiburg an attractive place for both students and environmentally conscious people (2).

As can be understood from the table, there are lots of ways to apply green infrastructure in smart cities. All the ways in table are made by using both technology and ecological methods. The first program, "the usage of solar energy" plays a key role in term of renewable energy. As a result of the program, carbon emission rate in Freiburg has decreased significantly. It's a major effect not only for Freiburg, and also for the world because every little fall on carbon emission helps to close the hole in the ozone layer and indirectly reduces global warming. Also, the second program "encouragement of walking and cycling instead of car usage" does the same effect and decreases carbon emission. Freiburg offers opportunities such as building walking and cycling paths so that people can choose to walk and cycle instead of driving. As a result of this program, air pollution is also decreasing with motor vehicles. Therefore, Freiburg has the lowest car density of any city in Germany (5).

Next 3 programs are all related to the use of renewable energy. Freiburg procures energy from ecological and sustainable sources instead of resources at risk of depletion. Bio-energy is one of the resources available to help meet our demand for energy. It is a form of renewable energy that is derived from recently living organic materials known as biomass, which can be used to produce transportation fuels, heat, electricity, and products (6). It basically depends on getting energy from bio-waste such as wood-waste, plant-waste, animal-waste (fertilizer) and energy plants. Energy production from these kinds of sustainable resources is one of the main aims of green infrastructure. It reduces environmental pollution. Also, wind energy is a pretty useful alternative. The wind brings enormous kinetic energy with itself. This type of energy can be utilized in many different areas if managed properly by people. Hydro-energy also operates on a similar principle. It uses the kinetic energy of water, often saltwater, to produce the energy needed to meet human demands. It's sustainable because water on Earth is never lost and always comes back by water cycle. Therefore, these 3 resources to gain energy, are pretty sustainable, eco-friendly and inexhaustible. And lastly, green urban planning mainly aims to green up the city as much as possible by planting more plants. It supports forest conservation, encourages planting, and enhances overall green

life. (4) The people of Freiburg are made aware about how important it is to protect nature for a more sustainable life. People are learning and getting the habits of recycling, planting etc. from kindergarten onward. They grow up with the concept of plant love. As they become adults, they become individuals with green consciousness. Also, Freiburg not only raises awareness but also provides its people with green spaces to enjoy. There are lots of green places for all age groups. This green urban planning program seems like its works because everybody knows Freiburg for its environmentally friendly and sustainable city planning. Especially in Vauban Neighborhood. It's a sustainable heaven for environmentalists. In here, we can say everything is sustainable and eco-friendly and ecologically important factors such as car-free living, environmentally conscious society, community participation and common areas come to the fore. So, it's a qualified city for people who wants to live sustainable (2).

Conclusion

In conclusion, this research shows the importance of green infrastructure for a more sustainable world and how beneficial it can be when combined with smart cities. It observes this in the German city of Freiburg and examines some programs that can be implemented in other cities. Freiburg is a good example in this sense with its ecological city infrastructure and conscious society. Cities around the world should also follow this city as an example because sustainability is an important part of our lives. We do not have another planet to live on, so we must take care of our Earth.

REFERENCES

1. Crncevic T, Tubic L, Bakic O. Green Infrastructure Planning for Climate Smart and "Green" Cities. Spatium. 2017; (38): 35–41.

2. Green City Times. Freiburg [Internet]. Green City Times; [cited 2025 Jun 21]. Available from: https://www.greencitytimes.com/freiburg/

3. Machac J, Louda J, Dubova L. Green and Blue Infrastructure: An Opportunity for Smart Cities? 2016 Smart Cities Symposium Prague (SCSP). IEEE; 2016.

4. Sustainable Germany. Freiburg: Unparalleled greenspace integration [Internet]. Medium; 2021 Apr 12 [cited 2025 Jun 21]. Available from: https://medium.com/sustainablegermany/freiburg-unparalleled-greenspace-integration-7256e6727be9

5. Sustainable Germany. Freiburg: Green infrastructure, collaboration and policy [Internet]. Medium; 2021 Apr 19 [cited 2025 Jun 21]. Available from: https://medium.com/sustainablegermany/freiburg-green-infrastructure-collaboration-and-policy-7691253e1c93

6. U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. Bioenergy Basics. [Internet]. [cited 2025 Jun 22]. Available from: https://www.energy.gov/eere/bioenergy/bioenergy-basics

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From Collective Trauma to Community Resilience: A Proposed Community-Based Social Work Model for Post-Disaster Psychosocial Intervention in Türkiye

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ABSTRACT

Disasters affect not only the physical environment but also leave profound psychological and social consequences for individuals and communities. In countries like Türkiye, where disasters occur frequently, psychosocial support services are often implemented reactively, only after crises emerge—hindering the comprehensiveness and sustainability of the intervention. This paper introduces a multidisciplinary, community-based psychosocial intervention model that emphasizes preparedness before disasters occur.

The model suggests the pre-identification of teams composed of social workers, psychologists, and pedagogues, supported by systematic in-service training and supervision mechanisms. This approach aims not only to foster the resilience of disaster-affected individuals but also to enhance the psychological well-being of the professionals who provide support. The model is grounded in Judith Herman's trauma recovery process [1], Antonovsky's theory of sense of coherence and resilience [2], and Dominelli's green social work model that highlights the proactive and ethical role of social work throughout the disaster cycle [3].

Arguing that disasters constitute collective traumas, the paper proposes a shift from individual-centered to community-based approaches, calling for a preventive, ethically grounded, and scalable social work model for building long-term social resilience.

Key words: Disaster Preparedness, Psychosocial Support, Collective Trauma, Community Resilience, Social Work

Introduction

Disasters are multidimensional events that not only damage physical infrastructure but also disrupt the psychological integrity of individuals, the social fabric of communities, and long-term resilience. In Türkiye, where disasters are frequent and intervention systems are largely centralized, post-disaster support often follows a crisis-driven pattern. However, the psychological and social impacts of disasters require structured responses not only during the event but also before and after. Particularly in the field of psychosocial support, this continuity is often neglected, and professionals entering the field unprepared or vulnerable to secondary trauma can undermine the quality of services.

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In this context, there is a clear need for a psychosocial intervention model in Türkiye that emphasizes pre-disaster preparedness and has not yet been systematically developed. The model proposed in this paper aims to enhance the psychosocial resilience of both disaster-affected individuals and professionals working in the field. By incorporating in-service training, supervision mechanisms, and a multidisciplinary team structure, it offers a framework that is both ethical and functional.

The model is grounded in Judith Herman's trauma recovery process [1], Aaron Antonovsky's theory of sense of coherence and resilience [2], and Lena Dominelli's green social work approach [3]. While existing literature often focuses on the restorative role of social work after disasters, this paper distinguishes itself with a preventive perspective, arguing for the urgent need to systematize pre-disaster preparedness within social work practices.

Main Results

This paper proposes a preventive and community-based social work model to address the psychosocial impacts of disasters in Türkiye. The model aims to strengthen not only the resilience of disaster-affected individuals but also the mental well-being and preparedness of professionals involved in disaster response. Studies have shown that disaster workers often experience emotional exhaustion, secondary traumatic stress, and burnout, particularly in the absence of structured support systems [1,2].

The proposed model is based on three core components:
(1) the early formation of multidisciplinary teams composed of social workers, psychologists, and educators;
(2) systematic in-service training and ongoing supervision before any crisis occurs; and
(3) a trauma-informed, community-centered intervention framework.

This approach seeks to overcome the limitations of Türkiye's reactive, crisis-oriented disaster management system by integrating preparedness and psychosocial resilience into institutional planning. By shifting the focus from individual-based emergency response to collective, pre-crisis resilience, the model contributes to both theoretical discourse and applied social work practice in disaster settings. It also emphasizes intersectional sensitivity by recognizing that affected populations—such as children, persons with disabilities, women, and the elderly—experience layered vulnerabilities and require differ- entiated psychosocial responses [3,4].

The model aligns with existing frameworks in psychiatric and trauma-informed social work, particularly in its preventive, therapeutic, and rehabilitative components [5], and addresses the structural gaps identified in recent studies on post-disaster psychosocial support in Türkiye [6].

Conclusion

This study highlights the need for a preventive and community-based social work approach, which has often been overlooked in Türkiye's post-disaster psychosocial support processes. Research shows that disaster response professionals frequently experience secondary trauma when inadequately prepared, which negatively affects the quality of interventions [1,2]. In this regard, disasters have profound impacts not only on individuals but also on the mental well-being of professionals involved in the field.

The proposed model includes:
•Structured in-service training programs implemented prior to disasters,
•Continuous supervision and psychological support for professionals,

•Pre-identified, multidisciplinary teams that are ready to be deployed.

This approach aims to provide ethical, sustainable, and resilient disaster response mechanisms by enabling systematic psychosocial interventions before, during, and after disasters. In addition, it adopts an intersectional perspective by acknowledging the differentiated needs of vulnerable groups such as children, women, persons with disabilities, and the elderly [3,4].

This study positions social work not merely as a support mechanism in disaster response but as a key actor in strengthening **community-level resilience**. In countries like Türkiye—frequently exposed to disasters and operating within centralized response systems—such preventive and holistic models should not only be considered a necessity, but also an opportunity. **Türkiye's constant exposure to crisis should not be viewed solely as a weakness, but as a potential strength to develop institutional resilience in a systematic manner.** Integrating this model into national social work policies would not only address current deficiencies but also position Türkiye as a leading example in post-disaster psychosocial intervention.

For future research, it is recommended that this model be tested through small-scale pilot programs, evaluated comparatively across regions with varying risk profiles, and integrated into undergraduate and graduate curricula in social work education with a focus on disaster preparedness and resilience.

REFERENCES

1. Figley CR. Compassion Fatigue: Coping With Secondary Traumatic Stress Disorder In Those Who Treat The Traumatized. New York: Brunner/Mazel; 1995.
2. Travma Çalışmaları Derneği. 2023 Depremleri Sonrası Psikososyal Destek Raporu. Ankara: TÇD Yayınları; 2023. [Available from: https://www.travmacalistmalari.org]
3. Dominelli L. Green Social Work: From Environmental Crises to Environmental Justice. Cambridge: Polity Press; 2012.
4. Aksoy Ş, Kabasakal Z. Afet Sonrası Psikososyal Destek Uygulamaları: Türkiye Örneği. IBAD Journal of Social Sciences. 2023;15:80–91.
5. Özcan C. Psikiyatrik Sosyal Hizmet: Koruyucu, Tedavi Edici ve Rehabilite Edici Ruh Sağlığı Alanında. Ankara: Nobel Yayıncılık; 2021.
6. Erdur-Baker Ö, Doğan T, editors. Afetler, Krizler, Travmalar ve Psikolojik Yardım. Ankara: PDR Yayınları; 2017.

Reclaiming Silence in the Digital Age:
Designing New Urban Realms for Youth Creativity

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ABSTRACT

In today's overstimulated, digitally saturated urban landscape, young people are bombarded by relentless sensory overload that stifles creativity and strains mental wellbeing. Based on interdisciplinary references and case studies, we explore how silence, as both a spatial and cognitive element, enhances creativity, mental resilience, and social innovation. Grounded in interdisciplinary research and global case studies, we demonstrate that silence is not merely the absence of noise but a catalyst for neurocognitive restoration, emotional regulation, and creative ideation. Cities that prioritize youth-focused quiet zones—not just for rest but for active ideation and cultural production—foster deeper democratic participation. The research proposes integrative urban strategies including youth-led design contests, digital detox architecture, and policy inclusion mechanisms. These approaches aim not only to provide relief from sensory overload but to embed creativity into the core of resilient urban futures. The study is constructed using qualitative research methods, specifically document analysis and selected case study review.

Keywords: Silence, Youth Creativity, Cognitive Urbanism, Participatory Design, Mental Sustainability

Introduction

Urban environments today are saturated with sensory input. The recognition that urban environments significantly impact psychological wellbeing aligns with growing evidence that city design directly influences cognitive function and emotional states. Despite growing awareness of mental health and cognitive fatigue, city designs largely neglect the importance of accessible spaces for mental recovery and individual thought. Silence, once considered a luxury, is now a necessity—both for psychological well-being and for creative flourishing.

The concept of *cognitive urbanism*—which explores how urban design influences mental processes—and *neuroarchitecture*—which studies the brain's response to built environments—provide crucial frameworks for understanding silence as a vital urban resource. These interdisciplinary fields reveal that thoughtfully designed silent spaces can reduce cognitive overload, improve emotional regulation, and foster the mental

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clarity necessary for creative thinking and social innovation (3).

Drawing inspiration from the "A Room of One's Own[1]" (4) idea and extending it to collective urban design, this study aims to reframe silence as a form of infrastructure (1). By reviewing recent design experiments in Tokyo, Helsinki, and Amsterdam, we contextualize how youth-centered silent spaces can become platforms for ideation, reflection, and low-stimulus collaboration. For instance, EEG Research (2) shows that exposure to silent environments increases alpha wave activity by approximately 15-20%, reflecting a relaxed yet alert brain state that enhances creative ideation.

Main Results

Our comparative analysis reveals that youth who access intentional silence zones (such as sensory-neutral reading pods, signal-free gardens, or thought rooms) demonstrate improved cognitive flexibility and report stronger creative output. Cities that embed these principles into their urban strategies allow for the emergence of micro-publics: spaces where spontaneous collaboration and artistic ideation can occur.

Figure 1. EEG Frequency

Figure 1. EEG spectral power comparison between "mind wandering" and "on-task" cognitive states. Note the higher alpha band (8–12 Hz) power during mind wandering, which correlates with increased internal cognition and potential creative ideation. In addition, we propose a participatory model where municipalities organize local art-based competitions (e.g., digital illustration, soundscape design) themed around "urban silence," with winners contributing to real urban installations. This not only democratizes planning but also bridges youth and policymakers through co-creation.

Table 1. Examples of Creative Youth-Oriented Silent Urban Interventions

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1 "A Room of One's Own" is a long essay written by Virginia Woolf, published in September 1929.

City	Intervention	Type	Outcome
Tokyo	Silent Reading Pods	Architecture	Boosted focus and reduced screen fatigue among youth.
Helsinki	Kamppi Chapel of Silence	Religious/Public Space	Visitors reported increased emotional clarity.
Melbourne	Urban Mind Lab Gardens	Co-designed Green Space	Youth-designed spaces; improved mood and calm.
Barcelona	Pause Points (Bus Stop Reuse)	Tactical Urbanism	Triggered spontaneous youth-led art and ownership.

In addition to individual cognitive benefits, silent zones in urban areas foster collective wellbeing. These spaces function as urban "pause points," allowing youth from diverse backgrounds to experience a shared environment without pressure for performance or consumption. In low-income urban neighborhoods, where personal space is often limited, accessible silent spaces become critical for emotional recovery and equitable access to rest. The design of these silent spaces can be guided by principles from cognitive urbanism and neuroarchitecture, which focus on how spatial environments influence mental processes and wellbeing. Cities could sponsor "Silence and Sound" art festivals where youth contribute digital artworks, ambient music, or installations inspired by quietude. Mobile apps could collect city soundscapes curated by youth, blending artistic and environmental data. These emerging technologies offer innovative ways to engage youth in co-creating silent urban spaces. Mobile applications that enable youth to record, share, and curate city soundscapes can foster a sense of ownership and deepen awareness of urban acoustic environments. These digital tools, combined with participatory design workshops and art festivals centered on themes of silence and sound, can transform silent spaces into dynamic cultural hubs that celebrate quietude as an active, creative force.

Importantly, the equitable distribution of silent urban spaces is essential. In densely populated, low-income neighborhoods, where private quiet spaces are scarce, accessible silent zones serve as critical refuges for mental restoration and emotional wellbeing. Ensuring that silence infrastructure is inclusive can help mitigate urban health disparities and promote social justice by providing all youth with opportunities for cognitive recovery and creative engagement. This calls for policy frameworks that prioritize silent space development in underserved areas, integrating community voices in the planning process to reflect diverse needs. Furthermore, new policies can institutionalize silence-friendly urban design, including zoning laws, noise regulations, or mental health initiatives.

Conclusion

This paper highlights the overlooked importance of silence in urban design for youth. In cities built for speed and efficiency, the slow, quiet, and creative aspects of urban life must be re-integrated. Designing for silence is not retreating from engagement; it is creating the nutritious mental ground upon which innovation grows. Future research may further explore the neuro-architectural impact of silence-based infrastructure on youth learning, productivity, and resilience.

The fruits of silence in urban design can also be accessible for broader population, including adults and elderly residents who also face sensory overload and cognitive fatigue. Future research should explore scalable models of silence infrastructure that accommodate diverse urban demographics. Additionally, longitudinal studies

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employing neuro-architectural methods could quantify the long-term impacts of silent spaces on cognitive health, creativity, and social cohesion. Embedding silence into urban futures is not merely a design choice but a public health imperative that nurtures resilient, innovative, and inclusive cities.

REFERENCES

1. Ito S. Tokyo's Silent Pods: Rethinking Cognitive Architecture for Overstimulated Youth. Proceedings of the Urban Futures Forum; 2023 Apr 14–16; Tokyo, Japan. Tokyo: Urban Design Press; 2023.

2. Schwab D, Benedek M, Papousek I, Weiss EM, Fink A. Time-Course of EEG Alpha Power Changes in Creative Ideation. Front Hum Neurosci. 2014; 8: 310.

3. Schwartz M. Designing Cities for the Mind: Silence as a Spatial Resource. Urban Studies. 2022; 59 (4): 788–803.

4. Woolf, V. A Room of One's Own. London: Hogarth Press; 1929.

Smart City Security: An Explainable AI Methodology for Identifying Key Elements in DoS and Spoofing Attack

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ABSTRACT

Smart city devices offer significant benefits to urban environments, but their susceptibility to cyberattacks, particularly DoS (Denial of Service) attacks, raises substantial security concerns. Understanding the factors that contribute to these attacks is essential for developing robust detection mechanisms. This paper focuses on the application of Explainable Artificial Intelligence (XAI) to identify the most impactful features in the detection of DoS attacks on smart city devices. Using SHAP (SHapley Additive exPlanations) values, we interpret the contribution of various features within the CICIoV2024 dataset to model predictions, providing transparency in how the detection model identifies potential threats. By analyzing SHAP values, we pinpoint key features that drive predictions, offering insights into the security risks faced by smart city devices. The study demonstrates that SHAP-based XAI methods allow for a deeper understanding of the attack patterns and their key indicators, enhancing the interpretability of security models. This paper emphasizes the potential of XAI, particularly SHAP, in improving the effectiveness of intrusion detection systems for smart city environments, ensuring better protection against DoS and spoofing attacks while providing clear explanations for security professionals to act upon. The experimental analysis using the CICIoV2024 dataset reveals the significant impact of key features in detecting these attacks.

Key words: Smart City, Explainable AI, Artificial Intelligence, SHAP, DoS.

Introduction

A smart city is an urban area that uses advanced technologies to enhance the quality of life for its residents and improve urban efficiency. These cities leverage digital tools to optimize resource management, enhance services, and promote sustainability [1, 2]. IoT devices play a key role in smart cities. They include sensors, smart meters, and connected appliances that collect real-time data to improve everything from energy efficiency to traffic management [3]. The Internet of Vehicles (IoV) is a crucial part of IoT in smart cities. It connects vehicles to each other and to infrastructure. Utilizing IoV technology helps reduce traffic

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congestion, enhance safety, and optimize transportation networks. These technologies significantly impact urban environments, making them more efficient, sustainable, and safer for residents [1,4].

Smart cities face numerous challenges, including data privacy concerns, cybersecurity threats, and the complexity of managing interconnected systems [5]. Two of the most significant threats are Denial of Service (DoS) attacks and spoofing attacks [6]. DoS attacks can overwhelm smart city infrastructure by flooding it with malicious traffic, disrupting critical services and causing widespread system failures. In the context of IoT and IoV, DoS attacks pose an even greater risk due to the interconnectedness of smart devices and vehicles. Attackers can target communication networks, disrupt vehicle-to-infrastructure interactions, and create chaos in transportation and urban management systems [7]. Similarly, spoofing attacks, where malicious actors impersonate legitimate devices or users, can deceive IoT and IoV systems, leading to unauthorized access, data manipulation, or false information being fed into critical systems. These attacks can compromise the integrity, efficiency, and safety of smart city operations, making robust detection and security measures essential to safeguard against these evolving cyber threats [8].

To address the challenges of cybersecurity in smart cities, particularly DoS and spoofing attacks, machine learning (ML) and artificial intelligence (AI) offer powerful solutions [9]. These technologies can help detect anomalies and identify potential threats in real-time, improving the ability to respond to attacks swiftly. Explainable AI (XAI), particularly through tools like SHAP (SHapley Additive exPlanations), provides further benefits by making the decision-making process of AI models transparent and understandable [10]. SHAP helps to identify which features are most influential in detecting DoS attacks, allowing security teams to better understand the underlying causes of suspicious activity. By leveraging these tools, smart cities can enhance their defenses against cyberattacks, ensure more effective intrusion detection, and create more resilient systems for managing critical infrastructure [11].

In this study, we use SHAP as an XAI tool to identify the key features responsible for detecting DoS and spoofing attacks in IoV systems. SHAP allows us to analyze the impact of these features and assess their severity, providing clear insights into the decision-making process behind attack detection. The analysis is based on the CICIoV2024 dataset [6], which serves as a benchmark for IoV cybersecurity solutions. This dataset includes three main categories: benign, DoS (Denial-of-Service), and spoofing, with the spoofing category further divided into four variants—Steering Wheel, RPM, Gas, and Speed. The dataset was created through experiments on a 2019 Ford vehicle, where five types of attacks, including spoofing and DoS, were executed via the CAN-BUS protocol. These attacks were performed on the vehicle's Electronic Control Units (ECUs) without putting any occupants at risk, ensuring the safety of the testing process. The CICIoV2024 dataset provides an in-depth view of intra-vehicular communications, which is crucial for developing more secure IoV systems. To evaluate the effectiveness of the attack detection, we employed seven machine learning algorithms: AdaBoost, J48, Logistic Regression, Multilayer Perceptron, Naive Bayes, Random Forest, and Random Tree. The primary contributions of this research include the establishment of a realistic benchmark dataset for IoV cybersecurity, the application of SHAP for feature identification and impact analysis, and the exploration of various machine learning techniques to improve IoV security. By laying the groundwork for future IoV security research, this work helps enhance detection systems and optimize machine learning models to defend against cyberattacks in smart city environments.

The paper is structured as follows: Section 2 provides a review of related work on IoV cybersecurity, focusing on DoS attacks, machine learning techniques, and explainable AI methods, particularly SHAP.

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Section 3 introduces the CICIoV2024 dataset, describing its creation, the types of attacks it includes, and its role as a benchmark for IoV cybersecurity research. Section 4 explains the methodology, including the use of SHAP for feature extraction, impact analysis, and the assessment of feature severity in DoS attack detection. Section 5 covers the experimental setup, detailing the machine learning models, data preprocessing, and application of the CICIoV2024 dataset in the analysis. Section 6 presents the results and discusses the effectiveness of SHAP in identifying key features and the performance of the detection system. Finally, Section 7 concludes the paper, summarizing the findings and suggesting directions for future research in IoV security and XAI applications. We will provide further details of these sections during the complete paper submission.

System Structure

The structure of the proposed system begins with the collection of IoV traffic data from the CICIoV2024 dataset. This dataset is a comprehensive collection of intra-vehicular communications and is used to simulate various cyberattacks on IoV systems, specifically focusing on benign traffic, Denial of Service (DoS) attacks, and spoofing attacks. The spoofing attacks are further divided into four distinct variants: Steering Wheel, RPM, Gas, and Speed. To ensure the integrity and accuracy of the model, the dataset is split into two parts: 80% of the data is allocated for training the machine learning models, while the remaining 20% is reserved for testing and validation. Generating the dataset is explained in figure 2.

In the next phase, seven different machine learning algorithms are applied to assess the performance of attack detection. These algorithms include AdaBoost, J48, Logistic Regression, Multilayer Perceptron, Naive Bayes, Random Forest, and Random Tree, which are implemented using the Weka tool. Each algorithm is trained and tested on the prepared dataset to evaluate their effectiveness in identifying and classifying benign traffic and various attack types. The goal is to determine which machine learning models perform best in distinguishing between normal and malicious traffic, thereby improving the overall security of IoV systems.

Finally, to enhance the interpretability and transparency of the detection models, Explainable AI (XAI) techniques, specifically SHAP (SHapley Additive exPlanations), are employed. SHAP is used to explain the impact of each feature on the model's predictions, providing insights into the most influential factors for detecting DoS and spoofing attacks. This enables security professionals to better understand how the machine learning models identify attacks and assess their severity. The overall structure and flow of the proposed system, from data preprocessing to attack detection and explanation, is illustrated in Figure 1.
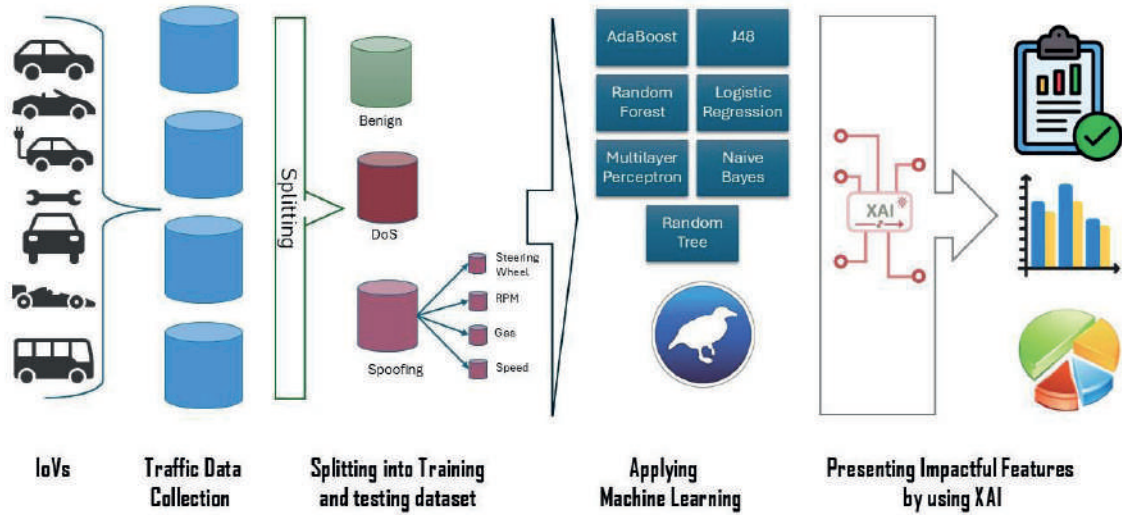
Figure 1. Graphical abstract of the proposed model

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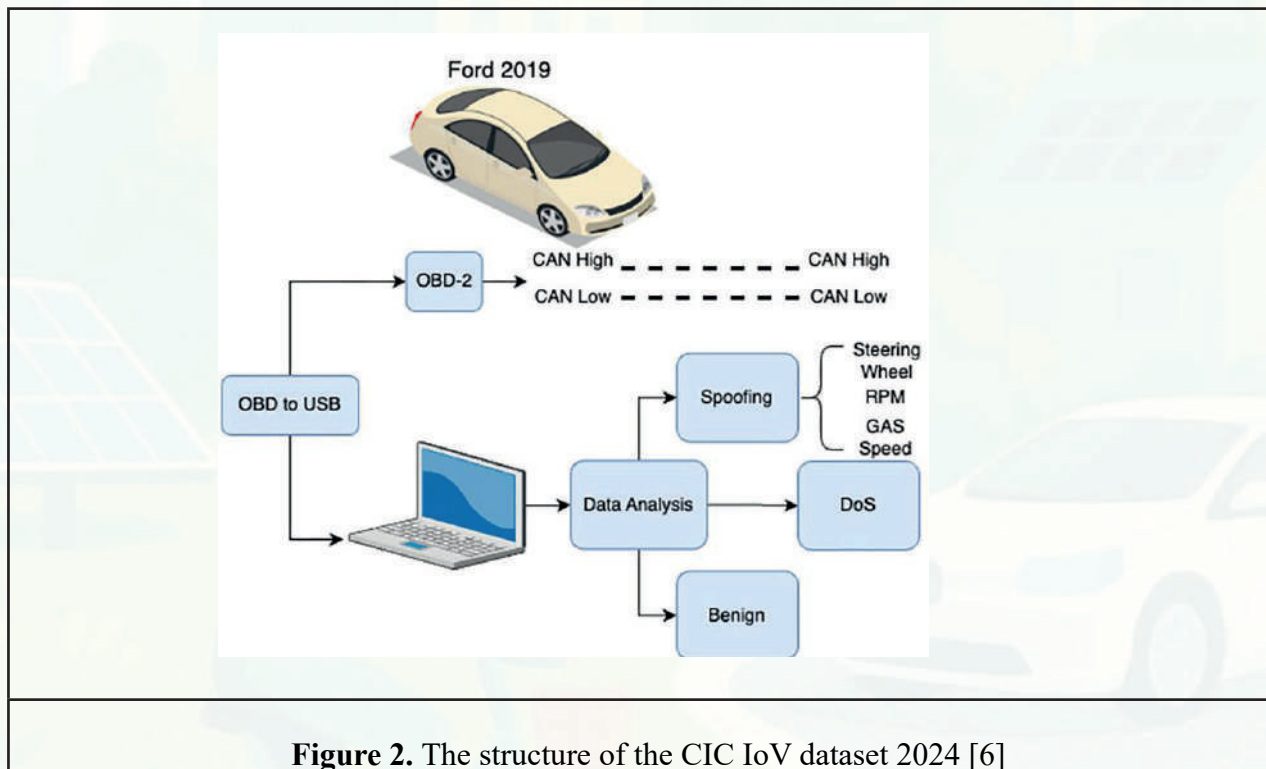
Figure 2. The structure of the CIC IoV dataset 2024 [6]

Conclusion

In conclusion, this paper highlights the significant role of Explainable AI (XAI), particularly SHAP, in enhancing the detection of DoS and four types of spoofing attacks within IoV systems. By utilizing the CICIoV2024 dataset, we have demonstrated how SHAP can effectively identify the most impactful features responsible for detecting these attacks and assess their severity. The dataset includes DoS attacks and spoofing variants such as Steering Wheel, RPM, Gas, and Speed, providing a comprehensive foundation for analyzing IoV security threats. The results show that XAI methods not only improve the transparency of machine learning models but also offer valuable insights into the critical factors driving attack detection in smart city environments. To achieve the best results, seven machine learning algorithms—AdaBoost, J48, Logistic Regression, Multilayer Perceptron, Naive Bayes, Random Forest, and Random Tree—were employed, highlighting the importance of selecting the most effective models for attack detection. The contributions of this work establish a solid foundation for further research in IoV cybersecurity and the application of XAI for transparent and effective defense mechanisms. This study paves the way for future explorations into optimizing IoV security solutions, enabling better protection against evolving cyber threats and enhancing the resilience of smart city infrastructures. Future work will explore additional techniques and datasets to refine detection systems and advance the state of cybersecurity in IoV systems.

REFERENCES

1. Nazari H, Alkhader H, Akhter AS, Hizal S. The Contribution of Deep Learning for Future Smart Cities. In Cybersecurity for Smart Cities: Practices and Challenges 2023 Mar 30 (pp. 135-150). Cham: Springer International Publishing.
2. Aldhanhani T, Abraham A, Hamidouche W, Shaaban M. Future trends in smart green iov: Vehicle-to-everything in the era of electric vehicles. IEEE Open Journal of Vehicular Technology. 2024 Jan 26;5:278-97.
3. Hızal S, Akhter AS, Çavuşoğlu Ü, Akgün D. Blockchain-based IoT security solutions for IDS research centers. Internet of Things. 2024 Oct 1;27:101307.
4. Mishra P, Singh G. Internet of Vehicles for Sustainable Smart Cities: Opportunities, Issues, and Challenges. Smart Cities. 2025 May 30;8(3):93.
5. Tahmasebi D, Sheikh M, Dabbaghjamanesh M, Jin T, Kavousi-Fard A, Karimi M. A security-preserving framework for sustainable distributed energy transition: Case of smart city. Renewable Energy Focus. 2024 Oct 1;51:100631.
6. Carlos Pinto Neto E, Taslimasa H, Dadkhah S, Iqbal S, Xiong P, Rahman T, Ghorbani A. CICIoV2024: Advancing realistic IDS approaches against DoS and spoofing attack in IoV CAN bus. Hamideh and Dadkhah, Sajjad and Iqbal, Shahrear and Xiong, Pulei and Rahman, Taufiq and Ghorbani, Ali, Ciciov2024: Advancing Realistic Ids Approaches Against Dos and Spoofing Attack in Iov Can Bus. 2024 Jul 1.
7. Munnee R, Armoogum V, Armoogum S. Analysis of DoS Attacks and Detection Techniques in Smart City Systems. In2024 4th International Conference on Mobile Networks and Wireless Communications (ICMNWC) 2024 Dec 4 (pp. 1-8). IEEE.
8. Hao L, Ma Y. Spoofing Traffic Attack Recognition Algorithm for Wireless Communication Networks in a Smart City Based on Improved Machine Learning. Journal of Testing and Evaluation. 2024 May 1;52(3).
9. Bukhowah R, Aljughaiman A, Rahman MH. Detection of dos attacks for IoT in information-centric networks using machine learning: Opportunities, challenges, and future research directions. Electronics. 2024 Mar 9;13(6):1031.
10. Ali MN, Imran M, Bahoo G, Kim BS. DoS Attack Detection Enhancement in Autonomous Vehicle Systems with Explainable AI. In2024 IEEE International Conference on Future Machine Learning and Data Science (FMLDS) 2024 Nov 20 (pp. 228-233). IEEE.
11. AsSadhan B, Bashaiwth A, Binsalleeh H. Enhancing explanation of lstm-based ddos attack classification using shap with pattern dependency. IEEE Access. 2024 Jul 1.

Youth-Led Social Innovation and Urban Resilience in Conflict-Affected Peripheries: Case Reflections from the Chenab Valley and Delhi's Informal Settlements

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ABSTRACT

This paper examines how youth in conflict-affected and marginalized urban spaces—such as the Chenab Valley of Indian administered Jammu & Kashmir and the informal settlements of Delhi—play a crucial but underrecognized role in building resilient urban futures. Through field research, participatory community profiling, and NGO-interventions in both rural-urban fringe zones and inner-city slums, the study investigates youth-led responses to urban challenges, including poor health infrastructure, environmental degradation, unsafe public spaces, and limited civic representation. Drawing from a blend of ethnographic fieldwork and programmatic data from ChildFund India and independent mapping of Sanjay Colony in New Delhi, and villages of Doda district, the paper proposes a framework of 'resilient citizenship' where youth are not just beneficiaries but agents of systemic change. This framework is positioned within the broader global debates on urban resilience, digital governance, and participatory democracy. The findings challenge metropolitan-centric urban discourse and call for new policy imaginaries that integrate youth into localized, adaptive governance systems—particularly in zones of protracted neglect.

Keywords: Urban Resilience, Youth Innovation, Chenab Valley, Informal Settlements, Participatory Governance

Introduction

Urban resilience has become a focal concept in 21st-century city planning, yet it often fails to include the agency of youth in regions marred by systemic fragility. Cities on the periphery—those shaped by both geographic marginality and political conflict—offer distinct insights into how resilience is practiced from below. This study brings together two such sites: the conflict-affected Chenab Valley in northern India and Sanjay Colony, a resettled urban slum in Delhi. Both regions highlight the interlinkages between exclusion, precarity, and innovation.

The study used a mixed-methods approach, combining community profiling and participatory rural appraisal (PRA) in both locations. Field data were collected through partnerships with ChildFund India and local civil

society actors. Informal interviews were conducted with teachers, Anganwadi workers, doctors, and youth activists. Secondary data from municipal records and climate vulnerability indexes helped triangulate findings.

Main Results

In Sanjay Colony, a compact, high-density informal settlement in New Delhi, key resilience challenges include:

I.   Water insecurity, poor health services and unhygienic waste management.
II. High prevalence of anemia among young women (based on field screening).Youth mobilization led to successful campaigns on millet awareness (200+ homes reached) and peer-led workshops on Anemia and reproductive health (49 women attended).
III. Door-to-door data collection for community mapping helped identify several uncredentialed healthcare providers and supported collaboration with some local clinics and NGOs like Dipalaya, ChildFund India and Learning by Locals.

Chenab Valley: Navigating Dual Marginalities

I.   In Chenab Valley, persistent governance gaps are compounded by environmental vulnerabilities such as landslides, cloudbursts, high seismic activity, and climate-induced water scarcity.
II. Young people have begun digital mobilization via informal collectives and campaigns demanding greater political attention, jobs, safer roads, better schools, and healthcare centers.
III. Despite limited institutional support, youth-run organizations like Ababeel Foundation and Furqan trust have come up as alternative platforms for civic expression and trauma-informed social work.
IV. Their grassroots services include community-operated ambulances, accident rescue teams, and localized disaster management networks. Notably, they played a central role in post-fire rehabilitation during the recent Warwan Valley fire, facilitating reconstruction and relief in one of the region's most marginalised villages.

Conclusion

Youth across informal and conflict-affected geographies are not passive subjects but dynamic stakeholders in reimagining urban life. These youth-led initiatives demonstrate that resilience is not merely infrastructural but deeply social and participatory. The state often views these communities through a lens of dependency or risk; however, the empirical cases illustrate their proactive role in knowledge co-production, local problem-solving, and micro-level governance. Policy frameworks should shift from "managing vulnerability" to "nurturing agency," especially in areas recovering from conflict or living under the shadow of informality. Governments, especially at municipal and regional levels, must:

I.   Establish youth resilience councils to integrate young people into local planning processes.

II. Support peer-led health education in underserved urban and rural areas.

III. Fund community mapping and disaster-response initiatives led by youth groups.

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IV. Enable digital platforms for youth to report issues and co-create local solutions.

Acknowledgment

REFERENCES:

1. Arup International. Cities and Resilience in Conflict Zones. 2020.
2. UN-Habitat. Youth 2030: Working With and For Young People. Nairobi: 2022.
3. ChildFund India. Health & Education Program Report: Sanjay Colony. New Delhi, 2023.
4. Satterthwaite D. The Role of Local Actors in Urban Resilience. Environment & Urbanization. 2017;29(1):43-59.
5. Bhagat R. Urban Challenges in India's Peripheries. IIHS, 2021.
6. Meerow S, Newell JP, Stults M. Defining urban resilience: A review. Landscape and Urban Planning. 2016;147:38–49.
7. Srinivasan S. Reclaiming public health for India's urban poor: Reflections from field interventions. Indian Journal of Public Health. 2019;63(2):132–6.
8. Zargar AM. Fieldwork report on Sanjay Colony: Community profiling and intervention analysis. Unpublished report. Department of Social Work, Jamia Millia Islamia; 2023.

Solid Waste Management:
A Comparison of Conventional and Technological Methods

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ABSTRACT

Our unique, unstinting, endowed earth is dying because of people day by day. In daily life, people use many products which are harmful for the earth and because of those so much waste remains. If the pollution is not managed properly, our world will be polluted. Without any doubts our future is attached to the management of waste which is the control mechanism of pollution. Waste management is very important to prevent this pollution. Waste management is the main point of the process from waste generation to final disposal and is the planning and development of economic and social sustainability policies. The paper will explain waste management, examine the traditional waste management and smart waste management in detail, focus on the differences between them. And give examples of these differences from daily life. The article's purposes are to compare traditional waste management and the smart technological waste management using the comparative analysis method and be beneficial for nature.

Keywords: Waste, Pollution, Earth, Traditional Management, Smart Technologies

Introduction

Waste management is a critical component of modern society's efforts to preserve environmental health and promote sustainability. As the global population and urbanization rates continue to rise, managing waste efficiently becomes increasingly important. Waste management is a critical component of modern society's efforts to preserve environmental health and promote sustainability. "Solid waste management affects every person in the world" (7). As the global population and urbanization rates continue to rise, managing waste efficiently becomes increasingly important. The way in which waste is handled impacts not only the environment but also human health, economic well-being, and resource availability. This comprehensive process involves various stages, from waste prevention to disposal, each of which plays a significant role in reducing the negative impact on the planet. In this context, both traditional and modern systems of waste management are being uti-

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lized, with new technologies enhancing efficiency and sustainability. Understanding the importance of waste management, its processes, and its evolution is essential to building a more sustainable future.

Main Results

Waste management is the process of collecting, transporting, sorting, recycling, reusing, recovering energy from, or safely disposing of waste materials in a way that does not harm human health or the environment. This process supports environmental sustainability, resource efficiency, and economic benefit. Waste management is not only a technical activity; it is also a social, economic, and environmental system. Proper waste management helps protect natural resources, reduce greenhouse gas emissions, prevent pollution, and protect public health. Waste management comprises a systematic sequence of stages aimed at minimizing environmental impact and ensuring sustainable resource use. The most effective approach begins with waste prevention and reduction, which entails minimizing waste generation through efficient production techniques, conscious consumption patterns, and the promotion of environmentally responsible behaviors. Following this, source separation is critical; categorizing waste at the point of origin—into organic, recyclable, hazardous, etc.—significantly enhances the efficiency of subsequent recycling processes. The collection and transportation phase involves the regular and safe transfer of waste to designated treatment or disposal facilities, with careful consideration given to reducing environmental harm during transit. In the recycling and reuse stage, materials such as paper, glass, metal, and plastic are reprocessed for further utilization, while biodegradable waste may be composted. Additionally, certain waste types can undergo energy recovery, whereby they are incinerated to produce thermal or electrical energy. The final phase, disposal, involves the environmentally controlled destruction or landfilling of non-recyclable and hazardous waste materials.

Traditional waste management involves collecting waste without separating it and mostly burying it in landfills. This system does not support recycling and often causes environmental pollution, so natural risks. It based on a "collect–transport–dispose" model and is no longer effective for modern cities. Traditional systems are no longer enough in modern cities because they are not sustainable and cannot handle the growing amount of waste. Traditional waste management systems are often characterized by several critical shortcomings. Firstly, waste is typically collected without prior separation, which significantly limits the potential for effective recycling or recovery. As a result, recycling efforts are minimal or entirely absent, leading to a predominantly linear waste flow—a one-way process from production to collection and finally to disposal. This model not only contributes to a high risk of environmental pollution but also results in the irreversible loss of valuable materials and natural resources. Moreover, the lack of proper handling and treatment frequently gives rise to serious public health concerns, including unpleasant odors, infestations by pests, and the contamination of soil and water through leaking substances.

Smart waste management uses new technologies such as the Internet of Things (IoT), sensors, and data analysis. With these tools, waste collection becomes more efficient. For instance, sensors in bins can measure how full they are, so trucks collect waste only when necessary. This saves time, fuel, and money while reducing environmental damage. "One of the big challenges that today's growing cities are coping with is the delivery of effective and sustainable waste management, together with a good sanitation" (5). Smart waste management systems utilize a range of advanced technologies to enhance efficiency and sustainability. IoT sensors are installed in waste containers to measure parameters such as fullness, temperature, and odor, enabling real-time monitoring and timely collection. Geographic Information Systems (GIS) help track the locations of containers and optimize collection routes, reducing fuel consumption and operational costs. Artificial In-

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telligence and data analytics are employed to determine the most efficient collection times and to analyze waste generation patterns. Cloud-based systems offer centralized control and coordination, ensuring smooth communication between different components of the system. Additionally, QR or NFC technologies allow for household-level tracking, improving accountability. Key features of these systems include smart routing, real-time data access, public engagement through mobile applications, and an overall reduction in carbon emissions through energy-efficient operations.

Criteria	Istanbul (Traditional) 1950	İstanbul (Smart) 2023
Collection	Waste was collected manually on certain days, and the garbage accumulating on the streets caused bad smells, hygiene problems and pest breeding.	With sensor-equipped containers that report the occupancy rate, waste collection routes are optimized, fuel and time are saved, and carbon emissions are reduced.
Storage	The waste would be piled up in open areas outside the city, causing soil, water and air pollution (methane gas emissions).	With mobile apps citizens can get information about waste separation and recycling points. Also organic and other waste that cannot be recycled are converted into energy in incineration or biogas facilities, reducing the need for storage.
Recycle	Recycling awareness and infrastructure were very weak, valuable resources were wasted.	By separating waste at source, valuable materials such as paper, plastic, glass and metal are recycled and natural resources are protected. Also Organic waste is composted and turned into fertilizer.
Lack of Data	Effective planning was difficult due to lack of reliable data on the amount and type of waste.	With the big data collected, waste generation can be predicted and management strategies can be planned more effectively.

In the history of İstanbul there have become a lot of solid waste management techniques. "When all regions and Istanbul are examined, it is seen that the amount of waste collected in Istanbul is strikingly higher than in other nations" (8). 103 Traditional vs. Smart Technologies (for Istanbul): Traditional waste management's main components are labor, intensive and causing so much pollution. In the past, solid waste management in Istanbul was characterized by manual collection processes and uncontrolled wild dumping areas. Unless sustainability with the Power of Technology Today, Istanbul has adopted a much more efficient, environmentally friendly and sustainable system by utilizing technology in solid waste management. This transformation is

an important step towards making Istanbul a more livable and environmentally friendly megacity. This chart evaluates both of them detailed.

Conclusion

The increase in the amount of waste poses a significant problem in terms of sustainable environmental management. Waste management is the planning of the process from the generation of waste to its disposal in line with the principles of environmental, economic and social sustainability. In this paper, traditional and smart waste management approaches were compared. The traditional method is based on the collection of waste without separation at the source and its direct disposal, which has low resource efficiency and high environmental impacts. Smart waste management, on the other hand, increases efficiency, reduces environmental impacts and supports sustainability by optimizing waste collection processes with technologies such as IoT, sensors and data analytics. The analysis conducted on the examples of Istanbul's old and new waste managements shows the effectiveness and economic advantages of smart systems in waste management. "Solid waste management (SWM) has been an integral part of every human society" (5). As a result, smart waste management plays a critical role in the sustainable development of modern cities.

REFERENCES

1. Çetin, M. Akıllı Şehirlerde Atık Yönetimi Uygulamaları. Çevre ve Şehircilik Dergisi, 2015, 4(2), 45–59.

2. Güleryüz D. Evaluation of Waste Management Using Clustering Algorithm in Megacity Istanbul. Environmental Research and Technology [Internet]. 2020; 3 (3). Available from: http://dx.doi.org/10.35208/ert.764363

3. Söylemez, A. Akıllı Kentlerde Atık Yönetimi Ve Dünyadan Akıllı Atık Yönetimi Üzerine Örnekler, 2018.

4. Environment UN. UNEP - UN Environment Programme [Internet]. UNEP - UN Environment Programme. [cited 2025 Jun 22]. Available from: https://www.unep.org

5. Wilson, D. C. Development Drivers for Waste Management. Waste Management, 2018. 29 (4), 1438–1448. https://doi.org/10.1016/j.wasman.2008.07.031

6. Wilson, D. C., Velis, C., & Cheeseman, C. Role of Informal Sector Recycling in Waste Management in Developing Countries. Habitat International, 2006. 30 (4), 797–808.

7. World Bank. (2018). What a waste 2.0: A Global Snapshot of Solid Waste Management to 2050. World Bank Publications.

8. Zaman, A. U., and Lehmann, S. Urban Growth and Waste Management Optimization towards "Zero Waste City. In P. Newton, P. Newman, and D. Jones (Eds.), Urban Consumption. 2011. CRC Press/Balkema.

Youth Participation in Urban Decision-Making in Türkiye

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ABSTRACT

Youth participation in urban decision-making stands out as a fundamental element of a sustainable and inclusive urban development approach. However, in Türkiye, youth involvement in local governance processes remains largely symbolic, and their ability to create real impact within decision-making mechanisms is limited. This study examines youth participation in urban governance in Türkiye, revealing that young people aged 15-25 are often limited to symbolic, consultative roles without real decision-making power. Institutional weaknesses, age biases, and underestimation of youth contribute to their marginalization and disengagement. Drawing on global literature and local examples, the study advocates for empowering youth councils with voting rights, formal representation, capacity-building, and digital tools. Recognizing youth as active decision-makers is essential for sustainable and inclusive urban development. Conducted through qualitative data analysis, literature review, and examples of local practices, this study identified effective models that support active and continuous youth participation and developed corresponding recommendations. The findings indicate that digital tools, capacity-building programs, and models enabling direct involvement in decision-making processes are effective in enhancing youth participation.

Key words: Youth participation, Urban governance, Local decision-making

Introduction

In today's world, the increasing pace of global urbanization necessitates a more inclusive and detailed approach to the planning and governance of cities. In this context, the participation of young people— particularly those aged 15 to 25—in decision-making processes has become a critical component of sustainable and democratic urban development. However, the rapid growth of urban areas presents a challenge to incorporating public opinion into decision-making, and this challenge becomes especially apparent when attempting to include youth in urban governance (2).

In Türkiye and many other countries, youth participation in urban decision-making mechanisms remains limited; existing youth councils and city assemblies often serve only consultative functions and fail to play a decisive role in governance processes. In other words, such structures frequently remain

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at a symbolic level.

This study aims to examine the level of youth participation in local urban governance in Türkiye, identify the institutional and social barriers they face, and analyze successful participation practices. Drawing on previous studies and international literature, the study also aims to provide practical recommendations for improving youth engagement in decision-making processes.

Main Results

A review of the literature and analysis of local practices reveal several structural and cultural barriers to youth participation in urban decision-making processes. Among the most prominent issues are the weakness of the institutional framework, developmental and age-based biases against youth, symbolic participation practices, and the ineffective use of technological tools.

In Türkiye, youth councils and city assemblies generally function in an advisory capacity and rarely hold a decisive role in decision-making processes(4). This passive form of engagement is perpetuated by several factors: the lack of voting rights or formal representation for youth, the perception that young people are not mature enough to contribute meaningfully, and the view of youth as easily manipulated or inexperienced individuals(1). Additionally, youth are often romanticized or underestimated in urban planning contexts. This leads to symbolic participation, where young people are invited to events but not included in actual decision-making mechanisms. Over time, this exclusion results in a loss of motivation and growing detachment from governance structures (3). These conditions underscore the need for youth to be recognized not only as participants who are heard, but as actors who actively share in decision-making. In this context, the "co-decision" model proposed by Kathryn I. Frank becomes highly relevant (1).

In this regard, the following recommendations are proposed: granting youth councils not only consultative but also voting and decision-making authority; institutionalizing youth representative roles within local governments; expanding capacity-building efforts such as training in project writing, budget literacy, and participatory governance; integrating digital participation platforms into the strategic frameworks of municipalities; and scaling up successful local practices to serve as policy models at the national level.

Conclusion

The findings of this study reveal that youth participation in urban governance in Türkiye largely remains symbolic, limited by institutional weaknesses and societal biases. For cities to become truly inclusive and democratic, young people must be empowered not only to voice opinions but to actively shape decisions.

By transitioning from consultative to co-decisional models, strengthening youth representation, and leveraging digital tools, municipalities can transform youth from passive observers into active stake-

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holders—ensuring more just, dynamic, and future-oriented urban development.

This study is crucial not only for identifying the barriers youth face but also for recognizing their untapped potential as agents of change. As urban challenges grow increasingly complex, the inclusion of young voices becomes indispensable. A future shaped with youth is a future driven by innovation, fairness, and sustainability—and that future begins with meaningful participation today.

REFERENCES

1. Frank KI. The potential of youth participation in planning. Journal of Planning Literature. 2006;20(4):351–371.
2. Poplin A. Digital serious game for urban planning: "Get the Glasses". In: Schrenk M, Popovich VV, Zeile P, editors. REAL CORP 2017: Panta Rhei - A World in Constant Motion. Vienna: CORP - Competence Center of Urban and Regional Planning; 2017. p. 563–570.
3. Rodela R, Norss E. Opening up spatial planning to the participation of children and youth: the Swedish experience. European Planning Studies. 2023;31(2):252–269.
4. United Nations Development Programme (UNDP). Youth Civic Engagement and Political Participation. New York: UNDP; 2016.

Deep Learning Based Route Optimization in Urban Waste Collection

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ABSTRACT

With increasing urbanization, waste management has become a critical element in the resource planning of municipalities. In particular, the planning of waste collection routes both increases operational efficiency and provides significant savings in resource utilization. Today, these processes are mostly carried out by manual methods and are insufficient in terms of adaptation to real-time conditions. In this study, it is aimed to optimize waste collection routes using location data of garbage containers in Karatay district of Konya province. In addition to the classical Travelling Salesman Problem (TSP) algorithm, two different deep learning models based on Deep Q-Network (DQN) and Graph Convolutional Network (GCN) were developed. Each of the models was trained to generate routes for containers belonging to a specific sector and the generated routes were compared in terms of total distance and computation time. According to the results obtained, in some sectors, the GCN model was able to produce shorter routes than the classical TSP algorithm, while the DQN model produced routes in a longer time and showed high deviations in some cases. In addition, through the mobile application developed, all model outputs were visualized comparatively, and operational management of field teams was supported.

Keywords: Route optimization, deep learning, waste collection, smart city

Introduction

Waste collection operations are among the essential services under the responsibility of municipalities and play a crucial role in ensuring the sustainability of urban life. With the rapid growth of urban populations, these services have become a critical operational challenge for local governments. Managing such processes entails the effective coordination of numerous parameters—including vehicles, containers, personnel, and fuel—leading to significant operational costs. Currently, many municipalities plan

waste collection routes based on past experience and the personal judgment of field personnel. Although such an approach allows the system to operate to a certain degree, it also leads to issues such as planning inefficiencies, fuel waste, and labor productivity loss. In order to overcome these problems, various meta-heuristic algorithms, especially Genetic Algorithm and Ant Colony Optimization, have been proposed in recent years to optimize waste collection routes more efficiently [1]. However, although these methods can produce acceptable solutions when the number of nodes is large, their rigid structures often fall short of adapting to real-time and dynamic conditions. TSP, widely used in the literature, is an effective optimization method for identifying the shortest route [2]. Yet, as the number of nodes increases, the solution space grows exponentially, substantially increasing computation time [3]. With the advancement of artificial intelligence, AI-based methods capable of responding to real-time and dynamic system requirements have gained prominence. Reinforcement Learning (RL) approaches, which allow the system to learn decision-making strategies through continuous interaction with the environment, offer a significant alternative. However, traditional RL methods often struggle in high-dimensional problem spaces. To address this, Deep Reinforcement Learning (DRL) architectures have been developed, incorporating deep neural networks into decision-making processes to offer a more flexible and generalizable framework. DQN architecture, in particular, has been employed in route planning applications that require sensitivity to environmental changes [4].

Yue et al. achieved successful results in time-constrained vehicle routing problems using Q-learning-based ant colony optimization [5]. Shoab and Alotaibi, on the other hand, achieved low latency and high efficiency in heterogeneous networks by using DQN-based routing systems [6]. Moreover, since road networks inherently possess a graph-based structure, architectures such as GCN can be meaningfully and effectively applied in this domain. GCN-based models, which take topological relationships between locations into account, offer distinct advantages in decision-making processes. Almasan et al. combined GCN and DRL techniques to build effective routing systems in dynamic networks [7]. Similarly, Monemi et al. successfully adapted GCN-based architectures to logistics optimization problems [8].

In this study, an artificial intelligence supported approach is proposed to make waste collection processes more efficient, flexible and suitable for digital transformation. In the system developed by considering the container locations in Karatay district of Konya province, containers are divided into manageable subgroups by considering operational constraints (waste collection capacity of vehicles, etc.) and route optimization for these subgroups is performed by deep learning methods. In this context, two different artificial intelligence models based on DQN and GCN, as well as the TSP algorithm, which is the frequently preferred classical optimization method to find the route that provides the shortest total distance, were evaluated comparatively. In addition, a Flutter-based mobile application has been developed to increase the usability of these models by field teams. Through the application, the routes generated by different models were visualized and made directly integrable into field operations. Thus, this study provides an artificial intelligence-based flexible and learnable route planning infrastructure that contributes to the digitalization process of municipalities and enables the structuring of waste collection processes to the vision of smart urbanism.

Main Results

To evaluate the performance of the three route optimization methods (TSP, DQN, and GCN), 15 randomly

selected waste collection sectors within the Karatay district were used as test scenarios. Each model was tasked with generating the most efficient route to collect waste from containers within its assigned sector. The evaluation was based on two main criteria: total route distance (in kilometers) and computation time (in seconds).

Figure 1 presents a comparison of route computation times (in seconds) for the DQN, GCN, and TSP algorithms across different sectors. As shown in the figure, the DQN model exhibited significantly longer computation times compared to the other methods. This can be attributed to the DQN model's reinforcement learning and decision-making mechanisms, which inherently involve higher temporal complexity. Notably, in sectors 1075-0 and 1081-2, computation times exceeded 150 seconds. In contrast, the GCN model achieved much shorter computation times than DQN, completing its tasks in durations close to those of the TSP algorithm across many sectors. The shortest computation time was recorded in sector 1077-8. These results indicate that GCN, by leveraging its graph-based structure, can make faster routing decisions than DQN. On the other hand, the TSP algorithm consistently demonstrated the shortest computation times across nearly all sectors. This is primarily due to the deterministic and often greedy nature of TSP solutions, which are optimized for efficiency. Overall, this comparison highlights that in terms of computation time, TSP is the most time-efficient method, while GCN and DQN may be inadequate for certain sectors.
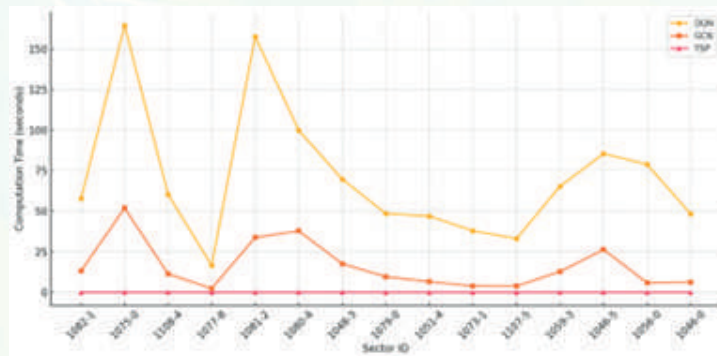
Figure 1. Model-based route computation time comparison for waste collection sectors

Figure 2 shows the comparison of route distances (in kilometers) generated by DQN, GCN, and TSP algorithms for each sector. As illustrated, the routes produced by DQN were significantly longer than those of GCN and TSP in sectors 1108-4 and 1107-5. This suggests that in certain sectors, DQN may follow longer paths due to excessive exploration behavior. However, in sectors 1075-0, 1073-1, and 1056-0, DQN generated shorter routes than GCN. Still, it failed to outperform TSP in any of the tested cases. GCN, on the other hand, produced route lengths that were generally close to those of TSP, except in sector 1075-0. In fact, in sectors 1059-3 and 1046-0, GCN managed to generate shorter routes than TSP. As expected, TSP frequently achieved the shortest route distances across the board.
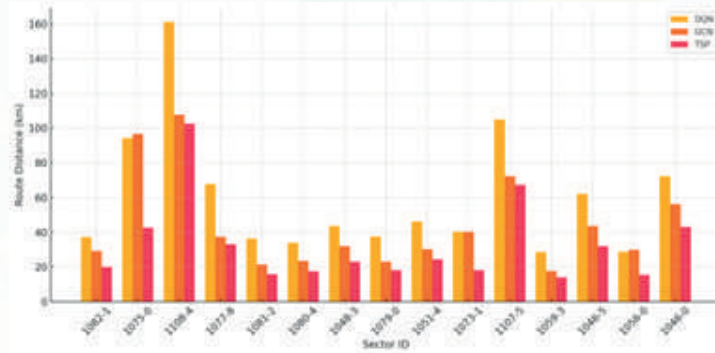
Figure 2. Comparative analysis of route distances generated by models

Table 1 summarizes the overall performance of the models. Here, the Optimal Ratio is used to compare each model's performance against the reference model, TSP.

Table 1. Performance metrics and optimality ratios of models for route planning

Model	Avg. Distance (km)	Std Distance (km)	Avg Runtime (sn)	Std Runtime (sn)	Optimal Ratio Distance	Optimal Ratio Time
DQN	60	37	71	42	1.8	991
GCN	44	28	16	15	1.4	225
TSP	33	24	0.07	0.02	1	1

The classical TSP algorithm was designated as the optimal baseline with an average route distance of 33 km and an average computation time of 0.07 seconds. While the DQN model offered high flexibility, it produced the longest average routes (60 km) and required the most time (71 seconds). This corresponds to an optimality ratio of 1.8 in terms of distance and 991 in terms of computation time. The GCN model provided a more balanced performance, with an average route distance of 44 km and an average computation time of 16 seconds (distance ratio: 1.4; time ratio: 225).

Conclusion

This study presents a comparative analysis of artificial intelligence-supported route optimization methods for urban waste collection. Utilizing real-world geographic location data obtained from Karatay Municipality, three models—TSP, DQN, and GCN—were implemented and evaluated in terms of route efficiency and computational performance. The classical TSP algorithm served as a strong baseline, delivering rapid and generally optimal solutions. The GCN-based approach, which leverages the spatial structure of the container network, outperformed TSP in certain scenarios. While the DQN model exhibited inconsistent performance and longer computation times, it demonstrated potential for reinforcement learning-based decision-making, particularly in dynamic environments. Furthermore, integrating all three models into a mobile application significantly enhanced their operational usability by providing comparative route visualizations for field teams. In conclusion, the GCN model offers a more practical alternative for real-time waste collection applications by striking a reasonable balance between solution

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quality and computational cost. Future research may explore the development of adaptive hybrid models, the incorporation of real-time traffic and environmental data, and the use of cloud-based inference systems to improve scalability and response time.

REFERENCES

1. Xu Y, Che C. A brief review of the intelligent algorithm for traveling salesman problem in UAV route planning. In: 2019 IEEE 9th International Conference on Electronics Information and Emergency Communication (ICEIEC); 2019 Jun; Beijing, China. IEEE; 2019. p. 1–7. doi:10.1109/ICEIEC.2019.8784651.
2. Hu B, Zhang R. A&I-ED-TSP: Association and integration encoder–decoder for traveling shortest path planning. IEEE Access. 2024;12:129601–10. doi:10.1109/ACCESS.2024.3412075.
3. Gutin G, Punnen AP, editors. The traveling salesman problem and its variations. Vol. 12. New York: Springer Science & Business Media; 2006.
4. Mnih V, Kavukcuoglu K, Silver D, Rusu AA, Veness J, Bellemare MG, et al. Human-level control through deep reinforcement learning. Nature. 2015;518:529–33. doi:10.1038/nature14236.
5. Yue P, Liu S, Jin Y. Graph Q-learning assisted ant colony optimization for vehicle routing problems with time windows. In: Proceedings of the Companion Conference on Genetic and Evolutionary Computation; 2023 Jul; New York, NY. p. 7–8.
6. Shoab M, Alotaibi AS. Deep Q-learning based optimal query routing approach for unstructured P2P network. Comput Mater Continua. 2021;70(3):5765–81.
7. Almasan P, Suárez-Varela J, Rusek K, Barlet-Ros P, Cabellos-Aparicio A. Deep reinforcement learning meets graph neural networks: Exploring a routing optimization use case. Comput Commun. 2022;196:184–94.
8. Monemi RN, Gelareh S, González PH, Cui L, Bouamrane K, Dai Y, Maculan N. Graph convolutional networks for logistics optimization: A survey of scheduling and operational applications. Transp Res E Logist Transp Rev. 2025;197:104083.

Young People's Spiritual Quest with the Loss of the Sacred in the Modern City

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ABSTRACT

In today's cities, where modernization and urbanization are rapidly advancing, the visibility and social function of sacred spaces and religious symbols in public areas are gradually diminishing. In traditional societal structures, sacred spaces were not merely places of worship; they also served as the spatial embodiment of social memory, belonging, and cultural identity. However, in today's world, individualization, digitalization, and a consumption-driven lifestyle are undermining the representation of the sacred in public spaces. In an age of increasing individualism, digitalization, and speed, younger generations are moving away from traditional religious structures and rituals and turning to alternative ways of addressing their sense of spiritual emptiness. For young people, meditation spaces, nature walks, digital worship groups, silent retreats, urban retreats, and mindfulness practices have become ways of establishing a new relationship with the sacred. Young people, moving away from traditional places of worship, are constructing new types of meaningful spaces and seeking to fulfill their spiritual needs in this way. An assessment conducted within the framework of Charles Taylor's theory of secularization, Mircea Eliade's approach to sacred spaces, and Henri Lefebvre's urban sociology sheds light on the transformation of the sacred in terms of space. As sacred spaces become less prevalent, personal and alternative spaces are finding new counterparts. This paper demonstrates that the sacred has not been completely erased from urban life, but rather has been reproduced by young people in different digital and physical spaces. For this reason, urban planning must take into account not only physical needs, but also emotional and spiritual needs.

Keywords: Sacred space, Youth, Spirituality, Secularization

Introduction

In traditional societies, religion plays a decisive role as a fundamental element shaping individual and social life.(1) In almost every period, sacred places have played a central role in the construction of social memory, belonging, and cultural identity, beyond being merely areas where worship practices are carried out.(2) Religious beliefs, cultural and moral norms, and feelings of individual and social belonging are among the primary

factors in the establishment and development of cities.(10) In Islamic cities, mosques and other religious buildings form the central public space, while traditional Ottoman cities were also shaped around religious structures. In today's world, where modernization and urbanization are rapidly advancing, profound transformations have taken place in all layers of social life.(1) Modern cities, as areas where secularization, individualization, and consumer culture are concentrated, have reduced the visibility of the sacred in public life and weakened the relationship between religious structures and individuals.

Classical secularization theorists predicted that the process of modernization would gradually diminish the importance of religion and mythological and similar supernatural structures. According to these theories, metaphysical beliefs will weaken and lose prestige as a result of the differentiation and rationalization of societies. However, religiosity will not only lose its decisive influence on social institutions, but will also undergo a significant shift in the individual's life.(7) In the postmodern era, although individuals have shifted in their lives, it is seen that the representation of the sacred in public spaces and its social function (12) have undergone changes and taken on a new form, particularly due to the effects of individualization, digitalization, and consumption-oriented lifestyles. To describe this new phenomenon, concepts such as "new religions," "cult," "esoteric movements," "new religious movements," "new age beliefs," and "new age spirituality" are used. It is noteworthy that similar forms of belief have become visible in modern Turkey in particular.(1) This study aims to reveal how the sacred has not been completely erased in a spatial and symbolic sense, but rather transformed through new digital and physical spaces.

Main Results

The main findings of the report reveal the effects of modernization, secularization, and digitalization on traditional forms of religiosity and how individuals' spiritual quests find new areas of expression. These areas of expression can be understood in a more theoretical context within the framework of Mircea Eliade's approach to sacred space, Charles Taylor's theory of secularization, and Henri Lefebvre's urban sociology.

Although Eliade emphasizes places where the sacred acquires a special meaning by separating itself from the profane (4), this situation takes on a different dimension today with young people's re-creation of the sacred. According to Eliade, sacred places serve as a bridge between the physical and spiritual worlds. These places are also exalted in a spiritual sense as areas containing various symbolic elements. Virtual sacred spaces, despite not having a physical presence, can also offer individuals the opportunity to achieve spiritual peace. (9) According to Taylor, it emerges in different forms in individual life by withdrawing from the sacred public sphere. Secularization is defined as a process in which religious beliefs, practices, and institutions lose their social significance. This process causes religion to become private rather than external.(13) Lefebvre, on the other hand, examines the relationship between space and social and cultural processes and how these spaces are produced and transformed, arguing that new spaces are shaped according to different socioeconomic and cultural conditions.(3) These three theoretical approaches provide a comprehensive framework for understanding how the sacred manifests itself in different ways in today's cities, how individuals' religious experiences are being restructured, and how space is being socially transformed in this process. Based on this theoretical foundation, how sacred space and the search for spirituality are being reshaped can be better expressed under the following headings.

Secularization and the Reshaping of Religiosity; Although classical secularization theories predicted that religion would lose its importance in social life with modernization, it is seen that religion continues to exist in different forms in postmodern societies, despite the claim that religion has lost its decisive role and sanctity. In

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the social science literature, these new forms of religiosity are referred to as "new age beliefs," "new religious movements," or "the individualization of religion." As Linda Woodhead points out, secularization theories seem unable to explain this change in religiosity. It can be argued that with the decline of institutional religiosity and religious knowledge, individuals are increasingly turning to new forms of religiosity. Indeed, a study has found that people with a high level of religious knowledge are less inclined to embrace new beliefs.(1) This change causes people to transform not only their belief systems, but also the spaces where they experience and interpret these beliefs. Thus, a process begins in which sacred spaces are reproduced on both a physical and symbolic level, and the sacred begins to find new spatial counterparts in modern cities, independent of traditional structures.

The Manifestation of the Sacred and Spatial Transformation; Mircea Eliade's approach to sacred space focuses on the "manifestation" (hierophany) and continuity of the sacred rather than its loss. According to Eliade, the sacred is the opposite of the non-sacred and manifests itself in various forms. "Once a place has been sanctified, it is unlikely to lose this characteristic," and sacred places can be transferred from one culture to another. The history of all religions consists of the accumulation and continuity of manifestations of the sacred. The manifestation of the sacred emerges when a place, person, object, or time rises from the ordinary to an important position. This situation presents itself as a process of "re-sacralization" that can pave the way for the development of religiosity in different forms with the weakening of traditional religious structures.(8)

Within the framework of Henri Lefebvre's urban sociology, it is emphasized that sacred spaces are not static structures but rather undergo transformation alongside social change, in line with the idea that the city is a social production site that is constantly being reshaped. With modernization, the traditional order of cities and the concept of development centered on sacred spaces have given way to rational forces. The transformation of public space is evident, for example, in the attempt to replace mosque-centered settlements with squares. However, even if sacred spaces cannot find a place in the public sphere, they have begun to take on new forms of expression in individual and digital spaces.(5) Therefore, sacred spaces are formations that are fixed and unchanging, yet reshaped by social transformations and acquire new meanings in different periods and contexts. In this sense, the sacred continues to exist in modern cities by finding new spatial counterparts at both the individual and digital levels.

The Spiritual Quest of the Younger Generation and Alternative Spaces; Younger generations are loosening their ties with traditional religious institutions while continuing their spiritual quests in new areas. A study conducted on emerging adults (aged 18-29) studying at Sakarya University shows that university youth have a "new spiritualist" understanding of religion that is distant from traditional-institutional religious understanding, questions religious authorities, and prioritizes individuality. This new trend toward spirituality is dynamic, open to change, and temporary, emphasizing individual interpretations of religion rather than the formalism of traditional religiosity. Young people find current interpretations of religion rigid and are open to new interpretations of religious issues. Additionally, some young people perceive morality as an area independent of religion, which is another reflection of this new spiritualism.

When the younger generation evaluates the legends or stories of sacred places as "mythical narratives" and questions why they do not occur in today's conditions, it shows that they maintain a certain distance from institutional religious approaches and have ideas about changing traditional religious thought.(14)

New age beliefs are generally used to describe individual hybrid belief forms that are not centrally organized, lack authority, and focus on personal development. In this context, practices such as astrology, meditation, and

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yoga are related to individuals' levels of religiosity. (1) Practices such as silent retreats and mindfulness exercises can also be carried out through virtual meditation sites that offer the opportunity to achieve spiritual peace. (11) Nature walks and nature-based spirituality can be defined as unconscious environmentalism movements inherent to the culture to which people belong, based on the concept of "implicit environmentalism." This concept is related to feelings toward a place and the emotional connection formed with it. Natural elements such as mountains, rivers, trees, or caves that are considered sacred are becoming new "sacred" spaces that respond to people's spiritual quests.(11) This situation shows that younger generations' ways of redefining the sacred are shaped around individual experience, connecting with nature, and digital practices, and that they sanctify new spaces that can generate personal meaning and emotional attachment rather than traditional spaces.

Digitalization and the Reproduction of the Sacred; The digitalization process has transferred concepts and manifestations related to sacred spaces to various platforms ranging from games to movies, social media to the virtual universe. Virtual sacred spaces are areas that do not have a physical presence but are created through digital platforms. Online church services, online meditation sessions, and virtual community meetings are examples of this. Social media is also being effectively utilized for missionary activities, facilitating the transfer of sacred texts to the digital environment. These developments demonstrate that religion is no longer confined to physical spaces but is developing new forms of existence in the digital realm. Experiences in virtual worlds can be real and meaningful for users because relationships and communities can exist there.(11) However, this digital sacred experience cannot fully replace physical rituals and body-based worship practices, revealing that the spatial dimension of spirituality has not completely disappeared, even though it has undergone a transformation.

In his book Virtual Religion, Mehmet Haberli states that digital technologies are not merely a means of transmitting religion, but also serve as an environment that reshapes and transforms the sacred. According to him, worship practices, online community-building processes, and virtual sacred spaces that emerge in the digital environment not only offer alternatives to the experiences provided by traditional physical spaces but also become spaces where the sacred is reproduced at both the individual and collective levels. As Haberli emphasizes, digitalization does not strip the sacred of its spatiality but rather relocates it to a different space, enabling new sacred space experiences rooted in emotion, belonging, and meaning.(6)

Conclusion

It is evident that the transformation of sacred spaces in modern societies is not a linear process of decline, but rather a cyclical one that paves the way for the development of new spaces. Although the public function of traditional places of worship has weakened, the search for spirituality continues, and this search paves the way for the formation of new sacred spaces in both physical and digital environments. This transformation requires us to consider not only technical infrastructure in urban planning, but also people's search for meaning, their need for silence, and their collective spiritual experiences.

For this reason, integrating quiet areas, spiritual meeting places, public non-worship social spaces, and digital spiritual platforms into the urban fabric can enable younger generations in particular to reconnect with the city and express themselves. The paper argues that this transformation also presents an opportunity to strengthen the spiritual dimension of urban resilience, highlighting that increasing young people's participation in urban decision-making processes can lead to more inclusive and meaningful urban lifestyles.

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REFERENCES

1. Ekber Şah Ahmedi. Yeni Çağ İnanışlarının Çeşitli Değişkenlerle İlişkisi Üzerine Bir Araştırma: Bursa Örneği. Cumhuriyet TheologyJournal. 2022; 26(1): 135-152.

2. Hasan Basri Alkaya. Bursa Ve Çevresindeki Ziyaret Yerleri Ve Bunların Etrafında Oluşan Dini İnançlar Bursa: Uludağ Üniversitesi, Sosyal Bilimler Enstitüsü Felsefe Ve Din Bilimleri Anabilim Dalı, Yüksek Lisans Tezi. 2006.

3. Serhat Ay. Bir Kaçış Mekanı Olarak Heterotopya: Moda (Kadıköy) Örneği. Bilecik: Bilecik Şeyh Edebali Üniversitesi, Sosyal Bilimler Enstitüsü Coğrafya Anabilim Dalı, Yüksek Lisans Tezi. 2018.

4. Mustafa Alıcı. Dichotomies of "Holy", "Temple" and "InvitationtoReligion" AccordingtoReligiousStudies in the Postmodern Age: Crises, ChallengesandPossibleAnswers. ASAR Akademik Dini Araştımalar Dergisi. Ekim 2023; 1(3): 23-54

5. Bilal Çavdar. "Makanın Üretimi, HenriLefebre, Işık Ergüden (çev.)" *Sinop Üniversitesi Sosyal Bilimler Dergisi.* 7/1, (15 Ekim 2023) 1857-1862

6. Mehmet Haberli. *Sanal Din Tarihsel, Kuramsal ve Pratik Boyutlarıyla İnternet ve Din.* İstanbul. Açılım Kitap; 2014. 190.

7. İsmail Ekinci. Sekülerleşme ve Din. Bitlis Eren Üniversitesi Sosyal Bilimler Enstitüsü Dergisi. 2018; 7(1): 320-337.

8. Fetullah Kalın. RudolfOtto'da Din, Kutsallık Ve Mistik Tecrübe (Doktora Tezi). Erzurum: Atatürk Üniversitesi; 2012.

9. Eliade Mircea. *Kutsal ve Din Dışı.* Çev. M. A. Kılıçbay. Ankara. Gece Yayınları; 1991. 191.

10. Ali Şahin – Mücahit Navruz. İslam Şehri Teorisi Çerçevesinde Karaman İl Merkezinin Geçmişten Günümüze Değerlendirilmesi. *Karaman Sempozyumu Sosyal Ve Beşeri Bilimler.* Karaman, 20-22 Haziran 2019. http://ktpmakale.isam.org.tr/

11. Buse Yıldız. Kutsal Mekan Ve Coğrafya: Nazimiye (Tunceli) Örneği(Balıkesir: Balıkesir Üniversitesi, Sosyal Bilimler Enstitüsü Coğrafya Anabilim Dalı, Yüksek Lisans Tezi. 2018.

12. Özge Yıldırım. Kutsal Mekan Ve Teknolojideki Tezahürleri. Gaziantep: Gaziantep Üniversitesi, Sosyal Bilimler Enstitüsü, Felsefe Ve Din Bilimleri Ana Bilim Dalı, Yüksek Lisans Tezi. 2025.

13. Kültür ve Medeniyet Vakf (Küme vakfı), "Algoritmaya İman: Teknoloji Dinsel Olanın Yerini Alırken" (19.06.2025). https://kumevakfi.org/tr

14. Abdullah İnce. Beliren Yetişkinlerde Din Anlayışı-Gelecek Beklentisi İlişkisi: Sakarya Üniversitesi Örneği, Eskiyeni 54 Dergisi, Eylül 2024, 951-975

Are We a Youth City According to EU Youth Policies: Young People's Perception of Sakarya as a Youth City

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ABSTRACT

This study examines the perceptions of young people living in Sakarya about their city and investigates whether Sakarya can be considered a "youth-friendly city" within the framework of the European Union Youth Strategy (2019–2027). A quantitative survey was conducted with 300 young participants. The findings reveal that young people feel there are serious shortcomings in areas such as participation in city administration, social and cultural opportunities, transportation, digital access, security, and career opportunities. The vast majority of participants stated that young people are not involved in decision-making processes in Sakarya and evaluated the perception of Sakarya as a youth-friendly city negatively. There is a significant gap between the principles of participation and inclusivity envisioned by EU youth policies and the current situation. In this context, there is a need for structural and participatory policies that will support Sakarya's youth-focused transformation.

Key words: Youth participation, EU youth strategy, urban policy, youth-friendly city

Introduction

Cities are important places that shape young people's lives, enable them to realize their potential, and foster a sense of belonging (1,2). The concept of a "youth-friendly city," which takes into account the needs of young people and encourages their participation, is critical to sustainable urban development and the overall well-being of society (2,3). International frameworks such as the European Union (EU) Youth Strategy 2019-2027 aim to encourage young people's participation in democratic life and ensure that all young people have the necessary resources to participate in society (4). These strategies do not merely view young people as citizens of the future, but also position them as active architects and agents of change in their cities and communities (4,5) However, understanding young people's perceptions and expectations of urban life is essential for developing effective and evidence-based youth policies (2,5). Issues such as young people's participation in local governance processes, their access to social, cultural, and economic opportunities, and their access to safe and accessible public spaces are key factors in determining the youth-friendliness of a city (4–6). This study aims to investigate Sakarya's position as a youth city within the framework of EU youth policies by assessing the perceptions, expectations, and problems faced by young people in Sakarya regarding their current urban living

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conditions. In this context, the views of young people in Sakarya on issues such as participation in urban governance, social and cultural activities, education and career opportunities, transportation, digital access, green spaces, and security were analyzed using quantitative survey data.

Main Results

This study presents the perceptions of young people in Sakarya regarding their city from a multidimensional perspective. Below, the main findings of the study are interpreted in comparison with relevant international youth policies and research results.

The vast majority of survey participants rated the level of youth participation in city management (municipality, provincial directorates, etc.) in Sakarya as "Very limited" (42%) or "None" (38%). This situation shows that the EU Youth Strategy's goal of "Space and Participation for All" and the "100% Youth City" project's stages encouraging young people to take an active role in co-governance and participatory processes in local administrations are not fully reflected (4,6). International studies also indicate that young people are not adequately represented in decision-making processes and that their voices are not heard (5)

In Sakarya, responses regarding the variety and accessibility of social, cultural, and sporting activities for young people were largely "Very little" (42%) or "No participation" (10%). However, cultural and social facilities play an important role in city satisfaction (7,8). Young people value green spaces in their cities where they can enjoy entertainment, culture, and socializing, as well as being close to nature, engaging in various physical activities, and promoting mental well-being (2). The "Funcity+ Youth Festival" in Varna and youth-focused cultural initiatives in Turin are examples of how various activities aimed at young people can increase their participation in city life (6) . The statements of young people in Sakarya emphasize the inadequacy of current activities and their lack of budget-friendliness.

Young people rated educational opportunities in Sakarya as "average," while they rated job/internship/career opportunities as "very limited" (32%) or "none" (18%). OECD data also highlights young people's concerns about unemployment and career uncertainty (7,9). The EU Youth Strategy aims to facilitate young people's transition from education to the labor market and end discrimination, with the goals of "Quality Employment for All" and "Quality Learning" (4). Perceptions in Sakarya indicate significant shortcomings in achieving these goals.

The situation in Sakarya in terms of public transportation and accessibility has been described as mostly "Very poor" (38%) or "Poor" (26%). Public transportation is an important factor in a city's suitability for the "20-minute neighborhood" concept and in the quality of life within the city (8). A study conducted with hybrid electric buses shows that bus service quality (design, comfort, punctuality) affects customer satisfaction (10) . Young people have cited the inadequacy of public transportation, infrequent service, overcrowding, and high fares as one of the biggest problems.

While responses regarding young people's access to digital tools vary, a significant proportion say it is "inadequate" (26%) or "very inadequate" (10%). The EU Youth Strategy aims to promote the use of digital democracy tools and ensure equal access to information for young people (4). Although the concept of "smart cities" emphasizes digital transformation and bridging the digital divide, some young people do not feel they have the necessary digital skills (5).

Responses regarding the adequacy of green spaces and open-air social areas were "Moderate" (36%) or "Partially" (30%), while young people's sense of safety was generally reported as 'Sometimes' (50%) or "Rarely" (30%). Security and safety have a significant impact on city satisfaction (7). The survey results highlight security concerns (especially for women) and cleanliness/safety issues in green spaces. Young people consider green spaces important for socializing and relaxation, and expect them to be clean, comfortable, and suitable

for a variety of physical activities (2).

Responses regarding young people's access to health services (psychological counseling, sports facilities, etc.) were mostly "Insufficient" (38%) or "Very limited" (24%). The quality of the healthcare system is a factor that directly affects city satisfaction (7). The EU Youth Strategy also embraces the goal of "mental health and well-being" (11).

Young people's responses to open-ended questions indicate that the most significant problems they face in Sakarya are inadequate and expensive transportation, lack of social/cultural/sports activities, unemployment and lack of internship opportunities, high rent prices, security concerns, and the absence of platforms where young people's voices can be heard. These findings are consistent with OECD reports reflecting young people's concerns about economic and financial insecurity, housing, and lack of social participation (7,9).

When asked, "Would you generally describe Sakarya as a youth-friendly city?" the majority of young people responded with 'No' (46%) or "I'm not sure" (30%). This situation shows that young people are generally dissatisfied with the current state of the city and believe that Sakarya is far from its vision of becoming a youth-friendly city. A youth-friendly city is defined as a place that empowers young people, involves them in decision-making processes, provides opportunities, and offers safe and enjoyable environments (6). Young people prioritize allocating resources to people-centered themes (5).

Conclusion

This research provides an in-depth perspective on the current urban conditions of young people in Sakarya and reveals significant shortcomings in the city's efforts to become "youth-friendly." Survey results indicate that young people have limited participation in city governance, insufficient social, cultural, and sporting activities, limited education and career opportunities, inadequate and expensive public transportation, and concerns regarding digital access and security. These issues negatively impact young people's overall satisfaction with the city and prevent them from viewing Sakarya as a "youth-friendly" city.

While Sakarya has the potential to become a youth-friendly city, this potential can only be realized through the implementation of comprehensive and youth-focused policies. In line with the approaches recommended under the EU Youth Policies, it is suggested that Sakarya local authorities and relevant stakeholders consider the following.

The results of the study, when supported by the literature, indicate that platforms should be created to enable young people to actively participate in decision-making processes through mechanisms such as youth councils, youth forums, and participatory budgeting (2,4,5). Young people should be given opportunities to turn their ideas into concrete projects, rather than just being listened to (6) According to the study, free or affordable concerts, theater performances, workshops, and festivals that appeal to young people's interests should be organized. The number of youth centers and multipurpose public spaces should be increased, and these spaces should be made more attractive by supporting them with digital technologies (2). According to the study, cooperation between universities and local businesses should be increased to provide part-time jobs, internships, and career guidance opportunities for young people. Entrepreneurship support programs and free training opportunities should be provided to improve the skills of young people. Public transportation networks should be expanded, the number of trips increased, and affordable pricing policies for young people implemented. Within the framework of the "15-minute city" or "20-minute neighborhood" concepts, easy and sustainable access to basic services should be provided (7,8)) . According to the study, green spaces and outdoor social areas should be better maintained, cleaned, and secured. Especially at night, places where young people feel safe should be created, and surveillance should be increased.

The active participation of young people will not only meet their needs, but also make the city a more inclu-

sive, sustainable, and innovative place to live (2). Sakarya has the opportunity to achieve this transformation thanks to its natural beauty and university potential.

REFERENCES

1. Antonova N, Abramova S, Tomberg O. Territorial Mobility of Young People: Attractive Cities and Countries. In: 5th International Conference on Social, Economic, and Academic Leadership (ICSEALV 2019). 2019.
2. Jurkevičienė J, Budrytė P. Youth Perception of Public Spaces in the City. Urban Science. 2025 Feb 1;9(2).
3. European Commission. Resolution of the Council of the European Union and the representatives of the Governments of the Member States meeting within the Council on the revision of the EU Youth Strategy Work Plan 2022-2024. 2023.
4. European Commission. The European Union Youth Strategy 2019-2027 [Internet]. 2018. Available from: https://www.eurofound.europa.eu/topic/NEETs
5. Shtebunaev S, Gullino S, Larkham PJ. Planning the Smart City With Young People: Teenagers' Perceptions, Values and Visions of Smartness. Urban Plan. 2023;8(2):57–69.
6. Santos C de S. 100% Youth City - Quality Label for Youth Friendly Cities. 2020.
7. Castelli C, de Dominicis L, Dijkstra L, Montalto V, Pontarollo N. What Makes People in Europe Satisfied Wıth The City Where They Live? 2022.
8. Bulloch M, Olsen JR. Exploring young people's views of their local area related to the 20-minute neighbourhood policy: a national cross-sectional study. Cities Health. 2024;8(6):1081–93.
9. OECD. Risks That Matter For Young People: Concerns, Perceived Vulnerabilities And Policy Preferences. 2024.
10. Munim ZH, Noor T. Young people's perceived service quality and environmental performance of hybrid electric bus service. Travel Behav Soc. 2020 Jul 1;20:133–43.
11. European Union. Resolution of the Council and the representatives of the governments of the Member States meeting within the Council on the EU Youth Strategy Work Plan 2025-2027 [Internet]. 2024. Available from: http://data.europa.eu/eli/C/2024/7438/oj

GREEN CYCLE: Integrated Water and Waste Recovery System for Smart Neighborhoods

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ABSTRACT

This study introduces the "Green Cycle" project, which offers a holistic solution to critical environmental challenges such as urban water scarcity, waste disposal problems, and linear resource consumption. The project aims to design and implement an integrated water and waste recovery system at the neighborhood scale. The system optimizes greywater treatment and organic waste composting/biogas processes through Internet of Things (IoT)-enabled sensors and Artificial Intelligence (AI) algorithms. Treated greywater is utilized for toilet flushing and urban agriculture, while compost/biogas by-products derived from organic waste nourish local vertical farming units and community gardens. Citizen participation is incentivized via a reward-based mobile application, supporting a cycle of water conservation, waste segregation, and local food production. Expected outcomes include a 30-40% reduction in water consumption, an 80-90% decrease in organic waste sent to landfills, and reduced carbon emissions. This project aims to enhance the environmental sustainability of cities while promoting a circular economy model and improving the quality of life for communities. The abstract should indicate the subject and scope of the paper, and also summarize the author's conclusion. It should not be more than 200 words. A structured abstract must be a brief, comprehensive summary of the contents of the article. It should summarize the major aspects of a paper including the purpose, methods, major results, and conclusions.

Key words: Urban Water Management, Waste Recovery, Smart Cities, Circular Economy, IoT

Introduction

Cities are facing significant environmental challenges such as water scarcity, pollution, and waste management, exacerbated by rapid population growth and the impacts of climate change. In water-stressed geographies, including Turkey, inefficient water use in urban areas and the negative environmental impacts of waste necessitate urgent solutions. The current "take-make-dispose" linear economic approach leads to the waste of valuable resources and an increased environmental burden. This situation mandates the development of new, integrated, and circular models for urban sustainability and resilience.

This study presents the "Green Cycle" project, which addresses urban water and waste management within a single system, supported by technology and focused on community engagement. The primary aim of the project is to enable the local treatment and reuse of greywater and the on-site processing of organic waste for integration into urban agriculture at the neighborhood level. This approach will enhance resource efficiency, reduce the environmental footprint, and strengthen the local circular economy within cities. In this section,

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the author should address the introduction and background of the research. The extended abstract should be written in MS Word format in single-spaced in 11-point Times New Roman except for abstract (10-points Time New Roman). Do not indent the text paragraphs. Please briefly explain the aim and scope of the study, the materials and methods, and the main findings and brief analysis of the study. This format is to be used for submissions of extended abstract that will be published in the proceeding of the cities4youth. We wish to give this proceeding a consistent, high-quality appearance. We therefore ask that authors follow some simple guidelines. In essence, you should format your paper exactly like this document. The easiest way to do this is simply to download a template from the conference web site and replace the content with your own material.

Main Results

The "Green Cycle" project aims to yield significant findings and tangible outputs upon pilot implementation. The main components of the project and their expected operation are as follows: This section should address the findings and discussion.

- **Integrated Water Recovery:** Greywater from buildings will be collected via a separate plumbing system and directed to compact modular treatment units. Advanced technologies like Membrane Bioreactors (MBR) will be employed in these units to treat the water to a "service water" quality suitable for secondary uses such as irrigation, toilet flushing, and car washing. A 30-40% reduction in mains water consumption is anticipated in the pilot area.

- **Organic Waste Valorization:** Organic waste collected from households and local businesses will be accumulated in smart, sensor-equipped containers and transported to neighborhood-scale composting or biogas units. This process is expected to achieve an 80-90% reduction in organic waste sent to landfills. The produced compost and biogas by-products (digestate) will be utilized.

- **Urban Agriculture Integration:** The treated greywater and compost/fertilizer derived from organic waste will be used in urban farming areas such as vertical farming units, rooftop gardens, and community gardens established within the neighborhood. This will promote local, fresh, and chemical-free food production, shorten the food supply chain, and reduce the carbon footprint.

- **Smart Management and Citizen Engagement:** Data collected via IoT sensors (waste bin fill levels, water quality, soil moisture) will be analyzed on a cloud-based platform supported by artificial intelligence. These analyses will optimize system efficiency and predict maintenance needs. The "Green Cycle" mobile application will educate citizens on waste segregation and water conservation, incentivize participation through gamification and a reward system, and transparently present the environmental and economic benefits of the system.
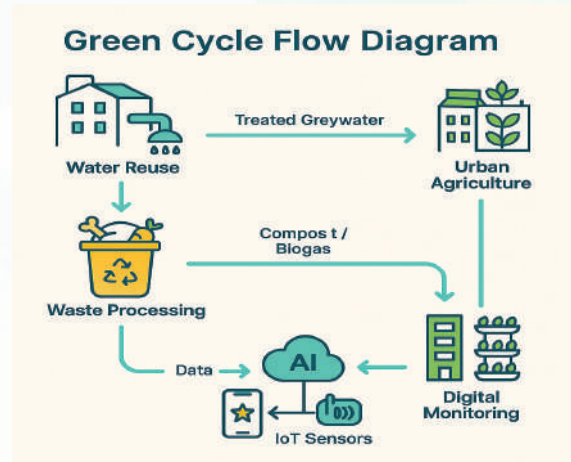
Figure 1. Green Cycle Flow Diagram

Table 1. Expected Environmental and Economic Gains (Pilot Area)

Indicator	Current State (Estimated)	Green Cycle Project (Target)
Water Consumption Reduction	0%	30-40%
Organic Waste Reduction	0%	80-90%
Urban Agriculture Production	None	Yes (Local Food Production)
Greenhouse Gas Emissions	High	Decrease

Conclusion

The "Green Cycle" project offers an integrated, circular, and smart approach to urban water and waste management, presenting a sustainable model for the future of cities. This project will not only provide practical solutions to environmental problems but also stimulate the local economy, create new job opportunities, and enhance community environmental awareness and participation. A pilot project implemented in İnegöl or a similar urban settlement will demonstrate the potential of this model and pave the way for a nationally scalable "Smart Green Neighborhood" standard. Future research can delve deeper into the applicability of this system in various urban densities and its long-term socio-economic impacts. The conclusion is intended to help the reader understand why your research should matter to them after they have finished reading the paper. A conclusion is not merely a summary of the main topics covered or a re-statement of your research problem but a synthesis of key points and, if applicable, where you recommend new areas for future research.

Acknowledgment

REFERENCES

1. Yılmaz, A. Urban Water Management and Innovative Approaches. Environmental Sciences Journal. 2023; 15(2): 112-125.
2. Demir, S., Aktaş, E. Artificial Intelligence Applications in Smart Waste Management Systems. Proceedings of the International Smart Cities Conference; May 10-12, 2022; Ankara.
3. Can, Ö. Greywater Treatment Technologies. In: Kaya, E., Deniz, F., editors. Water Management for Sustainable Cities. Istanbul: Çevre Yayınları; 2021. p. 245-260.

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Virtual Reality: Innovative Approaches for Disaster Education Targeting Youth

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ABSTRACT

Disasters such as earthquakes, floods, and fires continue to pose serious threats to public health and infrastructure systems. While traditional preparedness methods often rely on printed guides or face-to-face drills, these approaches frequently fail to capture the interest of young individuals. In recent years, virtual reality (VR) technology has emerged as a promising tool for delivering interactive and immersive disaster education. This study examines the potential of VR applications to enhance disaster preparedness training, focusing particularly on youth engagement. VR technology allows users to experience high-pressure emergency scenarios in a safe and controlled environment, improving decision-making under stress. The study explores the role of VR in educational settings, assessing the relevance and applicability of such tools for disaster education. Additionally, it highlights the potential of gamification in improving memory retention and response time during emergencies. Barriers to the widespread adoption of VR, such as access and infrastructure limitations, are also discussed. In conclusion, integrating VR applications into disaster education programs for young people could contribute significantly to awareness-raising and the development of urban resilience.

Keywords: Virtual Reality, Disaster Education, Youth Engagement, Urban Resilience, Simulation

Introduction

Disasters like earthquakes, floods, and wildfires are occurring with increasing frequency, particularly in densely populated urban areas, resulting in substantial physical, social, and economic losses. According to the Turkish Disaster Response Plan, a disaster is defined as "a natural or human-induced event that severely disrupts the normal functioning of society and causes significant physical, economic, and social losses" [2]. Given the complexity of modern cities and rapidly increasing population density, the need for effective and inclusive disaster preparedness strategies is growing.

Conventional approaches—such as printed brochures, public announcements, or limited drills—often fall short in engaging young individuals. These methods tend to be passive and do not align with the learning preferences of today's youth. Recently, simulation-based and interactive technologies, particularly virtual

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reality (VR), have emerged as compelling alternatives in educational settings.

VR offers users the opportunity to experience high-stress emergency situations in a secure and controlled environment, enhancing awareness, knowledge acquisition, and decision-making skills. For tech-savvy youth, VR has the potential to significantly enhance the impact of disaster education. Indeed, a 2019 report by the United Nations Office for Disaster Risk Reduction (UNDRR) revealed that young people show greater engagement with digital tools in disaster education programs, which in turn leads to more lasting behavioral change [5].

In Türkiye, disaster education and awareness activities are mainly carried out by AFAD (Disaster and Emergency Management Authority) and local governments. Although some digital initiatives, such as earthquake simulators and mobile applications, have been implemented, large-scale VR-based applications have yet to become widespread. This study explores the impact of VR technologies on disaster preparedness education, particularly for youth, and offers recommendations for integrating these tools into education policy frameworks.

Main Results

Recent studies indicate that VR applications are frequently used in educational contexts. They are employed in various disciplines including health, engineering, and computer sciences, with their effectiveness widely documented [6][7][8]. VR can present complex scenarios such as earthquakes, fires, or floods in highly realistic ways, enhancing both individual awareness and the learning process. Furthermore, the gamification features provided by VR have been shown to increase student participation and intrinsic motivation [9][10].

Focusing specifically on disaster management applications, a study by Lin et al. (2021) found that students who participated in a VR-based earthquake drill exhibited higher risk perception and faster response times compared to those who received traditional video-based instruction [1]. In Japan, a pilot project using VR-supported fire evacuation simulations in schools demonstrated that students responded more safely and consciously [3].

In Türkiye, initiatives such as AFAD's mobile applications and earthquake simulation trucks are in place. However, these tools offer limited interactivity and are not fully aligned with current technological advancements. In contrast, VR offers an interactive, hands-on approach that directly appeals to youth.

In this context, integrating VR into disaster education programs at schools, universities, and community centers could increase awareness and support long-term retention and practical application. The high level of digital literacy and interest in technology among youth represents a major advantage in this process.

Conclusion

In the face of increasing natural disaster risks, there is a pressing need for new approaches that effectively raise disaster awareness and preparedness, particularly among young people. Given the limitations of traditional education methods, virtual reality offers an interactive and lasting educational environment that aligns with young individuals' learning styles.

This study assessed the potential of VR technologies in disaster education targeting youth and discussed how this technology could enhance urban resilience based on both national and international case studies. VR applications not only support the development of decision-making skills through realistic simulations but also encourage active participation by young people in the learning process.

Existing disaster awareness campaigns in Türkiye could be made more inclusive and effective through the integration of VR-based solutions. With the collaboration of public institutions such as AFAD, local governments, and educational organizations, VR could become a practical and innovative component of national disaster preparedness strategies.

Ultimately, the integration of digital technologies into education is a key to building a resilient future, not only at the individual level but also across society. Engaging young people in this process is fundamental to creating more prepared and resilient urban communities.

REFERENCES

1. Lin Y, Huang Y, Chang L. Using Virtual Reality to Enhance Earthquake Preparedness in Schools. *Int J Disaster Risk Reduct.* 2021;60:102291.
2. AFAD – Afet ve Acil Durum Yönetimi Başkanlığı. Deprem Simülasyon Tırı Projesi [İnternet]. Ankara: AFAD; 2019 [erişim 2025 Mayıs 20]. https://www.afad.gov.tr
3. Takahashi K, Yamada T. Application of VR Technology in Fire Evacuation Training: A Case Study in Japan. Safety Science. 2020;128:104756.
4. Güler H, Şen B. Digital Tools in Disaster Education: A Review on VR-Based Practices in Turkey. J Urban Safety Technol. 2022;6(2):45–53.
5. United Nations Office for Disaster Risk Reduction (UNDRR). Words into Action: Engaging Children and Youth in Disaster Risk Reduction and Resilience Building. Geneva: UN; 2019.
6. Kim, D. and Im, T. (2022). A systematic review of virtual reality-based education research using latent dirichlet allocation: focus on topic modeling technique. Mobile Information Systems, 2022, 1-17. https://doi.org/10.1155/2022/1201852
7. Oyelere, S., Kaliisa, R., Obaido, G., Yunusa, A., & Jimoh, E. (2020). Exploring the trends of educational virtual reality games: a systematic review of empirical studies. Smart Learning Environments, 7(1). https://doi.org/10.1186/s40561-020-00142-7
8. Huang, W. and Roscoe, R. (2021). Head-mounted display-based virtual reality systems in engineering education: a review of recent research. Computer Applications in Engineering Education, 29(5), 1420-1435. https://doi.org/10.1002/cae.22393
9. Freina, L., & Ott, M. (2015, April). A literature review on immersive virtual reality in education: state of the art and perspectives. In *The international scientific conference elearning and software for education* (Vol. 1, No. 133, pp. 10-1007).
10. Bastiaens, T., Wood, L., & Reiners, T. (2014). New landscapes and new eyes: The role of virtual world design for supply chain education. *Ubiquitous Learning*, *6*(1), 37-49.

Developing Green Human Capital through the Model United Nations: A Social Innovation Perspective

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ABSTRACT

This paper explores how Model United Nations (MUN) programs can contribute significantly to the development of green human capital among youth. Drawing on the theoretical frameworks of Green Human Resource Management (Green HRM) and social innovation, the study investigates the ways in which MUN fosters essential environmental values, skills, and civic engagement. Using a qualitative case study methodology focused on a group of high school students who participated in an international MUN conference in Doha, Qatar, the paper analyzes multiple sources of data including teacher observations and student reflections. Findings suggest that MUN acts as an informal but powerful tool for promoting green HRM principles by encouraging value-based participation, raising environmental awareness, and enhancing students' understanding of global sustainability policies. The study concludes with practical recommendations for educators and policymakers to integrate MUN and similar programs into educational curricula, thus supporting the wider agenda of sustainable development and green human capital formation.

Key words: Green Human Capital, Model United Nations, Social Innovation, Sustainable Development, Environmental Education.

Introduction

The 21st century has brought forward pressing global environmental challenges that call for a transformation in how future generations are educated and empowered. Climate change, biodiversity loss, and resource depletion have made it clear that sustainable development must be a key priority worldwide. One important aspect of this transformation is the development of green human capital — the knowledge, skills, values, and behaviors that support sustainable practices and environmental stewardship. Green human capital is increasingly recognized as essential for organizations and societies aiming to meet environmental goals and transition to a low-carbon economy. However, formal education systems, especially at the secondary and higher education levels, often lack comprehensive curricula focused on environmental education and sustainability competencies. In many countries, there is a gap in the practical training of young people to become environmentally responsible citizens and future professionals.

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In this context, informal and non-traditional learning experiences play a vital role. Model United Nations (MUN) is an educational simulation where students role-play delegates to the United Nations and engage in debates on global issues. Traditionally, MUN enhances diplomatic, negotiation, and communication skills. However, its potential to contribute to environmental education and the development of green human capital has received less attention.

This paper investigates how participation in MUN programs can foster green human capital among youth, using a social innovation perspective. It argues that MUN's interactive and participatory format creates opportunities for young people to acquire environmental knowledge, develop pro-environmental values, and build civic engagement skills necessary for sustainable development.

Additionally, MUN's real-world simulation encourages students to explore the political, social, and economic dimensions of environmental problems. By assuming the role of diplomats from various countries, participants gain exposure to diverse environmental priorities and policy strategies. This global lens reinforces the interconnectedness of sustainable development and fosters intercultural empathy.

Main Results

The analysis revealed three significant dimensions through which MUN contributed to the development of green human capital:

1- Environmental Awareness and Knowledge Students demonstrated a heightened understanding of global environmental issues such as climate policy, renewable energy alternatives, and international cooperation mechanisms. The research component required for preparing position papers on environmental topics prompted in-depth learning. Several students noted that the complexity and urgency of environmental challenges became more tangible through role-playing as affected nations. MUN also encouraged critical analysis of international agreements such as the Paris Climate Accord and the role of the United Nations Environment Programme.

2- Value Orientation and Ethical Reasoning Participation in MUN fostered strong environmental ethics and empathy, particularly for students assigned to represent countries severely impacted by climate change and environmental degradation. The immersive experience nurtured a sense of responsibility and moral commitment to sustainability, echoing key principles of Green HRM which emphasize value-driven leadership. Students reported a deeper awareness of ethical dilemmas in climate policy and began considering the balance between economic development and environmental conservation.

3- Skills Development and Agency for Action The simulation strengthened critical skills including negotiation, public speaking, diplomacy, and leadership, all framed within sustainability discourse. Notably, many students expressed increased confidence and motivation to engage in environmental advocacy beyond the classroom, including joining clubs, volunteering, and pursuing green career pathways. These actions reflect the transfer of learning into practical initiatives and personal transformation.

These results affirm that MUN functions as an informal educational space fostering social innovation by blending global policy simulation with environmental education. In contexts where formal sustainability education is limited, such programs offer vital opportunities to cultivate green human capital among youth, empowering them as future agents of change.

Conclusion

This study provides strong evidence that Model United Nations programs can serve as effective informal learning environments for developing green human capital. By integrating environmental topics into diplomatic simulations and fostering collaborative problem-solving, MUN not only enhances knowledge but also inspires proactive civic behavior oriented towards sustainability.

The paper recommends that educational institutions and policymakers recognize and expand the role of MUN and similar initiatives in youth education frameworks. Specifically, integrating explicit environmental dimensions in MUN agendas and supporting reflective practices can maximize their impact on sustainability competencies.

In conclusion, as the world faces mounting environmental crises, cultivating green human capital through innovative social learning models like MUN is both timely and essential. These programs can nurture a generation equipped with the knowledge, values, and skills needed for a sustainable future.

Acknowledgment

The author would like to express sincere gratitude to the organizers of the International Cities4Youth Symposium for their support and encouragement throughout this research.

REFERENCES

1. Renwick D, Redman T, Maguire S. Green human resource management: A review and research agenda. International Journal of Management Reviews. 2013;15(1):1–14.
2. Jabbour CJ. How green are HRM practices, organizational culture, learning and teamwork? A Brazilian study. Industrial and Commercial Training. 2011.
3. Moulaert F, Martinelli F, Swyngedouw E, Gonzalez S. Towards alternative model(s) of local innovation. Urban Studies. 2005;42(11):1969–1990.
4. Albareda L, Lozano JM. The role of governments in CSR. Journal of Business Ethics. 2007;74(4):391–407.
5. UNDP. Human Development Report 2021: Sustainability and Equity. New York: United Nations Development Programme; 2021.

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Reclaiming Silence in the Digital Age:
Designing New Urban Realms for Youth Creativity

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ABSTRACT

In today's overstimulated, digitally saturated urban landscape, young people are bombarded by relentless sensory overload that stifles creativity and strains mental wellbeing. Based on interdisciplinary references and case studies, we explore how silence, as both a spatial and cognitive element, enhances creativity, mental resilience, and social innovation. Grounded in interdisciplinary research and global case studies, we demonstrate that silence is not merely the absence of noise but a catalyst for neurocognitive restoration, emotional regulation, and creative ideation. Cities that prioritize youth-focused quiet zones—not just for rest but for active ideation and cultural production—foster deeper democratic participation. The research proposes integrative urban strategies including youth-led design contests, digital detox architecture, and policy inclusion mechanisms. These approaches aim not only to provide relief from sensory overload but to embed creativity into the core of resilient urban futures. The study is constructed using qualitative research methods, specifically document analysis and selected case study review.

Keywords: Silence, Youth Creativity, Cognitive Urbanism, Participatory Design, Mental Sustainability

Introduction

Urban environments today are saturated with sensory input. The recognition that urban environments significantly impact psychological wellbeing aligns with growing evidence that city design directly influences cognitive function and emotional states. Despite growing awareness of mental health and cognitive fatigue, city designs largely neglect the importance of accessible spaces for mental recovery and individual thought. Silence, once considered a luxury, is now a necessity—both for psychological well-being and for creative flourishing.

The concept of *cognitive urbanism*—which explores how urban design influences mental processes—and *neuroarchitecture*—which studies the brain's response to built environments—provide crucial frameworks for understanding silence as a vital urban resource. These interdisciplinary fields reveal that thoughtfully designed silent spaces can reduce cognitive overload, improve emotional regulation, and foster the mental clarity necessary for creative thinking and social innovation (3).

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Drawing inspiration from the "A Room of One's Own[1]" (4) idea and extending it to collective urban design, this study aims to reframe silence as a form of infrastructure (1). By reviewing recent design experiments in Tokyo, Helsinki, and Amsterdam, we contextualize how youth-centered silent spaces can become platforms for ideation, reflection, and low-stimulus collaboration. For instance, EEG Research (2) shows that exposure to silent environments increases alpha wave activity by approximately 15-20%, reflecting a relaxed yet alert brain state that enhances creative ideation.

Main Results

Our comparative analysis reveals that youth who access intentional silence zones (such as sensory-neutral reading pods, signal-free gardens, or thought rooms) demonstrate improved cognitive flexibility and report stronger creative output. Cities that embed these principles into their urban strategies allow for the emergence of micro-publics: spaces where spontaneous collaboration and artistic ideation can occur.

Figure 1. EEG Frequency

Figure 1. EEG spectral power comparison between "mind wandering" and "on-task" cognitive states. Note the higher alpha band (8–12 Hz) power during mind wandering, which correlates with increased internal cognition and potential creative ideation. In addition, we propose a participatory model where municipalities organize local art-based competitions (e.g., digital illustration, soundscape design) themed around "urban silence," with winners contributing to real urban installations. This not only democratizes planning but also bridges youth and policymakers through co-creation.

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1   "A Room of One's Own" is a long essay written by Virginia Woolf, published in September 1929.

Table 1. Examples of Creative Youth-Oriented Silent Urban Interventions

City	Intervention	Type	Outcome
Tokyo	Silent Reading Pods	Architecture	Boosted focus and reduced screen fatigue among youth.
Helsinki	Kamppi Chapel of Silence	Religious/Public Space	Visitors reported increased emotional clarity.
Melbourne	Urban Mind Lab Gardens	Co-designed Green Space	Youth-designed spaces; improved mood and calm.
Barcelona	Pause Points (Bus Stop Reuse)	Tactical Urbanism	Triggered spontaneous youth-led art and ownership.

In addition to individual cognitive benefits, silent zones in urban areas foster collective wellbeing. These spaces function as urban "pause points," allowing youth from diverse backgrounds to experience a shared environment without pressure for performance or consumption. In low-income urban neighborhoods, where personal space is often limited, accessible silent spaces become critical for emotional recovery and equitable access to rest. The design of these silent spaces can be guided by principles from cognitive urbanism and neuroarchitecture, which focus on how spatial environments influence mental processes and wellbeing. Cities could sponsor "Silence and Sound" art festivals where youth contribute digital artworks, ambient music, or installations inspired by quietude. Mobile apps could collect city soundscapes curated by youth, blending artistic and environmental data. These emerging technologies offer innovative ways to engage youth in co-creating silent urban spaces. Mobile applications that enable youth to record, share, and curate city soundscapes can foster a sense of ownership and deepen awareness of urban acoustic environments. These digital tools, combined with participatory design workshops and art festivals centered on themes of silence and sound, can transform silent spaces into dynamic cultural hubs that celebrate quietude as an active, creative force.

Importantly, the equitable distribution of silent urban spaces is essential. In densely populated, low-income neighborhoods, where private quiet spaces are scarce, accessible silent zones serve as critical refuges for mental restoration and emotional wellbeing. Ensuring that silence infrastructure is inclusive can help mitigate urban health disparities and promote social justice by providing all youth with opportunities for cognitive recovery and creative engagement. This calls for policy frameworks that prioritize silent space development in underserved areas, integrating community voices in the planning process to reflect diverse needs. Furthermore, new policies can institutionalize silence-friendly urban design, including zoning laws, noise regulations, or mental health initiatives.

Conclusion

This paper highlights the overlooked importance of silence in urban design for youth. In cities built for speed and efficiency, the slow, quiet, and creative aspects of urban life must be re-integrated. Designing for silence is not retreating from engagement; it is creating the nutritious mental ground upon which innovation grows. Future research may further explore the neuro-architectural impact of silence-based infrastructure on youth learning, productivity, and resilience.

The fruits of silence in urban design can also be accessible for broader population, including adults and elderly

residents who also face sensory overload and cognitive fatigue. Future research should explore scalable models of silence infrastructure that accommodate diverse urban demographics. Additionally, longitudinal studies employing neuro-architectural methods could quantify the long-term impacts of silent spaces on cognitive health, creativity, and social cohesion. Embedding silence into urban futures is not merely a design choice but a public health imperative that nurtures resilient, innovative, and inclusive cities.

REFERENCES

1. Ito S. Tokyo's Silent Pods: Rethinking Cognitive Architecture for Overstimulated Youth. Proceedings of the Urban Futures Forum; 2023 Apr 14–16; Tokyo, Japan. Tokyo: Urban Design Press; 2023.

2. Schwab D, Benedek M, Papousek I, Weiss EM, Fink A. Time-Course of EEG Alpha Power Changes in Creative Ideation. Front Hum Neurosci. 2014; 8: 310.

3. Schwartz M. Designing Cities for the Mind: Silence as a Spatial Resource. Urban Studies. 2022; 59 (4): 788–803.

4. Woolf, V. A Room of One's Own. London: Hogarth Press; 1929.

Erasmus+ 2024-3-TR01-KA154-YOU-000279592
Resilient Cities and Sustainable Future: Youngsters Discuss Future of the Cities

Green Roofs as Climate Adaptation Strategy: A Youth Perspective on Sustainable Urban Futures

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ABSTRACT

Urban areas increasingly suffer from the effects of climate change, including extreme heat, flooding, and poor air quality. Green roofs, as a form of nature-based infrastructure, offer promising adaptation strategies. This study explores the perceptions, awareness, and advocacy roles of young people regarding green roof implementation in Baku. Using a survey conducted among 150 architecture and environmental science students, the study found that 81% of respondents view green roofs as essential for sustainable urban development. However, practical knowledge and institutional support are lacking. The study proposes a youth-led policy framework that combines education, pilot projects, and digital advocacy to accelerate green infrastructure adoption. The findings underscore the critical role of youth in promoting resilient and livable cities through ecological urban design.

Key words: Green Roofs, Youth Engagement, Climate Adaptation, Urban Sustainability, Nature-Based Solutions

Introduction

As cities grow denser and climate risks intensify, green infrastructure becomes vital for environmental resilience. Green roofs — vegetated layers installed on rooftops — reduce urban heat, manage stormwater, and enhance air quality. This study investigates youth perspectives on green roof applications in Baku, focusing on their level of awareness, perceived benefits, and willingness to advocate for broader implementation. Involving youth in climate adaptation strategies is crucial, particularly as they inherit the long-term impacts of current urban planning choices.

Main Results

The survey, conducted with 150 university students, revealed high conceptual support for green roofs,

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with 81% agreeing they should be mandatory in new constructions. However, only 26% had encountered real-life examples in Baku. Respondents identified lack of public information and political will as the main barriers. Interviews with two young architects highlighted the role of student-led design studios and online campaigns in promoting pilot installations. This suggests untapped potential in integrating green roof education into university curricula and municipal sustainability plans.

Statement	Agreement (%)
Green roofs should be part of city policy	81%
I have seen a green roof in Baku	26%
I would participate in a green roof project	77%
Green roofs improve city health and livability	88%

Table 1. Youth Survey Results on Green Roof Perceptions
Illustration of a proposed green roof pilot project by student architects in Baku.

Conclusion

This study shows strong youth support for green roofs as an urban climate solution. To transform this interest into action, urban planners should engage youth in co-design processes, offer technical training, and support youth-led pilot projects. Green roofs are not just technical fixes; they are symbols of a greener urban future that youth are ready to lead. Future studies should explore financing models and policy incentives for widespread adoption in post-Soviet cities.

REFERENCES

1. Oberndorfer E, et al. Green Roofs as Urban Ecosystems. Bioscience. 2007; 57(10): 823-833.
2. Berardi U. Green Roofs in Sustainable Urban Planning. Journal of Environmental Management. 2021; 288: 112-134.
3. Ahmadova G. Climate Resilience in Baku. Smart Cities Conference; 2023 Oct; Tbilisi, Georgia.

Social Innovation and Urban Resilience: A Case Study of Eskişehir City Center

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ABSTRACT

This study explores the city center of Eskişehir through the lenses of social innovation and urban resilience. Modern urban areas face increasing challenges such as climate change, rapid urbanization, migration, and socio-economic inequalities. Social innovation offers creative, participatory, and sustainable solutions that improve urban quality of life. Eskişehir, with its dynamic population, status as a university city, and cultural diversity, presents strong potential for implementing such approaches.

The research investigates current social innovation initiatives and urban resilience strategies in Eskişehir. Projects and policies developed collaboratively by civil society, local governments, universities, and the private sector are evaluated. The study focuses particularly on digital transformation in municipal services and the development of green infrastructure.

A mixed-methods approach was used, combining literature review, stakeholder interviews, surveys, and case analyses. The findings highlight the strengths and gaps in Eskişehir's social innovation ecosystem, revealing opportunities to enhance its resilience capacity.

Ultimately, the study emphasizes how social innovation contributes to making Eskişehir a more resilient, inclusive, and sustainable urban environment. It offers strategic recommendations for local policymakers, municipal authorities, and urban stakeholders to strengthen long-term urban development and resilience planning.

Key words: Social Innovation, Urban Resilience, Eskişehir, Participatory Governance, Sustainable Cities

Introduction

Modern cities are confronted with intertwined and multilayered challenges including climate change, migration, and socio-economic inequality. These complexities necessitate innovative and inclusive solutions beyond traditional planning methods. Social innovation is increasingly recognized as a creative, participatory, and sustainable response to such issues (1,2). It generates social value through novel services, products, or models while enhancing quality of life (3). Three dimensions of social innovation are emphasized: meeting unmet needs, enhancing social participation, and empowering individuals (4). The involvement of young people particularly strengthens these dynamics (5).

This study analyzes the social innovation process in Eskişehir in four stages: problem identification, idea generation, solution implementation, and impact evaluation. Each stage is examined with examples from both literature and local practices.

Urban resilience, another key concept, refers to the ability of cities to withstand and recover from acute shocks and chronic stressors such as natural disasters, infrastructure deficits, and economic crises (6). Resilient cities not only respond to crises but adapt and transform through learning (7). Key resilience indicators include strong social networks, participatory governance, sustainable environmental policies, and digital transformation strategies.

Social innovation and urban resilience are interconnected and serve as strategic tools for building inclusive and sustainable cities. Eskişehir's youthful demographic, cultural diversity, and strong civic participation provide an ideal setting for exploring this intersection.

Main Results

Survey findings indicate that 68% of participants are open to innovative urban solutions, and 52% are familiar with the concept of social innovation. Moreover, 60% reported awareness of urban resilience strategies.

Table 1. Awareness of Social Innovation and Urban Resilience

Awareness Indicators	Percentage (%)
Awareness of Social Innovation	52
Awareness of Urban Resilience	60
Willingness to Participate in Local Initiatives	68

Qualitative interviews highlighted impactful practices such as youth centers, digital municipal services, urban gardens, and cultural solidarity initiatives (1,2). Social innovation in Eskişehir must be integrated into systemic urban policy beyond grassroots initiatives. The four pillars of resilience identified by OECD—economic, environmental, social, and governance—should be balanced within municipal strategies (6).

Conclusion

Key recommendations emerging from this research include:

1. Establishing local social innovation departments focusing on youth, education, environment, and health;
2. Enhancing participatory governance through digital platforms for inclusive decision-making (8);
3. Promoting collaboration among municipalities, academia, and NGOs;
4. Prioritizing urban resilience themes such as climate adaptation, crisis response, green infrastructure, and social equity (7);
5. Launching awareness campaigns and incentive systems to foster a culture of social innovation.

This research provides a roadmap for policymakers and local actors aiming to build a more resilient and inclusive Eskişehir.

REFERENCES

1. Tatar BŞ. Sosyal inovasyon kavramı. Int J Acad Value Stud. 2017;3(12):321–338.

2. Topsakal Y, Yüzbaşıoğlu N. Sosyal inovasyon kavramsal model önerisi. Int J Manag Econ Bus. 2017;13(3).

3. Bureau of European Policy Advisers (BEPA). Empowering people, driving change: Social innovation in the European Union. Brussels: European Commission; 2011.

4. Moulaert F, Martinelli F, Swyngedouw E, Gonzalez S. Towards alternative model(s) of local innovation. Urban Stud. 2005;42(11):1969–90.

5. UNICEF. Unicef Up Shift Social Innovation Curriculum Introduction [Internet]. 2024 [cited 2025 Jul 20]. Available from: https://www.unicef.org

6. OECD. Urban resilience: Understanding and strengthening cities [Internet]. 2024 [cited 2025 Jul 20]. Available from: https://www.oecd.org

7. Çamuşoğlu N. Kentsel dayanıklılık nedir? Ekoyapı Dergisi [Internet]. 2024 [cited 2025 Jul 20]. Available from: https://www.ekoyapidergisi.org/kentsel-dayaniklilik-nedir

8. Stanford University. A history of Stanford [Internet]. 2021 [cited 2025 Jul 20]. Available from: https://www.stanford.edu

Psychological Bonds of Young People with the City: An Investigation of Spatial Belonging, Feelings of Loneliness and Social Connectedness Levels in Sakarya

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ABSTRACT

Today's rapidly increasing urbanization processes are making the psychological bonds individuals form with their cities more visible. Young people, in particular, view cities not only as a living space but also as a context in which fundamental psychosocial processes such as belonging, social interaction, and identity development are shaped. This study aims to examine levels of spatial belonging, loneliness, and social connectedness in the case of Sakarya.

The research was conducted with a sample of 195 young people aged 15-30 living in Sakarya. Data collection tools included the Spatial Belonging Scale, the UCLA Loneliness Scale (Short Form), the Social Connectedness Scale, and the Personal Information Form. The obtained data were analyzed using descriptive statistics such as frequency, percentage, mean, and standard deviation using SPSS.

The research contributes to understanding the components of young people's psychological bonds with their cities and to revealing the levels of spatial belonging, loneliness, and social connectedness. The results will have important implications for urban planning, youth policies, and psychosocial intervention models.

Key words: Spatial belonging, loneliness, social connectedness.

Introduction

Today's cities are dynamic living spaces where speed, change, and mobility are intensely experienced [1]. Global cities, in particular, have become places where diversity and change in workforce, capital, information, lifestyles, and value systems are most intensely felt [1]. With the development of transportation and communication opportunities, social mobility has increased; individuals can move more easily between physical spaces and have the opportunity to meet and interact with different people [2].However, this increase in density and interaction does not always translate into strengthening human ties or achieving social integration [3]. On the contrary, the urbanization process often creates an effect that increases the feeling of fragmentation, alienation, and loneliness among individuals [4].Social scientists often describe cities as "uncanny" and "chaotic" spaces due to the diversity and complexity they contain [5]. Because urban life is built on relation-

ships based on rationality and individualism, it paves the way for the emergence of attitudes and behaviors that contradict human values.

While modern cities offer individuals a variety of opportunities, they also bring risks [1]. Urban living spaces are transforming into environments fraught with uncertainty, where the boundaries between security and threat, belonging and alienation, and survival and extinction are constantly being redefined. This process of change leads to the weakening of fundamental human values such as trust, loyalty, cooperation, and solidarity. The increasing distance between individuals causes social networks to become woven with superficial and temporary relationships [4]

Technical collaborations and forced encounters, particularly observed in large cities, lead to superficial relationships defined as "pseudo-sociality" [2]. This situation leads to the erosion of moral values in cities and paves the way for increased violence. Fast-paced and individualized urban life replaces permanent values with temporary, utilitarian, and distant relationships, weakening individuals' sense of ethical and social responsibility.

Another significant consequence of urbanization is that cities struggle to maintain their historical and authentic identities [6]. Modern cities are increasingly taking on more artificial, temporary, and fictional forms. This transformation also leads to the fragmentation of social life; individuals become increasingly isolated, lonely, and alienated in the metropolis [7]. Living in the city can lead to a loss of belonging, a growing sense of emptiness, and social disconnection. The urbanization process leads to the alienation of individuals from both the city and themselves, leading to psychological, sociological, and administrative problems [4].

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In the era defined by Zygmunt Bauman as "liquid modernity," individuals are losing their ties to strong social structures (family, community, society) to which they might have felt an innate sense of belonging and are struggling to rebuild their identities in uncertainty [2]. The dissolution of fixed values of belonging and the superficialization of spatial experience deepen the sense of rootlessness and disbelieve, especially among younger generations. Research reveals that mental health problems are more prevalent in cities than in rural areas [8]. Social fragmentation, loneliness, isolation, and adaptation problems pave the way for the development of mental illnesses [9].

In this context, the psychological bonds young individuals form with the city; It is crucial to examine spatial belonging in terms of its dimensions of loneliness and social connectedness [4].

Spatial belonging describes an individual's sense of emotional attachment to a place (10). According to Scannell and Gifford's model, spatial belonging is considered in three dimensions: person, place, and process [4]. The bonds individuals establish with places often develop on the basis of social relationships, and in this context, people need continuity and community belonging [11]. However, in modern life, these bonds become superficial, and individuals consciously choose to form temporary and fragile bonds [10].

Social connectedness relates to an individual's voluntary sense of belonging to a group or society and their desire to establish social relationships. The need to belong is a fundamental factor in the formation of an individual's sense of self and in maintaining a healthy social life. Individuals with low social connectedness feel isolated and may lack confidence in social settings. This insecurity can pave the way for psychological problems such as social anxiety.

The impacts of urban transformation and modern life on individuals, especially young people, are This makes it important to understand the psychological bonds young people form with their city. While various studies

exist on this topic in Turkey, holistic studies specifically addressing the spatial belonging, loneliness, and social connectedness of young people in Sakarya are limited. However, university students and young adults are at a critical developmental stage in terms of forming close relationships and developing a social identity. This research aims to understand the psychological bonds young individuals aged 15-30 living in Sakarya form with the city through the dimensions of spatial belonging, loneliness, and social connectedness.

Research Questions
1. What are the spatial belonging levels of young people living in Sakarya?
2. What are the loneliness levels of young people living in Sakarya?
3. What are the social connectedness levels of young people living in Sakarya?
4. Do demographic variables (gender, age, education level, etc.) have an impact on these three variables?

The study was conducted with 195 young people aged 15-30 living in Sakarya. The following scales were used as data collection tools:

- Spatial Belonging Scale
- UCLA Loneliness Scale (Short Form)
- Social Connectedness Scale
- Personal Information Form.

The collected data were analyzed using descriptive statistics such as frequency, percentage, mean, and standard deviation using SPSS.

Main Results

This study aimed to understand the psychological bonds young people living in Sakarya have with the city. To this end, the demographic characteristics of the participants were examined to detail the sample structure. Gender, age, education level, length of residence in Sakarya, and district of residence were analyzed. This demographic information about the participants is shown in Table 1 and was used to support the relationships with the psychological variables in the subsequent stages of the study.

Table 1. Participant Demographic Information

Variables		Frequency	%
Gender	Female	114	58,5
	Male	81	41,5
Educational Status	High School Degree	36	18.5
	Associate Degree	59	30.3
	Bachelor's Degree	77	39.5
	Master's Degree	23	11.7
Length of Residence	0–5 years	88	45.1
	5–10 years	48	24.6
	10 years or more	59	30.3
	Serdivan	27	13.8

	Arifiye	26	13.3
	Hendek	26	13.3
District	Karasu	25	12.8
Distribution	Erenler	24	12.3
	Adapazarı	23	11.8
	Sapanca	22	11.3
	Akyazı	22	11.3

When the distribution of the 195 young individuals participating in the study by district of residence is examined, it is seen that the highest participation rate was from Serdivan (13.8%). This was followed by Arifiye, Hendek, Karasu, Erenler, Adapazarı, Sapanca, and Akyazı. This distribution indicates that young people predominantly live in districts close to the center of Sakarya or with high social opportunities.

The high participation in central districts such as Serdivan, Arifiye, and Adapazarı is due to the higher concentration of both university students and the young population in these areas. However, the significant participation from peripheral districts such as Sapanca, Akyazı, Karasu, and Hendek demonstrates that the connection young people have with urban life is not limited to central districts. This also demonstrates that the study provides a more balanced representation of the youth profile across the city.

The analysis of data from the Spatial Belonging Scale, the UCLA Loneliness Scale (Short Form), and the Social Connectedness Scale used in the study is currently ongoing. The results obtained from these scales will contribute to a more detailed understanding of the psychological bonds young people form with their cities. Once the relevant analyses are complete, the relationships between the variables will be more clearly demonstrated, and the results will be discussed in detail in the discussion section.

Conclusion

This research aims to examine the multifaceted impacts of the dynamic and complex structure of today's cities on individuals' lives. The findings demonstrate that the rapid pace of urban life, constant change, and intense interaction often lead to the weakening of human bonds, social disintegration, and individual alienation.

Indeed, previous research has also revealed the negative effects of urban life on mental health. In urban environments, where social cohesion is weakened and individuals experience loneliness and isolation, the incidence of depression, anxiety, adaptation problems, and other psychological disorders increases [12].This suggests that cities should not be evaluated solely with a focus on economic and physical development, but should also be considered living spaces that address the psychosocial needs of individuals.

The research findings emphasize that cities are not merely functional and spatial structures, but rather social organisms that play a decisive role in individuals' identity construction, emotional bonds, and psychological well-being [12]. In this context, the data presented in this study will contribute to the development of more humane, livable, and sustainable urban policies.

In this context, the following recommendations can be made for future research:
Longitudinal Studies: Longitudinal studies are needed to more comprehensively assess the psychological and social impacts of young generations' changing perceptions and experiences of belonging over time.

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Qualitative Research Approaches: Due to the quantitative nature of this study, it is difficult to fully explore the background of individuals' experiences. Future research is recommended to examine young people's connections to the city in more detail using qualitative methods such as in-depth interviews, focus group discussions, or narrative analysis.

Rural-Urban Comparisons: To more clearly assess the impact of urbanization on individuals, comparative studies conducted in rural areas with individuals of similar age groups will contribute to understanding how concepts such as spatial belonging and loneliness are affected by context.

Analyzing Local Government Policies: Applied research is needed to evaluate the impact of social spaces, transportation services, cultural events, and youth-friendly spatial planning provided by city governments on young people's psychological connections to the city.

Digital Space Experience and Social Media: Today's youth experience urban life not only in physical spaces but also through digital platforms. Therefore, research on the effects of digital communities, social media interactions, and virtual space experiences on spatial belonging, loneliness, and social connectedness will make significant contributions.

Further studies conducted in line with these recommendations will enable a more holistic approach to the impact of urbanization on individuals and contribute to the adoption of people-centered approaches in urban planning.

REFERENCES

1. Aytaç Ö. City, metropolis and changing place/space images. *Mukaddime*. 2017;8(1):1–23.
2. Hatipoğlu GŞ, Ünal S. The phenomenon of rootlessness among younger generations in the liquid modern era: Homeland belonging through the lens of lost collective ties. *Sociological Context*. 2024;5(2):208–258.
3. Yılmaz M, Akyüz N. A sociological research in the context of urbanization and belonging: The case of Ankara. *Iğdır Univ J Soc Sci*. 2023;12(32):325–340.
4. Aytaç Ö. The pathology of the city and urban life. *Journal of City and Civilization*. 2020;15(2).
5. Koyuncu, A. The City İn Sociological Theories. Journal Of Faculty Of Letters, Selçuk University. 2011; 25: 31–56.
6. Saçlı A. The Spatial Effects Of Globalization And Urban Identity. Journal Of Urban Studies. 2022; 13(3): 2108–2128.
7. Turhanoğlu FA. Socio-Spatial Organization And Urban Collective Memory In Turkey's Urbanization Process (1923–2023). Anadolu University Journal Of Social Sciences. 2024; 24(2): 629–662.
8. Şatıroğlu A. Urban sociology studies of Ayda Yörükan. *Sociology Journal*. 2014;3(29):387–402.
9. Bolat T., Bolat Ö.İ., Taştan S. The Relationship Between Perceived Social Connectedness And Post-Traumatic Growth. Dokuz Eylül University Journal Of Social Sciences Institute. 2019.; 22(1).
10. Turut H, Özgür EM. A Story Of Migration To A City: Processes, Integration And Belonging. Journal Of Geographical Sciences. 2018; 16(1): 153–180
11. Göregenli M, Karakuş P, Özgen Kösten EY, Umuroğlu İ. Examining The Level Of Neighborhood Attachment In Relation To Urban Identity. Turkish Journal Of Psychology. 2014; 29(73): 73–85.
12. Uygun M, Güner E, Kılıç S. The Role Of Urban Experiences In The Development Of City Satisfaction And Sense Of Attachment Among University Students. Journal Of Economics And Administrative Sciences, Aksaray University. 2016; 8(4): 129–152.

Perceptions of International Students Living in Sakarya Regarding the City for Learning Turkish as a Foreign Language

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ABSTRACT

This study aims to evaluate the extent to which Sakarya qualifies as an "international education city" by analyzing This study aims to evaluate the extent to which Sakarya qualifies as an "international education city" by analyzing the experiences of international students studying in Sakarya to learn Turkish as a foreign language. The main objective of the study is to determine students' perceptions of accommodation, transportation, social integration, access to public services, and overall life satisfaction, and to develop policy recommendations accordingly. The research was designed using a quantitative methodological approach, and a questionnaire was used as the data collection tool. A pool of survey questions was created, and the opinions of two experts were sought. The questions were revised based on the experts' opinions and finalized. The survey consists of 22 questions and includes multiple-choice and open-ended questions on accommodation, transportation, social life, safety, and general evaluation, in addition to participants' demographic information. The findings indicate that Sakarya is generally evaluated positively in terms of accommodation facilities, transportation convenience, and safety; however, the lack of social activities and difficulties in communicating with the local community make the adaptation process challenging for some students. These results highlight the need to develop internationalization policies in the city and the importance of enhancing university-city collaboration.

Key words: International Students, cities, city of education, young people's perception of the city

Introduction

In today's world, where globalization is accelerating, higher education institutions are directly affected by internationalization processes, and in this context, international student mobility is increasing every day. According to UNESCO (2023) data, approximately 6 million students worldwide are studying in a country other than their own. This mobility not only enables students to acquire academic knowledge but also allows them to engage in different cultural environments and gain new life experiences. Altbach and Knight (2007) state that international students make significant contributions to their personal development in this process; however, they also face various challenges in adapting to cultural, social, and economic environments (Altbach & Knight, 2007, p. 291). In this regard, the living conditions offered by the cities where international students

study directly affect both their satisfaction levels and the city's potential to become an "international education city."

In addition to providing economic contributions to host countries, international students also enrich the academic and cultural environment of universities. The OECD's (2020) Education at a Glance report emphasizes this contribution by stating, "International students not only contribute economically to host countries but also enrich the academic and cultural environment of universities" (OECD, 2020, p. 34). However, living in a different country and city presents both opportunities and challenges for students. Zhou et al. (2008) note, "Living and studying in a foreign country can be both an exciting and stressful experience for international students, often influenced by cultural differences, language barriers, and lack of social support," drawing attention to the main difficulties faced by international students (Zhou, Jindal-Snape, Topping, & Todman, 2008, p. 63). These challenges often concentrate on essential aspects of life such as housing, transportation, social life, safety, and access to public services, directly affecting students' overall life satisfaction.

The infrastructure and services provided by cities play a decisive role in the integration and satisfaction levels of international students. Anderson (2008) highlights the critical role of city living conditions in student satisfaction, stating, "The level of integration and satisfaction among international students is strongly related to the living conditions and services offered by the city where the university is located" (Anderson, 2008, p. 45). Similarly, Knight (2012) underlines the importance of cities providing inclusive and accessible environments in the internationalization process by stating, "Host cities play a critical role in internationalization of higher education by creating inclusive, accessible, and welcoming environments" (Knight, 2012, p. 23). Particularly, factors such as affordable housing, reliable transportation, and accessible public services are key to increasing international student satisfaction. Glass and Westmont (2014) stress the importance of these elements by stating, "A supportive city infrastructure that includes affordable housing, reliable transportation, and accessible public services significantly impacts the overall satisfaction of international students" (Glass & Westmont, 2014, p. 44).

This study aims to analyze the extent to which Sakarya, one of Turkey's prominent university cities, possesses the qualities of an "international education city" from the perspective of international students. With its geographical location, university infrastructure, and cultural diversity, Sakarya has the potential to be an attractive destination for international students. However, the extent to which this potential is realized depends on the experiences and perceptions of the international students living in the city. In this context, the study will quantitatively assess the experiences and perceptions of international students learning Turkish as a foreign language in Sakarya regarding city life. By examining the opportunities and challenges students face in key areas such as housing, transportation, social life, safety, and access to public services, the study aims to identify Sakarya's strengths and weaknesses in its path to becoming an international education city.

This analysis will not only evaluate Sakarya's current situation but also contribute to the development of policies aimed at enhancing the potential of cities to become international education hubs. Cities that increase international student satisfaction not only support the internationalization processes of higher education institutions but also gain a competitive advantage in the global education market. Therefore, developing an inclusive and supportive infrastructure that meets the needs of international students will provide long-term benefits for both students and the city itself.

Main Results

Quantitative Results

This section presents the results of a survey conducted with 154 international students studying in Sakarya.

The findings reveal the students' experiences and perceptions regarding various aspects of living in the city, including accommodation costs, public transportation, social facilities, communication with locals, healthcare services, internet access, and sense of belonging. These factors are discussed under the following headings:

Accommodation Costs: The perceptions of students regarding accommodation costs vary. The most common response was "neither cheap nor expensive" (31.2%, n=48). 26% of the participants (n=40) considered the costs "expensive," and 12.3% (n=19) rated them as "very expensive." In contrast, 22.7% (n=35) found the costs "reasonably priced," and 8.4% (n=13) described them as "very reasonably priced." These findings indicate that while accommodation costs pose a challenge for some students, the general perception is moderate.

Public Transportation: The majority of participants (85.1%, n=131) reported using public transportation several times a week. When evaluating the ease of use of the transportation system, 46.8% (n=72) described it as "easy," 27.9% (n=43) found it "very easy," and 27.9% (n=43) considered it "average." Only 2.6% (n=4) found transportation "difficult," and no students considered it "very difficult."Regarding fares, 48.7% (n=75) of the participants considered public transportation to be "reasonably priced," 27.3% (n=42) found it "very reasonably priced," and 20.8% (n=32) rated the fares as "neither cheap nor expensive." Only 8.4% (n=13) considered the fares "expensive." No participants found the transportation fares "very expensive." Additionally, 86.5% (n=134) of the students reported that there were student discounts available for transportation in the city.

Social Activities and Communication with Locals: Regarding the adequacy of social facilities, 39.6% (n=61) of the students considered them "somewhat sufficient," and 30.5% (n=47) found them "sufficient." 15.6% (n=24) found the social activities inadequate, while 17.5% (n=27) did not express an opinion on this matter. In terms of communication with locals, 50% (n=76) of the students found communication "somewhat easy," 30.9% (n=47) considered it "easy," and 9.2% (n=14) found it "very easy." On the other hand, 13.8% (n=21) considered communication "difficult," and 1.3% (n=2) found it "very difficult."

Healthcare Services: Regarding access to healthcare services, 30.5% (n=47) of the students found access "easy," while an equal percentage (30.5%, n=47) found it "somewhat easy." 18.2% (n=28) experienced difficulties, and 22.1% (n=34) had not used healthcare services at all.

Sense of Belonging: When it comes to their sense of belonging in Sakarya, 49.4% (n=76) of students reported feeling "somewhat a sense of belonging," and 44.2% (n=68) felt a sense of belonging. 9.7% (n=15) did not feel a connection to the city.

Internet Access: Regarding internet access, 47.4% (n=72) of students rated it as "good," 33.6% (n=51) considered it "average," and 19.1% (n=29) described it as "very good." The percentage of students who found internet access to be poor was relatively low, with 4.6% (n=7) rating it as "bad" and 1.3% (n=2) considering it "very bad."

Overall, the findings show that the experiences of international students in Sakarya are generally positive and characterized by a moderate level of satisfaction. Public transportation, with its accessibility, affordable fares, and student discounts, stands out as an important advantage. While accommodation costs are challenging for some students, the general perception of these costs is moderate. Social activities and communication with locals are mostly viewed positively or somewhat positively. Access to healthcare services and internet quality have also been rated as satisfactory, and a high sense of belonging has been observed among the students.

Qualitative Findings

Most Liked Aspects of Sakarya
According to the qualitative findings, the aspects of Sakarya that international students most appreciate include the city's tranquility, natural beauty, and recreational areas, especially Lake Sapanca. Additionally, the academic quality of Sakarya University, the campus environment, the warm and hospitable attitude of the people, the relatively affordable cost of living, and the ease of transportation are frequently mentioned. The fact that the city is far removed from the hustle and bustle of large metropolises is also highlighted as a positive feature by the students. These findings suggest that Sakarya offers an environment that is peaceful, safe, and easy to adapt to, making it an ideal place for international students.

Challenges Faced in Sakarya
The challenges faced by international students in Sakarya are concentrated in various areas. The primary issue is accommodation and finding housing. Participants pointed out the high rental prices, the constant rent increases, and the limited number of available apartments as the major difficulties. The distance of dormitories from the university and the inadequacy of public transportation options are also additional problems related to accommodation.

The second major challenge is the language and communication barrier. Students, especially when they first arrive, struggle to communicate due to the lack of English speakers and view the difficulty of learning Turkish as a factor that further complicates the process. Misunderstandings during street-level communication and the lack of foreign language support during official procedures make the adaptation process more challenging for students.

The limited transportation options are another frequently mentioned problem. The limited number of bus schedules, overcrowded buses, expensive minibus fares, and the lack of alternative transportation options make daily life difficult for students.

Lastly, access to healthcare services has been problematic for some students. Difficulties in finding the right specialists, the high cost of dental care, and certain deficiencies in the healthcare system were highlighted as issues faced by students.

These findings indicate that the living experiences of international students in Sakarya are not solely characterized by positive aspects. They face significant challenges in areas such as accommodation, language, transportation, cost of living, and social integration.

Advice for New International Students
Students who participated in the research offered various recommendations for those who will be coming to Sakarya in the future. The most frequently mentioned piece of advice is to prioritize learning Turkish. Students noted that mastering the language would ease the adaptation process and reduce communication barriers in daily life. They emphasized that language practice should be supported not only through programs like TÖMER but also through personal effort and daily interactions.

The second key recommendation is the importance of preparation and planning. Participants suggested that

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students should complete necessary paperwork, secure health insurance, research the city's characteristics, and prepare financially before arriving in Sakarya.

Students also advised newcomers to be patient and open-minded, stating that understanding cultural differences could facilitate their social adaptation. Additionally, regular attendance in classes and fulfilling academic responsibilities without delay were emphasized as important for academic success.

Moreover, some students warned about potential risks. They highlighted the need to be cautious of fraud, the high cost of living in the city, and pointed out that Sakarya may not be suitable for every student.

Overall, the students' advice focuses on language learning, financial and academic preparation, cultural adaptation, and openness to social relationships.

Conclusion

This study shows that Sakarya has many characteristics of a developing "international education city" with its strengths such as ease of transportation, affordability, safety, and accommodation options for those who will learn Turkish as a foreign language. However, there are still difficulties in areas such as providing social activities, language barriers, and access to certain services. While many students feel a sense of belonging to some extent, full integration remains limited. Making housing more affordable, expanding cultural and recreational opportunities, and improving support services will be crucial to strengthening Sakarya's role in the global education market and enhancing the satisfaction of international students.

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REFERENCES

1. Anderson, G. M. (2008). *International Education and the University: City Spaces and Student Experience*. London: Routledge.

2. Glass, C. R., & Westmont, C. M. (2014). Comparative and International Higher Education, 6, 44–47.

3. Knight, J. (2012). *Concepts, Rationales, and Interpretive Frameworks in the Internationalization of Higher Education*. In De Wit, H., & Hunter, F. (Eds.), *The European Higher Education Area*. Springer.

4. OECD. (2020). *Education at a Glance 2020: OECD Indicators*. Paris: OECD Publishing.

5. Zhou, J., Jindal-Snape, D., Topping, K., & Todman, J. (2008). Theoretical models of culture shock and adaptation in international students in higher education. *Journal of Studies in International Education*, 12(1), 63–84. https://doi.org/10.1177/1028315306295310

6. Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş., & Demirel, F. (2012). *Bilimsel araştırma yöntemleri*. Ankara: Pegem Akademi.

7. Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Thousand Oaks, CA: Sage.

8. Dörnyei, Z. (2007). *Research methods in applied linguistics: Quantitative, qualitative, and mixed methodologies*. Oxford: Oxford University Press.

9. Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education* (8th ed.). New York: McGraw-Hill.

The Right to Mobility is a Human Right: Transport for All, Lifelong Mobility

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ABSTRACT

Although the physical structures and transportation infrastructure of urban areas are accessible to most individuals, disadvantaged groups such as people with disabilities, the elderly, children, pregnant women, and women face serious access problems in these areas. This study aims to examine the physical barriers that disadvantaged individuals encounter in transportation, mobility, and access to structures in the context of sustainable urban mobility through a literature review. Sustainable urban mobility aims not only to reduce environmental impacts but also to promote an inclusive urban life that respects the independent, safe, and equal access rights of all individuals. The literature review categorises the issues under four main headings: transportation vehicles; sidewalks and pedestrian paths; educational, health, and work structures; and entertainment, recreation, and sports areas. The principles of the European Urban Charter regarding transportation and mobility emphasise that transportation should not be viewed merely as a technical service but as a fundamental condition for individuals' participation in social life. In line with this principle, solutions have been proposed for each category to strengthen disadvantaged individuals' access to urban areas and ensure their equal participation in social life. This study emphasises that accessibility is a fundamental right not only for disadvantaged individuals but for all individuals who may encounter situations such as ageing, illness or temporary mobility restrictions at any stage of life. With this understanding, a model of an inclusive city that improves quality of life is proposed. Therefore, efforts to enhance the accessibility of the physical environment should be addressed through a comprehensive approach that supports social participation, prioritises spatial accessibility, and aligns with sustainable development goals.

Key words: Sustainable Urban Mobility, Accessibility, Disadvantaged Groups, Universal Design

Introduction

Sustainable transport is defined as a system that enables the basic access needs and development of individuals and communities to be met in a safe manner that is compatible with human and ecosystem health. Sustainable development, as defined in the Brundtland Report, is 'meeting the mobility needs of both the present and the future by protecting and improving human and ecosystem health, economic development, and social justice' [1].

Sustainable transport encompasses urban mobility and urban transport. The difference between sustainable urban mobility and sustainable urban transport is that the former refers to 'action' while the latter refers to static physical infrastructure. Urban mobility refers to taking action in line with goals and needs, creating dynamism by changing locations, while urban transport refers to the overall state of the infrastructural

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system created to utilize mobility opportunities in a broader context.

Urban mobility refers to movement or transportation that takes place in urban areas. Urban mobility occurs when our journey from the moment we leave home to the moment we return home passes through at least one urban settlement [2]. Sustainable urban mobility means not only 'protecting basic human or ecological values but also 'meeting people's need to move freely, access places, and connect with others [3].

Disadvantaged individuals are unable to leave their homes, which are seen as compulsory living spaces, due to the lack of urban space regulations and facilities tailored to their needs, and they are unable to benefit from basic rights granted to them by law, such as education, health, work, leisure, rest, and sports. The aim of this study is to highlight the difficulties disadvantaged individuals face in transportation, circulation, and access to buildings in urban areas and to make recommendations regarding the necessary urban and architectural arrangements.

Disadvantaged groups face problems with transportation and mobility in urban areas. The main problem is that people with disabilities cannot access urban spaces and buildings that other user groups can access easily and without difficulty. The vast majority of disadvantaged groups express dissatisfaction with the physical environment in their living areas [4]. Although various institutions and organizations have been established to coordinate regulations in this area, disadvantaged groups have not yet been able to actively benefit from urban areas and structures to the desired extent.

European Urban Rights evaluate the right of individuals to live in a safe, healthy, and quality urban environment, along with equal access to basic services and areas such as work, movement, health, sports, and recreation, and define these elements as indispensable components of urban life [5].

The European Urban Charter Principles define how cities should be in order to ensure that every individual has the rights defined in the European Urban Rights, while also emphasizing architectural arrangements for the use of urban areas and structures by disadvantaged groups such as disabled, elderly, and child users, who are often overlooked in our cities. Within the scope of the European Urban Charter principles, the creation of barrier-free, liveable, usable, and accessible urban spaces and structures, raising awareness of disadvantaged groups, and improving the quality of urban life are targeted [6,7].

Prioritizing sustainable mobility solutions, the European Urban Charter encourages the balanced and integrated development of all modes of transport to ensure they are accessible to all segments of society. The Charter includes a total of 13 principles, with the fundamental principles related to transport and mobility grouped under four headings: (1) developing strategies to reduce private vehicle use; (2) structuring transportation systems in a multifaceted and alternative manner that enables the creation of liveable cities; (3) evaluating public streets as areas for social interaction; and (4) the necessity of continuous education and awareness-raising activities to increase social awareness.

In this study, the transportation and mobility problems of disadvantaged groups in urban areas were examined under five headings: transportation vehicles, sidewalks and pedestrian paths, education, health and work structures, and recreation, leisure, and sports areas. Solution proposals were presented for each category.

1. Problems Related to Transportation of Vehicles

• Failure to implement established standards for public transportation and private vehicles accessible to persons with disabilities
• Lack of public transportation vehicles designed or adapted for persons with disabilities
• Irregular and inconsistent transportation services
    o Uncertainty regarding bus schedules and stop locations
    o Insufficiently simple and understandable informational materials for people with intellectual

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disabilities
• Insufficient parking spaces reserved for people with disabilities and existing parking spaces being occupied by private vehicle owners

2. Issues Related to Sidewalks and Pedestrian Routes
• Sidewalks and pedestrian routes that are non-standard and variable in terms of width and height
• Sidewalks and pedestrian routes that are uneven, rough, or slippery
• Absence of ramps or failure to meet the 6% slope standard
• Uneven, rough, or slippery floor coverings
• Occupation of sidewalks and pedestrian paths by vehicles
• Irregular placement of urban furniture and other elements that obstruct access
    o Bus stops, lighting poles, mushroom-type barriers, displayed products, irregular urban furniture, etc.

3. Problems Encountered in Education, Health, and Work Buildings
• Architectural details:
    o Walls with sharp corners and surfaces that could cause injury
    o Inadequate acoustic arrangements
• Physical accessibility:
    o Inaccessible building entrances and interior passageways
    o Inadequate vertical circulation systems (elevators, ramps, etc.)
    o Disabled toilets that do not meet accessibility criteria
• Equipment and signage:
    o Signs, signage systems, door handles, electrical switches, etc., are not in the appropriate location or at the appropriate height
• Common areas
    o Cafeterias, libraries, and laboratories lack accessible design features in particular, there are no audio systems for the visually impaired

4. Problems Identified in Recreation, Rest, and Sports Areas
• Inadequate signage and information systems:
    o Signs lacking visual and auditory support
    o Information not being simple and accessible
• Physical infrastructure deficiencies:
    o Insufficient number and quality of toilets, changing rooms, and private areas
    o Lack of seating and inappropriate placement of seating in rest areas
    o Lack of sheltered structures and inadequate climate control
• In sports areas:
    o Lack of accessible exercise and sports equipment

Recommendations for transportation vehicles: Regular and continuous transportation services (consistent bus schedules and stops, written information for people with mental disabilities communicated in simple language) are practices that will facilitate access to transportation vehicles for disadvantaged individuals. In order to create safe areas for disadvantaged individuals, vehicle density and speed should be reduced in city centers, and non-motorized alternative transportation and public transportation should

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be used. Some disadvantaged individuals use specially designed vehicles. Therefore, a sufficient number of disabled parking spaces should be allocated in proportion to the existing parking areas. Transportation vehicles should have free Wi-Fi and provide the necessary visual and audio information, and the materials used for this purpose should be inspected frequently. Drivers should be required to receive training in disability awareness. Seats reserved for disabled individuals on buses should be standardized. Bus stops should be designed to be easily accessible to pedestrians, with locations that are easy to understand and visible from a certain distance. Bus stops should be covered, have seating, and have areas where wheelchair users can move independently; sidewalks should be made accessible with ramps of appropriate slope. Bus stops with transparent surfaces such as glass that are difficult to perceive should be marked with 7.5 cm wide contrasting colored warning strips on both the inner and outer surfaces at a height of 130 cm-140 cm for the first level, 90 cm-100 cm for the second level, and 10 cm-30 cm for the third level. The height of the bus stop signs from the ground should be at least 220 cm. Sufficient lighting should be provided at the bus stops.

Accessibility Regulations at Train Stations and Airports

Due to inadequate infrastructure in areas such as train stations and airports that operate 24/7, many individuals with disabilities require staff assistance in order to travel. This situation limits individuals' right to independent movement and equal access to services. Therefore, standardization of indoor accessibility must be ensured, and effective passenger assistance programmers must be implemented.

Passenger assistance services should be provided at specific times at each stop and station, with reservations made in advance; these reservations should be made by the passengers up to two hours before the journey. Assistance without a reservation should be provided when reasonably feasible.

The complexity of the decision-making process during ticket reservation and the inadequacy of alternatives, such as inaccessible ticket vending machines, create additional barriers for persons with disabilities. Therefore, ticket sales systems should be simplified, and accessible options should be increased.

For individuals who cannot stand for long periods of time, ticket queues at stations and airports should include bars to lean on; these bars should be wide enough to allow wheelchairs and prams to pass through. Informative leaflets should be distributed and placed in easily accessible locations.

Waiting areas and cafeterias should be made accessible, and special rooms with seating areas should be created for individuals with autism spectrum disorder, dementia or cerebral palsy. Rest areas should include sections suitable for guide dogs for individuals travelling with guide dogs.

Trains should provide sufficient space for wheelchair users, and these areas should be expanded to accommodate individuals with disabilities. During the ticket purchase process, systems should be developed that give priority to disabled individuals in the selection of open seats. These systems should be monitored; for example, individuals who use crutches, tripods, walkers, or guide dogs should be given priority in seat selection.

All toilets should be designed to be accessible in a way that allows independent movement; mainline train stations should allow step-free access or provide level boarding from the street to the platform (e.g., the train floor should be at the same level as the platform) [8].

Recommendations for pavements and footpaths: To ensure that people with disabilities and disadvantaged individuals can move around comfortably and without difficulty on pavements and pedestrian walkways, there must be sufficient space for movement, free space below head height (free of plants and signs that pose a hazard), a flat and non-slippery surface with contrasting colors, the presence of guidance and warning devices, and simple, understandable, visually and audibly supportive materials. The pave-

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ment and pedestrian path surface must be slip-resistant and facilitate movement. The fixtures and fittings on the surface (manhole covers, grates, etc.), trees, billboards and advertising panels, flower beds, rubbish bins and similar urban furniture should not contain any arrangements that would endanger the mobility of persons with disabilities and interrupt the continuity of access. There should be no plants or signs at head height below 220 cm on the pedestrian path that pose a hazard.

The height of the kerb separating the pedestrian pavement and the vehicle road should be no less than 3 cm and no more than 15 cm, and a ramp with a width of 90 cm and a maximum slope of 8% should be installed at an appropriate location on the pavement at pedestrian crossings. There should be no trees, billboards, flower beds, rubbish bins or similar urban furniture on the pedestrian walkway and pavement. Simple markings, directional and informative equipment that can be perceived and interpreted by people with intellectual disabilities should be used on pedestrian walkways and pavements [9,10].

Recommendations for areas used for recreation, relaxation, and sports: Public areas such as parking lots should have wide spaces, pedestrian paths, entrances, and parking lots that allow children, adults, and the elderly to enter and exit with their vehicles. Protection against adverse weather conditions should be provided, and adequate lighting should be available. Rest stops should be placed along long paths in recreational, park, and open areas. Plants and surrounding structures should not be located at eye level in a way that could cause harm, and plants should be regularly inspected to ensure they do not pose a risk to people. Structures such as rest areas, concert halls, and open-air theatres should be designed according to the needs of disadvantaged individuals. The size of seats or seating areas, accessibility to these spaces, and objects that can be used in common areas within the space (taps, barbecue areas, exercise equipment, etc.) should be arranged so that they are accessible to everyone [11]. Accessible relief maps should be placed at the entrances to the areas to support the independent movement of users. Sports areas should be designed so that all individuals, whether disabled or not, can benefit equally; their architectural and hardware features should comply with universal design principles.

Each piece of sports equipment should have signs providing information, guidance, and warnings regarding its use; these signs should be simple and understandable, especially for individuals with cognitive impairments, and should be supported by visual and auditory materials.

Recommendations for buildings used for education, health, and work: Buildings accessible to individuals with disabilities should be designed to eliminate physical barriers both indoors and outdoors. Wall and door edges should be rounded, surfaces should be smooth, and passageways should be free of sharp protrusions. Floors should be non-slip, and thresholds and mats should be at the same level as the floor. From the entrance onwards, directional signs, colored markings, Braille alphabet, and audio systems should be used; visual symbols should be used for individuals who cannot read or write. The building should be single storey if possible; multi-storey buildings should have lifts, ramps, and wheelchair lifting systems. Doors, corridors, toilets, and equipment for wheelchair users should be at accessible heights; doors should be designed to show the opposite side. The location and structure of buildings and libraries used for education should be such that they are not affected by external noise. Tables and chairs should be movable, and the heights of some furniture should be adjustable. Furniture should have rounded edges rather than sharp ones. The space between desks should be wide enough to allow for easy passage. In areas with fixed seating, there should be sufficient space for wheelchair users. Sound amplification devices should be installed in areas where large groups will be trained and gathered. Countertops, taps, work desks, and sinks should be arranged so that everyone can use them independently. Taps should be designed to be opened and closed with a lever rather than by turning [4,5,12].

In order for disadvantaged individuals to actively participate in society and urban life and enjoy equal access to fundamental rights, accessibility must be taken into account not only in housing but also in all structures such as educational, healthcare, office, and park facilities. In this context, access, guidance, emergency safety, and building design principles should be comprehensively addressed by designing and implementing standards for access to the building first, and then to spaces within the building.

Conclusion

Disadvantaged individuals should not be viewed as a separate group from society, but rather as a natural and integral part of the social structure. Cities should be designed and organized in a way that ensures equal access to fundamental rights for all individuals. Accessibility is of vital importance not only for people with disabilities, but also for anyone who may encounter situations such as ageing or temporary or permanent mobility limitations. Therefore, all urban environment elements, from transportation systems to public buildings, should be designed in accordance with accessibility principles, and inclusive solutions should be implemented in areas such as guidance, circulation, safety, and comfort. This approach is a fundamental requirement for sustainable and equitable urban living.

REFERENCES

1. Cirit F. Sürdürülebilir kentiçi ulaşım politikaları ve toplu taşıma sistemlerinin karşılaştırılması [Uzmanlık Tezi]. Ankara: İktisadi Sektörler ve Koordinasyon Genel Müdürlüğü; 2014. Yayın No: 2891. ISBN: 978-605-9041-04-1.

2. Cavar Semanjski I. Introduction to Smart Mobility. In: Smart Urban Mobility: Transport Planning in the Age of Big Data and Digital Twins. Amsterdam: Elsevier Science; 2023. p. 9-23 https://doi.org/10.1016/b978-0-12-820717-8.00009-9.

3. Amendola C, La Bella S, Joime GP, Frattale Mascioli FM, Vito P. An integrated methodology model for smart mobility system applied to sustainable tourism. Adm Sci. 2022;12(1):40. doi:10.3390/admsci12010040.

4. Koç S, Çolak K. Engelli bireylerin istihdamında erişilebilir şehirlerin kolaylaştırıcı etkisine dair bir analiz. Şura Akademi. 2024;5:11-24.

5. Tıpı Çbd. Avrupa Kentsel Şartı Ulaşım ve Dolaşım İlkeleri Kapsamında Engellilerin Kentsel Alan Ve Yapılara Erişebilirliklerinin Sorgulanması: Yozgat Örneği. Engineering Sciences. 2011;6(4):838-5.

6. Pektaş EK, Akın F. Avrupa kentsel şartları perspektifinde bir kentli hakkı olarak "Katılım Hakkı" ve Türkiye. Afyon Kocatepe Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi. 2010;12(2):23–49.

7. Erbay Y, Arapgirlioğlu K, Alataş Z. Yenilenen Avrupa Kentsel Şartı ve Belediyeler. İstanbul: Marmara Belediyeler Birliği Kültür Yayınları; 2023. Yayın No: 23. ISBN: 978-625-8164-11-4.

8. T.C. Ulaştırma ve Altyapı Bakanlığı. *Erişilebilir Ulaşım ve İletişim* [İnternet]. Ankara: Ulaştırma ve Altyapı Bakanlığı; 2019 [erişim tarihi: 29 Temmuz 2025]. Erişim adresi: https://www.uab.gov.tr

9. Koç H. Erişilebilir: Engelsiz yerleşmeler arayışında. PLANLAMA-PLANNING. 2001;2001(1-2):50–56.

10. Öznaneci M, çeviren. European Conference of Ministers of Transport (ECMT), Organisation for Economic Co-operation and Development (OECD). Herkes için ulaşılabilirliğin iyileştirilmesi: örnek uygulama rehberi. Ankara: T.C. Başbakanlık Özürlüler İdaresi Başkanlığı; 2008. 155 p. ISBN: 9789751944337.

11. Zhang X, Lu H, Holt JB. Modeling spatial accessibility to parks: a national study. Int J Health Geogr. 2011 May 9;10:31. doi:10.1186/1476-072X-10-31.

12. Özdemir NÇ. Eğitim yapılarında erişilebilirliğin incelenmesi [Yüksek Lisans Tezi]. İstanbul: İstanbul Kültür Üniversitesi; 2019.

Multiscalar Planning in Urban Energy Transformation: Renewable Energy Usage and Environmental Impact Management in Turkey

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ABSTRACT

This paper examines the environmental impacts of renewable energy use in cities and focuses on how these impacts can be managed through spatial planning. The analysis, developed through Turkey's energy policies and planning practices, explores the Karapınar SPP and İzmir WPP examples in detail and proposes solutions based on approaches such as environmental justice, cumulative impact assessment, and multi-scale planning strategies. In addition, innovative practices in countries such as Germany, China, Denmark, and the Netherlands are evaluated comparatively. As a result, in the energy transformation of cities, not only production but also environmental sustainability, social participation, and spatial integration should be targeted.

Key words: Renewable energy, urban planning, environmental impact, energy transformation, energy justice

Introduction

Renewable energy is of strategic importance in terms of increasing energy demand, combating climate change, and sustainable urbanization. In the face of the environmental impacts of fossil fuels, clean energy sources are also associated with energy security, social justice, ecological balance, and economic resilience. Cities are key actors in this transformation due to their high energy demand and planning authority.

Global agreements such as the Paris Agreement and the European Green Deal promote renewable energy strategies at the urban scale. This study examines the integration of renewable energy into spatial planning in Turkey and evaluates multi-scale strategies to mitigate environmental impacts. The case of Turkey is addressed in a comparative framework with countries such as

China, Germany, Denmark, and the Netherlands, analyzing institutional structures, planning scales, environmental assessments, and participation processes with a holistic approach.

2. ENERGY AND ENVIRONMENT RELATIONSHIP

2.1. Fossil Fuel-Based Energy Systems and Environmental Degradation
Fossil fuels significantly contribute to environmental degradation through pollution and carbon emissions, posing sustainability and geopolitical risks.

2.2. Environmental Impacts of Renewable Energy Systems
Despite being cleaner, renewable energy systems can still cause environmental issues like land use conflicts and impacts on wildlife.

2.3. Life Cycle Assessment (LCA) and Renewable Energy
LCA highlights that renewable energy technologies have substantially lower total emissions than fossil fuels across their full life cycle.

2.4. Energy and Environment Dilemma in Turkey
Turkey's energy transition faces challenges due to misalignment between planning and environmental impact processes, despite ambitious climate goals.

3. TURKEY'S ENERGY POLICIES AND PLANNING APPROACHES

Turkey's energy policies have evolved from state-led growth to liberalization, but weak coordination with spatial planning limits renewable integration and causes public opposition.

4. MULTI-SCALE SPATIAL PLANNING PRACTICES

4.1. National Scale

Although YEKA regions are designated considering national energy needs and resource potential, this process generally operates top-down and lacks coordination with local plans.

4.2. Regional Scale

While designating energy production regions, environmental thresholds, protected areas, and land-use pressures should be evaluated together. Southeastern Anatolia's hydropower, Central Anatolia's solar, and the wind potential of the Aegean and Marmara regions require specific planning approaches.

4.3. Urban and Local Scale

Municipalities can integrate solar energy systems for rooftops into plan notes and imple-

ment cooperative-type production and energy projects supported by local administrations (e.g., Seferihisar model).

5. INTERNATIONAL CASES AND SUCCESS MODELS

5.1. Germany: "Energiewende" Model

Germany socialized renewable production through energy cooperatives. As of 2023, 47% of electricity production is provided by renewable sources. Public participation has become a legal obligation in the planning system.

5.2. China: Planned Wind-Solar Zones

China aims to limit environmental impact by pre-designating mega energy zones. Pre-investment infrastructure and environmental assessment processes are integrated into national strategy.

5.3. Denmark: Neighborhood-Based Energy Systems

In Copenhagen, micro energy grids are established at the neighborhood scale, supported by smart meters and digital monitoring platforms.

6. CASE STUDY: KARAPINAR SPP AND İZMİR WPP

6.1. Karapınar Solar Power Plant (SPP)

With 1350 MW installed capacity, this project is one of the largest in Europe and was constructed on barren non-agricultural lands in Konya. Although land-use pressure was low, public participation in the planning process remained weak.

6.2. İzmir Wind Power Plants (WPP)

WPPs in districts such as Aliağa, Karaburun, and Bergama experienced conflicts with coastal tourism, agriculture, and bird migration routes. The opposition from NGOs and citizen initiatives revealed how environmental impacts and social acceptance may clash.

7. PLANNING-BASED SOLUTION PROPOSALS

7.1. Standardization of Spatial Suitability Analyses

Planning should be supported by multi-layered data such as slope, solar duration, wind data, protection statuses, and groundwater relationships.

7.2. Cumulative Impact Assessment (CIA)

EIA processes should not be limited to individual projects; the total impact of multiple projects within the same basin should be considered.

7.3. Mandatory Participatory Planning Processes

Energy investments cannot be sustainable without public approval and ownership. Therefore, participation must be legally defined at all levels.

8. POLICY AND LEGISLATION STRATEGIES

8.1. Integration of Planning and Legislation

8.2. Promotion of Energy Cooperatives

8.3. Just Transition and Energy Poverty

Main Results

This study shows that cities are not only energy production points in renewable energy investments but also environmental impact managers, social mediators, and sustainability actors. Turkey's energy transition process, despite successful infrastructures, needs improvement in terms of social acceptance, environmental sensitivity, and spatial integration. In this context:

- Energy and spatial planning integration must be ensured.
- Participatory, transparent, and scientific planning processes should be encouraged.

Conclusion

This study shows that renewable energy investments go beyond energy production, requiring management of environmental impacts, social participation, and integration of planning scales. In Turkey, the gap between energy policies and spatial planning poses risks to environmental sustainability and social acceptance. Cases like Karapınar SPP and İzmir WPP emphasize the importance of social and ecological sensitivity alongside technical feasibility. Therefore, future energy projects should adopt multi-scale planning, ensure participatory and transparent processes, conduct holistic environmental impact assessments, and strengthen local government capacity. Energy policies based on these principles will form the foundation for a sustainable and just energy transition.

REFERENCES

1. Akkaya, S. (2020). Türkiye'nin Yenilenebilir Enerji Politikaları ve Avrupa Birliği ile Uyum Süreci. Uluslararası Ekonomi ve Yenilik Dergisi, 6(2), 333–350. https://doi.org/10.20979/ueyd.763158

2. Atik, M., & Erdoğan, E. (2019). Yenilenebilir Enerji Kaynaklarının Kırsal Kalkınmadaki Rolü: Türkiye Örneği. Sosyoekonomi, 27(42), 247–262. https://doi.org/10.17233/sosyoekonomi.2019.02.13

3. Çevre, Sehircilik ve Iklim Değisikliği Bakanlığı. (2023). Türkiye Ulusal Enerji Verimliliği Eylem Planı (2024–2030). This includes building climate resilient infrastructure, protecting ecosystems, and better land use planning.

4. Daily Jus. (2025, Subat). The "Super Permit": Türkiye's Renewable Energy Agenda. This includes building climate resilient infrastructure, protecting ecosystems, and better land use planning.

5. Enerji ve Tabii Kaynaklar Bakanlığı. (2023). Enerji Verimliliği 2023 Raporu. This includes building climate resilient infrastructure, protecting ecosystems, and better land use planning.

6. International Energy Agency (IEA). (2022). Türkiye 2021 Enerji Politikaları Gözden Geçirme Raporu. https://www.iea.org/reports/turkey-2021

7. Kibaroğlu, A. (2020). Renewable energy and water–energy nexus in Turkey. Energy Policy, 138, 111233. https://doi.org/10.1016/j.enpol.2020.111233

8. Middle East Technical University. (2022). Socio-Spatial Sensitivities and Nudging Conditions: A Case Study on Wind Energy Development in Turkey [Master's thesis, METU]. This includes building climate resilient infrastructure, protecting

9. ecosystems, and better land use planning.

10. Öztürk, I., & Acaravcı, A. (2013). The long-run and causal analysis of energy, growth, openness and financial development on carbon emissions in Turkey. Energy Economics, 36, 262–267. https://doi.org/10.1016/j.eneco.2012.08.25

An Insight into the Kahramanmaraş Public Transportation System Using Statistical and Artificial Intelligence Methods

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ABSTRACT

This study investigates the transition of Kahramanmaraş's public transportation system from a fragmented mini-bus-based model to a centralized municipal bus network, emphasizing its impact on passenger satisfaction. A structured 13-item Likert-scale survey was conducted with 85 participants at key transit hubs, and the results were analyzed using both SPSS and Artificial Neural Networks (ANN). Statistical analysis revealed improvements in service frequency and comfort, while concerns remained regarding access to travel information and complaint handling. The ANN model was developed to assess the relative importance of socio-demographic and behavioral variables in shaping satisfaction. Permutation-based feature importance analysis indicated that gender, particularly female respondents, was the most influential factor, followed by private vehicle ownership and educational background. These findings reveal pronounced differences in service perception across user groups. Notably, young passengers, especially university students, played a crucial role in shaping feedback due to their high share among public transport users. The study demonstrates the value of AI-based tools for identifying complex patterns in survey data and informing user-centered transit planning. By integrating statistical and machine learning approaches, this research offers practical insights for designing more inclusive and sustainable urban mobility strategies, not only in Kahramanmaraş but also in similar mid-sized metropolitan areas.

Keywords: Kahramanmaraş, Public Transportation, SPSS, ANN, Survey Analysis

Introduction

Kahramanmaraş is a metropolitan city in southern Türkiye with a population of approximately 1.2 million. The urban center comprises the districts of Dulkadiroğlu and Onikişubat. The city's public transportation system operates a fleet of around 510 buses across 10 main routes, supported by the Kahramankart smart fare

system. The system in the city was, historically, fragmented among municipal buses, private public buses, and minibuses. This lack of coordination resulted in overlapping routes, underutilized vehicle capacity, and overall inefficiency.

To address these issues, a major transformation was initiated in 2015, by replacing minibus fleets and consolidating services into a unified public bus network. To evaluate the outcomes of this transformation, a structured survey was conducted in 2023 with 85 participants. The survey included 13 Likert-scale questions grouped under four categories: usability, system information, customer satisfaction, and comfort.

Passenger satisfaction in public transport is often influenced by key quality factors such as accessibility, punctuality, cleanliness, and seat availability (1,2). While traditional statistical approaches have long been used for analysis, recent advances in artificial intelligence (AI) particularly neural networks and deep learning methods have significantly improved prediction accuracy and interpretability in transport-related studies (3,4). These methods improve satisfaction analysis and support demographic profiling, helping to create more inclusive and responsive transportation plans (5).

This study applies AI-based models to survey data from Kahramanmaraş to identify key factors shaping public transportation satisfaction and explore the utility of AI in evaluating and improving urban mobility systems.

Main Results

The survey analysis highlights key aspects of user perceptions regarding Kahramanmaraş's updated public transport system. While overall satisfaction is moderate, certain features are clearly seen as strengths, whereas others reveal areas needing improvement. These insights help pinpoint which parts of the system are effective and which require enhancement.

The ANN model showed good predictive performance, with an average error of about one point (MAE = 1.075), indicating it effectively captured the link between socio-demographic factors and passenger satisfaction.

The study used descriptive statistics and an ANN model to identify key socio-demographic factors affecting satisfaction. Gender, especially being female was the most influential variable, followed by private vehicle ownership. Education, marital status, and employment also affected satisfaction, but less significantly.

The results show that service frequency is the most positively rated aspect of the new system, especially benefiting students and workers, while access to travel information received the lowest satisfaction. Women expressed lower satisfaction with crowding and driver behavior, emphasizing the need for gender-sensitive planning. The ANN analysis reinforced gender and car ownership as key factors shaping satisfaction. Given that most respondents were young and tech-savvy, improvements like mobile apps and real-time tracking are recommended to enhance the user experience.

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Conclusion

This study used a structured survey and ANN model to evaluate passenger satisfaction with Kahramanmaraş's updated public transport system. Results showed improved satisfaction due to better vehicles, capacity, and maintenance. However, challenges like resistance to change and economic factors persist. The ANN analysis highlighted education, gender, employment, and marital status as key influences on satisfaction. Overall, AI methods proved valuable for understanding diverse user perspectives and guiding more user-focused, data-driven, and sustainable transport policies within a broader urban mobility framework.

REFERENCES

1. Islam MR, Hadiuzzaman M, Banik R, Hasnat MM, Musabbir SR, Hossain S. Bus service quality prediction and attribute ranking: a neural network approach. Public Transp. 2016 Sept;8(2):295–313.

2. Zhao S, Ni Y, Sun S, Chang T. Passenger Satisfaction Evaluation and Achieving Sustainable Integrated Urban Transport: Structural Equation Analysis Based on Macau Data. Sustainability. 2023;15(6):5463.

3. Ruiz E, Yushimito WF, Aburto L, de la Cruz R. Predicting passenger satisfaction in public transportation using machine learning models. Transportation Research Part A: Policy and Practice. 2024; 181:103995.

4. Marra AD, Corman F. Modelling route choice in public transport with deep learning. Transportation [Internet]. 2025 Mar 10; Available from: https://doi.org/10.1007/s11116-025-10597-7

5. Zhang Y, Cheng T, Sari Aslam N. Deep learning for demographic prediction based on smart card data and household survey. In: Proceedings of the 27th Conference on GIS Research UK (GISRUK); 23–26 April 2019; Newcastle, UK. Vol. 2019.

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Exploring of Young People's Volunteering Motivation in the Context of Interaction

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ABSTRACT

This study emerged from the need for a sustainable motivation strategy in non-governmental organization (NGO) volunteering. In various fields of NGO work, the sustainability and contribution of volunteers are crucial due to differing dynamics. Focus was placed on young volunteers as it is important to have more young people in this field and for sustainability. To enhance volunteer motivation, it was first necessary to examine volunteering and volunteer motivations in detail. For this in-depth analysis, data was collected using qualitative methods by observing 2 volunteer activities and 7 interviewing volunteers. In order to make sense of the details of the volunteering process and sustainable strategies, I examined volunteering within the framework of the socio-ecological model, which considers individual processes in relation to their contexts and interactions. This is because volunteer motivation is a process shaped and influenced by various contexts. Within this framework, volunteer motivation was contextualized on four levels: individual, group, individual-group interaction, and institution & leadership interaction. The findings showed that while volunteer motivation begins with individual processes such as personal development and interest, it becomes sustainable through institutional factors such as organizational belonging, group structure, group interactions, leadership characteristics, and institutional structure. These contexts interact with and influence each other. This study should be expanded by considering volunteers' social environments, families, societal norms, and policies, and by including volunteers from various other NGOs.
Key words: <u>volunteering</u> motivation, socio-ecological model, context interaction

Introduction

Volunteering is defined as a form of planned prosocial behavior in which individuals engage in activities for the benefit of society without expecting any personal gain (Güder & ÖGSD, 2006; The Public Policy and Management Institute, & the Committee of the Regions, 2009; United Nations Volunteer, 2015). Studies on volunteer motivation have generally focused on personality traits; however, inconsistent results have been obtained (Akhtar, 2019; Tortumlu & Uzunbacak, 2021; Bulut, 2021). Volunteer motivation scales developed in the context of Turkey indicate that individuals are driven to volunteer by factors such as the desire to help, values, and social interaction (Çevik, 2015; Akiş, 2019).

This study approaches the volunteering process holistically by addressing not only initial motivation but also sustainability. The socio-ecological model was preferred to understand volunteering, as this model comprehen-

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sively evaluates the individual's interaction with multilayered environments such as family, institutions, and society (Bronfenbrenner, 1979; Bronfenbrenner, & Evans, 2000).

Within the framework of the socio-ecological model, volunteering was addressed as a process that develops from the individual level through environmental and social contexts. Therefore, this study aims to contribute to the improvement of volunteer management by thoroughly examining the relationship between volunteering and institutional structure as well as group dynamics.

Main Results

According to the observations, team dynamics significantly impact volunteers' motivation and performance. Volunteers working with close friends demonstrated higher motivation and willingness to take on tasks. Mixed-gender teams were observed to be more energetic than homogeneous ones. While individual tasks were less preferred, volunteers appeared more committed and satisfied when working alongside professional staff. Regarding team size, the most efficient working structure was found in small teams of 2–3 members; as team size increased, it became harder for volunteers to take ownership of tasks.

On the other hand, the participation of managers had a positive effect on volunteers' attitudes. When the manager attended meetings, volunteer engagement and willingness to express themselves increased, decisions were more easily adopted, and tasks became more feasible. However, close friend groups constantly validating each other hindered the emergence of new ideas and suppressed the participation of other team members. Although the inclusion of volunteers in decision-making initially had a positive impact, motivation decreased when their suggestions were not met. This revealed a significant difference between having a say in decisions and actually being effective.

In the individual interviews, the focus was on how team structuring affects volunteer motivation and performance. As a result, some sub-themes were eliminated, while others were combined. Ultimately, four main themes emerged: individual, group, individual-group interaction, and leader-system. Sub-themes included self-planning, personal development, interest, and helping at the individual level; group composition, group size, and task distribution at the group level; belonging and communication in individual-group interaction; and supportive leadership, leader's sincerity, leader's volunteer experience, professionalism, knowledge about volunteering, open-mindedness, volunteer involvement in decision-making processes, regular meetings, and feedback at the leadership-system level.

At the individual level, helping and personal development were identified as primary motivations for joining volunteering. In the individual-group interaction level, communication and a sense of belonging were seen as important. At the group level, task sharing and responsibility stood out. At the leadership and system level, systematic work, one-on-one communication, and volunteers being recognized individually were found to have a positive effect on motivation. Overall, it was concluded that the sustainability of volunteer motivation is determined by team structure and management processes.

While internal communication and a sense of belonging increase motivation, close friend groups may negatively affect other members. When leaders recognize volunteers and work within a systematic structure, sustainable motivation is supported. Feedback and the gradual inclusion of volunteers in decision-making processes were also found to be important. Volunteer motivation should be considered not only based on individual factors but also in conjunction with team and leadership dynamics. It is evident that volunteer motivation is a dynamic and multilayered structure that changes over time. While volunteering often begins due to individual reasons, its sustainability is influenced by factors such as team structure, communication, leadership, and institutional systems.

Conclusion

By addressing volunteer motivation in context, this study can serve as a guide for civil society organizations to develop strategies. It is recommended to include interviews with individuals who have quit volunteering in order to better understand the factors that reduce motivation.

As a limitation, factors such as family, social environment, and societal norms related to volunteering were not sufficiently addressed. Additionally, the influence of public perception of volunteering and state policies should also be examined. In this way, volunteer motivation can be evaluated with a more holistic and sustainable approach. Furthermore, since data were collected from volunteers of a single NGO, future studies should expand the sample to include different organizational types (foundations, federations, etc.) and NGOs working in various fields to improve the quality and validity of the research.

REFERENCES

1. Güder N, Özel Sektör Gönüllüler Derneği (ÖSGD). Guide to volunteering and volunteer management for NGOs [Internet]. Ankara: Civil Society Development Center Publications; 2006 [cited 2025 Jul 18]. Available from: https://www.stgm.org.tr/sites/default/files/2020-08/stoler-icin-gonulluluk-ve-gonullu-yonetimi-rehberi_1.pdf

2. The Public Policy and Management Institute, Committee of the Regions. Mobility of volunteers across Europe [Internet]. 2009 [cited 2025 Jul 18]. Available from: [No URL provided]

3. United Nations Volunteers (UNV). State of the world's volunteerism report: Transforming governance [Internet]. 2015 [cited 2025 Jul 18]. Available from: https://www.unv.org/sites/default/files/2015%20State%20of%20the%20World%27s%20Volunteerism%20Report%20-%20Transforming%20Governance.pdf

4. Tortumlu M, Uzunbacak HH. The impact of personality traits of young volunteers on their prosocial motivations. Pamukkale Univ J Bus Res. 2021;8(1):101–14. doi:10.47097/piar.885482

5. Bulut BA. Investigating the effect of personality traits of volunteers working in international sports organizations on their motivation for volunteering in sports [master's thesis on the Internet]. Istanbul: Istanbul Gelisim University Graduate School of Education; 2021 [cited 2025 Jul 18]. Available from: https://acikerisim.gelisim.edu.tr/xmlui/handle/11363/3094

6. Akhtar H. Predicting participation in volunteering based on personality characteristics. J Educ Health Community Psychol. 2019;8(2):32–44. doi:10.12928/jehcp.v8i2.12617

7. Çevik A, Gürsel F. Volunteer motivation inventory: Adaptation to Turkish population. Spormetre J Phys Educ Sport Sci. 2015;13(2):83–92. doi:10.1501/Sporm_0000000272

8. Akis MS. Examination of volunteer motivation sources in non-governmental organizations (NGOs) in terms of socio-demographic variables [Internet]. Marmara J Soc Res. 2019;(15) [cited 2025 Jul 18]. Available from: https://dergipark.org.tr/en/pub/marusad/issue/69134/1094839

9. Bronfenbrenner U. The ecology of human development: Experiments by nature and design [Internet]. Cambridge (MA): Harvard University Press; 1979 [cited 2025 Jul 18]. Available from: https://books.google.com.tr/books?hl=tr&lr=&id=OCmbzWka6xUC

10. Bronfenbrenner U, Evans GW. Developmental science in the 21st century: Emerging questions, theoretical models, research designs and empirical findings. Soc Dev. 2000;9(1):115–25. doi:10.1111/1467-9507.00114

Challenges to Social Inclusion for Youth Migrants in Türkiye's Secondary Cities: The Case of Sakarya

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ABSTRACT

Turkish cities have become pivotal arenas for the daily negotiations of identity, belonging, and inclusion amid heightened global migration and urbanization. Although extensive research has focused on major metropolitan centers such as Istanbul and Ankara, the lived experiences of young migrants in secondary cities remain underexplored. This study investigates how young foreigners navigate social inclusion in Sakarya, a northwestern Turkish city with a growing population of international students and migrants. These urban spaces often lack the multicultural infrastructure and policy frameworks unlike larger cities. Adopting a qualitative approach, the research employs autoethnography and digital narrative analysis to explore how youth create informal networks and digital communities to foster a sense of belonging. Drawing on the researcher's own experience and the observation of online peer spaces, the study identifies key barriers to inclusion: language limitations, institutional invisibility, cultural disconnect, social isolation, and overreliance on digital communities for belonging. The paper argues that recognizing these grassroots forms of social participation is crucial for building more inclusive and resilient urban futures. It calls for increased involvement of youth perspectives in local integration strategies, particularly in secondary cities where institutional resources are limited but social creativity thrives.

Key words: Youth Migration, Social Inclusion, Secondary Cities, Sakarya

Introduction

Scholars and policymakers have long been interested in migration, especially in Western Europe and North America, where integration is commonly defined as the process through which newcomers are assimilated into society (1,2). In Türkiye, a country characterized by both past and present waves of forced migration, this process takes place in the context of distinct social, political, and cultural factors (3). Migration is more than just a physical shift; it is a profoundly psychological shift that includes cultural displacement, identity change, and environmental adaptation (4). Migration has a variety of repercussions that influence both the migrants and the host society (5). It presents problems, especially in areas with little institutional capacity for social cohesion (7), but it also has the ability to enhance local culture and bring in key human capital (6,7). In everyday interactions, migrants are frequently subjected to social stigmatization, which erodes their sense of identity and belonging by

establishing imperceptible barriers (8,9). Youth are particularly susceptible to these obstacles since they are a group that is socially active and shapes the future. The transitional period of their lives and their vulnerability to exclusionary behaviors present significant difficulties for migrant youth in terms of social inclusion (10). In addition to affecting their own well-being, their integration or lack thereof, has long-term effects for social inclusion and advancement (11,12). For the purpose of creating effective, long-lasting inclusion policies, it is therefore essential to comprehend the lived experiences and perspectives of migrant youth.

This research focuses on Sakarya, a secondary urban city in Türkiye that has seen an increase in the number of young migrants and international students. Secondary cities in Türkiye frequently lack inclusive policy frameworks and strong multicultural infrastructures, in contrast to the country's larger cities. The purpose of this study is to investigate how difficult it is for young migrants to integrate socially in these environments. Through a qualitative approach, specifically digital narrative analysis and autoethnography, the research explores how young people negotiate community, social exclusion, and belonging in both real-world and virtual contexts. By doing this, it hopes to educate scholars, public society, and decision-makers on the changing needs of young migrants in metropolitan areas like Sakarya that have received little attention.

Main Results

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The results of the study show that migrant youth in Sakarya encounter a wide range of difficult obstacles to social inclusion. The main ones include the widespread experiences of daily prejudice and social stigma, cultural isolation, and the lack of institutional support in secondary cities. Participants frequently express feeling "in-between," as though they are not totally established in their communities of origin or fully assimilated into the host society. Nonetheless, the study also emphasizes the tenacious and adaptable tactics used by young migrants. Digital platforms become essential places for identity creation, community building, and emotional support when formal inclusion mechanisms are not available. Youth can create new networks of belonging in Türkiye while preserving international relationships using social media, messaging applications, and university-based online forums.

Furthermore, autoethnographic reflections show how everyday encounters in urban settings—like public transportation, schools, and local markets which act as both negotiating and excluding spaces. Young migrants acquire sophisticated coping mechanisms to deal with these situations, such as selective social interaction, cultural translation, and linguistic adaption. Overall, the findings imply that migrant youth actively create alternative forms of social belonging, even when institutional inclusion is still restricted in secondary cities like Sakarya. These digital and grassroots tactics must to be acknowledged as valid integration methods and used to inform local policymaking.

Conclusion

The experiences of young migrants in Sakarya provide insight into how social inclusion is changing in secondary cities, where official integration systems are frequently lacking. Instead of only pointing out the challenges these young people encounter, this study highlights how they might develop resilience through digital connectivity, cultural negotiation, and informal networks. These results show how young migrants have agency in creating their own social realities, challenging traditional notions of inclusion as a process that is institutionally regulated or driven by policy. Given the current state of migration in Türkiye, where big urban centers have received the majority of attention, this viewpoint is particularly pertinent. It is important to acknowledge secondary cities like Sakarya as important locations for both innovation and exclusion. The knowledge gathered here indicates that youth-centered, technologically-aware, and locally relevant inclusion methods are required. Ignoring the actual, everyday reality of young migrants, particularly in digital settings, puts social cohesion at danger and increases marginalization.

Future studies should examine comparison examples in various secondary cities in Türkiye or the surrounding area in order to comprehend the diversity of experiences among young migrants. Furthermore, interdisciplinary research combining policy analysis, participatory techniques, and digital ethnography might provide deeper, more useful findings. In order to create genuinely inclusive urban futures, the perspectives of young migrants must be elevated from the periphery to the forefront of academic and policy discussions.

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REFERENCES

1. Penninx R, Garcés-Mascareñas B. Integration processes and policies in Europe. Springer; 2016.

2. Yükseker D. Migration, urban poverty and integration in Turkey. In: İçduygu A, editor. Turkey's Migration Transition. Koç University Press; 2023. p. 26.

3. Erder S. Göç ve kimlik: Türkiye'nin göç tarihi üzerine notlar. Toplum ve Bilim. 2018;142:55–66.

4. Akhtar S. Immigration and Acculturation: Mourning, Adaptation, and the Next Generation. Rowman & Littlefield; 2018.

5. Gülerce H, Şahin H, Hadi A. Migration and obstacles to social cohesion: The perception of young people in Turkey. Humanitas. 2022;10(20):206–225

6. Yıldırım K. Küreselleşme ve göç. Ankara Üniversitesi SBF Dergisi. 2004;59(2):31–45.

7. Dumont JC, Liebig T. Is migration good for the economy? OECD Migration Policy Debates. 2014;1:1–4.

8. Sezgin F, Yolcu H. Türkiye'de göçmenlerin toplumsal uyumu: politikalar ve uygulamalar. Uluslararası İnsan Bilimleri Dergisi. 2016;13(1):420–32.

9. Goffman E. *Stigma*: Notes on the Management of Spoiled Identity. Simon & Schuster; 2014.

10. Erbaş Y. Göçmenlere yönelik günlük yaşamda dışlayıcı tutumlar. Göç Araştırmaları Dergisi. 2019;5(1):85–101.

11. Şener O. Toplumda gençliğin yeri ve rolü. Gençlik Araştırmaları Dergisi. 2013;1(1):9–15.

12. Yükseker D, Korkut H. Life in Migrant Neighbourhoods: Post-2010 Migration in Turkey and the Social Participation of Migrants. Istanbul: Heinrich Böll Stiftung Derneği Türkiye Temsilciliği.

Children, Youth and the City in the Focus of Cultural Sustainability

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ABSTRACT

Cultural sustainability is of great importance in terms of education policies and youth strategies as an approach that aims to transfer social, cultural and historical accumulations to future generations. This study examines the opportunities offered for children and youth in the focus of cultural sustainability. Within the scope of the research; It was aimed to evaluate various application areas such as cultural heritage education curriculum contents, artistic activities, digital cultural platforms, national and local government supported programs. The data obtained as a result of the literature review was transferred with qualitative methods. The findings show that cultural sustainability requires not only the preservation of cultural values, but also the transfer of these values to young generations in meaningful and participatory ways. In addition, it was concluded that cultural opportunities play an important role in terms of social belonging and the development of creative expression skills, and intercultural communication. The study provides guidance for politicians and educators by suggesting inclusive and innovative strategies in educational, social and digital areas to strengthen cultural sustainability.

Keywords: Cultural sustainability, child, youth, city, education

Introduction

On a global scale, social transformations have accelerated due to the impact of digitalization. The preservation of cultural values and their transmission between generations are becoming more critical than ever in such cases. The risk of weakening local cultures, especially due to dynamics such as digitalization, urbanization and globalization, has made cultural sustainability an important topic in the sustainable development agenda. Although culture is not directly included as a target within the framework of the United Nations 2030 Sustainable Development Goals (SDGs), it is seen as a fundamental factor in achieving all goals.

In this context, cultural sustainability does not only mean preserving the past; it also means reproducing cultural heritage under today's conditions and especially transferring it to children and young generations. Young generations play a critical role both as carriers of cultural diversity and as actors who will shape the society of the future. Therefore, cultural opportunities offered to children and young people are an important indicator in terms of the effectiveness of sustainable cultural policies. The effects of global digitalization and urbanization on cultural heritage in the context of sustainable development goals have been emphasized before (UNESCO, 2019).

This report examines the scope, qualities and accessibility of cultural opportunities offered with a focus on children,

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youth and the city; and evaluates how these opportunities function in terms of cultural sustainability. In addition, the roles of different institutions (education, local government, civil society, etc.) in this process and inferences are presented through application examples.

Main Findings

1. Youth sports centers, social development centers, and public education centers established by national administrative bodies and local governments greatly affect the sustainability of cultural activities. Applications such as culture-art workshops, digital cultural content, local storytelling workshops, mobile cultural tools, conferences, folk dance courses, museum visits, and youth camps contribute to the development of cultural belonging in children and young people. Some companies have also been established to bring these programs to a sustainable structure and they also contribute to the increase in intercultural communication. The role of local governments in cultural activities is similarly addressed in Göker's (2022) study. Cultural sustainability activity types have different areas of impact according to target groups.

Activity Type	Target Group	Impact Area
Culture-art workshops	12-18 years old	Creativity, participation
Digital cultural content	15-25 years old	Access to information, diversity
Local storytelling workshops	10-16 years old	Cultural transfer, belonging
Mobile cultural tools	Rural areas	Accessibility, equal opportunities

Table 1. Cultural Sustainability Activity Types and Impact Areas

2. In order for cultural heritage education and transfer not to be limited to school-based programs; activities are organized and projects are developed to increase the active participation of the family and society in the process. A comprehensive analysis on cultural sustainability education strategies was made by Erten (2021).

3. Although regional inequalities in access to cultural events and projects are striking, sustainability is ensured with the spread of digital education. While children and young people living in big cities can access more cultural events, these opportunities are quite limited in rural areas. In order to ensure cultural sustainability, digital content production should be increased, and incentives such as financing, transportation, and awards should be provided for participation in projects and events.

4. Digital cultural content (art, documentaries, local stories, etc.) is increasingly consumed among young people. Universal cultural elements are increasing in digital content, but local cultural elements need to be increased as digital content. Due to the increase in digital content, the need to eliminate regional inequalities has also been emphasized by Keleş and Bilgin (2018).

5. Projects carried out by civil society organizations in the field of cultural sustainability play an important role, especially in reaching disadvantaged groups, but the impact of these projects is usually limited to the duration of the project.

Conclusion

Ensuring cultural sustainability means not only preserving the past, but also keeping cultural diversity alive and carrying it into the future. Children and young people are of critical importance as both transmitters and transformers of this process. In this context, the diversity, inclusiveness, and sustainability of the cultural opportunities offered to them are decisive in terms of the success of cultural sustainability. Raising awareness of families, supporting them economically, and increasing incentives will be effective in ensuring cultural sustainability.

Cultural digital content should be added in order to balance cultural opportunities regionally, and portable culture-art units (mobile library, traveling theater, etc.) for rural areas should be expanded. Activities and models that include families and society in the process should be added to interdisciplinary programs that include local cultural elements integrated into

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school curricula. Local governments should institutionalize cultural activities within the framework of sustainable cultural policies by removing temporary events. Local cultural content production should be encouraged on digital platforms, and creative areas (e.g. digital storytelling workshops) should be created where young people can take part as producers in these contents. Cooperation models should be supported and successful practices and projects should be supported to increase the impact of civil society in cultural sustainability studies.

REFERENCES

1. Erten H. Educational policies in the context of cultural sustainability. Journal of Education and Society Research. 2021;8(2):115-130.

2. Göker G. The role of local governments in cultural sustainability. City and Culture Journal. 2022;10(1):33-49.

3. Keleş S, Bilgin H. Transfer of cultural values in the digitalizing world. New Media Research. 2018;2(3):45-58.

4. UNESCO. Culture 2030 indicators: UNESCO framework [Internet]. Paris: United Nations Educational, Scientific and Cultural Organization; 2019 [cited 2025 Jun 21]. Available from: https://unesdoc.unesco.org/ark:/48223/pf0000371562

Surveillance, Space, and Exclusion: A Critical Analysis of Urban Security Policies

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ABSTRACT

This study offers a critical review of the literature on urban security and crime prevention policies, based on the discourse of "safe cities for all." Existing literature often frames security through physical spatial arrangements, surveillance technologies, and the efficiency of law enforcement. However, these policies frequently overlook how they reproduce social inequalities and marginalize vulnerable groups. Security measures are predominantly concentrated in economically valuable and central urban areas, while peripheral neighborhoods—often inhabited by low-income communities, women, and other disadvantaged groups—are excluded from these protections. This spatial imbalance in the distribution of security reinforces urban inequality. Although surveillance systems are presented as neutral, they tend to prioritize protecting specific parts of the city, thereby deepening spatial and social exclusion. The literature also shows that current urban security policies are often shaped by gendered assumptions, which limit the mobility and participation of vulnerable groups in urban life. The study argues that the discourse of "safe cities for all" remains structurally incomplete in practice. It calls for a shift toward a rights-based approach to the city, emphasizing the need for inclusive and equitable security policies that center the experiences and needs of marginalized populations.

Key words: Urban Security, Right to the City, Spatial Justice, Surveillance Systems, Urban Inequality

Introduction

Contemporary cities have become heterogeneous social spaces where increasingly diverse social groups coexist based on differentiated needs. Cities are not merely collections of physical structures; they are also arenas where social relations and inequalities are materially manifested. This growing diversity necessitates comprehensive regulation in terms of social security. Historically, urban security and crime prevention policies have primarily been developed as technical solutions aimed at reducing crime rates. Interventions such as surveillance camera systems, increased police presence, enhanced lighting, and spatial design have constituted the main tools of these policies. However, such approaches often fail to adequately consider variables such as individuals' social positions, physical differences, or gender

identities. Moreover, these interventions tend to be standardized across urban populations, overlooking the fact that perceptions of safety, experienced threats, and everyday life practices differ significantly across various urban groups and neighborhoods. In particular, the security experiences of disadvantaged groups—such as women and persons with disabilities—highlight the need to question the inclusiveness of existing policies. The discourse of "safe cities for all" is strongly emphasized in many global policy documents, most notably in the United Nations Sustainable Development Goals. Yet the extent to which this discourse is reflected in urban space and whether it truly applies to everyone remains a critical question that warrants close attention.

Today, urban security policies are largely concentrated in central, economically valuable, and strategically significant areas of cities in terms of capital accumulation. In these zones, perceptions of safety are reinforced through advanced surveillance systems, increased police presence, and consistent public services. Urban space is aestheticized and reshaped to appeal to specific segments of the population. Within this framework, the subjective security perceptions, lived experiences, and needs of disadvantaged groups—such as the poor, women, and other marginalized communities—are rendered invisible. In contrast, peripheral urban areas, where these groups predominantly reside, are often excluded from security policies altogether. This reveals the fragmented and selective nature of urban security implementation, clearly indicating who is deemed worthy of protection and safe living within the city. Physically under-resourced and infrastructurally neglected, these marginalized urban peripheries have become zones where multiple threats—such as social exclusion, discrimination, and insecurity—converge. In this context, urban security is not merely a technical issue but also a deeply embedded problem of class-based, gendered, and spatial inequalities.

In the existing literature, studies on urban security predominantly focus on physical arrangements, crime statistics, and technical prevention strategies, while the everyday experiences of vulnerable groups within urban space receive limited attention. However, the concept of security is not only about eliminating physical threats or enforcing spatial regulations; it is also directly linked to individuals' ability to exist freely and equally in all areas of life. This study questions the extent to which urban security and crime prevention policies are accessible, inclusive, and equitable from the perspective of disadvantaged groups, including women, the poor, and other marginalized populations. It critically analyzes the discourse of "safe cities" by asking whose needs are prioritized and who is excluded or marginalized in current policies. Focusing particularly on the experiences of vulnerable groups, the study explores the spatial and social dimensions of urban security practices. From a right to the city perspective, it aims to demonstrate that security is not solely a matter of physical safety, but a multidimensional right intrinsically linked to social equality, accessibility, and participation. Accordingly, this approach enables a critical analysis of existing security policies and opens a discussion on the need to develop alternative frameworks that center the presence and needs of vulnerable groups in urban life.

Main Results

The literature review conducted within the scope of this study clearly reveals how urban security policies contribute to the reproduction of spatial and social inequalities. Security policies are not applied uniformly across the city; rather, they are implemented in a class-based and selective manner that prioritizes certain spaces and social groups over others. One of the most significant findings is that urban security measures are pre-

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dominantly concentrated in central areas of the city, which are economically valuable and strategic in terms of capital accumulation, while peripheral neighborhoods inhabited by the poor, marginalized, or vulnerable communities are systematically neglected (Coaffee, 2003; Low, 2006).

This pattern is not limited to the spatial distribution of security services; it also reflects how surveillance technologies and spatial regulation strategies are deployed in ways that further deepen existing inequalities. For instance, surveillance cameras, security barriers, and street lighting systems are commonly found in tourist zones, commercial districts, and upper-income neighborhoods. In contrast, informal settlements, social housing areas, and disadvantaged communities are often deprived of such infrastructure (Graham & Marvin, 2001; Koskela, 2000).

For individuals with disabilities, the accessibility of urban spaces is a fundamental condition for a safe and dignified life. However, in many cities, the inadequacy of sidewalks, the inaccessibility of public transportation, and physical barriers in public spaces significantly limit the participation of disabled individuals in urban life (Gümüş, 2015, p. 15). This situation contributes to a persistent sense of insecurity among people with disabilities. As Garland-Thomson (2002, p. 7) notes, "Disabled women face dual exclusion based on both gender and disability. This intersection generates profound insecurity in their urban experiences." Similarly, Lyon (2001, p. 56) argues that "although modern surveillance systems operate under the premise of enhancing security, they restrict the capacity of subjects to move freely within space."

In parallel, the security perceptions and needs of various vulnerable groups—such as women, the poor, and individuals with disabilities—are either rendered invisible or treated as part of a homogenized urban subject in policy documents. This indicates that, in practice, the discourse of "safe cities for all" is often transformed into an exclusionary structure that fails to account for the lived realities of specific populations (Mitchell, 2003; Smith, 1996).

These findings challenge the assumption that current urban security policies are purely technical and politically neutral. On the contrary, security practices are deeply intertwined with existing social and economic inequalities in cities. They tend to protect certain spaces and communities while neglecting—or even categorizing—others as potential threats. Therefore, it becomes evident that urban security cannot be achieved through technical solutions alone. Instead, security policies must be re-evaluated through a rights-based, inclusive, and equitable lens that centers the needs and lived experiences of vulnerable groups, including women, the poor, and other marginalized populations.

Conclusion

This study demonstrates that urban security policies cannot be limited to physical interventions alone; they must be understood in relation to deeper structural issues such as social exclusion, spatial and accessibility inequalities, and broader forms of societal vulnerability. The literature review shows that security measures are largely concentrated in central urban areas, while poor individuals, women, and other vulnerable groups residing in peripheral neighborhoods are systematically excluded from such policies. This highlights that the discourse of urban security is not inclusive but selective, and that it reinforces existing forms of social exclusion in the city.

The research contributes to the literature by emphasizing that security is not merely a technical matter but

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is inherently linked to social justice, accessibility, visibility, and the right to equal urban life. As Lefebvre (1968) argues, the "right to the city" is not only about access to urban space but also about participation in its production. This notion is closely tied to the principles of social equality, participation, and spatial justice (Lefebvre, 1968/1996).

Seemingly neutral technical solutions—such as surveillance systems and physical design—draw attention to the exclusionary, gender-blind, and class-blind nature of current security approaches and raise critical questions about how disadvantaged groups can participate more actively in urban planning. Future research may focus on how security policies can be monitored at the implementation level and how spatial regulations can evolve alongside shifting social perceptions. Ultimately, this study argues for a reconceptualization of urban security beyond narrow crime-prevention frameworks, toward an understanding grounded in social justice, spatial equality, and human rights.

REFERENCES

1. Coaffee, J. Terrorism, risk and the city: The making of a contemporary urban landscape. Newcastle: Ashgate; 2003.

2. Garland-Thomson, R. The politics of staring: Visual rhetorics of disability in popular photography. Disability Studies Quarterly. 2002; 22(2), 56–75.

3. Graham, S., & Marvin, S. *Splintering urbanism: Networked infrastructures, technological mobilities and the urban condition*. London: Routledge; 2001.

4. Gümüş, S. Kentte eşitsizlik ve engellilik: Mekânsal adalet perspektifi. Toplum ve Demokrasi. 2015; 9(21), 7–28.

5. Koskela, H. 'The gaze without eyes': Video-surveillance and the changing nature of urban space. Progress in Human Geography. 2000; *24*(2), 243–265.

6. Lefebvre, H. Writings on cities. Editor and translation E. Kofman & E. Lebas. Oxford: Blackwell, 1996. (Original work published 1968)

7. Low, S. M. The erosion of public space and the public realm: Paranoia, surveillance and privatization in New York City. City & Society. 2006; 18(1), 43–49.

8. Lyon, D. Surveillance society: Monitoring everyday life. Buckingham and Philadelphia: Open University Press; 2001.

9. Mitchell, D. The right to the city: Social justice and the fight for public space. New York: Guilford Press; 2003.

10. Smith, N. The new urban frontier: Gentrification and the revanchist city. London: Routledge; 1996.

High School Students' Urban Belonging, Cultural Awareness and Participation Tendencies in Local Government: İnegöl Case

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ABSTRACT

Understanding the emotional and social ties that young people establish with the city they live in, their level of knowledge about cultural values and their attitudes towards local decision-making processes are important for the creation of participatory and inclusive urban policies. Addressing the perceptions of young individuals towards the city from a multidimensional perspective is necessary for local governments to develop youth-centred strategies. Developing a sense of belonging to the city where young individuals live, recognising and valuing the historical and cultural heritage of that city, and the desire to be actively involved in urban decision-making processes can be shown among the multidimensional components mentioned.

This study aims to examine the interactions of young people living in İnegöl with the city within the framework of urban belonging, cultural awareness and participation tendencies in local government. The three concepts focussed on in the research, on the one hand, strengthen the identity ties that the individual establishes with the city, on the other hand, contribute to the formation of a more democratic, participatory and conscious society structure. In the research, the survey technique was used as a quantitative data collection method and the attitudes of high school students towards these three basic concepts were analysed. The findings reveal that young people's urban belonging is in a significant relationship with cultural awareness, while their desire to participate in local government is strengthened by the sense of belonging. In this context, the study offers suggestions for local governments to involve young people more in the process and contributes to understanding the relationship of youth with the city in İnegöl. The research draws attention to the role of young citizens in the perspective of future city management.

Key words: Urban Belonging, Cultural Awareness, Participation in Local Governance, Inegol

Introduction

This research aims to analyse the forms of relationship that high school students studying in İnegöl district establish with the city. The research is structured to understand young individuals' urban belonging, cultural awareness levels and their tendency to participate in local government. The main objectives of the study are

to examine the emotional and social attachment of high school students to the city they live in, their knowledge and participation levels regarding the cultural structure of the city, and their desire and attitudes towards having a say in the city administration. The importance of the study stems from the fact that young people are seen not only as future citizens, but also as active individuals who have the potential to shape today's urban life. In particular, revealing the perceptions of high school age individuals about the city and their desire to participate in local governance will contribute to the youth-oriented shaping of urban policies. In addition, this research is also noteworthy in terms of local governments and education policies in terms of providing unique data on the youth profile in İnegöl.

The theoretical basis of the research is based on three basic concepts: urban belonging, cultural awareness and participation in local government. Urban belonging refers to the emotional bond, level of social integration and tendency to take responsibility towards the city where individuals live (Tuan, 1977; Pretty, Chipuer & Bramston, 2003) and includes the individual's sense of ownership towards the city and integration with its spatial and social environment. The formation of urban belonging, especially in young individuals, is directly related to variables such as the level of social interaction, satisfaction with urban life and access to urban services (Scannell & Gifford, 2010). Urban belonging also has an important role in the construction of sustainable urban life and social integration (Manzo & Perkins, 2006).

Cultural awareness encompasses individuals' level of knowledge about the historical and cultural values, traditions, symbols, festivals and social heritage of the city they live in and the sensitivity they develop towards these values (Banks, 2001). Cultural awareness strengthens the historical and symbolic aspect of the bond that young individuals establish with the city. Information about local history and culture in educational institutions, opportunities to participate in cultural activities and contacts with the society are effective in the development of this awareness (Ünlü & Yıldız, 2016). Individuals with developed cultural awareness can become more sensitive, more participatory and more embracing individuals towards the identity of the city they live in (Dimitriadis & Kamberelis, 2006).

Participation in local governance encompasses the desire and actions of individuals to participate directly or indirectly in the decision-making processes of the city they live in (Michels, 2011). Youth participation in local government is not only a governance issue, but also an issue that needs to be addressed in terms of democratic citizenship education (Checkoway, 2011). In particular, taking the views of high school students on decision-making processes increases their sense of belonging to the city and contributes to the internalisation of democratic values (Sherrod, Flanagan & Youniss, 2002). Participation can be achieved not only through representative means such as elections, but also through volunteering, youth assemblies, community activities and feedback mechanisms.

Main Results

In this study, the perceptions and attitudes of young people studying high school in İnegöl district regarding these three basic concepts were analysed through the data collected by the questionnaire method developed by the researcher. In the study, the convenience sampling method was adopted and data were collected by using the face-to-face survey method with 429 students between January and May 2025. The results obtained are given in Table 1.

Item	Yes	No
I generally participate in social and cultural events held in İnegöl.	%25,4	%74,6
I follow current developments related to İnegöl.	%74,3	%25,7
I participate in activities organized by associations, foundations, or any other organizations in İnegöl.	%13,9	%86,1
I follow local festivals and events in İnegöl.	%38,1	%61,9
I have a good knowledge of İnegöl's history and geographical features.	%42,6	%57,4
I have seen most of İnegöl's important buildings and historical artifacts.	%82,4	%17,6
I can name most of İnegöl's symbols.	%88,1	%11,9
I would like to participate in various youth groups formed for İnegöl's future.	%87,6	%12,4
I think young people should be represented in local government.	%78,2	%21,8
I believe that the participation of young people in local governments positively affects decision-making processes.	%82,5	%17,5

While the research findings contribute to understanding the level of integration of young people with the city, they also aim to provide data that will guide the youth-oriented policy-making processes of local governments. Understanding young people's attachment to the city they live in, their interest in cultural values and their capacity to interact with local governments is considered to be a critical necessity for shaping not only today's but also the city governments of the future.

Conclusion

The findings of the research show that the bond of high school students studying in İnegöl with the city is strong in some dimensions and limited in some dimensions. 88,1% of the students stated that they could count the symbols of İnegöl and 82,4% stated that they saw most of the important buildings and historical artefacts of the city. These rates show that students have developed a visual and symbolic familiarity with the city. However, it was observed that this cognitive level of awareness was not reflected to the same extent in active cultural participation. For example, only 25.4% of the students stated that they regularly participate in social and cultural activities in İnegöl. Similarly, the rate of participation in the activities of associations, foundations or other organisations remained at a very low level of 13.9%. This situation reveals that the level of cultural awareness is based on knowledge and observation and does not turn into participation. On the other hand, the majority of the students (87.6%) stated that they would like to participate in the communities to be formed by young people

for the future of İnegöl, 82.5% believed that young people would positively affect local government decisions, and 78.2% stated that young people should be represented in local government. These data show that young people have a high tendency to participate in local governance, but this tendency has not yet found a sufficient institutional or practical response. As a result, it can be concluded that the relationship between students and the city is strong at the symbolic and intellectual level, but this relationship has not been effectively

REFERENCES

1. Banks, J. A. (2001). Cultural diversity and education: Foundations, curriculum, and teaching (4th ed.). Boston: Allyn & Bacon.
2. Checkoway, B. (2011). What is youth participation? Children and Youth Services Review, 33(2), 340–345. https://doi.org/10.1016/j.childyouth.2010.09.017
3. Dimitriadis, G., & Kamberelis, G. (2006). Theory for education. New York: Routledge.
4. Manzo, L. C., & Perkins, D. D. (2006). Finding common ground: The importance of place attachment to community participation and planning. Journal of Planning Literature, 20(4), 335–350. https://doi.org/10.1177/0885412205286160
5. Michels, A. (2011). Innovations in democratic governance: How does citizen participation contribute to a better democracy? International Review of Administrative Sciences, 77(2), 275–293. https://doi.org/10.1177/0020852311399851
6. Pretty, G. H., Chipuer, H. M., & Bramston, P. (2003). Sense of place amongst adolescents and adults in two rural Australian towns: The discriminating features of place attachment, sense of community and place dependence in relation to place identity. Journal of Environmental Psychology, 23(3), 273–287. https://doi.org/10.1016/S0272-4944(02)00079-8
7. Scannell, L., & Gifford, R. (2010). Defining place attachment: A tripartite organizing framework. Journal of Environmental Psychology, 30(1), 1–10. https://doi.org/10.1016/j.jenvp.2009.09.006
8. Sherrod, L. R., Flanagan, C. A., & Youniss, J. (2002). Dimensions of citizenship and opportunities for youth development: The what, why, when, where, and who of citizenship development. Applied Developmental Science, 6(4), 264–272. https://doi.org/10.1207/S1532480XADS0604_14
9. Tuan, Y. F. (1977). Space and place: The perspective of experience. Minneapolis: University of Minnesota Press.
10. Ünlü, A., & Yıldız, S. (2016). Kültürel miras bilincinin geliştirilmesinde sosyal bilgiler derslerinin önemi. Uluslararası Sosyal Bilgilerde Yeni Yaklaşımlar Dergisi, 1(1), 18–34.

Use of Agricultural Lands in Turkey and Product Tracking Decision Support System

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ABSTRACT

This study introduces a web-based decision support system aimed at monitoring agricultural land use and crop production trends across Turkey. The system allows users to analyze historical data from 2019 to 2023 by selecting a province and crop category (cereals, fruits, vegetables). It offers interactive visualizations through charts and geographic maps. In addition to analysis, the system also includes a prediction module developed with Python's scikit-learn library, using linear regression to forecast production quantity and cultivated area for 2024. The platform is built with PHP and open-source libraries like Leaflet.js and Chart.js, ensuring accessibility and low cost. This project, supported by TÜBİTAK 2209-A, aims to contribute to sustainable agriculture by supporting data-driven decision-making for farmers, researchers, and policymakers.

Keywords: Agriculture, Decision Support System, Crop Prediction, Data Visualization, Machine Learning

Introduction

Agricultural sustainability has become a growing concern for developing economies like Turkey, where decreasing farmland, changing climate conditions, and a shrinking farming workforce threaten national food security. With over 38 million hectares of land and diverse crop categories, Turkey presents both a challenge and an opportunity for data-driven agricultural reform. This study introduces a decision support system designed to visualize and predict agricultural production and land use at the provincial level.

The platform allows users to interactively explore historical data (2019–2023) for three major crop groups (cereals, fruits, vegetables). It provides visual analyses via Chart.js and spatial patterns through Leaflet.js maps. One of the core features of the system is the prediction module, which uses a linear regression model implemented in Python's scikit-learn to forecast production quantity and cultivated area for the upcoming year (2024).

The system, developed using PHP and MySQL, offers a scalable and low-cost solution accessible via web browsers. It enables farmers, policymakers, and researchers to monitor agricultural trends, identify regional patterns, and make data-informed decisions. Ultimately, this research contributes to digital agriculture transformation by offering a practical and accessible tool that supports sustainable rural development strategies.

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Main Results

The developed system enables users to view and compare agricultural statistics in a visual and dynamic way. For example, by selecting "Silage Maize" and the province of "Izmir," users can observe production trends and cultivated area changes from 2019 to 2023. The map interface highlights geographical differences in crop distribution, while the charts display annual variations, peaks, and declines.

Additionally, the prediction model forecasts 2024 production quantity and cultivated area using historical input features. The results show that production quantity is not solely dependent on the size of the cultivated land, but also influenced by annual yield variations and external conditions. For instance, in some years, increased production was achieved with less cultivated area, indicating efficiency gains.

Users can also access prediction error margins (e.g., Mean Absolute Error), which provide insights into the model's reliability. This functionality strengthens confidence in decision-making based on the outputs. The interface is user-friendly and suitable for various stakeholders, from researchers to local farmers.
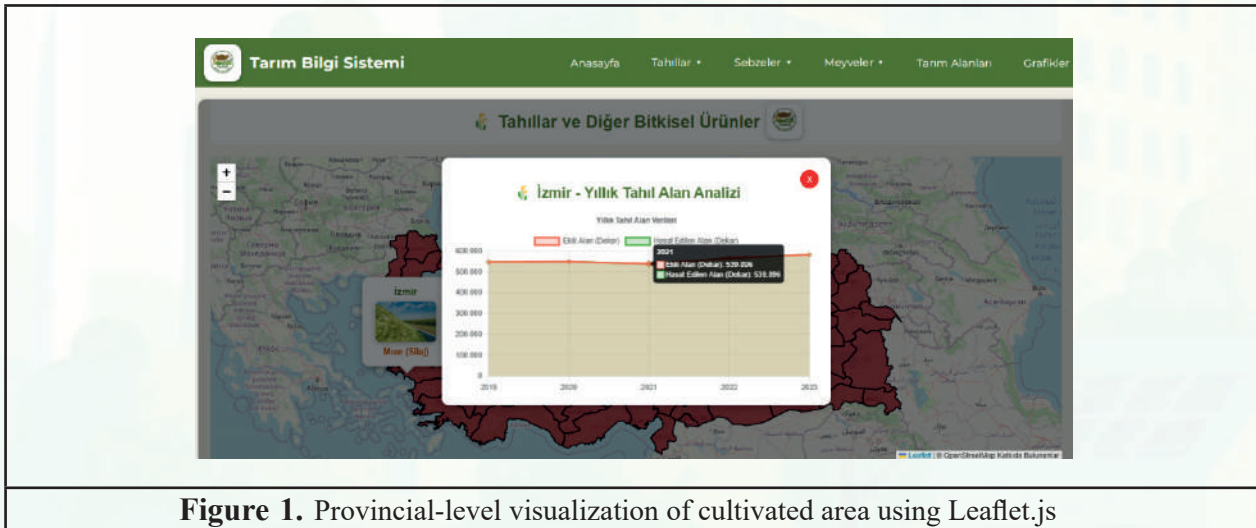
Figure 1. Provincial-level visualization of cultivated area using Leaflet.js

A table should be inserted like the one below and referred in the text. Please avoid vertical rules and shading in table cells.

Production (tons)	Cultivated Area (decare)	Predicted
3,079,394	548,252	✕
3,239,681	550,010	✕
3,198,662	539,896	✕
3,622,924	566,489	✕
3,646,781	582,120	✕
3,670, 638	597,751	✓

Table 1. Forecasted production and cultivated area for silage maize in Izmir (2024)

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As shown in Table 1, the predicted values for 2024 suggest a modest increase in both production and cultivated area…

Conclusion

This research demonstrates how digital technologies can effectively support sustainable agriculture by combining historical data analysis and predictive modeling. The developed decision support system enables stakeholders to make informed choices based on interactive maps, trend analysis, and data-driven forecasts. More than just visualizing past agricultural performance, the system provides actionable insight into future planning needs.

The implementation of open-source technologies such as Leaflet.js, Chart.js, and scikit-learn also showcases a cost-effective model that can be adapted for broader use in different regions or extended to real-time monitoring applications. Future improvements could include the integration of weather data, satellite imagery, or yield estimation via remote sensing to enhance prediction accuracy and system capabilities.

Ultimately, the project not only contributes to the digital transformation of the agricultural sector in Turkey but also offers a replicable framework for data-supported decision-making in rural development worldwide.

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REFERENCES

1. Turkish Statistical Institute (TÜİK). Agricultural Production Statistics [Internet]. Available from: https://biruni.tuik.gov.tr/medas/
2. Pedregosa F, Varoquaux G, Gramfort A, Michel V, Thirion B, Grisel O, et al. Scikit-learn: Machine Learning in Python. J Mach Learn Res. 2011;12:2825–2830.

Microplastic Contamination in Agricultural Soils: Risks, Pathways, and Sustainability Perspectives

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ABSTRACT

Microplastic (MP) contamination in terrestrial ecosystems—especially in intensively managed agricultural soils—has emerged as a growing environmental and agronomic threat. This paper synthesizes insights from recent international research to elucidate the primary sources of MPs in agricultural soils, including plastic mulches, biosolids, composts, and irrigation with treated wastewater. MPs have been shown to alter soil structure, reduce microbial and enzymatic diversity, impair root development, and act as vectors for pollutants. Furthermore, they can disrupt carbon and nitrogen cycling, contributing to greenhouse gas emissions. Climate change may exacerbate microplastic (MP) pollution in soils by altering degradation rates, mobilization patterns, and biological interactions, thereby intensifying the ecological risks posed by MPs in terrestrial ecosystems. Addressing gaps in management and research, through harmonized methodologies and sustainable land management strategies, is essential to reduce soil MP pollution and maintain agro-ecosystem resilience in line with global sustainability goals.

Key words: Microplastic, Soil pollution, Agriculture, Sustainability, Environmental risk.

Introduction

The extensive use of plastics in agriculture—such as mulching films, greenhouse covers, sludge amendments, and irrigation systems—has inadvertently contributed to increasing microplastic (MP) loads in terrestrial environments. Although marine MP pollution has been studied more intensively, emerging evidence now highlights agricultural soils as critical "sinks" for MPs. Recent studies report MP concentrations in farmland soils exceeding 40,000 particles/kg, particularly in areas where plastic mulching and sludge are common practices (Medyńska-Juraszek et al., 2023; Cai et al., 2024). This abstract critically reviews recent international studies to understand (i) the primary sources and pathways of soil MPs, (ii) the physicochemical and biological impacts on soil systems, (iii) potential threats to food safety and ecosystem integrity, and (iv) mitigation opportunities aligned with sustainability goals.

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Main Results

1. Sources and Distribution
Primary sources of MPs in agricultural soils include plastic mulch films, composts, treated wastewater irrigation, and biosolid applications (Medyńska-Juraszek et al., 2023; Chia et al., 2023). Atmospheric deposition and plastic degradation also contribute to widespread contamination (Wang et al., 2022). Fibers and fragments are the dominant forms, with PE, PP, PVC, and PET being the most commonly identified polymers (Qiu et al., 2022).
2. Impacts on Soil and Crops
MPs alter soil bulk density, aggregate stability, and water retention capacity (Gao et al., 2025; Mbachu et al., 2021). They also influence microbial community structure and suppress enzymatic activities vital for nutrient cycling (Gao et al., 2025; Qiu et al., 2022). Root development is impaired, and oxidative stress responses in plants are frequently reported (Gao et al., 2025).
3. Environmental and Climate Risks
MPs in soil may enhance greenhouse gas emissions via increased soil respiration and disrupted carbon-nitrogen cycles (Chia et al., 2023). MPs also act as vectors for persistent organic pollutants and heavy metals, further aggravating soil pollution (Wang et al., 2022; Chia et al., 2021).
4. Research Gaps and Standardization Needs
Current challenges include the absence of unified extraction and quantification protocols for soil MPs, lack of deep-soil profile monitoring, and underrepresentation of long-term field-scale studies (Wang et al., 2022; Pan et al., 2024).

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Table 1. Common polymer types and their primary agricultural sources

Polymer	Typical Agricultural Source	Dominant Form
PE	Mulch films, irrigation systems	Film, Fragment
PP	Fertilizer bags, containers	Fiber, Pellet
PVC	Irrigation pipes, covers	Fragment
PET	Textile fibers, compost additives	Fiber

Conclusion

Soil-based microplastic contamination presents a growing environmental challenge that threatens soil functionality, crop health, and overall ecosystem integrity. In agricultural contexts, the ubiquity of MPs—primarily from mulch films and organic amendments—requires immediate scientific, regulatory, and societal attention. Future efforts should focus on method harmonization, bio-based material development, and integration of MP mitigation into sustainable land management frameworks.

REFERENCES
1. Cai, L., Zhang, L., Liu, Z., Zhao, X., Han, J. (2024). The factors affecting microplastic pollution in farmland soil for different agricultural uses: A case study of China. Catena, 239, 107972.
2. Chia, R. W., Lee, J. Y., Cha, J., Çelen-Erdem, İ. (2023). A comparative study of soil microplastic pollution sources: a review. Environmental Pollutants and Bioavailability, 35(1), 2280526.
3. Chia, R. W., Lee, J. Y., Kim, H., Jang, J. (2021). Microplastic pollution in soil and groundwater: a review. Environ-

mental Chemistry Letters, 19(6), 4211-4224.

4. Chia, R. W., Lee, J. Y., Lee, M., Lee, G. S., Jeong, C. D. (2023). Role of soil microplastic pollution in climate change. Science of the Total Environment, 887, 164112.

5. Gao, S., Mu, X., Li, W., Wen, Y., Ma, Z., Liu, K., Zhang, C. (2025). Invisible threats in soil: Microplastic pollution and its effects on soil health and plant growth. Environmental Geochemistry and Health, 47(5), 158.

6. Mbachu, O., Jenkins, G., Kaparaju, P., Pratt, C. (2021). The rise of artificial soil carbon inputs: Reviewing microplastic pollution effects in the soil environment. Science of the Total Environment, 780, 146569.

7. Medyńska-Juraszek, A., Szczepańska, A. (2023). Microplastic pollution in EU farmland soils: preliminary findings from agricultural soils (southwestern Poland). Agriculture, 13(9), 1733.

8. Pan, B., Zhang, F., Zhu, X., Huang, L., Wu, Y., Tang, J. Q., & Feng, N. X. (2024). Global trends and hotspots evolution in soil microplastic pollution research: a bibliometric analysis based on the Web of Science. Ecological Indicators, 161, 111974.

9. Qiu, Y., Zhou, S., Zhang, C., Zhou, Y., Qin, W. (2022). Soil microplastic characteristics and the effects on soil properties and biota: A systematic review and meta-analysis. Environmental Pollution, 313, 120183.

10. Wang, C., Tang, J., Yu, H., Wang, Y., Li, H., Xu, S., Zhou, Q. (2022). Microplastic pollution in the soil environment: Characteristics, influencing factors, and risks. Sustainability, 14(20), 13405.

A Holistic and Preventive Environmental Management Approach to Evaluating Plastic Recycling Facilities

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ABSTRACT

Plastic recycling facilities play a significant role in reducing plastic pollution; however, if not managed holistically, they can pose serious environmental and health risks. This study evaluates key issues such as waste management, emission control, wastewater discharge, and occupational exposure risks in recycling facilities through an integrated and preventive environmental management perspective. The proposed framework emphasizes the importance of proactive risk assessments, pollution prevention strategies, and alignment with circular economy principles, highlighting transparency, sustainability, and public health protection within the recycling sector.

Key words: Plastic recycling, Environmental management, Pollution prevention, Circular economy, Risk assessment

Introduction

Plastics are widely used in various stages of modern life, including packaging, textiles, construction, automotive, electronics, medicine, and agriculture, and have become a source of persistent environmental and biological problems. The waste management hierarchy includes prevention, reuse, recycling, energy recovery, and ultimately disposal; however, for plastic waste, disposal techniques such as landfilling and environmentally unsound incineration are still commonly employed. Recent research has focused on environmentally friendly or energy-efficient alternatives such as biodegradation, pyrolysis, chemical recycling, and plastic-to-fuel technologies.

With the escalating global plastic waste crisis, there is an urgent need to develop sustainable waste management strategies (Geyer et al., 2017). Recycling has emerged as a key approach to reduce plastic pollution and conserve resources (Sambyal et al., 2025). However, studies have shown that without proper management practices, recycling facilities themselves can become sources of environmental contam-

ination (Hopewell et al., 2009, Dong et al., 2024; Merrington et al., 2024). Uncontrolled emissions, contaminated wastewater, and microplastic release during mechanical processes have raised concerns among regulatory bodies and communities (Blettler et al., 2017). This study proposes an integrated and preventive environmental management approach to assess the environmental performance of plastic recycling facilities.

Main Results

Environmental Discharge Standards for Plastic Recycling Facilities in Türkiye
The following tables represent the regulatory discharge limits that plastic recycling facilities in Türkiye must comply with, as outlined in the Regulation on Water Pollution Control (SKKY). These standards include limits on various physical, chemical, and biological parameters for wastewater discharged from solid waste recycling and disposal plants, as well as other industrial-type effluents.

Table 20.5: Sector – Other Industrial Wastewaters (Backwash Waters of Drinking Water Filters and Similar)

Parameter	Unit	Composite Sample 2-Hour	Composite Sample 24-Hour
Chemical Oxygen Demand (COD)	(mg/L)	100	70
Total Suspended Solids (TSS)	(mg/L)	150	100
pH	-	6–9	6–9

Table 20.6: Sector – Solid Waste Recycling and Disposal Facilities

Parameter	Unit	Composite Sample 2-Hour	Composite Sample 24-Hour
Chemical Oxygen Demand (COD)	(mg/L)	700	500
Total Kjeldahl Nitrogen	(mg/L)	20	15
Total Suspended Solids (TSS)	(mg/L)	200	100
Oil and Grease	(mg/L)	20	10
Total Phosphorus (P)	(mg/L)	2	1
Total Chromium	(mg/L)	2	1
Chromium (Cr^{6+})	(mg/L)	0.5	0.5
Lead (Pb)	(mg/L)	2	1
Total Cyanide (CN^-)	(mg/L)	1	0.5
Cadmium (Cd)	(mg/L)	1	0.5
Iron (Fe)	(mg/L)	10	5
Fluoride (F^-)	(mg/L)	15	10
Copper (Cu)	(mg/L)	5	3
Zinc (Zn)	(mg/L)	5	3
Fish Bioassay (ZSF)	-	2	2
pH	-	6–9	6–9

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1. Emission and Wastewater Management

Recycling operations often release volatile organic compounds (VOCs), particulate matter, and process-related contaminants. Inadequate ventilation and lack of closed-loop systems can exacerbate air quality issues. Similarly, wastewater generated from washing and separation processes may contain high levels of organic load, suspended solids, and chemical residues (Hahladakis et al., 2018). Advanced treatment systems, effluent monitoring, and reuse strategies are essential to minimize water pollution.

2. Microplastic Leakage and Residual Waste

Mechanical recycling processes such as shredding and grinding can release microplastics into the environment if containment measures are insufficient (Meng et al., 2021). Furthermore, residual fractions that are non-recyclable often end up in landfills or incineration, contributing to secondary pollution. Source separation, improved sorting technologies, and product design for recyclability are critical to reduce unrecoverable waste.

3. Occupational and Community Health Risks

Workers in recycling facilities are exposed to chemical fumes, noise, and physical hazards. Long-term exposure to such environments can result in respiratory issues, skin conditions, and ergonomic injuries. Nearby communities may also be at risk from fugitive emissions and inadequate buffer zones. A preventive management plan including occupational health surveillance and community engagement is vital.

4. Policy and Circular Economy Integration

The implementation of regulatory standards such as BAT (Best Available Techniques), EIA (Environmental Impact Assessment), and ISO 14001 can support environmental compliance. Integrating recycling operations into circular economy frameworks ensures resource efficiency and environmental justice. Eco-design, producer responsibility, and real-time environmental monitoring should be institutionalized.

Conclusion

Plastic recycling must evolve from a reactive waste diversion tool into a model of preventive environmental stewardship. A whole-system approach—incorporating pollution prevention, health and safety, regulatory compliance, and community involvement—is imperative. By aligning recycling operations with sustainability goals and circular economy principles, long-term environmental and societal benefits can be achieved.

REFERENCES

1. Geyer R, Jambeck JR, Law KL. Production, use, and fate of all plastics ever made. Sci Adv. 2017;3(7):e1700782.
2. Hahladakis JN, Velis CA, Weber R, et al. An overview of chemical additives present in plastics: Migration, release, fate and environmental impact during their use, disposal and recycling. J Hazard Mater. 2018;344:179-199.
3. Hopewell J, Dvorak R, Kosior E. Plastics recycling: challenges and opportunities. Philos Trans R Soc Lond B Biol Sci.

2009;364(1526):2115-26.

4.   Dong, L., Zhi, W., Gu, B., Li, J., Li, W., Zhang, P. (2024). Challenges and Opportunities in China's Journey in the Recycling of Plastic Wastes. ACS Sustainable Resource Management, 1(8), 1612-1615.

5.   Merrington, A. (2024). Recycling of plastics. In Applied plastics engineering handbook (pp. 191-217). William Andrew Publishing.

6.   Blettler MCM, Ulla MA, Rabuffetti AP, Garello N. Plastic pollution in freshwater ecosystems: macro-, meso-, and micro-plastic debris in a floodplain lake. Environ Monit Assess. 2017;189(11):581.

7.   SKKY (2008). Türkiye Su Kirliliği Kontrol Yönetmeliği. Su Kirliliği Kontrol Yönetmeliğinde Değişiklik Yapılmasına Dair Yönetmelik. Resmi Gazette No. 26786 (13 Şubat 2008).

8.   Hahladakis JN, Velis CA, Weber R, et al. An overview of chemical additives present in plastics: Migration, release, fate and environmental impact during their use, disposal and recycling. J Hazard Mater. 2018;344:179-199.

9.   Meng F, Flury M. Microplastics in the environment: their fate and effects. Sci Total Environ. 2021;780:146523.

BussPoint: A Conceptual IoT and AI-Enabled Smart Bus Stop System for Global Urban Mobility

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ABSTRACT

Navigating public transport in unfamiliar cities challenges newcomers such as tourists or students, especially those without smartphones or local knowledge. BussPoint is a conceptual IoT- and AI-enabled bus stop touchscreen system designed to enhance urban mobility in mid-sized cities worldwide, including Sakarya, Turkey. Touchscreens display real-time bus routes, multi-stage transfer plans, and payment options—such as smart card top-ups, bank card transactions, and QR-code tickets. Users can input individual or group "waiting" requests, which are verified by AI cameras tracking total passenger counts. A gamified incentive system awards free passes based on points earned through user interaction, fostering greater engagement. This inclusive design aims to empower users globally and can be adapted to systems like Sakarya's Kart54, promoting smart, youth-driven mobility.

Keywords: IoT, AI, smart cities, urban mobility, big data

Introduction

Public transport inefficiencies - such as unclear schedules, long waiting times, and limited real-time information - disproportionately affect both residents and visitors in mid-sized cities around the world. In places like Sakarya, Turkey, individuals arriving from abroad or neighboring regions, tourists and students for example, as well as some local residents, often struggle to navigate the system, particularly without access to local tools like the Sakarya Ulaşım mobile app.

This study introduces BussPoint, a conceptual IoT- and AI-enabled touchscreen system intended to improve the inclusivity and functionality of bus stops in urban areas. The system is designed to display real-time bus route information, accommodate multi-passenger waiting inputs, and utilize AI-powered cameras to estimate crowd sizes. It also envisions multi-stage journey planning and compatibility with diverse payment options, including QR-code tickets and smart cards such as Sakarya's Kart54.

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Additionally, a youth-oriented web portal featuring gamified incentives is proposed to boost engagement and interaction. By integrating these elements, BussPoint outlines a forward-looking approach to public mobility - positioning Sakarya as a representative model for broader global adaptation.

Main Results

The proposed BussPoint system envisions bus stops equipped with touchscreen panels, offering a user-friendly interface that could be adapted to various urban transport networks, such as Sakarya Ulaşım in Sakarya, Turkey. These screens are expected to display an interactive map showing real-time bus routes and stops, enabling users to search for buses and plan journeys that involve multiple stages - such as connections across university districts or different parts of a city, as seen in Lisbon or Sakarya.

Passengers would be able to submit "waiting" requests for individual or group travel (more than one) by selecting a simple on-screen option. These inputs could be verified using AI-powered cameras with motion detection capabilities, which will help estimate passenger numbers by monitoring boarding and departure activities. In addition, IoT components (potentially based on affordable platforms like Raspberry Pi and connected via Wi-Fi or 4G) transmit data to a cloud-based server. This information might then be used by an algorithm to suggest more efficient scheduling, for example by recommending additional buses during peak hours in busy regions such as Ankara or Sakarya.

The system is also expected to support a variety of payment methods. These may include smart card top-ups, bank card payments, cash, and QR-code-based ticketing. In the latter case, users would scan a QR code, pay online, and receive a digital single or multi-use QR ticket that becomes invalid after boarding. This approach is inspired by systems already in use in several European countries.

To promote active participation, particularly among younger users, a dedicated web portal could be introduced. This platform might allow users to suggest schedule improvements or provide feedback, with a gamified points system offering rewards such as free passes - one pass per three valid contributions, for instance. Unlike mobile-only solutions, the physical touchscreen interface would also ensure access for individuals without smartphones, supporting a more inclusive user experience. **Figure 1.**

In a city like Sakarya, BussPoint may have the potential to integrate with existing infrastructure such as the Kart54 card system. If implemented, this concept could enhance public transport accessibility for students, tourists, and other groups, while also helping to reduce waiting times and improve overall efficiency.

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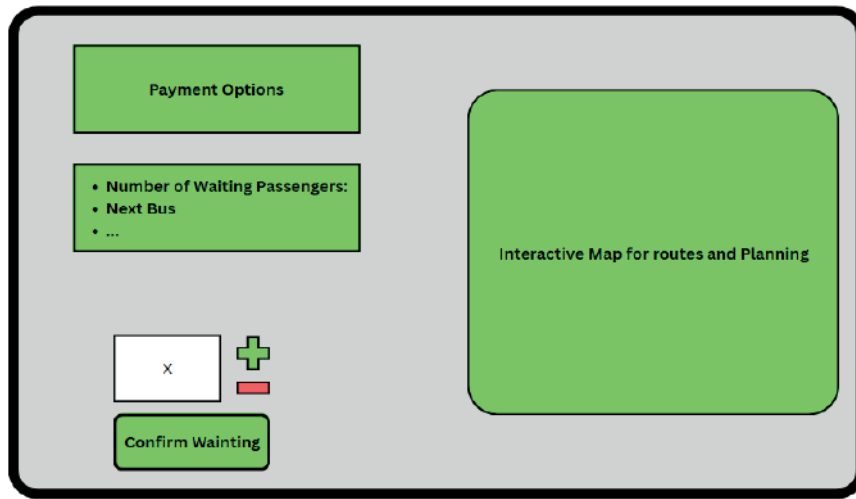
Figure 1. Example UI

Conclusion

BussPoint offers a flexible and inclusive concept for improving how people move through cities, especially those unfamiliar with local transport systems. By combining touchscreen access, real-time data, and group-based input with AI and IoT technologies, it aims to make public transport more approachable for everyone, from students and tourists in Sakarya to residents in cities like Ankara or Lisbon.

Rather than relying solely on smartphones, BussPoint provides a shared, on-site experience that could better serve a wider range of users. Its youth-focused web portal, with gamified incentives, adds a layer of civic engagement that is often missing in traditional transit systems. While still at the conceptual stage, the model points toward a future where smart technologies help shape more responsive and user-friendly urban mobility. Further exploration, particularly around predictive scheduling and real-world trials, help unlock its full potential.

REFERENCES

1. Elassy M, Al-Hattab M, Takruri M, Badawi S. Intelligent transportation systems for sustainable smart cities. Sci Direct. 2024;1(1):12-28.
2. Chen L, Wang Y. IoT in Smart Urban Mobility. J Smart Cities. 2024;7(2):33-50.
3. Kim S. AI for Urban Transport Optimization. Proc Int Conf Smart Cities; 2023 Jun 20; Ankara, Turkey. Ankara: Tech Press; 2023. p. 88-95.

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Youth-Led Social Innovation and Urban Resilience in Conflict-Affected Peripheries: Case Reflections from the Chenab Valley and Delhi's Informal Settlements

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ABSTRACT

This paper examines how youth in conflict-affected and marginalized urban spaces—such as the Chenab Valley of Indian administered Jammu & Kashmir and the informal settlements of Delhi—play a crucial but underrecognized role in building resilient urban futures. Through field research, participatory community profiling, and NGO-interventions in both rural-urban fringe zones and inner-city slums, the study investigates youth-led responses to urban challenges, including poor health infrastructure, environmental degradation, unsafe public spaces, and limited civic representation. Drawing from a blend of ethnographic fieldwork and programmatic data from ChildFund India and independent mapping of Sanjay Colony in New Delhi, and villages of Doda district, the paper proposes a framework of 'resilient citizenship' where youth are not just beneficiaries but agents of systemic change. This framework is positioned within the broader global debates on urban resilience, digital governance, and participatory democracy. The findings challenge metropolitan-centric urban discourse and call for new policy imaginaries that integrate youth into localized, adaptive governance systems—particularly in zones of protracted neglect.

Keywords: Urban Resilience, Youth Innovation, Chenab Valley, Informal Settlements, Participatory Governance

1. Introduction

Urban resilience has become a focal concept in 21st-century city planning, yet it often fails to include the agency of youth in regions marred by systemic fragility. Cities on the periphery—those shaped by both geographic marginality and political conflict—offer distinct insights into how resilience is practiced from below. This study brings together two such sites: the conflict-affected Chenab Valley in northern India and Sanjay Colony, a resettled urban slum in Delhi. Both regions highlight the interlinkages between exclusion, precarity, and innovation.

2. **Methods**

The research employs mixed methods:
I.   Community Profiling and Participatory Rural Appraisal (PRA) techniques in both Sanjay Colony and villages in Doda District (Chenab Valley).
II. Field data collected through partnerships with ChildFund India and local civil society actors.
III. Informal interviews, stakeholder engagement with teachers, Anganwadi workers, doctors, and youth activists.
IV. Supplemented by secondary data from municipal records and open-source climate vulnerability indexes.

3. **Findings**

1.1 Sanjay Colony: Resilience Amidst Urban Neglect

In Sanjay Colony, a compact, high-density informal settlement, key resilience challenges include:

I.   Water insecurity, poor health services and unhygienic waste management.
II. High prevalence of anemia among young women (based on field screening).Youth mobilization led to successful campaigns on millet awareness (200+ homes reached) and peer-led workshops on Anemia and reproductive health (49 women attended).
III. Door-to-door data collection for community mapping helped identify several uncredentialed healthcare providers and supported collaboration with some local clinics and NGOs like Dipalaya and ChildFund India.

3.2 Chenab Valley: Navigating Dual Marginalities

I.   Persistent governance gaps in the Chenab region intersect with environmental vulnerability (landslides, cloud bursts, high seismic activity, climate change events leading to glaciel melt and water scarcity).
II. Young people have begun digital mobilization via informal collectives and campaigns demanding greater political attention, safer roads, better schools, and healthcare centers.
III. Despite limited institutional support, youth-run organizations like Ababeel Foundation and Furqan trust have come up as alternative platforms for civic expression and trauma-informed social work.

4. Discussion

These youth-led initiatives demonstrate that resilience is not merely infrastructural but deeply social and participatory. The state often views these communities through a lens of dependency or risk; however, the empirical cases illustrate their proactive role in knowledge co-production, local problem-solving, and micro-level governance. Urban resilience cannot be a top-down affair. Policy frameworks should shift from "managing vulnerability" to "nurturing agency," especially in areas recovering from conflict or living under the shadow of informality.

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5. Conclusion and Recommendations

Youth across informal and conflict-affected geographies are not passive subjects but dynamic stakeholders in reimagining urban life. These youth-led initiatives demonstrate that resilience is not merely infrastructural but deeply social and participatory. The state often views these communities through a lens of dependency or risk; however, the empirical cases illustrate their proactive role in knowledge co-production, local problem-solving, and micro-level governance. Policy frameworks should shift from "managing vulnerability" to "nurturing agency," especially in areas recovering from conflict or living under the shadow of informality. Governments, especially at the municipal and regional levels, must:

I.   Institutionalize youth advisory councils for planning.
II. Support peer education models in public health.
III. Fund community mapping and digital storytelling initiatives to amplify hyperlocal urban knowledge.

REFERENCES:

1. Arup International. Cities and Resilience in Conflict Zones. 2020.
2. UN-Habitat. Youth 2030: Working With and For Young People. Nairobi: 2022.
3. ChildFund India. Health & Education Program Report: Sanjay Colony. New Delhi, 2023.
4. Satterthwaite D. The Role of Local Actors in Urban Resilience. Environment & Urbanization. 2017;29(1):43-59.
5. Bhagat R. Urban Challenges in India's Peripheries. IIHS, 2021.
6. Meerow S, Newell JP, Stults M. Defining urban resilience: A review. Landscape and Urban Planning. 2016;147:38–49.
7. Srinivasan S. Reclaiming public health for India's urban poor: Reflections from field interventions. Indian Journal of Public Health. 2019;63(2):132–6.
8. Zargar AM. Fieldwork report on Sanjay Colony: Community profiling and intervention analysis. Unpublished report. Department of Social Work, Jamia Millia Islamia; 2023.

The Mood of Space: The Impact of Architectural Design on Human Psychology and Quality of Life

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ABSTRACT

This paper aims to explore, in a multidimensional manner, how architectural and public design decisions in urban spaces affect individual psychology, social participation, and quality of life. Analyses based on different population groups—women, the elderly, the youth, and the general population—highlight that well-designed spaces have long-term positive effects not only on individuals but also on society as a whole. Considering impacts such as mental well-being, economic savings, social integration, and reduced burden on the healthcare system, the societal responsibility of architecture is discussed.

Key words: Architectural Design, Urban Spaces, Quality of Life, Public Landscape, Urban Sociology

INTRODUCTION

Architectural design is not limited to the creation of physical structures; it is a planning discipline that can profoundly affect human behavior, emotional states, social relationships, and even national economies. In urban life, spaces play a determining role in areas ranging from identity development to social belonging. This study examines the individual and societal impacts of architectural decisions across various age and social groups, emphasizing the indirect yet decisive power of design choices.

METHOD

This study employs a qualitative research methodology, combining descriptive analysis, literature review, and sociological observation supported by statistical data. Data sources include institutions such as TÜİK (Turkish Statistical Institute), WHO, OECD, and the Ministry of Health of the Republic of Türkiye, as well as academic literature.

FINDINGS AND EXAMPLES

1. Public Landscape and Societal Well-Being
Public areas enriched with shaded walking paths, sports equipment, bike lanes, and playgrounds serve to protect individuals' physical and mental health. According to the Ministry of Health (2023), obesity rates are 15% lower in neighborhoods with such facilities. These areas also strengthen family bonds and foster social soli-

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darity by bringing together diverse segments of society.

2. Spatial Comfort and Social Connection for the Elderly

For elderly individuals living on fixed incomes, access to energy-efficient and water-saving housing reduces economic burdens. Moreover, spatial features such as walking paths, seating areas, and shaded spots in parks help prevent social isolation. According to WHO (2022), depression rates among elderly individuals in age-friendly cities are 30% lower.

3. Urban Socialization Among Youth

University students residing in areas near campuses that are integrated with social life show improvements in academic success, social integration, and psychological resilience. According to OECD (2021), students with access to social spaces achieve 17% higher academic success. Poorly planned campus surroundings lacking social support can trigger loneliness and addictive behaviors.

4. Accessibility and Quality of Life for Women

Living spaces designed for women that incorporate safety, accessibility, and childcare support have significantly increased employment rates. According to TÜİK (2022), women's participation in the workforce rose by 22% when they had access to childcare services. Additionally, adequate lighting, social amenities, and pedestrian-oriented designs in public spaces ease women's active participation in daily life.

DISCUSSION

The socio-psychological effects of architecture and urban planning decisions are often overlooked in long-term planning. However, these decisions can shape an individual's mental state, health, and social relationships. Designing public spaces to be inclusive, accessible, and participatory is a requirement of social justice. The ability of vulnerable groups—such as women, the elderly, and youth—to actively participate in daily life is directly linked to spatial sensitivity. In your opinion, based on which criteria and with what central objectives are newly designed areas in our country being developed?

CONCLUSION

Architectural design shapes not only the physical but also the mental and social world of individuals.
Public landscapes and building designs must offer livability for various segments of society.
Designs developed with this sensitivity contribute to both public health and economic policies in the long term.

REFERENCES

1   TÜİK (2022), "Profile of Working Women"
2.   OECD (2021), "Student Well-Being and Local Environment"
3.   WHO (2022), "Age-Friendly Cities and Communities"
4.   Ministry of Health of the Republic of Türkiye (2023), "Türkiye Nutrition and Health Survey"

Autism-Friendly Urban Innovation: Enhancing Social Resilience for Neurodiverse Youth in Sakarya

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ABSTRACT

This study presents a model of urban resilience strengthened by social innovation, aiming to promote fair and inclusive participation of individuals with autism in urban life in Sakarya. Key barriers such as sensitivity to sensory stimuli, lack of guidance, unprepared personnel, and spatial discrimination were identified. Based on the diagnostic criteria of DSM-5, WHO (2023) guidelines, and global case studies, this approach proposes solutions involving sensory-friendly areas, icon-based guidance, trained public personnel, and participatory governance. The model is fully aligned with SDG 10 and SDG 11, aiming to establish not only an accessible but also participatory urban vision in Sakarya.

Key words: Autism Spectrum Disorder, Urban Innovation, Social Resilience, SDG 11, Sakarya

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Introduction

Individuals with autism face many challenges in urban life, including sensory overload, social exclusion, and spatial complexity. In Turkey, planning processes are largely designed for neurotypical individuals, rendering cities inaccessible for the neurodiverse. In this context, our study proposes a resilience model supported by social innovation, aiming for the equal participation of autistic individuals in city life.

Main Results

The study defines four primary intervention areas based on DSM-5, WHO 2023 reports, and local situation analyses. These intervention areas, informed by field observations, literature reviews, and intercultural examples, are compatible with both local and global strategies.

1. Sensory-Friendly Spaces:

- Proposals include quiet corridors in city parks, transport stops, and school areas with noise levels below 60 dB and lighting below 500 lux. Similar implementations in cities like Sheffield and Amsterdam have improved emotional regulation in autistic children (Evans et al., 2021).

2. Mobile Access and Rural Support:

- Due to the scarcity of special education centers in rural districts of Sakarya, mobile support teams and digital consultancy platforms (e.g., Project ECHO) are recommended. These systems provide support without requiring travel to central facilities.

3. Public Education and ASD Certification:

- Only 20% of municipal personnel in Turkey have received autism-related training. Therefore, autism awareness programs and 'Autism-Friendly Institution Certification' should be developed. This will enhance service quality and reduce discrimination.

4. Participatory Governance:

- Advisory councils where autistic individuals and their families play active roles should be established within Sakarya Municipality. These mechanisms enhance societal empathy and generate user-centered solutions.

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Table 1. Urban Intervention Areas and Application Examples

Intervention Area	Description
Sensory-Friendly Spaces	Quiet parks, icon-based signage, low-light and low-noise environments
Mobile Access & Rural Support	Mobile teams in rural districts, online consultancy systems
Public Education & ASD Cert.	Autism awareness trainings and certification for municipalities
Participatory Governance	Planning councils with family involvement, empathy-centered training

Statistical Information On Autism In Sakarya And Worldwide
- Autism prevalence worldwide and in Turkey is estimated at 1 in 59 children (2014).
- Global prevalence (age-standardized): 788 per 100,000
- Estimated global population with ASD: ~61.8 million
- Male prevalence: 1,065 per 100,000 | Female: 508 per 100,000 | Male/Female ratio: ~4.3:1

Prevalence By Age:
 0–4 years: 169 | 0–19 years: 163 | 20+ years: 137 per 100,000

Regional Breakdown:
High-income Asia-Pacific (e.g., Japan, South Korea): ~1,559–1,560
General high-income countries (US, Canada, EU): ~1,090
Middle-income Europe & Central Asia (incl. Turkey): ~826
Latin America & Caribbean: ~743 | Southeast & East Asia: ~669
Tropical Latin America & Bangladesh: ~500–600 (lowest)

Sakarya Special Education and Rehabilitation Centers

There are approximately 120 special education and rehabilitation centers in Sakarya, which is numerically adequate compared to other mid-sized cities in Turkey. However, from a perspective of social innovation and urban resilience, not only quantity but also quality, accessibility, inclusive design, and municipal integration are essential.

Autistic individuals need not only educational interventions but also sensory-sensitive environments, community-based participation, and family support mechanisms. The literature emphasizes user involvement in service design processes (Mulgan, 2006; WHO, 2023). Many centers in Sakarya focus on individual therapy but lack multi-stakeholder projects, integrated support services, and resilient spatial access systems. Moreover, service access inequality is observed, with central districts like Adapazarı and Serdivan having more facilities than rural districts like Geyve or Kocaali.

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Recommendations:
- Design of sensory-friendly centers
- Mobile support teams
- Accessibility programs for rural districts
- Family-centered resilience projects

Special Educatıon Centers In Sakarya
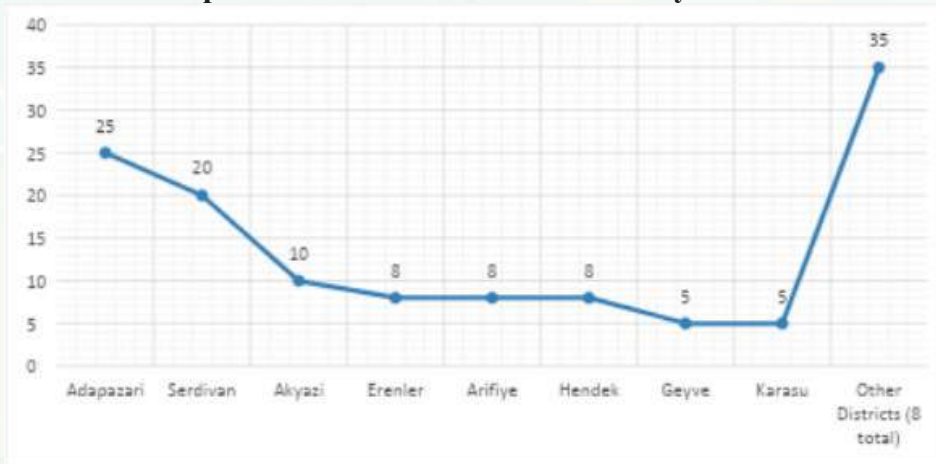
Figure 1. Estimated Special Education and Rehabilitation Centers in Sakarya Districts (2025)

Conclusion

Urban innovation requires not just infrastructure, but ideas, design, and social collaboration. This model developed in Sakarya aims to make individuals with sensory sensitivities visible, safe, and active in urban life. A city built not for, but with autistic individuals is the cornerstone of social resilience.

Acknowledgment:

REFERENCES

1. WHO. Autism spectrum disorders. World Health Organization. 2023.
2. American Psychiatric Association. DSM-5®. 2013.
3. Mostafa M. Architecture for autism. Archnet-IJAR. 2008;2(1):189–211.
4. Kinnealey M et al. AJOT. 2011;65(5):519–25.
5. Bayhan P et al. Anadolu J Clin Investigation. 2020;4(2):103–12.
6. Evans B et al. Social & Cultural Geography. 2021;22(5):687–705.
7. GBD 2021 – The Lancet Psychiatry, 2023
8. WHO Fact Sheet, April 7, 2023
9. CDC, ADDM Network Reports, 2021–2023
10. PubMed/NCBI Meta-Analyses (e.g., Baxter et al., 2015; Zeidan et al., 2022)

Child Friendly Public Spaces: An Evaluation on Istanbul Pendik Orhangazi Neighborhood

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ABSTRACT

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This study examines issues of spatial justice, safety, diversity, accessibility and belonging through children's access to and relations with urban public spaces. The research, conducted in the Orhangazi Neighborhood in Pendik district of Istanbul, aims to understand how children perceive, use and access local public spaces. Through site observation, spatial mapping and interviews with children and caregivers, the study found that the safety of playgrounds, inadequate diversity of public spaces and children's sense of belonging to these spaces are low. The study draws attention to the need for a child-centered and inclusive urban design approach and offers recommendations for the creation of safe, accessible and resilient urban public spaces for children.

Key words: child-friendly cities, public space, spatial justice, accessibility, urban safety

Introduction

Public spaces are not only physical spaces, but also social spaces where social interaction, belonging and daily life practices take place. Although children are among the most active users of these spaces, they often remain "invisible users" in urban planning and design processes. Considering Henri Lefebvre's concept of "right to the city", the fact that children's experiences and expectations regarding the city are not reflected in spatial decision-making processes points to a fundamental lack of participation. In this context, child-friendly public spaces should not only offer safe physical environments; they should also be social environments open to social interaction, where children can play, express themselves and develop a sense of belonging.

In Turkey, rapid urbanization and construction pressure, especially in metropolitan areas, severely limit children's access to safe and quality open spaces. This situation becomes more visible especially in neighborhoods

located on the peripheries of the city where disadvantaged groups are concentrated. Orhangazi Neighborhood in the Pendik district of Istanbul offers a striking example in this sense. The use of public space by children in this neighborhood, which has been affected by urban transformation processes and where social diversity is high, is worth examining in terms of spatial justice, social inclusion and local governance.

In this study, children's access to public spaces, the way these spaces are used and children's perceptions of these spaces in Orhangazi Neighborhood are evaluated under five main headings:

1. Safe access to public spaces
2. Physical and social security of public spaces
3. Functional diversity of public spaces
4. A sense of belonging to public spaces
5. Physical adequacy and design quality of public spaces

The aim is to question the child-friendly qualities of existing public spaces through children's spatial experiences and to offer suggestions for improving these spaces.

Main Results

In the study, fieldwork was conducted based on qualitative research methods. In this context, playgrounds, parks and open public spaces in the neighborhood were observed; children's daily movements were mapped spatially and semi-structured interviews were conducted with 15 children between the ages of 7-12 and 10 caregivers. The findings were analyzed both spatially and emotionally.

1. Accessibility: Children access public spaces on foot and often unsupervised. However, these areas are mostly limited to small-scale parks around the home. While children in the 7-9 age group are usually under the control of their families, children in the 10-12 age group move relatively more freely. Most of these areas can be accessed from routes close to vehicle traffic, without sidewalks or pedestrian crossings.

2. Safety: During the interviews, children expressed that they felt unsafe in the parks, especially in the evening hours. Expressions such as "The lights are not on, sometimes adults come, they chase us away when we make noise" point to the lack of social security as well as physical security. The weakness of control mechanisms also makes these areas unsafe for families.

3. Diversity: The existing public spaces in the neighborhood are limited to small parks with a limited number of play elements. These spaces are not only for children but also fail to meet the needs of different user groups such as the elderly, youth and women. The lack of multifunctional spaces where different age groups can spend time together weakens the inclusiveness of public spaces.

4. Belonging: Most of the children described the parks as "not ours" or "we get bored there". The fact that playgrounds are cold and monotonous in terms of color and form makes it difficult for children to establish an emotional connection to these spaces. Some children emphasized the repetition of design by saying "there is always the same thing, there is a slide and nothing else".

5. Quality of Design: Problems such as the quality of the materials used, the lack of shade for seating areas,

and the lack of water access points limit the time children spend in the spaces. In addition, the fact that none of the public spaces were designed with the participation of children is an important deficiency. This affects not only aesthetics but also children's sense of self-worth.

Conclusion

This study is a case study that examines how children access and experience public spaces in their daily lives and to what extent these spaces respond to their developmental, social and emotional needs. The evaluation of Istanbul Pendik Orhangazi Neighborhood provides important findings in terms of children's visibility and rights-based spatial representation in the city.

The research findings reveal that children's active and safe presence in urban space is directly related not only to physical access, but also to the functional diversity, social inclusiveness and the capacity of the space to generate belonging. The deficiencies observed in Orhangazi Neighborhood point to structural problems that are also valid for many transformation areas in Turkey: spatial inequality, uniform use, lack of participatory planning and insecurity.

In this context, the following policy and design principles are proposed for children to exist as equal citizens in public spaces:

- **Public space arrangements that prioritize pedestrians** should be implemented. Especially around schools, parks and playgrounds, vehicle traffic should be reduced, speed limits should be lowered and pedestrian safety should be prioritized.

- **Public spaces should be diversified to meet the physical, social and emotional needs of different age groups.** Multifunctional, intergenerational public spaces should be designed to appeal not only to young children but also to adolescents, parents and the elderly.

- **Children should be directly involved in design processes.** Municipalities and local governments should integrate children's voices into planning processes through tools such as neighborhood workshops, children's forums and participatory drawing exercises.

- **The quality of physical infrastructure should be improved.** Increasing lighting, orientation, seating areas, access to water, shade and natural landscape elements directly affect the quality of time spent in public spaces.

In conclusion, this study aims to contribute to the construction of more inclusive, just and child-friendly cities by providing an assessment based on children's spatial experiences. Public spaces should not only be places where children play, but also places where they express themselves, develop social belonging and realize their rights.

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2025 Symposium for their contributions and support.

REFERENCES

1.   Lynch K. The Image of the City. Cambridge, MA: MIT Press; 1960.
2.   Woolcock M, Narayan D. Social Capital: Implications for Development Theory, Research, and Policy. World Bank Research Observer. 2000;15(2):225-49.
3.   Gülgün B, Topal A. An Evaluation on Child Friendly Cities. Megaron. 2020;15(3):442-56.
4.   Hart R. Children's Participation: The Theory and Practice of Involving Young Citizens in Community Development and Environmental Care. London: Earthscan; 1997.
5.   UNICEF. Child Friendly Cities and Communities Handbook. Geneva: UNICEF; 2019.

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Karatay Youth Center: A Model for Inclusive and Sustainable Youth Empowerment

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ABSTRACT

In this study, the participation of Karatay Youth Assembly and Karatay City Council in the establishment of Karatay Youth Center is presented as a model proposal. In practice, the demands of the youth have been transformed into physical spaces with the help of various meetings and surveys. In this context, it is expected that the project carried out will coincide with the needs and demands of the youth and that the investment will contribute to the society in the most effective and efficient way.

Key words: youth empowerment, sustainable development, inclusive policy-making

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Introduction

Karatay City Council has accelerated youth and volunteering activities and ensured the establishment of the youth assembly. Thanks to the cooperation of Karatay Youth Assembly and City Council, the establishment of Karatay Youth Center was ensured within the framework of feedback received from young people. Details such as which areas will be included in this area, how big they will be and where they will be located, such as the library, workshop areas, sports halls, seating areas, conference halls, etc. were determined with the participation of young people.

Main Results

The needs and demands of youth in Karatay were systematically gathered through surveys, workshops, and meetings facilitated by the Karatay Youth Assembly in cooperation with the City Council. As a result, the construction of the Karatay Youth Center was designed based on direct feedback from young people. Karatay Youth Center offers a rich range of opportunities for the different interests and needs of young people. Common administrative offices are planned for both the Youth Assembly and the City Council, providing an environment of continuous cooperation between young people and local administrators.

Conclusion

The Karatay Youth Center stands out as a participant-driven, holistic facility that truly addresses the voiced needs of local youth. By embedding the design and priorities within youth-led workshops and surveys, the project ensured high levels of relevance and acceptance. Its multifunctional layout—spanning education, culture, art, technology, sports, and social interaction—supports a well-rounded developmental environment. Offering all services free of charge enhanced accessibility, demonstrating a commitment to equity and youth empowerment aligned with Cities4Youth's core values of inclusivity, sustainability, and participatory policy-making . Moreover, the center serves as a hub that reinforces community bonds through volunteer programs, cultural activities, and counseling services, embedding social impact and civic engagement at its core. This model provides an effective and replicable roadmap for municipalities: the youth-led planning process is supported by free and varied programs; concrete and sustainable results are achieved through continuous collaboration between the youth council and municipal authorities.

REFERENCES

1. European Commission. (2018). *Engaging, connecting and empowering young people: A new EU Youth Strategy*. Brussels. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52018DC0269
2. OECD. (2020). *Engaging and Empowering Youth in Policy Making*. OECD Publishing. https://doi.org/10.1787/fdbb4a50-en
3. UN-Habitat. (2020). *Enhancing Youth Participation in Urban Governance*. United Nations Human Settlements Programme. https://unhabitat.org/enhancing-youth-participation-in-urban-governance
4. United Nations. (2015). *Transforming our world: the 2030 Agenda for Sustainable Development*. https://sdgs.un.org/goals/goal11

Cities Connected with Data: Smart Cities Mapping Big Data

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ABSTRACT

This study examines the interaction between smart cities and big data. While explaining how smart cities provide solutions in areas such as health, transportation management, and energy efficiency, the role of big data analysis in these solutions is emphasized. The concept of big data is examined in five basic dimensions: volume, velocity, variety, veracity, and value. The use of big data in areas such as transportation, energy efficiency, and health is presented with examples. Along with applications in cities such as Bursa and Gümüşhane from Türkiye, successful smart city projects around the world such as Helsinki, GIFT City, and Zurich are also included.

Keywords: Smart Cities, Big Data, Technology, Urban Innovation

Introduction

Today cities are growing rapidly and becoming complex structures. This growth brings with it many problems from infrastructure to environmental sustainability, from transportation to health. Smart city technologies offer innovative solutions to these problems and make big data analytics more effective. Smart cities are cities that aim to increase the quality of life, optimize resource use and make city management more effective by using information and communication technologies. One of the basic dynamics of this structure is big data technologies. Big data makes it possible to make sense of high-volume, diverse, fast and valuable data obtained from different sources in the city. In this study, the definition of smart cities, their relationship with big data, the role of big data management in smart cities, and application examples from Turkey and the world are discussed.

Smart City

With the increasing population from rural areas to cities, the population in cities has also increased. This situation can be explained by the Gravity-Push theory: unemployment and lack of educational opportunities in rural areas constitute push factors, while the development of opportunities such as employment and transportation in cities constitute pull factors. Therefore, with the migration to cities, the management of services such as infrastructure, health, and transportation has become more difficult

every day. With the rapid increase in data and the subsequent difficulty of managing information, the concept of smart city has emerged in order to make cities sustainable and effective. Within the scope of the 2020-2023 National Smart Cities Strategy and Action Plan, the concept of Smart City has been defined as "More livable and sustainable cities that are implemented through cooperation between stakeholders, use new technologies and innovative approaches, are justified based on data and expertise, and produce solutions that add value to life by foreseeing future problems and needs" (Ministry of Environment, Urbanization and Climate Change, 2020). Smart cities consist of basic components such as smart transportation, smart governance, smart environment, smart life, smart economy, and smart citizen. These components will make the city's management, planning and sustainability effective.
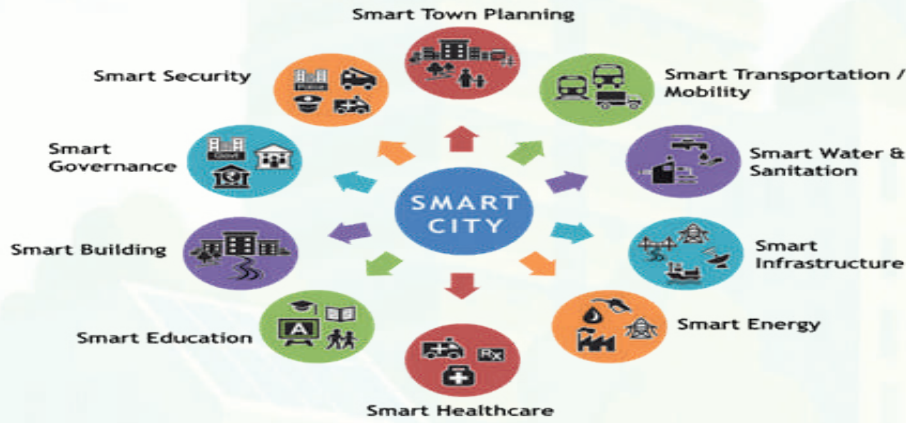
Figure 1. Smart City (Fernandes,2016).

Smart urbanization aims not only to digitize data, transform it into decision support systems and present it to senior managers, but also to ensure that citizens and other stakeholders understand this data and then use it to adapt it to their lives. For this reason, a smart city provides effective governance.

Big Data

Big data is like an ocean of data and this ocean is growing exponentially every day. Today, data production has become too big to be managed with traditional databases because it has grown so much in terms of speed, volume and data diversity, which is why big data has emerged. The components of big data are defined by the 5V model: Volume, Velocity, Variety, Veracity and Value. Volume refers to the size of the data produced. Velocity refers to the speed at which data is created, collected and processed. Variety is that data comes from different formats and sources because it is abundant. Accuracy is an indicator of the quality and reliability of the data. Value is extracting meaningful information from the data and benefiting from it. In short, big data does not only mean a lot of data; it means fast, diverse, reliable and value-creating data. Documents, videos, photos, maps, atmospheric data, e-commerce data, RFID data, social networks and all kinds of sensors are data sources. Analyzing and classifying this data enables it to be transformed into a meaningful and processable form. The main purpose of big data is to structure and analyze complex and large amounts of data correctly, add value to it and present it to users. Therefore, the stakeholders of big data are those who collect, use and produce it. While big data makes predictions about the future, it also enables analysis to be made based on the past. As Danah Boyd said, "Big data is

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not just about numbers, but about what these numbers mean." (Boyd & Crawford, 2012). Unprocessed data and unused information have no future and meaning. The importance of big data is also great in the smart city, which has been a popular topic in recent years. Since smart cities consist of data surrounding them, processing them has become inevitable. Here, big data comes into play and makes it mandatory to make data-based decisions in data-centered city management.

Big Data Management in Smart Cities

Data in cities is so extensive that it covers everything from weather sensors to energy and smart parking applications. The processing of such large data sets must be converted into real-time analysis with smart algorithms. Big data offers city managers the opportunity to foresee urban problems and make more accurate decisions. For example, the development of smart energy networks, smart waste management systems, and smart transportation systems is realized through big data. Here, too, the public may be concerned about data privacy and access, and such concerns should be taken into consideration. For this reason, big data applications should be developed and managed by taking into account the opinions of senior managers, city planners, and information experts.

Smart Cities of Turkey and The World

Projects from Turkey:
a.1) Bursa – Smart Sewerage and Stream Monitoring System:
This pilot project carried out by Bursa Metropolitan Municipality is one of the smart city applications where information and communication technologies are used with the vision of developing water management. While aiming to prevent color and odor problems in stream and sewage systems, parameters to be measured instantly in these areas have been planned. Project outputs include a smart map integrated with a smart sewage and stream monitoring system that provides instant data; these outputs are used by local government units such as BUSKİ and district municipalities. This application contributes to the digital transformation process for sustainable environmental management in Bursa (Smart City Ecosystem Portal, 2025).

a.2) Elazığ – Smart Bus Stops Project
The Smart Bus Stop Application developed by Elazığ Municipality Transportation Directorate is a project that aims to digitalize urban transportation services. The main vision of the project is to provide citizens with ease of time management by seeing where the buses are and to encourage the use of public transportation. This application, which enables transportation services to become more transparent and user-oriented, directly targets citizens in Elazığ province and increases the technological service capacity of the local government. The main output of the project is increased citizen satisfaction (Smart City Ecosystem Portal, 2025).

Projects from around the world:
b.1) Zurich, Switzerland – Smart Street Lighting and Building Management Project
With the smart street light project launched in Zurich, up to 70% energy savings were achieved thanks to sensor lamps that adjust brightness according to traffic density. Over time, these systems were developed and multifunctional lighting poles that collect environmental data, measure traffic flow and provide pub-

lic WiFi were spread throughout the city. In addition, energy efficiency was significantly increased with the smart building management system that integrates the city's heating, cooling and electrical systems. The vision of the project is to increase the quality of life with sustainable city infrastructure. The project outputs are energy savings, data-based urban management and a more livable city environment (Earth. Org, n.d.).

b.2) Helsinki, Finland – Carbon Neutral City and Electric Mobility Project
Helsinki is implementing an ambitious urban planning program that aims to be carbon neutral by 2035. The city's public transport fleet is being converted to electric buses, electric vehicle charging stations are being expanded and the metro network is being expanded. Since heating is a major contributor to the city's carbon emissions, it is aimed to reduce these emissions by 80% through energy efficiency renovations in buildings. The project vision is to establish a climate-friendly, digital and inclusive city structure. The project outputs are reduced carbon emissions, increased environmental awareness and a healthier city ecosystem (Earth.Org, n.d.).

Conclusion

The future of smart cities will be shaped not only by establishing and abandoning technological infrastructures, but also by managing these technologies efficiently and meaningfully. At this point, big data is the fundamental building block that makes city life safer and more productive. Big data offers city managers the opportunity to make fast and effective decisions, while also improving the quality of life of citizens. This process also includes social dimensions such as ethics, data privacy, and social participation. Examples from around the world show that cities can become more environmentally friendly and livable with the management of big data. Turkey's digital infrastructure potential can be used more efficiently with the support of local governments for these technologies. Application examples show that big data is not only a technological tool, but also the cornerstone of creating sustainable and livable cities. In this context, big data management should be at the center of future city policies.

REFERANSLAR

1. Aydın, N. (2023). Akıllı şehirlerde büyük veri. *Balkan & Near Eastern Journal of Social Sciences (BNEJSS)*, 9.
2. Boz, Y., & Çay, T. (2019). Şehri akıllı yapan özellikler ve dünyada öne çıkan akıllı şehirler. *TMMOB 6. Coğrafi Bilgi Sistemleri Kongresi*, 23-25.
3. Tamer, H. Y. (2022). Akıllı şehirlerde veri yönetimi yaklaşımları. *Abant Sosyal Bilimler Dergisi*, 22(2), 519-534.
4. Aydınoğlu, A. Ç., Bovkır, R., & Bulut, M. (2022). Akıllı şehirlerde büyük coğrafi veri yönetimi ve analizi: Hava kalitesi örneği. *Geomatik*, 7(3), 174-186.
5. Boyd, D., & Crawford, K. (2012). Critical questions for big data. *Information, Communication & Society*, 15(5), 662–679.
6. Fernandes, J. (2016, July 11). E-Governance, the best bet for smart cities' builders. *Medium*. https://medium.com/@joeferns13/e-governance-the-best-bet-for-smart-cities-builders-f0da66368b19
7. Batty, M. (2013). Big data, smart cities and city planning. *Dialogues in Human Geography*, 3(3), 274–279. https://doi.org/10.1177/2043820613513390

8. Li, R., Hou, S., Yu, Y., Lu, D., & Yang, C. (2016). Toward a smart city: Progress and challenges of urban informatization. *Engineering*, 2(2), 158-167. https://doi.org/10.1016/J.ENG.2016.01.002

9. Villanueva, M., Vlasceanu, L., & Zapata, F. (2014). Big data analytics: Architecture, algorithms and applications. *International Journal of Computer Applications*, 107(1), 1-7.

10. Akıllı Şehir Ekosistem Portalı. (2025). Bursa – Akıllı kanalizasyon ve akarsu takip sistemi. T.C. Çevre, Şehircilik ve İklim Değişikliği Bakanlığı. https://akillisehirekosistem.csb.gov.tr/DataBank/Detail?mId=3100340039003400

11. Akıllı Şehir Ekosistem Portalı. (2025). Elazığ – Akıllı duraklar projesi. T.C. Çevre, Şehircilik ve İklim Değişikliği Bakanlığı. https://akillisehirekosistem.csb.gov.tr/DataBank/Detail?mId=3200320038003100

12. Çevre, Şehircilik ve İklim Değişikliği Bakanlığı. (2020). 2020-2023 Ulusal Akıllı Şehirler Stratejisi ve Eylem Planı. https://akillisehirler.gov.tr/wp-content/uploads/EylemPlani.pdf

13. Earth.Org. (n.d.). Top 7 smart cities in the world. https://earth.org/top-7-smart-cities-in-the-world/

14. Fernandes, J. (2016). Infographic on e-governance for smart cities. *Medium*. https://miro.medium.com/v2/resize:fit:2000/format:webp/1*87QG89yIdA7CeUSOLxY_Dg.png

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Big Data in Smart Cities: Leveraging Energy Management for Sustainable Urban Transformation

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ABSTRACT

As urban populations grow and environmental impacts intensify, smart cities are emerging as a transformative framework for addressing complex urban challenges. This paper examines the role of big data in how smart city paradigms are evolving from infrastructure-centric models (Smart City 1.0) to citizen-centric and co-creative ecosystems (Smart City 3.0). While big data is improving decision-making across sectors, this study focuses on energy management, a critical area where smart systems can deliver measurable sustainability and economic benefits. Using case studies from municipalities in Turkey, we analyze how big data tools such as smart meters, monitoring platforms, and predictive analytics are being used to optimize energy consumption, reduce emissions, and support climate goals. Challenges in using big data are also explored. The findings highlight that smart energy management, supported by big data, plays a key role in making cities more resilient, efficient, and inclusive.

Keywords: Smart Cities, Big Data, Energy Management, Sustainability, Urban Analytics

Introduction

The rise of smart cities represents a strategic response to the increasing demands of urbanization, resource depletion, and climate change. Initially focused on digital infrastructure and service efficiency, smart city models have evolved to embrace participatory governance, citizen well-being, and environmental sustainability. At the core of this evolution is big data. By collecting, processing, and analyzing massive streams of urban data generated by IoT devices, sensors, and user interactions, municipalities gain insights into real-time conditions and long-term trends. Among the multiple application areas of big data, energy management stands out as a critical priority. Urban energy consumption accounts for a significant portion of greenhouse gas emissions and operational costs. Without efficient control, cities risk unsustainable growth, power outages, and missed climate targets. Therefore, applying big data to energy systems is not just a technical upgrade, but a fundamental requirement for sustainable urban futures.

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Main Results

Big data has become a strategic element that enables the efficient operation of smart cities, especially in the field of energy management. Thanks to the integration of real-time data collection, advanced analysis methods and machine learning algorithms, municipalities are transitioning from traditional energy systems to predictive and adaptive infrastructures. This transformation increases operational efficiency and contributes to long-term sustainability by optimizing energy consumption, improving load balancing and reducing transmission losses.

The use of big data provides detailed visibility into the supply-demand balance in cities, which enables the effective implementation of applications such as automatic lighting systems, dynamic pricing and real-time fault detection. In this way, not only energy efficiency is achieved, but also costs are reduced, the renewable energy transition is supported and environmental impacts are minimized. At the same time, big data-supported analyses strengthen strategic planning by providing decision-makers with important insights in determining investment priorities, policy design and resource allocation.

On the other hand, the success of these systems depends not only on technological capabilities; It also depends on strong data governance, the ability to integrate with legacy infrastructures, and the protection of individuals' data privacy. Otherwise, the potential offered by big data cannot be fully utilized. Therefore, all applications aimed at digitalizing energy management processes in smart cities should be accompanied by ethical data use, institutional capacity building, and active citizen participation.

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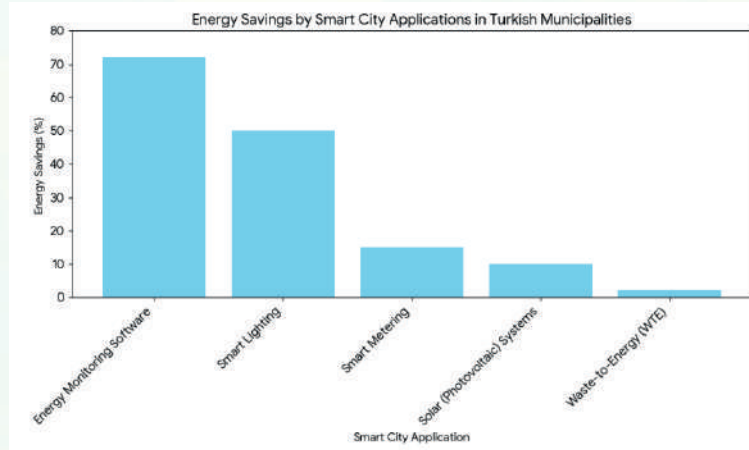
Figure 1. Energy Savings by Smart City Applications in Turkish Municipalities

Table 1. Projects

Project Name	City	Focus Area	Main Result / Goal
Enerji Takip Sistemi (ETS)	Ankara	Gerçek Zamanlı İzleme	%75 Enerji Tasarrufu
Akıllı Aydınlatma ve Sulama	Antalya	LED + Akıllı Kontrol	%80 Enerji / %15 Su Tasarrufu

Güneş Enerjisi Santralleri (GES-1,2)	Manisa	Yenilenebilir Enerji	13 Ayda +7 Milyon TL Gelir
Atıktan Enerji Tesisi	Eskişehir	Atıktan Enerji	Ankara'nın İhtiyacının Yaklaşık %5'ini Karşılıyor
Akıllı Sayaçlama (MASS Projesi)*	Kayseri	Tüketici İzleme	CO_2 Azaltım Taahhüdü

Conclusion

Energy is the lifeblood of modern cities, and in the age of climate emergency, its smart management is crucial. This article shows that big data is a key asset in transforming urban energy systems from static and inefficient to dynamic, adaptive, and sustainable. Turkish municipalities are making promising progress in implementing data-driven energy innovations. However, to maximize impact, cities need to address integration costs and data security. Ultimately, smart energy management is not just about kilowatt-hours saved, but about sustainably enabling a livable and inclusive urban future.

REFERENCES

1. Dergipark. The Transformation of Smart Cities in the Age of Big Data. 2023.
2. Ministry of Environment and Urbanization. Smart Cities Strategy and Action Plan (2019–2022). Ankara: 2019.
3. Ankara Metropolitan Municipality. Energy Tracking System Report. 2024.
4. Manisa Metropolitan Municipality. Solar Energy Strategy Document. 2023.
5. Kayseri Metropolitan Municipality. Sustainable Energy Action Plan. 2024.

Child-Friendly Urban Sustainability in Smart Cities: Adaptation of Kids Go Green and Kent95 Models in Türkiye

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ABSTRACT

This study examines how smart city approaches can be made child-friendly through the integration of global and local sustainability strategies. The study comparatively analyzes the gamified mobility education program Kids Go Green from Trento, Italy, and the Kent95 model developed by the Bernard van Leer Foundation and implemented in Istanbul. The study argues that children's active participation in urban life not only promotes social equality, but also increases long-term sustainability and innovation in urban development. In this context, a hybrid model "Kent95/TR" is proposed for Turkey to guide child-friendly smart city applications. The study ends with policy recommendations for municipalities, educators and planners that support children's rights and participation.

Key words: Smart Cities, Child Participation, Urban Sustainability, Kids Go Green, Kent95

Introduction

Smart cities aim to improve urban life through digital technologies, data-driven governance and sustainable infrastructures [1,2]. However, these systems often ignore children, who are an important component of the city. Children, who are today's and tomorrow's urban users, are often excluded from urban planning processes, which both violates their rights and limits the potential of more inclusive cities.

According to the United Nations Convention on the Rights of the Child, children have the right to express their opinions and participate in decisions that concern them. However, today's cities are often designed from an adult perspective; concepts such as "play", "safe access" and "free movement" are not prioritized in smart city strategies.

The Urban95 framework developed by the Bernard van Leer Foundation suggests experiencing the city

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from 95 cm away – that is, from the eye level of a 3-year-old child. UNICEF's Child-Friendly Cities initiative emphasizes that what makes a city child-friendly is that every child grows up in a safe, clean and participatory environment.

This study proposes a participatory and technology-supported child-friendly smart city framework suitable for Turkey by combining two strong models, Kids Go Green and Kent95.

Main Results

Kids Go Green – Trento, İtalya

This project is carried out in collaboration with schools, families and local governments. Children's environmentally friendly transportation methods (walking, cycling, public transportation) to school are transformed into global city journeys through virtual maps [3]. With the gamification method, both mobility is encouraged and sustainability and geography knowledge are gained. In pilot applications, car use decreased by 53% and 87% of the acquired habits were maintained after six months.

Kent95 – İstanbul, Türkiye

Developed by the Bernard van Leer Foundation, Kent95 aims to redesign urban environments for children aged 0–5 and their caregivers [4]. Within the scope of the Istanbul95 initiative, child-friendly green areas, sensory parks and social services have been planned. Early childhood programs have been delivered to more than 1,500 families [5].

Comparative View

While Kids Go Green provides behavioral transformation through gamification and collective action, Kent95 provides transformation through physical infrastructure and public policies. These two approaches complement each other: one focuses on values and participation, the other on concrete urban transformation. The "Kent95/TR" hybrid model proposed in this study proposes a system specific to Turkey through data-driven planning, inclusive design standards, and urban education for children.

Conclusion

Recognizing children as active stakeholders in urbanization processes is not only an ethical responsibility, but also a strategic necessity. Cities designed with children in mind provide safer, healthier and more inclusive living spaces for everyone. The proposed hybrid model, which combines the educational approach of Kids Go Green with the infrastructural and political principles of Kent95, offers a viable path to increase children's participation and transform city life.

Municipalities, urban planners and educators should jointly develop child-friendly infrastructures supported by digital tools and participatory processes. When children's voices are included in smart city policies, cities will not only be smarter, but also fairer, greener and more humane.

REFERENCES

1. IBM. Smarter Cities. IBM White Paper. 2010.

2. European Commission. Smart Cities - European Innovation Partnership. Brussels: EC; 2014.
3. Kids Go Green. Trento Mobilità Project Report. Trento Municipality; 2022.
4. Bernard van Leer Foundation. Urban95: Designing cities from 95 cm. The Hague: BvLF; 2019.
5. Istanbul95. Uygulama Raporu. Istanbul Büyükşehir Belediyesi & BvLF; 2021.

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Integrating Youth into Urban Decision-Making: A Proposal for Cooperation Between Youth Forums and Local Governments

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Abstract

This paper presents a simple model to help young people get more involved in how cities are run. Youth forums—like KOGEF or events similar to the European Youth Parliament—usually occur in schools, youth centers, or universities. In these forums, students are split into groups (called committees) to talk about specific topics and write down their ideas in a resolution paper. But most of the time, these papers don't go any further and are not seen by city officials.

In this model, local governments help choose the topics for the forums. After the events, experts from the municipality read the students' ideas and decide if they should be shared with other departments. If some of the ideas are useful, they can become part of real city projects. This gives young people a real chance to share their voices and be part of local decision-making. It is also aimed to support and spread youth forums by local governments.

Keywords: Youth Participation, Local Governments, Urban Policy, Youth Forums, Civic Engagement

Introduction

Youth forums are a good way for students to discuss problems and come up with solutions. These events usually take place in schools or youth spaces, where students are placed into committees. Each committee focuses on one topic and writes a short paper with ideas and solutions.

Even though these forums have great ideas, the results usually stay inside the event and don't reach people in charge. That's why it's important to connect youth forums with local governments. This way, the ideas from students can be used to actually help the city.

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Main Proposal

This paper suggests a way to make youth forums more useful by including local governments in the process:

City officials help decide the forum topics.

Committees of students work on these topics and write their ideas in a resolution paper.

After the event, the papers are sent to experts chosen by the municipality.

These experts give feedback or send the ideas to the right departments.

Good suggestions can be added to real city plans.

This makes youth forums more than just a fun school activity. It turns them into a real chance for young people to help shape their cities.

Conclusion

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Connecting youth forums with city governments can make decision-making more open and fair. Young people get to share their ideas and feel like they're part of something important. At the same time, cities benefit from the fresh and creative ideas that students bring. This model helps students learn how local governments work and gives them a voice in the future of their communities. Trying out this model in different cities could show how well it works and help make it even better.

REFERENCES

1.Istanbul City Council. Youth Assembly Activity Report 2023. Istanbul: Istanbul City Council; 2024.
2. Ministry of Development (Republic of Türkiye). Tenth Development Plan: Youth Working Group Report. Ankara: Ministry of Development; 2015.
3. Youth Organizations Forum (GoFor), NDI Türkiye. Youth Political Preferences Research Report 2021. Ankara: GoFor; 2021.
4.Kocaeli Youth Forum (KOGEF). Kocaeli Youth Forum Event Report, 10–13 June 2024. Hosted by 24 Kasım Anadolu Lisesi, Kocaeli, Turkey; 2024.

Child Friendly Cities and Peripheral Learning:
Designing Urban Space as a Pedagogical Tool

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ABSTRACT

This study aims to examine good practises in relation to the effects of the design of child-friendly cities on children's peripheral learning processes.

Peripheral learning is the process by which an individual obtains information indirectly from his/her physical and social environment without receiving direct instruction. It is seen that safe, aesthetic, interactive and livable urban areas designed for children increase learning motivation and support cognitive, affective and social development.

In this paper, the interaction between the concept of child-friendly cities and peripheral learning is discussed and a pedagogical perspective is proposed in sustainable urban planning. The paper is supported by good examples from different places that can contribute to children's peripheral learning and explains the impact and contribution of these places on children.

Key words: Child friendly city, peripheral learning, urban space

Introduction

Pedagogical Perspective on the Relationship between Children and the City

Modern cities are generally designed with an adult orientation. However, cities are both a living and a learning space for children.

Education takes place not only within the classroom, but also within all environmental factors that children interact with. In this context, child-friendly cities are urban learning environments that support not only physical safety but also mental and emotional development (1).

A signboard that a child sees on the street, icons in a park, posters on the facade of a science centre or art installations at a station leave a mark on the child's mind and contribute to the learning process. Public spaces where children explore through play, learn numbers through wall paintings, and internalise the concept of direction through shapes on the ground are peripheral learning spaces that support their cognitive and social development.

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In this paper, child-city interaction will be analysed in the context of peripheral learning, and it is aimed to discuss the design and areas that will support children's learning in the urban environment from a pedagogical perspective. At the same time, examples of good practices in different cities will be analysed to reveal how child-friendly spaces contribute to learning processes.

What is Peripheral Learning?

Peripheral learning is the process by which an individual learns indirectly, intuitively and usually unconsciously from his/her physical and social environment without receiving direct instruction. According to Jean Lave and Etienne Wenger's theory of situated learning, when individuals are part of a social environment, they are not passive but active participants who continuously learn from their surroundings (2). 'Peripheral learning' refers to the process by which children, in particular, learn from visual, auditory and physical stimuli in the environment that are outside of conscious focus. Children are engaged in peripheral learning even when they are playing in the park, observing on public transport or studying a mural (2).

The integration of child-friendly cities with peripheral learning has the following positive effects:

Information Acquisition through Visual and Semantic Stimuli:Signboards, direction signs, public art applications (murals, sculptures), posters and signs with environmental messages in the urban space attract children's attention and develop both aesthetic sensitivity and symbol literacy. Aesthetically organised environments contribute to children's cognitive development by positively affecting their attention and focusing skills (1).

Playgrounds and Discovery-Based Learning: Children make sense of the world through play. Children's playgrounds are simple, spiritually and physically developing areas where children can run and play freely in open spaces and utilise their free time. These areas constitute an important part of children's daily recreational needs (3). Games in urban areas can fulfil various functions such as feeling good, learning, accessing data, and participation (4). In child-friendly cities, playgrounds should be designed as educational structures that support not only physical mobility but also problem solving, trial and error, cooperation and creativity skills. Playgrounds with natural elements support the development of creativity and problem-solving skills.

Interaction with Nature and Ecological Learning: Vaske and Kobrin (2001) found in their study that children's experiences in nature increase their environmental awareness and knowledge level, which positively affects the shaping of their perceptions (5). Şahin and Dostoğlu (2015), in their study on school buildings, mentioned the benefits to children of designing schools in a way that is associated with fresh air, daylight and scenery, provides sports opportunities, can use the environment as a resource for learning, and supports social development. In child-friendly cities, areas such as parks and gardens where children can connect with nature and grow vegetables and fruits are created and children are helped to empathise with the environment. By creating areas in parks and forests that can be used for lessons, storytelling or nature observations, out-of-school learning areas are increased in cities (6).

Space for Independent Movement and Social Learning for All Children: Safe streets, pavements and pedestrian zones where children can move independently are critical for the development of their social skills. Traffic-free playgrounds are located in safe areas. Suitable areas are created for all children (including physically disabled individuals). For this reason, the principle of 'design for all' is adopted within the scope of 'usable space' arrangement by creating healthy environments for children. When designing children's playgrounds that physically disabled children can easily use, the approach of creating spaces for all children, not only for the disabled, is adopted. Regardless of the disability, the basic needs of children are the same (7,8).

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Designing In Accordance With The Needs Of Age Groups: The periodic needs of 0-3 years, 4-6 years, 7-12 years and adolescent groups should be taken into consideration and social environments should be designed to meet their needs in the city.

For the developmental period of 0-6 years, arrangements such as colourful painted floors made of rubber, soft materials, colourful walls, low-level benches, sound-making walkways and different textured surfaces enable children to experience their environment safely.

In the 7-12 age period, environmental stimuli such as thematic areas, nature-based discovery trails, observation areas (such as birdhouses, botanical gardens), pavements designed with mathematical shapes or operations support children's thinking, observation and experience skills.

These contributions ensure that peripheral learning creates not only knowledge but also sensitivity, responsibility and awareness in the child's mind. A child-friendly city is actually a learning ecosystem where every structure around the child is a 'teacher'.

Good Practises In Sakarya:

Living Street: Serdivan Municipality has implemented the 'Living Street Project' in order to transform city streets into livable spaces for children and their parents. With the start of the project, which also includes the Social Development Centre, it is aimed to transform various streets of the city into child-friendly public spaces (9). It supports children's indirect learning by offering a design that does not teach children through the environment, but makes them develop behaviours and concepts in the living space implicitly.

Traffic Parks: Signs such as traffic lights, road lines, stop, go, pedestrian priority signs develop children's ability to recognise and make sense of symbols. They learn street culture, use of public space and social skills such as empathy (with other drivers and pedestrians) through observation and experience. They are environments that teach rules, responsibilities, social communication and safe living behaviours without teaching them, and provide learning through social clues.

Karaman Barrier-Free Park: There are children's barrier-free playgrounds (10). The park also serves the discipline of "non-discrimination", one of the main principles of child-friendly cities.

Karaman Adventure Park: Adventure Park consists of tracks such as trust wall, climbing tower, tree path, multiple walking tracks, giant stairs and tree steps. Children will contribute to the development of daily life skills such as what can be done in natural environment conditions. Visual symbols and maps placed in the forest area will improve visual memory and perception skills. In addition, it supports learning by experimenting and experiencing, that is, developing communication skills, developing self-confidence and courage, developing skills such as risk-taking and focusing (11).

Planetarium: In the planetarium, the artificial image of the sun, stars, planets and all other celestial bodies is projected onto the dome-shaped ceiling with a special system. In the planetarium, the depths of space can be watched exactly.

Kocaeli Science Centre, Kocaeli: It is a centre with experimental and hands-on activities, encouraging visitors to experiment and explore. By exploring the centre in free movement, they are exposed to different experiences according to their individual interests. The fact that colours, writings and figures are designed in a fun and re-

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markable way attracts children's attention, which strengthens children's peripheral learning skills by triggering their curiosity without distracting their attention (12).

Menemen, Izmir: Children's Play Village is an effective outdoor education area that supports the peripheral learning approach in children's cognitive, emotional and environmental awareness development.

Eindhoven, Holland: Playgrounds are designed as innovative learning environments to support children's physical, mental and social development and peripheral learning (13).

COMPARATIVE ANALYSIS TABLE

Implementation Area	Place	Type of Learning	Skills & Outputs
Living Street	Sakarya, Türkiye	Peripheral, Social, Visual	Making Observation, Motor Skills Development
Traffic Park	Sakarya, Türkiye	Peripheral, Experiental, Social, Visual	Learning Street Culture, Social Skills Through Observation and Experience
Karaman Barrier-Free Park	Sakarya, Türkiye	Peripheral, Physical, Nature-based, Ecological, Social	Development of Sensory and Social Skills, Developing Autonomous Learning Skills, Motor Skills Development
Karaman Adventure Park:	Sakarya, Türkiye	Peripheral, Physical, Experiental, Ecological, Collaborative	Taking Risk, Making Observation, Motor Skills Development
Planetarium	Sakarya, Türkiye	Peripheral, Visual, Conceptual	Making Observation, Developing Sense of Curiosity, Gaining Astronomy Awarance
Kocaeli Science Centre	Kocaeli, Türkiye	Peripheral, Experiental, Informal	Scientific Thinking Skills, Developing Exploring and Problem-Solving Skills, Developing Sense of Curiosity
Menemen Children's Play Village	İzmir, Türkiye	Peripheral, Experiental, Conceptual	Emotional, Cognitive, Environmental Awareness Development
Spiel de Park	Einhoven, Holland	Peripheral, Experiental, Ecological	Physical, Mental and Social Development, Environmental Awareness

Main Results:
Child-friendly cities, which support children to learn from their environment, are not only places where children can physically move freely, but also spaces that support their affective, cognitive and social development. These areas, where peripheral learning is naturally supported, are powerful learning scenes that build not only the present but also the future identity of the child.
In the good practices analysed in Sakarya, its surroundings and around the world, areas that support children's

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peripheral learning transform the physical and institutional environment of the city into rich learning spaces for children. These projects enable children to learn about sustainability, nature, traffic safety and scientific curiosity through direct observation and experience.

Conclusion

Designing cities in a way that enhances children's learning potential enables them to acquire life skills through environmental learning. Urban space is both a play, a discovery and a teaching environment for children. In this context, child-friendly cities should be not only livable but also learnable. Areas with peripheral learning potential should be consciously planned to enrich children's relationship with space.

REFERENCES (Numbered, Vancouver Style)

1. Malone K. Children, Youth and Sustainable Cities. Local Environ. 2001 Feb;6(1):5–12.
2. Lave J, Wenger E. Situated Learning: Legitimate Peripheral Participation. Cambridge University Press; 1991.
3. Chawla L. Growing Up in an Urbanising World. Chawla L, editor. Earthscan from Routledge; 2002.
4. MEMİŞ L. Kentlerin Çocuklarından Çocukların Kentlerine: "Çocuk Dostu Akıllı Kentler." Pamukkale University Journal of Social Sciences Institute. 2022 Jan 2;
5. Jerry J. V, Katherine C. Kobrin. Vaske And Kobrin. 2001;(4):16–21.
6. Öztürk A, Bayrak D. ANAOKULLARINDAKİ DOĞAL MEKÂN VE MATERYALLERİN ÇOCUK GELİŞİMİNDEKİ YERİ. NWSA Academic Journals. 2017 Jan 1;12(1):25–36.
7. Pouya S, Bayramoğlu E, Demirel Ö. Doğa ile Uyumlu Fiziksel Engelli Çocuk Oyun Alanları. Süleyman Demirel Üniversitesi Mimarlık Bilimleri ve Uygulamaları Dergisi. 2016;1(1):51–60.
8. Üniversitesi Ziraat Fakültesi Peyzaj Mimarlığı Bölümü A. Kentsel Peyzajda Engelli/Yaşlı Birey İçin Bağımsız Hareket Olanağı ve Evrensel Tasarım Kavramı *Aysel USLU Nasim SHAKOURİ. Vol. 14, Journal of Forestry Faculty. 2014.
9. Gül M. https://www.medyarota.com/haber/22271232/serdivan-sokaklari-donusuyor-cocuk-dostu-oyun-sokagi-acildi. 2024. Serdivan Sokakları Dönüşüyor: Çocuk Dostu Oyun Sokağı Açıldı.
10. Karaman Engelsiz Millet Bahçesi açılıyor [Internet]. 2025 [cited 2025 Jun 26]. Karaman Engelsiz Millet Bahçesi açılıyor. Available from: https://sakarya.bel.tr/m/Haber/karaman-engelsiz-millet-bahcesi-aciliyor/17656
11. https://www.sakarya.bel.tr/a/Sayfa/yasayarak-ogrenme-macera-parki/17 [Internet]. Yaşayarak Öğrenme Macera Parkı.
12. https://www.kocaelibilimmerkezi.com/ [Internet]. KOCAELİ BİLİM MERKEZİ.
13. https://www.speelparkdesplinter.nl [Internet]. Speelpark de Splinter.

Perceptions of International Students Living in Sakarya Regarding the City for Learning Turkish as a Foreign Language

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ABSTRACT

This study aims to evaluate the extent to which Sakarya qualifies as an "international education city" by analyzing This study aims to evaluate the extent to which Sakarya qualifies as an "international education city" by analyzing the experiences of international students studying in Sakarya to learn Turkish as a foreign language. The main objective of the study is to determine students' perceptions of accommodation, transportation, social integration, access to public services, and overall life satisfaction, and to develop policy recommendations accordingly. The research was designed using a quantitative methodological approach, and a questionnaire was used as the data collection tool. A pool of survey questions was created, and the opinions of two experts were sought. The questions were revised based on the experts' opinions and finalized. The survey consists of 22 questions and includes multiple-choice and open-ended questions on accommodation, transportation, social life, safety, and general evaluation, in addition to participants' demographic information. The findings indicate that Sakarya is generally evaluated positively in terms of accommodation facilities, transportation convenience, and safety; however, the lack of social activities and difficulties in communicating with the local community make the adaptation process challenging for some students. These results highlight the need to develop internationalization policies in the city and the importance of enhancing university-city collaboration.

Key words: International Students, cities, city of education, young people's perception of the city

Introduction

In today's world, where globalization is accelerating, higher education institutions are directly affected by internationalization processes, and in this context, international student mobility is increasing every day. According to UNESCO (2023) data, approximately 6 million students worldwide are studying in a country other than their own. This mobility not only enables students to acquire academic knowledge but also allows them to engage in different cultural environments and gain new life experiences. Altbach and Knight (2007) state that international students make significant contributions to their personal development in this process; however, they also face various challenges in adapting to cultural, social, and economic environments (Altbach & Knight, 2007, p. 291). In this regard, the living conditions offered by the cities where international students study directly affect both their satisfaction levels and the city's potential to become an "international education city."

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In addition to providing economic contributions to host countries, international students also enrich the academic and cultural environment of universities. The OECD's (2020) Education at a Glance report emphasizes this contribution by stating, "International students not only contribute economically to host countries but also enrich the academic and cultural environment of universities" (OECD, 2020, p. 34). However, living in a different country and city presents both opportunities and challenges for students. Zhou et al. (2008) note, "Living and studying in a foreign country can be both an exciting and stressful experience for international students, often influenced by cultural differences, language barriers, and lack of social support," drawing attention to the main difficulties faced by international students (Zhou, Jindal-Snape, Topping, & Todman, 2008, p. 63). These challenges often concentrate on essential aspects of life such as housing, transportation, social life, safety, and access to public services, directly affecting students' overall life satisfaction.

The infrastructure and services provided by cities play a decisive role in the integration and satisfaction levels of international students. Anderson (2008) highlights the critical role of city living conditions in student satisfaction, stating, "The level of integration and satisfaction among international students is strongly related to the living conditions and services offered by the city where the university is located" (Anderson, 2008, p. 45). Similarly, Knight (2012) underlines the importance of cities providing inclusive and accessible environments in the internationalization process by stating, "Host cities play a critical role in internationalization of higher education by creating inclusive, accessible, and welcoming environments" (Knight, 2012, p. 23). Particularly, factors such as affordable housing, reliable transportation, and accessible public services are key to increasing international student satisfaction. Glass and Westmont (2014) stress the importance of these elements by stating, "A supportive city infrastructure that includes affordable housing, reliable transportation, and accessible public services significantly impacts the overall satisfaction of international students" (Glass & Westmont, 2014, p. 44).

This study aims to analyze the extent to which Sakarya, one of Turkey's prominent university cities, possesses the qualities of an "international education city" from the perspective of international students. With its geographical location, university infrastructure, and cultural diversity, Sakarya has the potential to be an attractive destination for international students. However, the extent to which this potential is realized depends on the experiences and perceptions of the international students living in the city. In this context, the study will quantitatively assess the experiences and perceptions of international students learning Turkish as a foreign language in Sakarya regarding city life. By examining the opportunities and challenges students face in key areas such as housing, transportation, social life, safety, and access to public services, the study aims to identify Sakarya's strengths and weaknesses in its path to becoming an international education city.

This analysis will not only evaluate Sakarya's current situation but also contribute to the development of policies aimed at enhancing the potential of cities to become international education hubs. Cities that increase international student satisfaction not only support the internationalization processes of higher education institutions but also gain a competitive advantage in the global education market. Therefore, developing an inclusive and supportive infrastructure that meets the needs of international students will provide long-term benefits for both students and the city itself.

Methodology

This research aims to evaluate the status of Sakarya as an "international education city" by examining the living experiences of international students studying in the province. The study is designed within the framework of the quantitative research method. Quantitative research is a systematic approach that aims to measure and analyze phenomena through numerical data (Creswell, 2014). In this context, the survey technique was

chosen as the data collection tool. The survey method is an effective and economical means of gathering data from many participants, identifying trends, and conducting comparative analyses (Dörnyei, 2007). The questionnaire used in the study was developed based on a literature review and similar studies. After the draft form was prepared, feedback was sought from two academics specializing in teaching Turkish as a foreign language and in the field of internationalization in education. In line with the feedback received, some statements were simplified, and certain questions were removed or revised to improve clarity. This process was carried out to enhance the validity and reliability of the data collection tool (Fraenkel, Wallen & Hyun, 2012). In its final form, the questionnaire consists of questions related to participants' demographic information, housing conditions, transportation facilities, social integration, safety, access to public services, and overall life satisfaction. It includes both closed-ended (Likert-scale and multiple-choice) and open-ended questions. The open-ended questions allowed students to share their experiences in their own words, thus providing a basis for qualitative interpretation. The study sample was determined using the simple random sampling method among international students studying Turkish as a foreign language at universities in Sakarya. This method is considered reliable and objective as it gives each individual an equal chance of being selected (Büyüköztürk et al., 2012). Data analysis was conducted using descriptive statistics (frequency, percentage, mean). In addition, responses to open-ended questions were thematically categorized and interpreted using descriptive analysis technique.

Main Results

Quantitative Results

This section presents the results of a survey conducted with 154 international students studying in Sakarya. The findings reveal the students' experiences and perceptions regarding various aspects of living in the city, including accommodation costs, public transportation, social facilities, communication with locals, healthcare services, internet access, and sense of belonging. These factors are discussed under the following headings:

Accommodation Costs: The perceptions of students regarding accommodation costs vary. The most common response was "neither cheap nor expensive" (31.2%, n=48). 26% of the participants (n=40) considered the costs "expensive," and 12.3% (n=19) rated them as "very expensive." In contrast, 22.7% (n=35) found the costs "reasonably priced," and 8.4% (n=13) described them as "very reasonably priced." These findings indicate that while accommodation costs pose a challenge for some students, the general perception is moderate.

Public Transportation: The majority of participants (85.1%, n=131) reported using public transportation several times a week. When evaluating the ease of use of the transportation system, 46.8% (n=72) described it as "easy," 27.9% (n=43) found it "very easy," and 27.9% (n=43) considered it "average." Only 2.6% (n=4) found transportation "difficult," and no students considered it "very difficult."Regarding fares, 48.7% (n=75) of the participants considered public transportation to be "reasonably priced," 27.3% (n=42) found it "very reasonably priced," and 20.8% (n=32) rated the fares as "neither cheap nor expensive." Only 8.4% (n=13) considered the fares "expensive." No participants found the transportation fares "very expensive." Additionally, 86.5% (n=134) of the students reported that there were student discounts available for transportation in the city.

Social Activities and Communication with Locals: Regarding the adequacy of social facilities, 39.6% (n=61) of the students considered them "somewhat sufficient," and 30.5% (n=47) found them "sufficient." 15.6% (n=24) found the social activities inadequate, while 17.5% (n=27) did not express an opinion on this matter. In terms of communication with locals, 50% (n=76) of the students found communication "somewhat easy," 30.9% (n=47)

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considered it "easy," and 9.2% (n=14) found it "very easy." On the other hand, 13.8% (n=21) considered communication "difficult," and 1.3% (n=2) found it "very difficult."

Healthcare Services: Regarding access to healthcare services, 30.5% (n=47) of the students found access "easy," while an equal percentage (30.5%, n=47) found it "somewhat easy." 18.2% (n=28) experienced difficulties, and 22.1% (n=34) had not used healthcare services at all.

Sense of Belonging: When it comes to their sense of belonging in Sakarya, 49.4% (n=76) of students reported feeling "somewhat a sense of belonging," and 44.2% (n=68) felt a sense of belonging. 9.7% (n=15) did not feel a connection to the city.

Internet Access: Regarding internet access, 47.4% (n=72) of students rated it as "good," 33.6% (n=51) considered it "average," and 19.1% (n=29) described it as "very good." The percentage of students who found internet access to be poor was relatively low, with 4.6% (n=7) rating it as "bad" and 1.3% (n=2) considering it "very bad."

Overall, the findings show that the experiences of international students in Sakarya are generally positive and characterized by a moderate level of satisfaction. Public transportation, with its accessibility, affordable fares, and student discounts, stands out as an important advantage. While accommodation costs are challenging for some students, the general perception of these costs is moderate. Social activities and communication with locals are mostly viewed positively or somewhat positively. Access to healthcare services and internet quality have also been rated as satisfactory, and a high sense of belonging has been observed among the students.

Qualitative Findings

Most Liked Aspects of Sakarya
According to the qualitative findings, the aspects of Sakarya that international students most appreciate include the city's tranquility, natural beauty, and recreational areas, especially Lake Sapanca. Additionally, the academic quality of Sakarya University, the campus environment, the warm and hospitable attitude of the people, the relatively affordable cost of living, and the ease of transportation are frequently mentioned. The fact that the city is far removed from the hustle and bustle of large metropolises is also highlighted as a positive feature by the students. These findings suggest that Sakarya offers an environment that is peaceful, safe, and easy to adapt to, making it an ideal place for international students.

Challenges Faced in Sakarya
The challenges faced by international students in Sakarya are concentrated in various areas. The primary issue is accommodation and finding housing. Participants pointed out the high rental prices, the constant rent increases, and the limited number of available apartments as the major difficulties. The distance of dormitories from the university and the inadequacy of public transportation options are also additional problems related to accommodation.

The second major challenge is the language and communication barrier. Students, especially when they first arrive, struggle to communicate due to the lack of English speakers and view the difficulty of learning Turkish as a factor that further complicates the process. Misunderstandings during street-level communication and the lack of foreign language support during official procedures make the adaptation process more challenging for

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students.

The limited transportation options are another frequently mentioned problem. The limited number of bus schedules, overcrowded buses, expensive minibus fares, and the lack of alternative transportation options make daily life difficult for students.

Lastly, access to healthcare services has been problematic for some students. Difficulties in finding the right specialists, the high cost of dental care, and certain deficiencies in the healthcare system were highlighted as issues faced by students.

These findings indicate that the living experiences of international students in Sakarya are not solely characterized by positive aspects. They face significant challenges in areas such as accommodation, language, transportation, cost of living, and social integration.

Advice for New International Students
Students who participated in the research offered various recommendations for those who will be coming to Sakarya in the future. The most frequently mentioned piece of advice is to prioritize learning Turkish. Students noted that mastering the language would ease the adaptation process and reduce communication barriers in daily life. They emphasized that language practice should be supported not only through programs like TÖMER but also through personal effort and daily interactions.

The second key recommendation is the importance of preparation and planning. Participants suggested that students should complete necessary paperwork, secure health insurance, research the city's characteristics, and prepare financially before arriving in Sakarya.

Students also advised newcomers to be patient and open-minded, stating that understanding cultural differences could facilitate their social adaptation. Additionally, regular attendance in classes and fulfilling academic responsibilities without delay were emphasized as important for academic success.

Moreover, some students warned about potential risks. They highlighted the need to be cautious of fraud, the high cost of living in the city, and pointed out that Sakarya may not be suitable for every student.

Overall, the students' advice focuses on language learning, financial and academic preparation, cultural adaptation, and openness to social relationships.

Conclusion

This study shows that Sakarya has many characteristics of a developing "international education city" with its strengths such as ease of transportation, affordability, safety, and accommodation options for those who will learn Turkish as a foreign language. However, there are still difficulties in areas such as providing social activities, language barriers, and access to certain services. While many students feel a sense of belonging to some extent, full integration remains limited. Making housing more affordable, expanding cultural and recreational opportunities, and improving support services will be crucial to strengthening Sakarya's role in the global education market and enhancing the satisfaction of international students.

REFERENCES

1. Anderson, G. M. (2008). *International Education and the University: City Spaces and Student Experience.* London: Routledge.

2. Glass, C. R., & Westmont, C. M. (2014). Comparative and International Higher Education, 6, 44–47.

3. Knight, J. (2012). *Concepts, Rationales, and Interpretive Frameworks in the Internationalization of Higher Education*. In De Wit, H., & Hunter, F. (Eds.), *The European Higher Education Area*. Springer.

4. OECD. (2020). *Education at a Glance 2020: OECD Indicators*. Paris: OECD Publishing.

5. Zhou, J., Jindal-Snape, D., Topping, K., & Todman, J. (2008). Theoretical models of culture shock and adaptation in international students in higher education. *Journal of Studies in International Education*, 12(1), 63–84. https://doi.org/10.1177/1028315306295310

6. Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş., & Demirel, F. (2012). *Bilimsel araştırma yöntemleri*. Ankara: Pegem Akademi.

7. Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Thousand Oaks, CA: Sage.

8. Dörnyei, Z. (2007). *Research methods in applied linguistics: Quantitative, qualitative, and mixed methodologies*. Oxford: Oxford University Press.

9. Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education* (8th ed.). New York: McGraw-Hill.

The Use of Agrivoltaic Systems in Rural Development: The Case of Eskişehir

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ABSTRACT

This study investigates the potential contributions of agrivoltaic (APV) systems to rural development, focusing on the province of Eskişehir, Türkiye. APV systems enable simultaneous agricultural production and solar energy generation on the same land, offering a dual-use solution to the challenges faced in rural areas such as water scarcity, energy dependency, and agricultural sustainability. Using a qualitative research design, semi-structured interviews were conducted with local farmers, agricultural consultants, energy sector professionals, and municipal authorities. The findings suggest that APV systems are generally perceived positively due to their potential to reduce energy and irrigation costs while improving crop quality and yield. However, initial investment costs, regulatory gaps, and limited technical knowledge are identified as key barriers to implementation. Eskişehir's high solar irradiation and agricultural capacity make it an ideal region for APV deployment. The study concludes that APV systems can serve as strategic tools for integrated rural development by promoting energy independence, sustainable agriculture, and additional income streams for farmers. Policy support, education, and regulatory frameworks are essential to overcome adoption barriers and unlock the full potential of agrivoltaic systems.
Key words: Rural Areas, Development, Agrivoltaic Systems, Eskişehir

Introduction

Rural regions constitute the backbone of Türkiye's socio-economic structure but are increasingly challenged by unsustainable agricultural practices, climate change, declining water resources, and rising energy costs [1]. In this context, agrivoltaic (APV) systems emerge as a promising innovation that combines solar energy generation with ongoing agricultural production on the same land, offering a dual-use solution [2].

By improving land-use efficiency, APV systems not only enhance agricultural sustainability but also provide farmers with additional income through electricity production, moderate microclimates, and reduce water evaporation [3]. This study aims to explore the rural development potential of APV systems through a local case study of Eskişehir province, a region with strong solar potential and agricultural activity.

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Visual 1 Climate Classification

Agrivoltaic systems represent a concept that enables more efficient use of agricultural land for both food production and the generation of energy, which is increasingly needed by humanity. These systems, by achieving dual objectives simultaneously, have emerged and been developed as a potential solution to the growing concerns of humanity regarding global warming and climate change [4].

Zainol Abidin et al. emphasized that agrivoltaic systems offer significant advantages, such as promoting the sustainable use of resources and providing additional economic benefits to farmers [5]. They highlight the importance of planning these systems under three main categories: energy-centered, agriculture-centered, and agro-energy-centered approaches. Moreover, they underline that such planning must account for factors including solar radiation intensity and characteristics of photosynthetically active radiation (PAR), along with adjustments in crop selection and management based on microclimatic conditions and light limitations [5].

Figure 1. Applications of Solar Energy in Agriculture

Main Results

1. Energy Independence and Economic Benefits
Most farmers identified reduced electricity costs as a primary advantage of APV systems, especially in relation to irrigation and greenhouse operations. The potential for self-sufficiency in energy was highlighted as a major motivator [6].

2. Water Efficiency and Microclimate Regulation
Participants noted a significant reduction in evaporation due to the shading effect of panels, particularly during summer, estimating irrigation needs to decrease by 20–30%. Panels were also found to shield plants from extreme temperatures [7].

3. Agricultural Productivity and Crop Quality
Depending on crop type, participants reported either increased or stable productivity. Leafy and shade-tolerant crops like lettuce, spinach, and tomatoes benefited from panel coverage. Crops requiring high sunlight needed careful calibration [8].

4. Barriers to Implementation
The most frequently mentioned challenges included high initial investment costs, lack of clear regulations, bureaucratic hurdles, and limited access to technical expertise [9].

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Eskişehir is well-positioned for APV deployment due to its strong solar irradiation and robust agricultural bas"e [10]. The findings support the view that APV systems can significantly improve not only energy efficiency but also agricultural sustainability and rural incomes.

However, their broader adoption depends on strategic planning, including financial incentives, technical support, and regulatory reforms. Successful international examples, particularly in Germany and France, demonstrate the importance of public-private collaboration in scaling APV applications [11].

Conclusion

This study demonstrates that APV systems can provide multifaceted benefits for rural areas in Eskişehir by reducing energy and water costs, increasing agricultural productivity, and offering new income sources for farmers. Despite existing challenges, these systems hold significant promise for integrated rural development. To maximize their potential, it is essential to enhance access to funding, provide technical training, and develop a supportive legal framework. APV systems should be considered strategic tools for sustainable rural transformation in Türkiye.

REFERENCES

1. Aydın F. The role of agrivoltaic systems in rural development: Theory and practice. Ankara: Tarım Yayınları; 2023.

2. Demirtaş S, Yılmaz E. Effects of agrivoltaic systems on agricultural productivity: A literature review. J Renew Energy Res. 2022;10(2):145–160.

3. Öztürk C. Innovative approaches in rural development: Integration of solar energy. J Rural Econ Dev. 2021;8(1):55–70.

4. Goetzberger A, Zastrow A. On the coexistence of solar-energy conversion and plant cultivation. Int J Sol Energy. 1982;1(1):55–69.

5. Zainol Abidin M, Mat Tahir N, Azzuhri SR, Ishak M, Yusoff Y. Potential of agrivoltaic system for sustainable energy and food production in Malaysia: A review. Environ Clim Technol. 2021;25(1):519–531.

6. Karataş M. Agrivoltaic potential and farmer perceptions in Eskişehir. Eskişehir: Anadolu University Publications; 2024.

7. El-Madany TS, Reichstein M, et al. Multi-benefit land use through solar parks: climate-smart agri-photovoltaic systems. Nat Sustain. 2020;3:1015–1023.

8. Amaducci S, Yin X, Colauzzi M. Agrivoltaic systems to optimize land use for electric energy production. Appl Energy. 2018;220:545–561.

9. Luthander R, Widén J, Nilsson D, Palm J. Photovoltaic self-consumption in buildings: A review. Appl Energy. 2015;142:80–94.

10. Şahin A. Evaluation of solar energy potential in Eskişehir. J Sol Energy Tech. 2023;6(1):25–34.

11. Dupraz C, Marrou H, Talbot G, Dufour L, Nogier A, Ferard Y. Combining solar panels and food crops for optimising land use: Towards new agrivoltaic schemes. Renew Energy. 2011;36(10):2725–2732.

Climate-Adaptive Strategies in Vernacular Architecture of Mountainous Rural Settlements: Comparative Insights from Türkiye and China

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ABSTRACT

This research investigates climate-adaptive strategies embedded within the vernacular architecture of two mountainous rural settlements, Fındıklı in Rize, Türkiye, and Jinjiang Chalet Village in the Changbai Mountains, China, each characterized by distinct climatic and topographic conditions. These ecologically vulnerable regions face escalating environmental challenges such as intensified rainfall, landslides, floods, temperature fluctuations, and thermal stress due to global climate change. Drawing upon a comparative architectural analysis, the study explores how passive design strategies, such as site-specific orientation, natural ventilation, thermal insulation, spatial layout, roof structure, and integration with terrain, have evolved as practical responses to local climatic pressures. The research reveals both shared principles and regionally unique construction techniques grounded in centuries-old traditional ecological knowledge. Fındıklı demonstrates adaptive responses to high precipitation and soil instability, while Jinjiang reflects resilience to cold climate extremes and topographic constraints. Beyond identifying architectural features, the study highlights the socio-cultural and environmental rationality underlying vernacular forms, offering a valuable knowledge base for contemporary sustainable development and climate-resilient rural planning. The findings advocate for a hybrid approach that bridges indigenous architectural wisdom with modern ecological design and risk-sensitive spatial planning. Such integration is essential for enhancing the resilience, sustainability, and cultural continuity of mountainous rural communities in the face of accelerating environmental change.

Key words: Vernacular architecture, Mountainous rural settlements, Climate resilience, Climate adaptation, Traditional building practices

Introduction

Mountainous rural regions are particularly vulnerable to climate change due to their vulnerable eco-

systems, steep terrain, and settlements often located in narrow valleys with limited land availability. These areas are increasingly exposed to intensified natural hazards, such as landslides, river floods, and droughts, which are projected to become more frequent and severe under global climate change scenarios (Pörtner et al., 2019; Kato et al., 2021). Moreover, the competition between land uses, such as agriculture, tourism, housing, and infrastructure, limits their adaptive capacity and increases environmental stress (Huber et al., 2013). In response to these challenges, vernacular architecture has gained recognition as a climate-resilient model shaped by centuries of local experience. Built with indigenous materials and adapted to site-specific climate and topography, vernacular structures often demonstrate high levels of energy efficiency, passive environmental control, and spatial harmony with nature (Oliver, 2006; Zhang et al., 2018). Recent studies confirm that such traditional practices offer valuable insights into sustainable settlement planning under changing climate conditions (Philokyprou et al., 2017; Aktürk & Fluck, 2022).

This study investigates how vernacular architecture in two ecologically vulnerable mountain settlements, Fındıklı in Rize (Türkiye) and Jinjiang Chalet Village in the Changbai Mountains (China), reflects adaptive responses to climate and environmental risks. Through a qualitative comparison based on literature, the research analyzes building orientation, material use, and environmental integration. It aims to identify both shared and context-specific climate-adaptive strategies that inform resilient rural architecture in similar topographic and climatic settings globally.

Methodology

This study adopts a comparative qualitative research methodology to examine the climate-adaptive strategies embedded in vernacular architecture from two geographically and climatically distinct mountainous regions: Fındıklı in Rize, Türkiye, and Jinjiang Chalet Village in the Changbai Mountains, China. The methodological framework consists of the following key steps:

1. **Case Selection:** The two case study locations were purposefully selected due to their ecological vulnerability, pronounced climatic variability, and rich vernacular architectural heritage. Fındıklı represents a humid subtropical Black Sea context, while Jinjiang represents a severe cold region in Northeast Asia.

2. **Literature-Based Data Collection:** Architectural and environmental data for both settlements were gathered from scholarly literature, including journal articles, dissertations, field studies, and official climate records. Sources include primary works such as Aktürk (2023) for Fındıklı and Zhao et al. (2025) for Jinjiang.

3. **Comparative Analysis Framework:** The study uses a matrix-based approach to compare architectural features related to climate adaptation. These features include:

     Site characteristics (elevation, slope, rainfall, temperature patterns)

     Building orientation and spatial configuration

     Material use and thermal performance

     Passive ventilation and daylighting strategies

     Roof and wall design elements

     Integration with topography

4. **Synthesis and Interpretation:** The data were analyzed thematically to identify common principles and context-specific adaptations. Emphasis was placed on passive design logic, ecological

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integration, and disaster risk responsiveness.

Main Results and Discussion

The vernacular architecture examples from Türkiye and China are presented in Figure 1. According to the determined factors, the selected examples are compared in various criteria in Table 1. The comparative assessment of vernacular architecture in Fındıklı (Rize, Türkiye) and Jinjiang Chalet Village (Changbai Mountain Region, China) reveals several common principles and region-specific strategies for adapting to climatic conditions and disaster risks through the use of passive design elements and local construction techniques.

A vernacular architecture example from Fındıklı, Rize
Source: Alkan, 2023.

A vernacular architecture example from Jinjiang Chalet Village
Source: Zhao et al, 2025.

Figure 1. Vernacular architecture examples.

According to the analysis by Fındıklı in Rize, it is observed that topography is a key factor in settlement and construction decisions. The masonry stone system built up to the first floor protects the building against the adverse effects of soil moisture and rainfall. Additionally, the locally specific wall type "göz dolma," built using local materials such as stone and wood, is a distinguished element of vernacular architecture. Here, the designed wall, made with local materials, serves as an insulator due to the thermal mass effect of the stone. Moreover, the use of natural materials such as stone and wood together creates an environmentally sensitive and harmonious design approach. Furthermore, it acts as a protection against the excessive humidity in the region. The windows, which serve as elements of natural light and ventilation, are positioned according to the prevailing wind direction to minimize the adverse effects of cold and precipitation. The eaves, which extend up to 150 cm, serve as shading elements and protect the building from precipitation. Although there has been a decrease in snowfall in recent years, in previous years, the roof was built with four ridge slopes, mid-sloped against the snow load. Timber trusses, beams, and studs carry and hold the weight of the roof.

Building characteristics (The data adopted from Aktürk, 2023; Zhao et. al, 2025).	Topography relations	Benefit from the topography for building placement. Buildings are far away from each other. The corn and tea fields are laid out in front of the dwellings, which are located on the highest point of the steep terrain, making the site useful. The main entrance of the buildings is generally oriented in the north or northeast direction to minimize wind effects. Timber-framed stone infill (göz dolma). Stone creates a thermal mass effect for insulation. The ground floor is primarily used as a barn, while the first floor is reserved for living spaces. Animals live in a barn, which makes the air warm, and it helps to make the first floor warmer in winter. The south and east sides have larger windows, while the north and northwest sides have fewer and smaller windows.	The village was settled 30 m above the Songhua River's flood level.
	Building orientation		The residences are housed in different positions on the sunny slope linearly. The main entrance of the buildings is located to the south. The building's form and envelope are designed to minimize heat loss. "Mukeden" is constructed as a pure wood load-bearing structure, featuring wood shingles and wood chimneys to withstand challenging climatic conditions. Uniquely designed firewall with wood and mud, and a wood chimney heating system. To utilize sunlight efficiently, buildings with surrounding trees are positioned high in the south and low in the north. The courtyard space allows more sunlight to enter the building. Buildings are erected to block the winter monsoon, forming a weak wind area that reduces the frost effect and freshens the air. Surrounded buildings Surrounded buildings with trees considering the sun path. with trees considering the sun path.
	Wall design – thermal insulation		
	Natural daylighting and ventilation		
	Shading and solar control	Extended eaves to 150 cm.	

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	Local material	Wood (chestnut, pine) and stone collecting from the river(s) as local materials.	Wood and mud.
	Roof design	Mid-sloped	Mid-sloped

The analysis of Jinjiang Chalet Village in the Changbai Mountain Region (China) shows that site characteristics form the vernacular architecture dominantly. The village maintains a well-balanced natural landscape with minimal impact on nature, thereby conserving the forest. The buildings are oriented to benefit from sunlight on the terrain. The buildings are constructed with wood as a whole structure, including the foundation, walls, chimney, and roof, which serve as a thermal insulation system. Additionally, a uniquely designed firewall, constructed with wood and mud, and a wood chimney, creates a well-designed heating system for the structure. The buildings are oriented to consider sun paths and wind directions, allowing for efficient use of sunlight and natural ventilation. Traditional material efficiency principles are applied to minimize waste and maximize environmentally friendly applications for construction.

From a disaster resilience perspective, both cases reflect adaptive capacities rooted in traditional knowledge: Fındıklı demonstrates responsiveness to hydro-climatic threats, such as floods and landslides, while Jinjiang showcases resistance to cold-related hazards, including frost, snow, and thermal stress. Both regions integrate passive design strategies, including material use, orientation, topographic integration, and environmental control, into vernacular construction to enhance energy efficiency and climate resilience.

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Conclusion

The comparative research demonstrates that vernacular architecture contains centuries of adaptive knowledge, providing sustainable and site-specific solutions to local climate, topography, and environmental constraints. These traditional buildings are not only physical structures but comprehensive systems designed in harmony with nature. In both case studies, architectural decisions, such as orientation, material choice, and spatial layout, demonstrate a deep understanding of local dynamics and passive climate control. However, with the increasing frequency of disasters such as floods and landslides due to global climate change, the need to preserve the authenticity of vernacular architecture while adapting them to evolving risks becomes more urgent. Failure to integrate such considerations may leave these buildings highly vulnerable to extreme events. Likewise, in contemporary development practices, neglecting nature-based settlement principles — such as avoiding construction in floodplains or disregarding the use of local materials — can result in significant human and material losses. A resilient future lies in learning from these vernacular models: integrating traditional wisdom with modern risk-sensitive planning and design to ensure both cultural continuity and environmental harmony.

REFERENCES

1.   Aktürk G. Climate Change and the Resilience of Collective Memories: The Case Study of Fındıklı in Rize, Türkiye [dissertation]. Delft: A+BE | Architecture and the Built Environment; 2023. Report No.: 01.

2.   Aktürk G, Fluck H. Vernacular heritage as a response to climate: Lessons for future climate resilience from Rize, Turkey. Land. 2022;11(2):276.

3.   Alkan SN. Türkiye'deki geleneksel ahşap çerçeve sistem konut yapılarında dış duvarların ısıl ve nemsel performansının değerlendirilmesi [dissertation]. İstanbul: İstanbul Teknik Üniversitesi; 2023.

4.   Huber R, Rigling A, Bebi P, Brand FS, Briner S, Buttler A, et al. Sustainable land use in mountain regions under global change: Synthesis across scales and disciplines. Ecol Soc. 2013;18(3):36. Kato T, Rambali M, Blanco-Gonzalez V. Strengthening climate resilience in mountainous areas. OECD Dev Cooper Work Pap. 2021;(No. 102).

5.   Oliver P. Afterword: raising the roof. In: Asquith L, Vellinga M, editors. Vernacular Architecture in the 21st Century: Theory, Education and Practice. London: Taylor & Francis; 2006. p. 262–8.

6.   Philokyprou M, Michael A, Malaktou E, Savvides A. Environmentally responsive design in Eastern Mediterranean: The case of vernacular architecture in the coastal, lowland and mountainous regions of Cyprus. Build Environ. 2017;111:91–109.

7.   Pörtner HO, Roberts DC, Masson-Delmotte V, Zhai P, Tignor M, Poloczanska E, Weyer NM, editors. The ocean and cryosphere in a changing climate. IPCC Special Report. Cambridge: Cambridge University Press; 2019.

8.   Zhang Z, Zhang Y, Jin L. Thermal comfort in interior and semi-open spaces of rural folk houses in hot-humid areas. Build Environ. 2018;128:336–47.

9.   Zhao H, Fang J, Lin Z, Tang J, Zhen S, Shi H, et al. Living inheritance of traditional knowledge and practical wisdom of severe cold-region traditional villages: A case study of Jinjiang Chalet Village in the Changbai Mountain Area. Sustainability. 2025;17(9):4225.

Greenhouse Gas Emission Inventory And Carbon Footprint Analysis In The Automotive And Supplier Industry Sector

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ABSTRACT

This study was carried out to reveal the corporate carbon footprint of a facility operating in the automotive and sub-industry sector and to develop greenhouse gas management policies. Greenhouse gas (GHG) emissions from the facility's activities in 2023 were determined within the scope of Scope 1, 2 and 3 categories based on ISO 14064-1:2018 and the GHG Protocol. An inventory was created by detailing Scope 1 (direct), Scope 2 (indirect energy source) and Scope 3 (other indirect) emissions; primary data was provided by the company, and secondary data was provided by IPCC, DEFRA and Ecoinvent 3.9 databases. The results of the study showed that the total emission of the facility for 2023 year is 30,575.71 t CO_2 e. It was observed that the facility's total emissions were mostly in category 4 with a rate of 79%, followed by category 2 emissions with a rate of 10%.

Key words: carbon footprint, sustainable development, climate change, greenhouse gas emissions

Introduction

Global warming and the resulting global climate change has become one of the most important threats to human development today Climate change causes losses and damages to ecosystems and people, increases negative impacts on agriculture and food production, and makes economic growth difficult It is accepted that the main cause of global warming and related climate change is the gases called greenhouse gases (GHG) that trapping heat in the atmosphere. Carbon dioxide (CO2), Methane (CH4), Nitrous oxide (N2O), Fluorinated gases are leading GHG that related with human activities. It has been reported that human activities are responsible for nearly all of the rising in GHG in the atmosphere over the last 150 years.

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Industrial activities and the energy production required for these activities have significant impacts on the environment. It is reported that industry is responsible for more than one-third of global primary energy consumption and energy-related carbon dioxide emissions, and industrial energy use is estimated to increase at an annual rate of between 1.8% and 3.1% over the next 25 years .Reducing the environmental impact of industrial activities is a fundamental element of combating climate change and sustainable development. All sectors involved in industrial activities have important responsibilities in controlling the observed and projected effects of global warming and related climate change and in achieving the international goals set for a sustainable planet. In this context, monitoring and reporting greenhouse gas emissions, especially in energy-intensive sectors, is of critical importance, and carbon footprinting is an important tool that can be used for this purpose.

Carbon footprint is a technique to measure the amount greenhouse gas released into the atmosphere directly or indirectly as a result of activities such as energy consumption and transportation of individuals and organizations, in terms of carbon dioxide equivalent. This allows assessing the climate change impact category associated with products, services, processes or an organization As a result of international climate-related efforts and growing consumer awareness, there has been increasing interest in determining corporate-level carbon footprints. International standards and guidelines such as the Greenhouse Gas Protocol (WRI 2004; WRI 2011), ISO 14064 (ISO 2019) are used in corporate carbon footprint calculation.

Implementing carbon footprinting at the corporate level can be beneficial for businesses in many ways, including identifying their role in climate change, defining greenhouse gas management policies and strategies, energy efficiency, compliance with legislation, improving their corporate image.

Among industrial activities, the automotive sector is one of the most important, providing direct or indirect employment for millions of people worldwide and having suppliers in a wide range of industries, including metal, plastics, glass, and electronics.Therefore, determining the environmental impacts of this sector and making necessary improvements in areas such as energy, technology, vehicles, equipment and business planning are of great importance for a sustainable future.

The aim of this study is to reveal the corporate carbon footprint of a facility operating in the automotive and sub-industry sector and to develop greenhouse gas management policies.

Method

The study was based on the ISO 14064-1:2018 standard and the Greenhouse Gas Protocol (GHG Protocol).
In GHG Protocol emissions are divided into three scopes.
Scope 1: Direct GHG emissions arising from activities that are owned or controlled by the organization

Scope 2: Indirect GHG emissions based on purchased electricity and other energy sources
Scope 3: Indirect GHG emissions from supply chain activities and downstream activities

ISO 14064-1 standard categorizes emissions and removals into 6 categories.
Category 1: Direct GHG emissions and removals
Category 2: Indirect GHG emissions from imported energy.
Category 3: Indirect GHG emissions from transportation.
Category 4: Indirect GHG emissions from products and services used by organization. (ISO
Category 5: Indirect GHG emissions associated with the use of products from the organization.
Category 6: Indirect GHG emissions from other sources

In this study emission calculations were made within the scope of Scope 1, 2 and 3 categories. An inventory was composed by detailing Scope 1 (direct), Scope 2 (indirect energy sources), and Scope 3 (other indirect) emissions. Primary data were obtained from units within the enterprise and covers data between 01.01.2023 and 31.12.2023. Secondary data were obtained from IPCC 2006, DEFRA and Ecoinvent 3.9 databases. The methodology used is an account-based method and is supported by relevant standard methods. Some indirect emission sources were excluded from the inventory due to lack of data or insignificance of emission impact (e.g. visitor transportation, some services).

Emissions are calculated using the following general formula:

Emissions (kgCO_2e) = Activity Data × Emission Factor × Global Warming Potential

Main Results

The results of the study are presented at the Table 1. The results showed that the total emission of the facility for 2023 year is 30,575.71 t CO2 e. It was observed that the facility's total emissions were mostly in category 4 with a rate of 79%, followed by category 2 emissions with a rate of 10%.

Table 1. GHG emissions

Emissions	Total CO_2-e	%
Category 1	655,87	2
Category 2	2.927,53	10
Category 3	2.220,19	7
Category 4	24.06,20	79
Category 5	755,93	2
Category 6	0,00	0

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In a study conducted by Dindar G., the carbon footprint of a company operating in the automotive supply industry, using 2019 and 2020 data obtained from company and Tier 1 approach, was calculated. The carbon footprint arising from fuels used for heating, electricity consumption, water consumption, waste generation, wastewater generation, and personnel or service vehicles provided by subcontractor services has been determined. The results showed that GHG was 16,501 tons in 2019 and 12,921 tons of CO_2 equivalents in 2020 Park et al., 2024 calculated the direct and indirect GHG emissions of the Korean automobile industry for 2017 year. The results revealed that Korean automobile industry is responsible from 8.4% of national GHG emissions in 2017. Scope 1, Scope 2, and Scope 3 emissions were 3.0%, 2.9%, and 94.7%, respectively

In a study performed by Lee, K.-H., carbon footprint of automobile supply chain management was investigated. Especially, Scopes 1, 2, and 3 of the carbon footprint boundary were implemented at selected key suppliers and automobile industry. The in-depth case study of the front bumper product showed that 18% of the carbon footprint can be attributed to the raw material stage, 70% to the in-house production stage, and 12% to the distribution stage

In a study conducted by Ediz SB., carbon footprint from part production activities in the automotive supplier industry was evaluated. The average annual average emission was calculated as 250 328 tons of CO2 eq. According to emission calculations, purchased raw materials account for 95.1% of emissions, electricity consumption accounts for 3.7%, post-production logistics and transportation activities account for 1.0%

Conclusion

The inventory created allowed the business to identify greenhouse gas sources and develop reduction strategies. The main strategies suggested for reducing emissions are:
- Renewable energy investments
- Energy efficiency projects
- Use of low-carbon emission equipment
- Sustainable transportation and supply chain solutions

REFERENCES

1. Sippel, Sebastian, Meinshausen, Nicolai, Fischer, Erich M., Szekely, Enikö, Knutti, Reto, 2020. Climate change now detectable from any single day of weather at global scale. Nat. Clim. Chang. 100 (1), 35–41.
2. R. Pachauri, L. Gnacadja, M.Z. Cutajar, A. Steiner, S. Briceno, J. Ogwu, V. Shiva, S. Dimas, Facing Global Environmental Change: Environmental, Human, Energy, Food, Health and Water Security Concepts, Springer Science & Business Media (2009).
3. J. Pan, M. Chen, B. Liu, Main paths of the net-zero carbon transition and optimal integration, China Population,Resources and Environment (11) (2023), pp. 1-12
4. Jingqi Deng, Tingting Hu, Mengqi Han, Yan Liu, Yusen Duan, Dungang Gu, Guanghui Li, Jiaqi Lu, Optimization strategies for the carbon footprint of aluminum-plastic materials under low-carbon targets, Journal of Cleaner Production, Volume 498, 2025, 145182, ISSN 0959-6526, https://doi.org/10.1016/j.jclepro.2025.145182.
5. IPCC, (2022), *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty,* Cambridge Uni-

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versity Press, Cambridge, UK and New York, NY, USA. doi:10.1017/9781009157940.

6. Gözde Çolak, Burçin Atılgan Türkmen, Kurumsal Karbon Ayak İzi Analizi: Bir Kimya Fabrikası için Örnek Hesaplama, *Journal of Natural Hazards and Environment, 2023; 9(1): 191-201, DOI: 10.21324/dacd.1120858.*

7. Patterson, M., Singh, P., Cho, H., 2022. The current state of the industrial energy assessment and its impacts on the manufacturing industry. Energy Rep. https://doi. org/10.1016/j.egyr.2022.05.242.

8. Kai Rüdele, Barbara Linke, Matthias Wolf, Always to neglect? About the contribution of tooling to product carbon footprints – Conclusions from literature, industry survey, and case studies, Cleaner Environmental Systems, Volume 17, 2025, 100277,

9. ISSN 2666-7894, https://doi.org/10.1016/j.cesys.2025.100277.

10. United Nations Industrial Development Organization, 2024. Industrial energy efficiency and climate change [WWW Document]. URL. https://www.unido.org/our-focus-safe guarding-environment-clean-energy-access-productive-use/ industrial-energy-efficie ncy-and-climate-change.

11. https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions#t1fn1++

12. https://www.epa.gov/climate-indicators/greenhouse-gases

13. IPCC (2013) Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. [Stocker, T.F., D. Qin, G.K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp. .

14. Wiedmann, T., Minx, J., 2008. A definition of carbon footprint. In: Pertsova, C. (Ed.), Ecological Economics Research Trends. Nova Science, Hauppauge, NY, pp. 1-11.

15. Lee K.H., (2011), *Integrating carbon footprint into supply chain management: the case of Hyundai Motor Company (HMC) in the automobile industry,* Journal of Cleaner Production, 19(11), 1216-1223.

16. Harangozo, G., Szigeti, C., Corporate carbon footprint analysis in practice e With a special focus on validity and reliability issues, Journal of Cleaner Production 167 (2017) 1177-1183.

17. Nguyen,Q., Diaz-Rainey, I., Kuruppuarachchi, D., Predicting corporate carbon footprints for climate finance risk analyses: A machine learning approach, Energy Economics 95 (2021) 105129.

18. WRI, (2004), *The greenhouse gas protocol: A corporate accounting and reporting standard,* World Resources Institute (WRI), https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf,

19. WRI, (2011), *The Greenhouse Gas Protocol and Corporate Value Chain (Scope 3) Accounting and Reporting Standard, Supplement to the GHG Protocol Corporate Accounting and Reporting Standard,* World Resources Institute and World Business Council for Sustainable Development, https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf,

20. Jurić, Ž., & Ljubas, D. (2020). Comparative Assessment of Carbon Footprints of Selected Organizations: The Application of the Enhanced Bilan Carbone Model. *Sustainability*, *12*(22), 9618.

21. ISO 14064-1. Greenhouse Gases—Part 1: Specification with Guidance at the Organization Level for Quantification and Reporting of Greenhouse Gas Emissions and Removals (ISO 14064-1:2018); International Organization for Standardization: Geneva, -Switzerland, 2018.

22. GHG Protocol Corporate. A Corporate Accounting and Reporting Standard (Revised Edition). World Resources Institute andWorld Business Council for Sustainable Development, 2004 (ISBN 1-56973-568-9). USA. 2004.

23. GHG Protocol Corporate. Corporate Value Chain (Scope 3) Accounting and Reporting Standard. World Resources Institute andWorld Business Council for Sustainable Development, 2011 (ISBN 978-1-56973-772-9). USA. 2011.

24. (Dindar, G., Otomotiv Yan Sanayinde Karbon Ayak İzinin Hesaplanması-Bursa İli Örneği, Yüksek Lisans Tezi, T.C.

Bursa Uludağ Üniversitesi Fen Bilimleri Enstitüsü, Çevre Mühendisliği Anabilim dalı, Bursa, 2021.

25. (Park, Y., Putra, A.S., Park H-S., Kim J., Characterization of the life cycle carbon footprint of the automobile industry in the Republic of Korea by environmentally extended input-output model, Environmental Engineering Research 2024; 29(5): 230583, DOI: https://doi.org/10.4491/eer.2023.583).

26. (Lee, K-H., Integrating carbon footprint into supply chain management: the case of Hyundai Motor Company (HMC) in the automobile industry, Journal of Cleaner Production,Volume 19, Issue 11, July 2011, Pages 1216-1223).

27. (Ediz, Sb., Otomotiv Yan Sanayisinde Parça Üretim Faaliyetlerinden Kaynaklanan Karbon Emisyonlari, Karbon Ayak İzi Hesaplamalari Ve Enerji Verimliliği Uygulama Önerileri, T.C. Bursa Uludağ Üniversitesi Fen Bilimleri Enstitüsü, Çevre Mühendisliği Anabilim Dali, Yüksek Lisans Tezi, Bursa 2023.).

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The Impact of Circular Economy on Urban Sustainability

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ABSTRACT

Rapid urbanization has led to critical sustainability challenges, including natural resource depletion, waste management problems, and environmental degradation. This study aims to analyze the impact of the circular economy on urban sustainability from a multidimensional perspective. Employing a qualitative review of recent circular economy practices in various cities, the research evaluates environmental, economic, and social sustainability indicators. The findings reveal that circular economy initiatives contribute significantly to reducing urban waste and resource consumption, promoting economic resilience, and enhancing social well-being. The study concludes that integrating circular economy principles in urban planning can foster a sustainable transformation of cities, offering a viable alternative to the traditional linear "take, use, dispose" model. These results highlight the importance of adopting circular practices to address the sustainability crises faced by rapidly growing urban areas.

Key words: Döngüsel Ekonomi, Kaynak Verimliliği, Atık Yönetimi, Kentsel Sürdürülebilirlik

Introduction

Today, cities accommodate the majority of the global population and consume a substantial portion of essential resources such as energy, water, and food [1]. Rapid urbanization has triggered multidimensional sustainability crises, including waste management challenges, increased greenhouse gas emissions, and the depletion of natural resources [2]. The traditional linear economic model — take, make, consume, dispose — is proving inadequate to support a sustainable future, particularly in urban areas characterized by high levels of consumption and waste generation [3].

In this context, the circular economy offers an alternative economic model that aims to systematically minimize waste, extend product lifespans, and promote the cyclical reuse of resources [4]. Redesigning cities in alignment with circular economy principles not only mitigates environmental impacts but also enhances economic inclusivity and social resilience [5]. The circular approach necessitates a profound transformation not only in production processes but also in consumption patterns. Cities, with their infrastructure systems, transportation networks, and social structures, play a central role in enabling this transformation.

The impacts of the circular economy on sustainable urban living extend beyond environmental benefits, contributing significantly to socio-economic inclusiveness, social equity, and climate resilience. The primary aim of this study is to evaluate these multidimensional contributions and to explore how the circular economy approach fosters a transformative path toward sustainability in urban environments.

Main Results

The implementation of circular economy principles at the urban level holds strategic significance for achieving sustainable development goals. In recent years, many European cities have come to view the circular economy not merely as an environmental policy but also as a tool for economic and social development. In this context, cities such as Amsterdam, Paris, Copenhagen, and Helsinki have published their own circular city strategies, creating detailed roadmaps for transition (6,7).

For instance, Amsterdam targets circularity in three key areas: the construction sector, food systems, and consumption habits. The city promotes modular building technologies, redirects food waste to local farms for composting, and establishes community-based reuse centers. This system aims to reduce both waste and resource consumption by 50% citywide. Copenhagen stands out with its waste-to-energy facilities, digital waste monitoring systems, and carbon reduction programs focused on public transportation (2).

Although Turkey has not yet developed a comprehensive circular city strategy, some examples such as zero-waste initiatives, energy efficiency projects, and sustainable transport investments can be observed in metropolitan municipalities like Istanbul and Izmir. However, these practices remain fragmented and project-based; strategic coordination among local authorities has yet to be established (8). The impacts of circular economy practices on urban sustainability can be examined under three interrelated dimensions: environmental, economic, and social.

Environmentally, circular strategies contribute significantly to the reduction of waste generation, the conservation of water and energy resources, and the mitigation of greenhouse gas emissions. These outcomes are particularly vital in enhancing urban resilience in the face of climate change and environmental degradation. By prioritizing resource efficiency and closed-loop systems, cities can minimize their ecological footprint while supporting long-term environmental goals.

Economically, the circular economy fosters the emergence of new job opportunities—particularly in areas such as recycling, repair services, and green innovation—contributing to the growth of a green labor market. Furthermore, by reinforcing localized production and consumption systems, cities can reduce their dependency on external supply chains and lower the cost of raw materials. This economic transformation enhances urban self-sufficiency and stimulates sustainable business models.

Socially, the circular economy encourages a shift in consumer behavior towards more responsible and sustainable consumption patterns. It also promotes inclusive and participatory planning processes, empowering local communities to engage in decision-making and grassroots initiatives. Moreover, the principles of equitable access to resources and social justice are emphasized, contributing to the creation of more inclusive and cohesive urban societies.

Conclusion

The circular economy offers an innovative and holistic framework for addressing the sustainability crises faced by cities. Circular strategies implemented in urban contexts go beyond merely reducing waste or utilizing resources efficiently; they also enhance economic inclusivity, social justice, and climate resil-

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ience. The pioneering practices of cities like Amsterdam and Copenhagen clearly demonstrate the feasibility and effectiveness of this approach, whereas in Turkey, circularity is still advancing at a fragmented and project-based level.

The success of circular economy practices at the urban scale depends not only on technical solutions but also on robust governance structures, policy coherence, the integration of digital technologies, and active citizen participation. In this regard, developing strategies that place the circular economy at the core of urban planning will not only respond to today's resource challenges but also help create sustainable living spaces for future generations.

The findings of this study indicate that the circular economy is not merely an option for urban sustainability but is increasingly becoming a strategic necessity. Future research should focus on developing integrated models tailored to local contexts and on monitoring implementation processes to ensure effective transitions.

REFERENCES

1. UN-Habitat. World Cities Report 2020: The Value of Sustainable Urbanization. Nairobi: United Nations Human Settlements Programme; 2020.
2. European Environment Agency. Circular Economy in Europe: Developing the Knowledge Base. Luxembourg: Publications Office of the European Union; 2020.
3. Ellen MacArthur Foundation. Towards the Circular Economy: Economic and business rationale for an accelerated transition. Cowes, UK: EMF; 2013.
4. Kirchherr J, Reike D, Hekkert M. Conceptualizing the circular economy: An analysis of 114 definitions. Resour Conserv Recycl. 2017;127:221–32.
5. Geissdoerfer M, Savaget P, Bocken NM, Hultink EJ. The Circular Economy–A new sustainability paradigm? J Clean Prod. 2017;143:757–68.
6. Ellen MacArthur Foundation. Cities and Circular Economy for Food. Cowes (UK): EMF; 2019.
7. Amsterdam Municipality. Amsterdam Circular 2020–2025 Strategy. Amsterdam (NL): City of Amsterdam; 2020.
8. T.C. Ministry of Environment, Urbanization and Climate Change. Turkey Circular Economy Strategy Draft. Ankara (TR): MoEUCC; 2022.

Integrating Spaces for Climate Change: The Beylikdüzü Example

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ABSTRACT

Beylikdüzü, a rapidly urbanizing and growing district in Istanbul, holds critical importance regarding the spatial impacts of climate change. This study, starting from an analysis of Beylikdüzü's current situation, proposes a holistic spatial planning model aiming to adapt to climate change. Key climatic risks such as urbanization and the urban heat island effect, as well as glacier melt and sea level rise, have been evaluated. Within the scope of the study, components of the spatial planning model, including the strengthening of Green Infrastructure, the integration of sustainable transportation networks, and the establishment of ecological corridors and carbon sinks, have been detailed. Through a focus area design, detailed analyses are presented for a selected region, leading to the development of a design approach that incorporates nature-based solutions tailored to Beylikdüzü's specific conditions. This model aims to enhance urban resilience, strengthen ecosystem services, and improve the local community's quality of life. Anticipated benefits include increased resistance to extreme weather events, biodiversity conservation, and reduced carbon emissions. The presented spatial planning model offers a concrete framework for Beylikdüzü's climate change adaptation process, while also serving as a guide for other regions with similar urbanization dynamics.

Key words: Climate Change, Green Infrastructure, Transportation Models, Carbon Emission Reduction, Ecological Corridor.

Introduction

Nowadays, global climate change poses serious threats to urban areas worldwide, exerting transformative effects on cities' physical, social, and economic structures. Combined with factors such as rapid urbanization, population growth, and the depletion of natural resources, climate change manifests itself in major metropolitan regions through consequences like the "urban heat island effect," extreme weather events, and rising sea levels. In this context, making cities resilient to the impacts of climate change is of critical importance for a sustainable future. Beylikdüzü, one of Istanbul's districts that has attracted attention in recent years with its notable planned urbanization trends, holds the potential to respond to this global challenge at a local level. Particularly with its rapid development and young population since the 2000s,

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Beylikdüzü offers an important case study for examining spatial planning approaches aimed at adapting to climate change. This study aims to develop a comprehensive spatial planning model for climate change adaptation in Beylikdüzü. This model seeks to provide a roadmap for a resilient and sustainable urban transformation, taking into account the district's existing urban structure, climatic risks, and potentials.

1. Current Status Analysis Of Beylikdüzü And İts Susceptibility To Climate Change Impacts:

In this section, the spatial and socio-economic structure of Beylikdüzü is analyzed in detail. Urban parameters such as the rapid urbanization process experienced particularly since the 2000s, building density, and green area ratio are evaluated. The potential impacts of climate change on the district are examined in light of scientific data and scenarios. In this context:

Urbanization Dynamics and Urban Heat Island Effect: The building fabric of Beylikdüzü, its impact on surface temperatures, and its contribution to urban heat island formation are investigated. Analyses are presented on how dense concrete and asphalt surfaces, lack of green spaces, and blocked wind corridors in the district exacerbate this effect.

Potential Impacts of Glacier Melt and Sea Level Rise: For Beylikdüzü, which has a coastline on the Marmara Sea, the potential effects of sea level rise due to global climate change will be evaluated. Risky areas in coastal zones, potential flooding, and pressures on infrastructure are examined. In this section, region-specific geological and topographical features are also considered.

Extreme Rainfall and Water Management Issues: The increasing frequency and intensity of extreme rainfall events due to climate change, and their burden on Beylikdüzü's existing drainage system and potential flood risks, are analyzed. The adequacy of current infrastructure and future needs are discussed.

2. Components of Beylikdüzü Climate Change Adaptation Spatial Planning Model:

This section details the fundamental components of the spatial planning model that will enable Beylikdüzü's adaptation to climate change. These components include strategic approaches aimed at increasing urban resilience:

Strengthening of Green Infrastructure: Strategies for the protection, development of existing green areas, and the creation of new green corridors are discussed. The potentials of green infrastructure elements such as urban parks, roadside tree plantings, green roofs, and vertical gardens in reducing the urban heat island effect, managing stormwater, and enhancing biodiversity will be deliberated.

Integration of Sustainable Transportation Networks: Emphasizing the importance of emission reduction in combating climate change, sustainable transportation alternatives for Beylikdüzü will be examined. Approaches such as the expansion of pedestrian and bicycle paths, public transport integration, and the planning of electric vehicle charging stations will be detailed.

Creation of Ecological Corridors and Carbon Sinks: The importance of establishing ecological corridors by connecting natural areas within and around the city is highlighted, in terms of wildlife passage and the continuity of ecosystem services. Furthermore, the carbon sequestration capacities of urban forests, parks, and other green areas, and their potential to mitigate climate change, will be evaluated.

Blue-Green Infrastructure Integration and Water-Sensitive Urban Design: The potential of blue-gre-

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en infrastructure solutions such as rainwater harvesting, increasing permeable surfaces, rain gardens, and bio-drainage systems in improving the urban water cycle and reducing flood risks is investigated. How water-sensitive urban design principles can be applied in Beylikdüzü will be discussed.

3. Focus Area Design and Implementation Approaches

This section will present concrete examples of how the developed spatial planning model can be applied in designated pilot or focus areas within Beylikdüzü.

Focus Area Selection and Rationale: The selection of one or more focus areas from within Beylikdüzü, possessing different urban textures and risk profiles, and the rationale behind this selection, are explained.

Focus Area-Specific Design Approaches: Urban design proposals developed in line with climate change adaptation goals for the selected focus area are presented. These proposals include concrete applications such as green infrastructure integration, increasing permeable surfaces, shading elements, water management solutions, and climate-sensitive material selection. They are supported by visual materials (maps, drawings, diagrams).

Nature-Based Solutions (NBS) Applications: How nature-based solutions are integrated into the focus area design will be detailed. The contributions of applications such as green roofs, vertical gardens, rain gardens, biological treatment systems, and wetland restoration to climate change adaptation and mitigation are explained.

Conclusion

This study highlights the vital role of spatial planning approaches in increasing the resilience of urban areas against escalating climatic risks, through the Climate Change Adaptation Spatial Planning Model developed specifically for Beylikdüzü, one of Istanbul's rapidly developing districts. The presented model integrates numerous components, ranging from the urban heat island effect to sea level rise, and from sustainable transportation networks to the strengthening of green infrastructure and the integration of ecological corridors, thereby offering a comprehensive and holistic adaptation strategy for Beylikdüzü against both current and future climate change threats. This integrated approach not only provides environmental benefits but also proposes a vision for sustainable urban development that enhances urban quality of life, supports societal well-being, and serves as a scalable "nature-based solution" example for other cities.

REFERENCES

1. Arslan, F., Saral, A. S., & Kılıç, A. B. (2019). Examination Of The Relationship Between Green Infrastructure And Climate Change In Cities: Assessment Center, Düzce.

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2. Bartlett, C. S., & Alan, M. (2020). Green Infrastructure Practices From Our Country And Around The World. Peyzaj (21), 86-100.
3. Nazlı, F. C., & Armağan, M. (2021). Green Infrastructure And Blue-Green Infrastructure In Urban Water Management. Ege University Faculty Of Agriculture Journal, 58(1), 145-162.
4. Şahin, F. (2022). Determination Of Flood Impacts Of Urban Extreme Rainfall Within The Framework Of Climatic Scenarios. Çanakkale Onsekiz Mart University, Graduate Education Institute
5. Akdemir, N. (2017). Nature-Based Solutions For Climate Change Mitigation And Adaptation In Urban Areas: Perspectives From Europe And The United States.
6. Uzun, Y. (2015). "Water-Sensitive Urban Design: A New Approach In Urban Water Management." TMMOB Chamber Of Environmental Engineers Publications.
7. Mcharg, I. L. (2014). "Urbanization And Its Impacts On Biodiversity And Ecosystem Services." Ecology And Environment Books, 10(16), 119.
8. Himmet, S., & Koç, A. (2016). "Sustainable Urban Development And Water Management: The Istanbul Case." Journal Of Environment And Human, 11(51), 130-133.
9. Derman, H., & Öztürk, İ. (2014). Water Resources Management And Sustainable Development.
10. Kadirbeyoğlu, G. (2020). Innovative Approaches And Practices In Urban Water Management.
11. Republic Of Turkey, Ministry Of Environment, Urbanization And Climate Change. Basic Concepts. Climate Change.
12. Beylikdüzü Municipality. Beylikdüzü Municipality Official Website.

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Greenhouse Gas Emissions Convergence in European Economies: The Impact of Economic Transition and Environmental Policies

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ABSTRACT

This study conducts a comprehensive panel data analysis using multiple regression models, including fixed effects, random effects, and 2SLS, incorporating interaction variables to assess the impact of economic and environmental factors on greenhouse gas emissions in two European clusters: the Nordic cluster and the Eastern cluster. The findings reveal both similarities and differences between the two clusters: in the Eastern cluster, an increase in renewable energy sources is associated with higher emissions, while in the Nordic cluster, both renewable energy sources and energy efficiency policies significantly contribute to emission re-ductions. Additionally, in both clusters, economic growth is associated with an increase in GHG emissions. The results suggest a convergence of emissions between the clusters as Eastern economies begin to implement more efficient environmental policies. The robustness, stability of the model, and cluster-specific findings provide valuable insights for policy recommendations, offering an original perspective on the convergence of environmental policies across regions.
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 Key words: GHG emissions, energy, environmental, renewable sources, GDP

Introduction

In this article, we aim to analyze the relationship between greenhouse gas (GHG) emissions, environmental taxes, and renewable energy sources, focusing on two distinct groups of countries in Europe. The study con-siders 8 European countries: 4 from the Nordic cluster and 4 from the Eastern cluster.

Countries in Eastern Europe, in an effort to catch up with the economic gap compared to Western Europe, adopted environmental policies later, the main goal being rapid economic growth and industrialization, while Nordic countries have developed, mature economies and the necessary resources. In this way, they managed to implement effective environmental protection policies and promote renewable energy sources.

Nordic countries are considered leaders in renewable energy and ecological measures, while Eastern countries implemented environmental policies in the context of economic transition and EU integration. Therefore, our

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study aims to explore to what extent these countries have adopted efficient measures to reduce emissions and which economic and political factors are the most influential.

This study attempts a comparative design to analyze the differences in environmental policy and energy efficiency between two groups of European countries, the Nordic and Eastern clusters.

The empirical analysis is based on a panel model, with observations for the period 2004-2023, for two clusters, the Nordic cluster consisting of Denmark, Netherlands, Sweden, and Finland and the Eastern cluster consisting of Poland, Czech Republic, Estonia, and Hungary, members of the EU.

For the empirical analysis, we will estimate and compare four specifications of the regression model: the fixed effects model with robust standard errors, the random effects model, as well as the TSLS model, including interaction variables to capture the complex relationships between the analyzed factors. The basic model will be selected based on diagnostic tests, thus ensuring the choice of the most appropriate specifications for the analysis of the impact on evening-effect gas emissions.

Global context of climate change and GHG emissions

GHG emissions are generated by a combination of direct and indirect factors.

Direct factors refer to fuel combustion or various industrial activities, while indirect indicators are associated with economic activities and consumption that generate emissions through other sectors or processes (Liu & Xiao, 2019). Evaluating and monitoring these indicators are essential for understanding the impact of human activities on climate change and for formulating effective policies to reduce GHG emissions.

In the current context, GHG emissions are a major challenge for the planet, the future of the environment, and human societies. Although there are currently solutions and strategies to reduce emissions, their implementation requires collaboration and an integrated approach that combines technological innovation, environmental policies, and public education (1).

For a long time, air pollution was believed to be a territorially limited phenomenon and was approached as a regional or local challenge (2). However, scientists now believe that the climate changes we are witnessing today are caused by human activities and represent a significant threat to the environment. Carbon dioxide has been released into the atmosphere in increasingly large quantities since industrial development began, and today its harmful effects on the environment have become a certainty (3).

For the European Union, the effects of climate change have become a genuine challenge and a priority, committing to implement the most effective measures to reduce GHG emissions while also monitoring their environmental impact.

Reducing GHG emissions and mitigating their effects must be undertaken within a common framework by eliminating uncertainties and identifying ways in which human activities contribute to climate and environmental changes (4).

Economic Growth and the Environmental Kuznets Curve (EKC) in the Context of GHG Emissions

In specialized literature EKC signifies the relationship between the level of economic development and environmental degradation and as a result including GHG emissions. In the early stages of economic growth, pollution and GHG emissions increase, then after a certain level of per capita income is reached, these emissions begin to decrease as economies become more developed and invest more in green technologies and regulations environmentally efficient (3).

In developing countries, economic growth is often based on industrialization and intensive use of natural resources, which can lead to increased GHG emissions due to fossil fuel burning, deforestation and intensive agriculture (5).

In developed economies, the priority of economic and environmental policies is more on sustainable development and sustainability, technological innovation and the use of renewable energy sources. The effect of such effective policies is to decrease GHG emissions simultaneously with economic growth (6).

Energy intensity, economic growth and the carbon factor are the main factors for increasing GHG emissions per capita in both the G7 and BRICS countries, but in the analyzed period 1990-2017, the results of the study reveal that the emissions of GHG per capita decreased in G7 countries and increased in BRICS countries (7), (8)

Key factors contributing to GHG emissions vary across different country groups. Investments in developing countries represent a major source of pollution compared to those in developed countries (9).

The rapid evolution of technology and digitalization, as well as their societal impacts, have drawn the attention of researchers regarding their role in influencing the environment. Studies on emerging economies within the BRICS group indicate that economic expansion and ecological innovation are significant factors influencing emissions in both the short and long term. However, digitalization, green technologies, renewable energy, and effective environmental policies play a critical role in improving environmental quality and sustainability (10). In the post-Soviet countries, the catch-up growth model was oriented exclusively towards economic growth, and there was a low concern for the effects of industrialization on the environment, something that exacerbated, experts say, significantly the consequences of climate change (11)

2.1.3. Impact of the environmental taxes on reduction of GHG emissions

Empirical evidence (the study examines nine European economies between 1994 and 2018) shows that environmental taxes and the promotion of cleaner energies are effective tools for reducing pollution and supporting sustainable development. The advanced methods used and the solid results support the adoption of these policies as an integral part of European efforts to combat climate change and improve environmental quality. (12). Environmental taxes accompanied by emission trading schemes are key tools for reducing GHG emissions, but each has advantages and limitations. EU Emissions Trading System (EU ETS) allow economic flexibility by trading certificates, reducing emissions where costs are lower, while carbon taxes provide greater price predictability for emitters and stimulate innovation in clean technologies (13).

Main Results

Nordic Cluster

With minor exceptions, all variables included in the model have a significant impact on GHG emissions. The Share of Energy from Renewable Sources (SERS) has a negative influence at a significance level of $p < .05$ in most models, indicating that an increase in the share of renewable energy leads to a reduction in GHG emissions.

The results confirm that climate policies and the energy transition have a long-term effect as a negative and significant relationship between Lag_GHG and GHG is observed across all presented models (p-value between .01 and .05).

The negative coefficient of the interaction variable SERS*EP in both estimations, suggests that as energy productivity (EP) increases, the positive effect of renewable energy sources (SERS) on reducing GHG emissions becomes less pronounced.

Eastern Cluster

Contrary to the findings in the Nordic cluster, in Eastern European countries, an increase in the share of renewable energy sources leads to higher GHG emissions. This result may seem counterintuitive but can be explained by the inefficient substitution effect, where the increased use of renewable energy is not sufficient to compensate for fossil fuel consumption. In developing countries, simply increasing the share of renewable energy sources without raising awareness through various methods cannot lead to a reduction in GHG emissions. GDP has a positive impact on GHG emissions across all models, a situation driven by the lack of a cleaner energy mix, as the additional energy demand is largely met by polluting energy sources.

In models with the interaction variable, we observe that the impact of GDP on GHG emissions is lower, indicating that while economic growth contributes to increased emissions, this effect is somewhat mitigated in

models that account for interactions between different variables (such as energy productivity and the types of energy sources used).

Conclusions

The results of the analysis suggest that the impact of SERS (Share of Energy from Renewable Sources) on GHG emissions varies significantly between the two clusters. Thus, SERS plays a different role in each cluster, and its impact on GHG emissions depends on the infrastructural and political context of each region. While in Northern Europe the transition to renewable sources has a positive effect on the environment, in Eastern Europe, it may be less effective in reducing emissions until there is full integration of energy efficiency technologies and policies.

Similarly, ETR (Environmental Tax Revenues) has different effects in each cluster, and its impact on GHG emissions reflects the level of economic development and specific policies of each region. In Nordic countries, environmental taxes are an effective tool for stimulating the transition to a green economy, while in Eastern countries, these taxes have not generated the same results, and further infrastructure reforms and more effective environmental policies are needed to maximize their positive effects on emissions.

Economic policies should support investments in energy-efficient technologies and renewable energy infrastructure. In Nordic countries, these investments can continue to support the transition to a green economy, already having a significant impact on reducing GHG emissions.

In Eastern countries, it is essential to provide economic and fiscal incentives for the adoption of green technologies and the improvement of energy efficiency and financial incentives should be implemented for businesses and households adopting renewable energy sources and energy efficiency measures, while the SME sector should be encouraged to adopt more efficient ecological solutions.

It is crucial for both national and local authorities in both clusters to enhance the capacity to implement environmental policies and educate the public and private sectors about the benefits of the green transition. In Eastern countries, climate change education needs to be strengthened to raise awareness of its effects and the benefits of implementing green policies. In both clusters, there should be more intensive cooperation between member states to implement common solutions for climate change

REFERENCES

1. Oyewo, B. Corporate governance and carbon emissions performance: International evidence on curvilinear relationships. *Journal of Environmental Management*, *334*, (2023) 117474. **(Journal Article**)
2. Balat, M. Energy and greenhouse gas emissions: A global perspective. *Energy Sources, Part B*, *1*(2), (2006), 157-170. . **(Journal Article**)
3. Lapinskienė, G., Tvaronavičienė, M., & Vaitkus, P. Greenhouse gases emissions and economic growth – evidence substantiating the presence of environmental Kuznets curve in the EU. *Technological and Economic Development of Economy*, *20*(1), (2014), 65–78. . **(Journal Article**)
4. Ramanathan, V., & Feng, Y. Air pollution, greenhouse gases and climate change: Global and regional perspectives. *Atmospheric environment*, *43*(1), (2009). 37-50. . **(Journal Article**)
5. Hove, S., & Tursoy, T. An investigation of the environmental Kuznets curve in emerging economies. *Journal of Cleaner Production*, *236*, (2019), 117628. **(Journal Article**)
6. Lorente, D. B., & Álvarez-Herranz, A. Economic growth and energy regulation in the environmental Kuznets curve. *Environmental Science and Pollution Research*, *23*, (2016), 16478-16494. . **(Journal Article**)
7. Zheng, X., Streimikiene, D., Balezentis, T., Mardani, A., Cavallaro, F., & Liao, H. A review of greenhouse gas emission profiles, dynamics, and climate change mitigation efforts across the key climate

294

change players. *Journal of Cleaner Production*, *234*, (2019), 1113-1133. . **(Journal Article)**

8. Fan, L., Usman, M., Haseeb, M., & Kamal, M. The impact of financial development and energy consumption on ecological footprint in economic complexity-based EKC framework: New evidence from BRICS-T region. In *Natural Resources Forum*. Oxford, (2019), UK: Blackwell Publishing Ltd. **(Book Section)**

9. Mohammed, S., Gill, A. R., Ghosal, K., Al-Dalahmeh, M., Alsafadi, K., Szabó, S., ... & Harsanyi, E. Assessment of the environmental kuznets curve within EU-27: Steps toward environmental sustainability (1990–2019). *Environmental Science and Ecotechnology*, *18*, (2024), 100312. . **(Journal Article)**

10. Zhang, H., Dogan, E., Khan, Z., & Binsaeed, R. H. Do digitalization and green innovation limit carbon emissions? Evidences from BRICS economies. *Energy & Environment*, 2024, 0958305X241289537. . **(Journal Article)**

11. Salahodjaev, R., & Isaeva, A. Post-Soviet states and CO2 emissions: The role of foreign direct investment. In *Strategies and Challenges of Sustainable Development in Eurasia*, 2024, (pp. 110-131). Routledge. . **(Journal Article)**

12. Ghazouani, A., Jebli, M.B. & Shahzad, U. (2021). Impacts of environmental taxes and technologies on greenhouse gas emissions: contextual evidence from leading emitter European countries. Environ Sci Pollut Res 28, (2021), 22758–22767. . **(Journal Article)**

13. Haites, E. (2018). Carbon taxes and greenhouse gas emissions trading systems: what have we learned? *Climate Policy*, *18*(8), (2018), 955–966. . **(Journal Article)**

The Importance of Disaster-Resilience on Post-Disaster Urban Planning in Non-Resilient Areas

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ABSTRACT

Earthquakes and urban disasters don't just break buildings, they expose how fragile our cities really are. The 2023 Kahramanmaraş quakes showed this in brutal detail: thousands died, buildings collapsed, and the economic toll was massive. All because of poor construction and planning. These disasters reveal deep flaws that take years to fix.

Here's the hard truth: we can't keep doing this. Every disaster proves we need to act fast. We need stronger buildings, fairer recovery plans, and smarter city designs, especially as climate change makes everything riskier. While we're learning to live with some risk, the patchwork safety standards across cities just aren't good enough. Türkiye's tragedy proves we'll never eliminate risk completely, but we can do much better. Right now, it's the poorest communities paying the price. If we don't change course now, it'll be too late

Key words: disaster resilience, earthquake recovery, urban reconstruction

Introduction

Disasters have always been a big deal for cities. They show us the weak spots of our buildings, governments, and even society's. But earthquakes? They're next-level scary especially in non-resilient urban areas. The damage isn't just physical; it messes up people's lives and local economies for years. Figuring out how to deal with these disasters is important. The February 6, 2023, Kahramanmaraş earthquakes in Türkiye exemplified this destructive potential, resulting in over thousands of fatalities, the collapse of buildings, and economic losses exceeding billions. This disaster not only underlined the consequences of inadequate seismic preparedness but also presented a critical opportunity to reconsider urban resilience in high-risk zones.

According to AFAD (2023a), two major earthquakes occurred on Monday, February 6, 2023. The first earth-

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quake, with a magnitude of 7.7, struck at 04:17 local time with its epicenter in the Pazarcık district of Kahramanmaraş province. This was followed by a second earthquake of magnitude 7.6 at 13:24, centered in the Elbistan district of Kahramanmaraş. The earthquakes were followed by 7,184 aftershocks. The seismic events caused widespread building collapses and severe structural damage across eleven provinces: Kahramanmaraş, Hatay, Adıyaman, Malatya, Gaziantep, Diyarbakır, Şanlıurfa, Osmaniye, Elazığ, Kilis, and Adana, resulting in a total of 53,537 fatalities. AFAD (2023a) reported that in the aftermath of the earthquakes, a total of 14,740 search and rescue personnel were deployed to the region. These teams comprised members from AFAD, JAK, PAK, DİSAK, the Coast Guard, JÖAK, DAK, fire departments, Güven teams, the Ministry of National Education, NGOs, and international search and rescue units. Additionally, field operations involved personnel from AFAD, the Gendarmerie, Police, UMKE (National Medical Rescue Teams), the Ministry of National Defense, ambulance teams, local security forces, and local support units, along with 5,396 volunteers. As of February 21, 2023, the total number of personnel operating in the affected areas reached 242,392 (AFAD, 2023a). (Aydin et al, 2024)

These seismic events in Türkiye have exposed profound structural deficiencies, revealing systemic non-compliance with established construction standards and seismic building codes. Post-disaster analyses show that these urban centers suffer not only immediate physical destruction but also continuing systemic failures that extremely compromise recovery directions and long-term rehabilitation efforts.

The second stream of thought is that improving the performance of natural resource systems requires an emphasis on institutions and property rights. A people-oriented approach which focuses on the resource user rather than on the resource itself is not a new idea; many have pointed out that 'resource management is people management'. However, tools and approaches for such people management are poorly developed and the importance of a social science resource management has not generally been recognized. (Berkes, F. et al)

Therefore, disaster resilience obviously connects risk management with sustainable development. The focus must shift from emergency response to proactive, long-term risk reduction. This transition is key to minimizing future disaster impacts.

Methodology

Context

This research is about the importance of urban planning on non-disaster resilient areas after the disaster occurs. In the light of this study, one could be able to find the reason why building and maintaining disaster resilience in urban areas before the disasters, especially earthquakes. This research was carried out comparatively in terms of disaster resilience. Specifying the Kahramanmaraş earthquake happened on February 6th, 2023, we collected the data from the sources of NGOs, search and rescue teams, and government recordings.

Sampling

The target population was the citizens of Türkiye. The vicinity for working and searching was the internet. In order to compare and contrast the non-disaster resilient cities of Türkiye with the resilient ones in the world, we searched for the publications collectively.

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Data Collection

While collecting data, we drained the information from prejudgement controls, dived into deep research and came up with the real numbers and amounts of the devastating earthquake.

Main Results and Discussion

The City Resilience Framework is a unique framework developed by Arup with support from the Rockefeller Foundation, based on extensive research in cities. It provides a lens to understand the complexity of cities and the drivers that contribute to their resilience. Looking at these drivers can help cities to assess the extent of their resilience, to identify critical areas of weakness, and to identify actions and programs to improve the city's resilience. (ARUP. 2014)

Figure 1

Resilience in individuals, institutions, and urban systems depends on key aspects: strategic foresight, adaptive reuse, load-bearing capacity, fail-safe networks, flexibility, inclusivity, and integration. Strategic foresight actors learn from past experiences to adapt their decisions and behaviors, making them more responsive to change. Adaptive reusing finds innovative ways to repurpose available means during crises.

Systems designed for resilience prioritize load-bearing capacity (ensuring failure is predictable and non-catastrophic), fail-safe networks (building spare capacity and diverse solutions), and flexibility (adapting strategies when faced with sudden challenges). For instance, cities might reorganize public transport for evacuations, while energy networks with redundant pathways can confront supply shocks.

Therefore, resilience is not just technical but also social. Inclusive governance makes certain that planning addresses the needs of the most vulnerable, nurturing shared ownership of solutions. Meanwhile, integrated approaches help different sectors work together instead of staying isolated. For example, cities are using multidisciplinary urban plans to address climate adaptation and disaster risks as one unified effort. Together, these strategies don't just help cities and their residents recover from disruptions, they set them up to grow stronger and thrive.

To present some quantitative data concerning the member organization and the work carried out in the region, it should be noted that 17,545 members declared their availability to support the efforts, while 8,944 members participated in damage assessment training. A total of 2,155 volunteer members engaged in fieldwork within the region. Volunteers were informed that contributing effectively required a minimum commitment of six days, and compliance with this duration was generally observed. Furthermore, depending on the scale of destruction in urban, rural, or operational zones, daily damage assessments varied, though each team evaluated an average of 30 structures per day. Based on this methodology, it can be estimated that members of the Chamber of Civil Engineers conducted structural damage assessments in approximately 200,000 buildings. (MO İstanbul, 2023)

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Table 1 Here is a table demonstrating damage frequencies and intensity measures city by city. (Pujol et al. 2024)

Table 3. Damage frequencies and intensity measures.

City/district	Damage frequency (%)	PGA (g)	PGV (m/s)	$S_{d0.3}$ (m)	$S_{v0.3}$ (m/s)	$S_{a0.3}$ (g)	S_{d1} (m)	S_{v1} (m/s)	S_{a1} (g)
Ministry survey									
Altınözü, Hatay	26	0.53	0.54	0.04	0.74	1.57	0.18	1.12	0.72
Andırın, Kahramanmaraş	12	0.16	0.15	0.01	0.19	0.40	0.03	0.16	0.10
Antakya, Hatay	50	0.54	1.04	0.04	0.81	1.73	0.45	2.84	1.82
Arsuz, Hatay	7	1.34	0.65	0.07	1.37	2.93	0.21	1.31	0.84
Belen, Hatay	9	0.38	0.51	0.03	0.59	1.27	0.13	0.79	0.50
Ceceli, Kahramanmaraş	44	0.68	0.96	0.07	1.54	3.29	0.19	1.22	0.78
Defne, Hatay	40	1.37	1.70	0.16	3.30	7.05	0.55	3.43	2.20
Dörtyol, Hatay	7	0.25	0.40	0.02	0.33	0.71	0.16	1.02	0.66
Göksun, Kahramanmaraş	39	0.64	1.71	0.02	0.51	1.09	0.18	1.13	0.72
Hassa, Hatay	28	0.65	1.12	0.04	0.85	1.82	0.23	1.41	0.91
İskenderun, Hatay	14	0.13	0.28	0.01	0.16	0.34	0.09	0.54	0.34
Islahiye, Gaziantep	27	0.66	1.13	0.05	1.11	2.37	0.31	1.93	1.23
Kırıkhan, Hatay	34	0.73	1.20	0.05	1.07	2.28	0.31	1.92	1.23
Nizip, Gaziantep	4	0.17	0.13	0.01	0.18	0.39	0.07	0.45	0.29
Nurdağı, Gaziantep	50	0.60	1.09	0.05	1.03	2.21	0.48	3.01	1.93
Pazarcık, Kahramanmaraş	31	0.63	1.22	0.03	0.68	1.46	0.24	1.52	0.97
Samandağ, Hatay	38	0.22	0.79	0.02	0.35	0.74	0.22	1.40	0.90
Türkoğlu, Kahramanmaraş	28	0.46	0.56	0.04	0.87	1.85	0.16	1.02	0.65
ACI-133 survey									
Antakya, Hatay	26	0.99	1.33	0.06	1.29	2.75	0.35	2.20	1.41
Elbistan, Kahramanmaraş	22	0.40	0.93	0.03	0.57	1.21	0.21	1.29	0.83
Hassa, Hatay	32	0.59	1.29	0.04	0.75	1.60	0.23	1.45	0.93
Kahramanmaraş (central)	35	0.41	0.61	0.03	0.56	1.19	0.22	1.36	0.87
Kırıkhan, Hatay	17	0.75	0.86	0.05	1.07	2.29	0.19	1.21	0.77
Malatya (central)	25	0.45	0.35	0.02	0.46	0.98	0.14	0.86	0.55
Nurdağı, Gaziantep	38	0.60	1.09	0.05	1.03	2.21	0.48	3.01	1.93
Türkoğlu, Kahramanmaraş	19	0.68	0.96	0.07	1.54	3.29	0.19	1.22	0.78

PGA: peak ground acceleration; PGV: peak ground velocity; ACI: American Concrete Institute.

These repeated disasters make it clear: we need change and we need it now. To prevent future tragedies, we must strictly invest in resilient and decentralized infrastructure, ensure fair recovery efforts, and incorporate cultural heritage into urban planning. What we can't accept is the same destructive cycle where disasters strike, and only some communities recover.

With climate change accelerating and cities expanding, the lessons from Kahramanmaraş and other disaster-prone areas should push us to act. We have to build cities that can resist the growing threats of our time before it's too late. Many cities in Türkiye remain disaster-vulnerable due to poor planning.

Conclusion

The earthquake's devastation is tragic; however, it is a chance to rebuild smarter. Unlike older cities that

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struggle to upgrade outdated systems, we can now design these areas as smart cities from the ground up. We should avoid the usual costs and complications of renewing. The upfront investment may seem steep, but technologies like renewable energy grids, advanced waste management, and streamlined governance will pay off in the long run by cutting costs and conserving resources.

But it's not just about infrastructure. These improvements can also empower people by integrating education and job training programs, we can boost community engagement and literacy rates, creating a stronger, more skilled workforce. In the end, this approach doesn't just rebuild cities, it transforms them into more efficient, sustainable, and resilient places to live.

Here is an OECD report to indicate how to establish disaster resilience in urban areas with a table classified by sectors and purposes. The table below shows sample aid activities and/or development objectives and potential eligibility and scoring for the DRR marker based on the decision process and eligibility criteria presented in the proposal. (*2-Principal; 1-Significant*) (Fabre C, et al. 2017

Table 2

Sector/ purpose	Short description of the aid activity and/or development objectives	Potential Score
General Environment Protection	Integrating disaster risk considerations in environmental law, regulation, policy, planning and programming.	2
Disaster Risk Reduction	Building disaster resilient communities by strengthening national systems for disaster risk management, with accompanying national and sub-national risk assessment.	2
Industry	Assessment of disaster risk in the development of the industrial sector, and corollary impacts of industrial development on disaster risk.	2
Multi-hazard response preparedness	Strengthening national weather forecasting and warning services and disaster risk analysis for building sustainable national capacity for disaster risk management.	2
Energy Generation and Supply	Retrofitting and upgrading smart grids to be resilient to modelled cyclonic wind and flood risk, and promoting continuous service delivery.	2
Other Multisector	Building a city's resilience to earthquakes by reinforcing public buildings to seismically safe standards, and developing city-level disaster preparedness plans and policies.	2
Water Supply and Sanitation	Mobilise networks of NGOs and communities to advocate in favour of a strengthened national water policy and law, which considers sustainable use of water resources, sanitation services, and disaster risk reduction to support vulnerable populations.	1
Education	Support to Ministry of Education for shaping the research agenda on education in conflict-affected states, developing guidelines on education and child protection and corresponding training to education practitioners, and developing disaster risk reduction (DRR) plans for the education sector.	1
Agriculture	Enhancing the resilience of smallholder producers to climate variability by improved management of watersheds, introducing or expanding soil management practices, and reducing vulnerability of crop storage facilities to hazards.	1

In the light of interpreting this table prepared by OECD, the proposed contributions can be outlined as such; The rebuilding plan isn't just about fixing what was destroyed, it's about making the region stronger, smarter, and more resilient than before. Instead of simply putting up new buildings, we're redesigning communities

with disaster prevention in mind, making sure they stay true to their cultural roots while integrating earthquake-resistant infrastructure. Houses and utilities (like water, power, and internet) will be built to confront future quakes, and we will obtain faster disaster responses meeting emergency supply centers strategically. Rural areas will get eco-friendly upgrades, better transportation links, and special support for at-risk groups. Debris will be recycled responsibly, and reconstruction will use energy-efficient materials to cut waste and lower long-term costs. Factories and farms will be modernized with quake-proof upgrades, and job training programs will bring back skilled workers. Technology and private-sector partnerships will come up with better disaster-proof solutions.

Recovery isn't just physical, it's social as well. The plan improves healthcare, education, and local decision-making, working closely with NGOs, universities, and leaders to ensure everyone has a voice. By combining smart urban planning, cultural preservation, and sustainability, this strategy doesn't just rebuild, it sets a global example for disaster-prone regions. Once the results lower energy use, cost savings, they will prove that resilience is possible without losing identity or progress.

REFERENCES

1. Aydın et al. A Review and Evaluation of the Coordination Processes of Humanitarian Aid Sent After the Kahramanmaraş Earthquakes on February 6, 2023. Turk Deprem Arastirma Dergisi 6(1). 2024; 181-214: 183.
2. Berkes, F, Folke C. Linking Social and Economical Systems. 2002. United Kingdom: Cambridge University Press, 2000. 2.
3. ARUP. (2014). City resilience framework. The Rockefeller Foundation. https://www.rockefellerfoundation.org/wp-content/uploads/100RC-City-Resilience-Framework.pdf
4. TMMOB İnşaat Mühendisleri Odası. 6 Şubat 2023 Kahramanmaraş Depremi Hasar Tespit Çalışmaları Değerlendirme Raporu. 8216: 2. [İnternet] MO İstanbul. Şuradan edinilebilir:https://www.imo.org.tr/Eklenti/8216,hasar-tespit-calismalari-degerlendirme-raporurpdf.pdf?0
5. Pujol et al. Quantitative evaluation of the damage to RC buildings caused by the 2023 southeast Turkey earthquake sequence. Eatrhquake Spectra. 2024; 40 (1): 517
6. Organisation for Economic Co-operation and Development (OECD). A. Proposal to Establish a Policy Marker for Disaster Risk Reduction (DRR) in the OECD DAC Creditor Reporting System (CRS). OECD Publishing; 2017 [cited 2025 Jul 25]. Available from: https://one.oecd.org/document/DCD/DAC/STAT(2017)26/en/pdf)

A Sociological Perspective on the Leisure Time Practices of Children as Subjects of Global Migration: The Case of Eskişehir Province

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ABSTRACT

The aim of this study is to reveal the civil society and active citizenship practices of refugee children attending high schools in Eskişehir within the scope of their leisure time, and thus to evaluate their level of integration into the social life of the city they live in. This research was conducted using the explanatory sequential design of the mixed methods approach. The sample consists of 276 refugee students in the quantitative phase and 27 refugee students in the qualitative phase. It was found that most refugee children do not attend events such as theater performances, charity fairs, concerts, cinema screenings, or sports competitions, and that the majority do not read books, daily newspapers, or magazines. A significant portion of the participants were found to work in insecure jobs during school holidays or on days they did not attend school. Female students were generally found to spend their leisure time at home, helping their mothers, doing household chores, and taking care of their younger siblings. Moreover, the students' leisure time activities were not found to be diverse, and their participation in the activities organized by institutions or organizations was observed to be low.

Key words: Refugee, Refugee Children, Refugee High School Students, Leisure Time, Eskişehir.

Introduction

When examining global migration movements, it would be accurate to say that one of the five main trends identified by Castles and Miller (2008) regarding contemporary migration is that "migration is increasingly taking on a child-intensive character." Indeed, children hold a significant quantitative place in international migrations and are important actors in migration movements. Children become part of migrating communities from different countries of origin for various reasons, either accompanied or unaccompanied, often enduring a migration journey filled with hardships. Regardless of where and how it occurs, it would not be wrong to say that the primary victims of migration movements are "children." During and after migration, children undergo a process that even adults find extremely challenging. Children experience this process sometimes accompanied by their families or relatives and sometimes unaccompanied and unprotected. Throughout the migration process, children may be exposed to human trafficking, suffer due to neglect and inadequacies, and face various forms of abuse after being forced to leave their country of origin (Yılmaz, 2014). According to Ikechukwu, Olu, and Bazza (2020), children involved in migration movements are frequently abused and face not only the psychological trauma of separation from their families but also mental and physical injuries caused by malnu-

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trition, forced labor, sexual and physical abuse, and deprivation of medical care and educational services and rights. Another challenging process begins for children who face difficulties before and during migration once they are settled in target or transit countries. Immigrant children and their family members, who come from different cultures, languages, capitals, and habitus, face significant problems in the countries where they settle.

On the other hand, children who start a new life in a different country face numerous disadvantages and must develop various strategies to adapt to social life and live with new people. Language barriers often negatively affect this process, and cultural and ethnic conflicts can disrupt the adaptation process. The majority of migrating children are of school age, and it has been observed that children who begin their education in the host country experience fewer difficulties during adaptation. Similarly, migrant children who use their out-of-school leisure time productively in the city where they live tend to have an advantage in adapting to urban culture and socializing. However, it is difficult to say that migrant children are able to fill their leisure time with sufficient and meaningful activities or have established practices in this regard. Factors such as being a foreigner, language problems, perceptions of otherness, fear of exclusion, cultural shock and conflict, resistance to change, differences in types of capital, remnants of the country of origin, and entrenched habitus significantly influence how migrant children spend their leisure time. Sometimes, the leisure time practices of migrant children also reflect a deprivation in terms of opportunities, making it important to present a sociological picture of how migrant children living in different countries continue their lives in this regard.

Main Results

Civil society practices: (In)ability to integrate into the democratic life of the city

Table 1. Membership status in any civil society organization, association, or political party

Membership status in a civil society organization, association, or political party	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Yes	6	2,1	2,2	2,2
No	272	97,1	97,8	100,0
Total	278	99,3	100,0	

Table 1 presents the views of refugee high school students participating in the study regarding their membership status in civil society organizations, associations, or political parties. Accordingly, nearly all participants (272 students; 97.1%) reported that they are not members of any civil society organization, association, or political party, while only 6 students indicated that they hold such membership. Civil society organizations, associations, and political parties are important components of democracy and democratic societies. It can be said that there are many reasons why refugee high school students living in Eskişehir show little interest in or do not become members of these institutions. Factors such as language barriers, living in a different culture, lack of knowledge about civil society organizations, associations, or political parties, absence of citizenship and voting rights, and lack of interest in these activities can be considered as causes of this situation. One interviewed student shared the following:

> After school, I go home, study, then watch my phone or TV and go to bed. I don't have any other activities besides that. (Participant 16-E, In-depth interview).

Active citizenship practices: Building social, cultural, and symbolic capital in the absence of economic capital

Table 2. Social activities participated in within the city of residence (Eskişehir)

Activities participated in within their city of residence	Frequency	Percentage	Valid Percentage	Cumulative Percentage
Youth organizations	14	5,0	5,0	100,0
Environmental organizations	9	3,2	3,2	100,0
Human rights organizations	13	4,6	4,7	100,0
Charitable activities	20	7,1	7,2	100,0
Municipal activities	22	7,9	7,9	100,0
Sports club activities	41	14,6	14,7	100,0
Artistic activities	15	5,4	5,4	100,0
Summer school activities	16	5,7	5,8	100,0
Other	37	13,2	13,2	100,0

Table 2 presents the views of refugee high school students participating in the study regarding the social activities they take part in within their city of residence. In this question, students were allowed to select more than one option. Accordingly, 41 participants stated that they participate in sports club activities, 22 in municipal activities, 20 in charitable activities, 16 in summer school activities, 15 in artistic activities, 14 in youth organizations, 13 in human rights organizations, 9 in environmental organizations, 5 in civil society organizations, and 4 in political party activities. Additionally, 28 participants selected "other." Looking at the data in the table, it appears that participants are more involved in sports, municipal, charitable, and other activities. Activities of political parties and civil society organizations were among the least attended by participants. These findings align with the data presented in the previous table. As seen in the previous table, nearly all participants (97.1%) were found not to be members of any political party, association, or civil society organization. Some students interviewed expressed the following:

> I don't participate in any social activities. After school, I go home, cook, and take care of the household chores. I have no free time. When other children go home, their mothers have already prepared the meal. That's not the case for me — since I live alone, I have to do everything myself. (Participant 22-K, In-depth interview).

> I don't participate in any social activities because they also require expenses. I cannot afford them. (Participant 14-E, In-depth interview).

> My brother and I play football. We play here at Demirspor Club. We were accepted into the club because we are talented. My position on the football team is goalkeeper. (Participant 25-E, In-depth interview).

> No, I can't go. I don't have the means or the time. Until about a month ago, I was working outside of school hours. There's a place called Antep Bahçe in Söğütönü — I worked there. I started during the summer break, and when school started, I continued going after school. I worked there as a waiter, a service staff member, and a busser. (Participant 23-K, In-depth interview).

Based on the views of the participating students, it is difficult to say that refugee high school students spend their leisure time engaging in diverse and enriching activities. This situation, which can be explained by various factors such as financial difficulties, weak social capital, the need to work to contribute to the household income, deeply rooted cultural norms and perceptions, anxiety about the future, and limited communication opportunities, reduces their participation in urban culture and diminishes the visibility of their agency. In other words, it also negatively affects the fulfillment of the "need for freedom" as defined by Max-Neff within the framework of human rights. This includes the realization of civil and political rights, the need for freedom, equal access to opportunities, and freedom of action (Max-Neff, 1991; Hatiboğlu Eren, 2016: 9).

Conclusion

It has been determined that refugee students are not in contact with civil society organizations, associations, or political parties in the cities where they reside. As these institutions are essential components of democratic life, the lack of interest shown by refugee children toward them suggests that they do not exhibit agency in terms of integrating into the democratic life of the city. Undoubtedly, there are various motives and legal barriers that can explain this situation and the lack of membership in such institutions. However, it is difficult to argue that refugee students are sufficiently motivated to participate even in the public events organized by these institutions. This situation can also be interpreted in the context of Berry's (1970) concepts of marginalization, stress, and ethnic identity issues experienced by local communities during modernization and interaction with external cultures. The weakening of refugee students' ties to their traditional cultures, combined with their inability to fully integrate into the culture of the host society, leads to marginalization. Furthermore, the process of cultural adaptation can be a stressful experience for refugee students. Berry (1970) states that this stress primarily stems from identity confusion, cultural conflicts, and changes in social roles within the community. While some refugee students strive to preserve their traditional culture, others attempt to adopt the dominant culture; however, those who fluctuate between these two poles are often the ones who experience the highest levels of marginalization and stress. This finding is also meaningful when evaluated in the context of Berry's acculturation strategies model (assimilation, marginalization, separation, integration). Therefore, it would be accurate to state that refugee high school students from different countries of origin, who participated in this research, experience a form of "deprivation" in terms of their civil society practices and right to participation, especially regarding their "capabilities."

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REFERENCES

1. Berry JW. Marginality, stress and ethnic identification in an acculturated Aboriginal community. *J Cross Cult Psychol*. 1970;1:239–52.

2. Castles, S., & Miller, M. J. (2008). *The Age of Migration: International Population Movements in the Modern World*. Translated by Bal, B. U., & Akbulut, İ. Istanbul: Istanbul Bilgi University.

3. Ikechukwu AK, Olu OI, Bazza MB. Migration and children. *Villanova J Soc Sci Arts Humanit*. 2020; 2(1). ISSN: 2672-5037 (Online), 2672-5029 (Print).

4. Kaygalak, S. (2001). New urban poverty, migration, and the spatial concentration of poverty: The case of Demirtaş

neighborhood in Mersin. *Praksis*, (2), 124-172.

5. Koçak, H., & Çetin, S. (2022). The impact of spatial concentration and segregation on the social integration of urban refugees. *İdealkent: Journal of Urban Studies*, 38(13), 2934–2952. https://doi.org/10.31198/idealkent.1134723

6. Yılmaz, A. (2014). The state of international migrant children in Turkey: The case of Van. *Mediterranean Journal of Humanities, IV*(2), 349–372. https://mjh.akdeniz.edu.tr https://doi.org/10.13114/MJH.201428449