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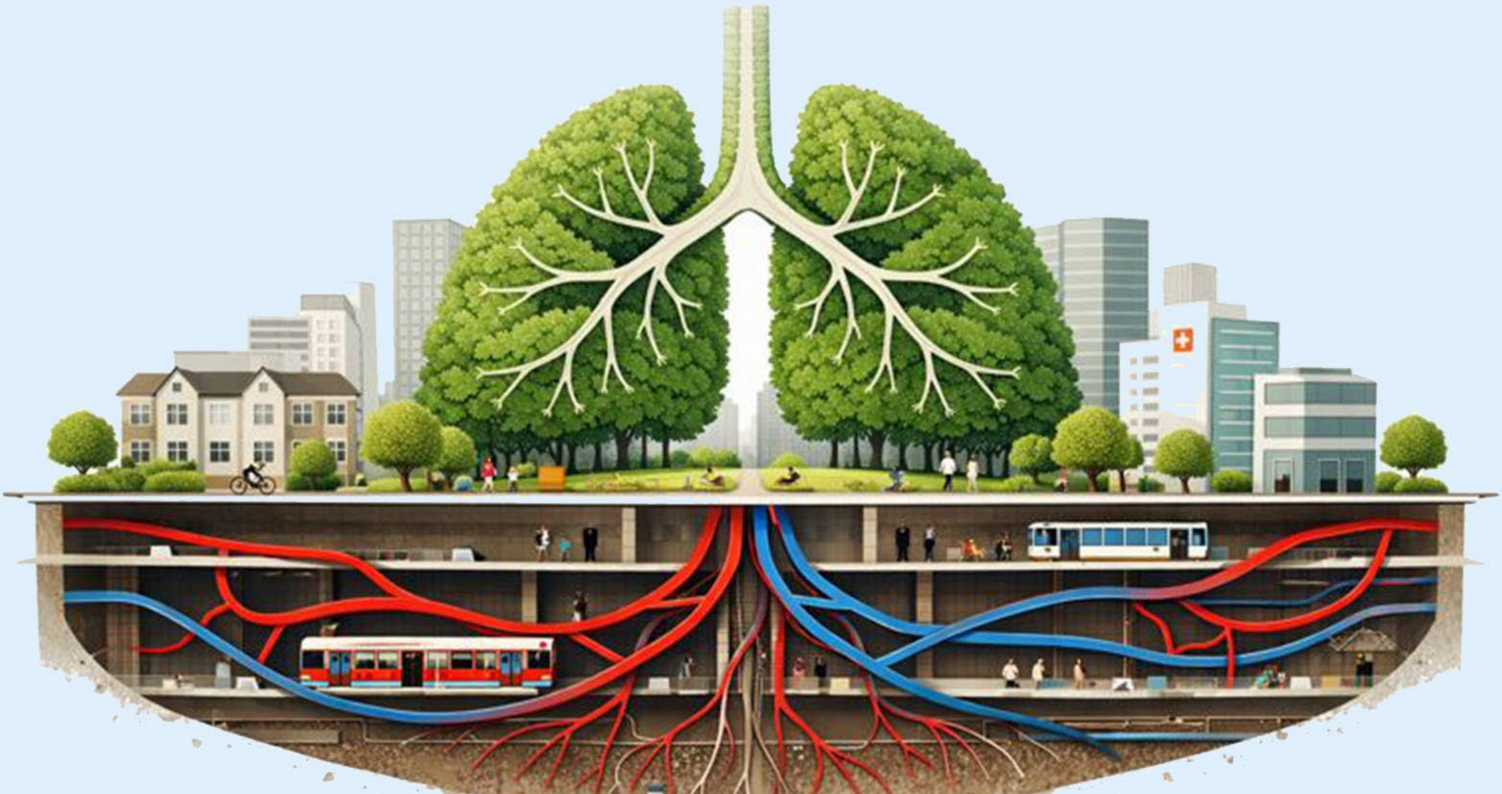

DAKAM

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HEALTHY SPACES AND CITIES

DAKAM BOOKS

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AGE-FRIENDLY SMART CITIES: A NEW PARADIGM FOR HEALTHY AGEING

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ABSTRACT

This study presents an integrated conceptual framework for healthy ageing by linking the age-friendly cities approach with the smart city paradigm and the perspective of gerontechnology. Building on the World Health Organization's (WHO) multidimensional approach to ageing—which encompasses biological, psychological, and social dimensions—it emphasizes that healthy ageing is sustained not only through individual lifestyle choices but also through social, environmental, and political support provided at the societal level. The research examines the practices of seven municipalities from Turkey that have joined the WHO Global Network for Age-friendly Cities and Communities (Izmir and Mersin Metropolitan Municipalities, along with Kadıköy, Beşiktaş, Bornova, Seyhan, and Muratpaşa district municipalities) using qualitative research methods and thematic analysis. Findings reveal that municipalities have developed successful initiatives particularly in the thematic areas of health services, social participation, and outdoor spaces, while shortcomings remain in housing policies, digital inclusion, and employment. Examples such as the 65+ Life Office in Izmir, the Alzheimer Center in Kadıköy, and digital literacy programs in Beşiktaş illustrate the integration of physical support, cognitive/communication, social support, and health/care technologies. The study recommends the establishment of national coordination mechanisms for the technological transformation of age-friendly cities, the expansion of digital literacy programs, the integration of AI-supported care services, and the strengthening of participatory structures such as senior councils. In conclusion, the paradigm of age-friendly smart cities represents a strategic orientation in terms of social inclusion, technological equity, and sustainable urbanization; however, the holistic implementation of WHO's eight domains requires interdisciplinary collaboration and national-level policy coordination.

KEYWORDS:

Age-friendly cities, smart cities, gerontechnology, healthy ageing, digital inclusion

1. INTRODUCTION

In academic literature, ageing is defined as a multilayered process encompassing biological, psychological, and social dimensions, and it is emphasized that ageing and health are best understood through a multidimensional and multitemporal perspective that integrates these dimensions (Galof, 2023; Palgi, Shrira, & Neupert, 2021). Lemoine (2020) identifies five fundamental characteristics most frequently used in the literature to define ageing: structural damage, functional decline, exhaustion, typical phenotypic changes, and increased probability of death. According to this view, any phenomenon that can be described as ageing must include at least one of these features. This approach conceptualizes ageing not merely as chronological progression but as a process emerging from the interaction of biological mechanisms. From an evolutionary biology perspective, ageing is explained as a phenomenon that evolved due to the reduced selective pressure of natural selection, which fails to eliminate late-life traits that are largely neutral. Gaviano et al. (2024) also highlight that ageing is a multilayered process with biological, psychological, and social dimensions, shaped by individual life experiences, and stress the importance of targeted interventions and programs that promote well-being, taking into account the complexity and multidimensionality of the ageing process.

The concept of healthy ageing is addressed not solely as a biological process but as a multidimensional phenomenon defined by individuals' capacity to continue engaging in activities they value throughout their lives. The World Health Organization's Healthy Ageing and Functional Ability document articulates this as follows: "Healthy ageing is defined as the process of developing and maintaining the functional ability that enables well-being in older age" (WHO, 2020). This definition provides a conceptual framework by considering ageing in terms of functionality and social participation.

Ensuring that the ageing process unfolds in a healthy manner requires actions at both individual and societal levels. The age-friendly cities approach developed by the World Health Organization proposes inclusive urban models that regard older adults not merely as individuals to be protected but as active and productive participants in social life. This framework enables the evaluation of the interaction between ageing, poverty, and spatial exclusion from the perspectives of social policy and urban planning (WHO, 2007). The WHO (2020) underscores that healthy ageing is not only determined by individual lifestyle choices but also by the social, environmental, and political support provided by society. The Healthy Ageing and Functional Ability framework introduced by WHO in 2020 defines healthy ageing not simply as a biological process but through individuals' capacity to sustain valued activities throughout their lives. This approach conceptualizes ageing by integrating dimensions of individual functionality and social participation, offering a theoretical lens. It further emphasizes that both individual and societal capacities must be strengthened to enable older adults to continue engaging in meaningful activities. At the individual level, healthy nutrition, regular physical activity, and social participation are highlighted, while at the societal level, the construction of age-friendly cities, the development of inclusive health policies, and the reinforcement of social support mechanisms are considered essential conditions for healthy ageing. Thus, ageing is addressed not merely as a biological transformation but as a holistic process framed through social policy and urban planning perspectives (WHO, 2020).

The smart city paradigm materializes this vision through digital infrastructure and technological solutions. The European Commission's Smart Age-Friendly Cities report emphasizes that older adults must be positioned as active stakeholders in urban life, stating: "Smart age-friendly cities are not only about technology; they are also about creating inclusive environments where older people can fully participate in urban life" (Van Staalduinen, Bond, Dantas, & Jegundo, 2022). This perspective highlights that smart cities should not be regarded merely as spaces providing technological infrastructure, but rather as holistic systems that enhance independence, social participation, and quality of life for older adults. Artificial intelligence and gerontechnology applications further strengthen this intersection.

Hu et al.'s (2024) systematic review demonstrates that smart technologies such as sensors, wearable devices, and AI-based support systems have significant potential to reduce long-term care costs while simultaneously increasing independence and social participation among older adults. Their study classified 44 different smart technologies across 32 articles, noting that applications such as home-monitoring sensors, security systems, wearable devices, and robotic support solutions play a crucial role in maintaining functional capacities. The findings underscore that these technologies provide benefits particularly in terms of physical health and social participation in later life, while also reducing long-term care expenditures. This evidence suggests that healthy ageing can be supported not only at the individual level but also at the societal level.

Similarly, Jonek-Kowalska and Wolny (2025) argue that smart cities should regard older adults not merely as service recipients but as equal and active stakeholders in urban sustainability. Woolrych and Li's (2025) field study in China further illustrates that smart cities offer opportunities to support ageing-in-place, while also revealing social and structural challenges. Their research, conducted in Chongqing, examined how smart city initiatives contribute to older adults' ability to sustain independent living, identifying both opportunities and barriers. The study emphasizes the importance of developing smart city solutions tailored to the needs of older adults at both policy and practice levels. Ultimately, the authors conclude that smart cities must be understood not only as providers of technological infrastructure but also as holistic systems that enhance safety, social participation, and quality of life for older adults. This approach provides a critical framework for developing sustainable policies that support ageing-in-place (Woolrych & Li, 2025).

As Öztürk (2025) also notes, ageing should not be considered solely as a biological process but as a multidimensional phenomenon encompassing social, economic, and spatial dimensions. Individual and societal roadmaps must therefore be established to promote healthy ageing. His review highlights that declining fertility rates, advances in healthcare, and increased life expectancy have led to a rapid growth in the older population, making the challenges faced by urban-dwelling older adults more visible. Limited income sources, inadequate social support mechanisms, housing problems, and rising living costs place older adults at greater risk of poverty and spatial exclusion. Healthy ageing, therefore, is not confined to individual lifestyle choices; it becomes sustainable only through the social, environmental, and political support provided at the societal level. While healthy ageing begins with individual lifestyle decisions, it cannot be sustained without age-friendly cities, inclusive policies, and robust social support systems.

The World Health Organization's (2021) Decade of Healthy Ageing (2021–2030) initiative constitutes a global action plan outlining the policies and programs that countries should implement to support healthy ageing. This strategy provides a comprehensive roadmap aimed at enhancing the quality of life of older adults, strengthening their social participation, and improving access to health services.

WHO's documents published in 2007, 2020, and 2021 conceptualize ageing not merely as a biological process but as one that encompasses social, economic, environmental, and political dimensions, emphasizing that the sustainability of healthy ageing critically depends on age-friendly cities, inclusive policies, and social support systems (WHO, 2007; 2020; 2021). The Global Age-Friendly Cities: A Guide (2007) introduced the age-friendly city approach at a conceptual level, positioning older adults as active and productive participants in urban life. The Healthy Ageing and Functional Ability framework (2020) developed a theoretical definition focusing on the preservation of functional capacities that enable older adults to continue engaging in valued activities throughout their lives. The Decade of Healthy Ageing (2021–2030) transformed this conceptual and theoretical framework into a global action plan, urging countries to enhance the quality of life of older adults through policies and programs. Collectively, these three documents underscore that healthy ageing requires not only individual lifestyle choices but also societal-level interventions such as age-friendly cities, inclusive policies, and robust social support systems.

This approach converges with the smart city vision articulated in the European Commission's Smart Age-Friendly Cities report (Van Staalduinen, Bond, Dantas, & Jegundo, 2022), which supports older adults' safety, mobility, and social participation through digital solutions. It is further reinforced by European initiatives addressing urbanization and ageing challenges. Within the framework of the European Innovation Partnerships, the Smart Cities and Communities (EIP SCC) and Active and Healthy Ageing (EIPonAHA) initiatives bring together the quadruple helix of citizens, public administration, commerce, and research actors to ensure that older adults can participate more actively and safely in urban life (Van Staalduinen, Bond, Dantas, & Jegundo, 2022).

In this context, smart cities are understood not merely as spaces providing technological infrastructure but as holistic systems that enhance independence, social participation, and quality of life for older adults. When digital solutions offered by smart cities are combined with age-friendly city policies, they enable both physical and social support for older adults, thereby contributing to the sustainability of healthy ageing. Discussions in the smart city literature regarding the positioning of older adults extend beyond viewing them as service users supported by technological solutions. When integrated with digital infrastructure and AI-enabled systems, this approach gains a more tangible dimension. In the literature, this convergence is framed as a model that enhances older adults' independence and safety while simultaneously strengthening social participation.

Similarly, Jonek-Kowalska and Wolny (2025) emphasize that smart cities should regard older adults not merely as service recipients but as active stakeholders in urban sustainability. Their systematic review reveals that most existing studies focus on the application of information and communication technologies to improve health and social care services for older adults, while largely neglecting their role as equal and active participants in urban life. The authors argue that, for the sustainability of smart cities, older adults must be considered not only as beneficiaries of services but also as actors engaged in decision-making processes and contributors to social cohesion. This perspective supports the development of a more inclusive urban vision that reduces social exclusion and promotes healthy ageing.

The reviewed studies demonstrate that the concept of healthy ageing intersects with the smart city paradigm in multiple dimensions. At the individual level, this intersection is manifested in the preservation of functional capacities and the support of independent living for older adults (WHO, 2020; Hu et al., 2024). At the societal level, the development of age-friendly policies and the strengthening of social participation reinforce the inclusive nature of smart cities (WHO, 2007; Van Staalduinen et al., 2022). Finally, at the level of urban sustainability, older adults must be positioned not only as service users but also as active stakeholders engaged in decision-making processes and enhancing urban cohesion (Jonek-Kowalska &

Wolny, 2025; Woolrych & Li, 2025). This holistic approach illustrates that healthy ageing and the smart city vision are complementary and mutually reinforcing paradigms.

All of these studies and findings demonstrate that the World Health Organization's age-friendly cities approach (2007; 2020; 2021), when combined with digital solutions, offers a more inclusive urban model and that the integration of artificial intelligence enables healthy ageing to be supported sustainably not only at the individual level but also at the societal level.

The first chapter discussed the theoretical foundations of the concept of healthy ageing and its relationship with the smart city paradigm. This discussion is directly connected to the second chapter, which will address the ageing society and the smart city paradigm, as the redefinition of urban space for older adults makes visible the social and spatial dimensions of healthy ageing. The third chapter will then examine the digital dimension of this spatial and social transformation, evaluating the impact of the transition from digital inequality to digital inclusion on older adults' participation in urban life. Finally, the fourth chapter will explore the technological dimension of these processes, discussing the potential of artificial intelligence and gerontechnology approaches to support healthy ageing.

Within this framework, the study will analyze the practices and projects of two metropolitan municipalities and five district municipalities in Turkey that have joined the WHO Global Network for Age-friendly Cities and Communities. The analysis will focus on age-friendly practices across the WHO's eight thematic domains, as well as within the conceptual categories of smart cities and technology. Ultimately, the study seeks to answer the question: "In Turkey's age-friendly city initiatives, how do digital inclusion and gerontechnological approaches interact, and to what extent do they support healthy ageing?"

2. AGE(ING) SPACE, SOCIETY AND THE SMART CITY PARADIGM

The concept of the ageing society and the smart city paradigm highlights the intersection between demographic transformation and technological urban development. Ageing is not only a biological process but also a social and spatial phenomenon that reshapes the structure of communities and cities. As populations age, urban spaces must be redefined to accommodate the needs, capacities, and aspirations of older adults. Within this paradigm, the ageing society is understood as a collective reality in which older adults are positioned not as passive recipients of care but as active participants in urban life.

Global ageing trends represent one of the most significant demographic transformations of the 21st century. According to United Nations data, the global population aged 65 and over was 727 million in 2020, and this number is expected to exceed 1.5 billion by 2050 (United Nations Department of Economic and Social Affairs, 2020). This demographic shift has brought the integration of the smart city concept with age-friendly approaches to the forefront of contemporary urban policies.

A smart city, or a smart and sustainable city, is defined as an innovative urban environment that utilizes information and communication technologies (ICT) and other tools to enhance quality of life, improve the efficiency of urban service delivery, and strengthen competitiveness, while addressing the economic, social, environmental, and cultural needs of present and future generations (ITU Shaping Smarter More Sustainable Cities, 2016).

With global demographic changes increasing year by year, smart cities have become crucial in the development of age-friendly urban policies. While smart cities leverage technology to improve urban management and public services, age-friendly cities focus on optimizing urban functions to meet the needs of older adults. Smart cities employ ICT to enhance accessibility and mobility, thereby directly benefiting older adults through improved urban services (Klimczuk & Tomczyk, 2016). Technologies such as IoT devices can further facilitate independent living for older adults by providing support through smart home ecosystems that manage daily tasks (Hoof & Yu, 2020). The effective implementation of both concepts requires collaboration among diverse stakeholders, including the public and private sectors, to ensure that initiatives remain sustainable and inclusive (Ivan et al., 2020; Woolrych & Li, 2024). The World Health Organization's guidelines for age-friendly cities also highlight the importance of integrating technology into urban planning to improve the living conditions of older adults (Hoof & Yu, 2020).

The World Health Organization (WHO) launched the Age-friendly Cities and Communities (AFCC) program in 2007, bringing the concept of active ageing to the urban scale (WHO, 2007). The program evaluates the adaptability of cities to older populations across eight key domains: outdoor spaces and buildings, transportation, housing, social participation, respect and social inclusion, civic participation and employment, communication and information, and community support and health services (WHO, 2025). Within this framework, megacities such as New York, Tokyo, and London have joined the WHO network to develop age-friendly policies. For example, New York's Age-friendly NYC initiative introduced 59 action plans encompassing a wide range of adjustments, from physical infrastructure to social services (The New York Academy of Medicine, 2009). Japan's Society 5.0 vision similarly integrates age-friendly city approaches, reflecting efforts to combine technological solutions with social policies in a society where 28% of the population is aged 65 and over (Cabinet Office, 2020).

Smart city indices increasingly integrate social inclusion criteria while measuring the technological maturity of cities. The IMD Smart City Index evaluates not only economic and technological infrastructure but also dimensions such as "health and safety" and "mobility," which directly affect the older population (IMD World Competitiveness Center, 2023). Singapore's Smart Nation initiative provides a successful example of this integration. The Moments of Life platform facilitates older adults' access to digital public services, while sensor-based home monitoring systems enhance the safety of those living alone (Smart Nation Singapore, 2025). Similarly, Barcelona's superilles (superblocks) project expands pedestrian-friendly areas, supporting both environmental sustainability and urban mobility for older adults (Scudellari et al., 2021). Copenhagen's smart city strategy combines age-friendly policies with climate goals, incorporating the concept of "healthy ageing" into urban planning processes. City-wide "quality of life sensors" monitor parameters such as air quality, noise levels, and sidewalk accessibility in older neighborhoods (Copenhagen Solutions Lab, 2019). While the potential benefits of smart city technologies for older populations are significant, the risk of a digital divide may deepen social exclusion (Van Dijk, 2020). Within the framework of Castells' network society theory, inequalities in access to information and communication technologies constitute a new dimension of social stratification (Castells, 2010).

Barriers to technology use among older adults stem from physical factors (vision, hearing, motor skills), cognitive challenges (complex interfaces, learning difficulties), and socio-economic constraints (device costs, internet access) (Seifert, Hofer & Rössel, 2019; Seifert & Cotten, 2020; Van Dijk, 2020). In this context, inclusive design principles are of critical importance. Universal design guidelines require features such as large fonts, high contrast, auditory feedback, and simplified navigation in interface design (Story et al., 1998). Finland's DigiIN project stands out with its digital competence programs for older adults. Training provided in libraries, community centers, and retirement associations has increased older adults' access to e-government services, health applications, and social media (Siren & Knudsen, 2017). Korea's Senior IT Education Program has significantly raised digital literacy rates by offering free technology education to millions of older adults (Korean Ministry of Science and ICT, 2021).

In the post-pandemic period, as the risk of social isolation among older adults increased, technological solutions provided alternative channels for socialization (Brooke & Jackson, 2020). Within Manchester's Age-friendly Manchester program, the Community Connect application connects older adults with local events, volunteering opportunities, and neighborhood networks (Manchester City Council, 2018). However, research by Huber et al. emphasizes that technology should not completely replace face-to-face interactions in order to enhance social engagement. While technology can strengthen social interaction, fully substituting in-person relationships poses risks for the social integration of older adults (Huber et al., 2021). Hybrid models that combine physical community centers with digital platforms generate more sustainable outcomes.

Smart health technologies (e-health, telemedicine, wearable devices) enable older adults to maintain independent living in their homes while reducing the burden on healthcare systems (Peek et al., 2016). Amsterdam's Aging in Place strategy supports safe and independent living for older adults through IoT sensors, emergency buttons, and remote health monitoring systems (Amsterdam Smart City, 2020). However, the acceptance of such technologies is closely linked to older adults' concerns about privacy, autonomy, and their level of trust in technology (Greenhalgh et al., 2017). The ethnographic study by Vines and colleagues shows that older adults may perceive monitoring technologies as "surveillance," and that participation in design processes increases acceptance rates (Vines et al., 2015). Despite these potential benefits, there is often a disconnect between smart city initiatives and the age-friendly agenda, leading to fragmented efforts that fail to fully address the needs of the older population (Woolrych & Li, 2024).

Addressing these challenges involves reconciling smart city policies with age-friendly principles in order to create environments that genuinely support active ageing (Woolrych & Li, 2024). While the integration of smart city technologies into age-friendly initiatives offers significant opportunities, it also underscores the need for coherent strategies that prioritize the unique needs of older adults. This dual approach can ultimately foster more inclusive urban environments.

The convergence of smart city policies and age-friendly principles represents a strategic turning point in an era when digitalization is reshaping urban life. As Woolrych and Li (2024) emphasize, creating inclusive environments that support ageing is possible not only through the implementation of technological innovations but also through their sensitive integration with the needs and capacity profiles of older adults. Therefore, aligning the opportunities offered by smart city technologies with the social and spatial objectives of age-friendly initiatives necessitates a redefinition of the concept of "active ageing" in the digital age.

The intersection of the smart city and age-friendly city paradigms entails not only the development of technological infrastructures but also the strengthening of digital skills, the enhancement of perceived benefits, and the design of technology in ways that support social participation. At this point of convergence, cities can become both more technologically functional and more socially inclusive.

FROM DIGITAL INEQUALITY TO DIGITAL INCLUSION

In contemporary urban contexts, digital technologies have become integral to everyday life, shaping how individuals interact with public services, social networks, and economic opportunities. Yet the uneven distribution of access and skills creates barriers that prevent certain groups—particularly older adults—from fully participating in this digital transformation. Moving from digital inequality to digital inclusion is therefore not only a technological challenge but also a social imperative. Within the framework of smart and age-friendly cities, this transition highlights the need to design environments where digital tools are accessible, usable, and meaningful for all generations, ensuring that ageing populations are supported in both their independence and social engagement.

In today's era, where digital technologies permeate every aspect of urban life, digital inequality has moved beyond being merely an issue of access to technology and has become a critical determinant of social participation, economic opportunities, and quality of life. As Van Dijk conceptualizes, the digital divide is not a one-dimensional phenomenon but rather a multi-layered and interconnected chain of inequalities (Van Dijk, 2005). Within this framework, the intersection of smart city and age-friendly city paradigms necessitates a rethinking of digital inclusion policies.

Jan van Dijk's digital inequality model examines the relationship between technology and society through four levels of access: motivational access, material access, skills access, and usage access (Van Dijk, 2020). Physical and economic access to digital technologies constitutes the fundamental prerequisite for digital participation. However, significant inequalities exist among older populations in terms of both device ownership and internet connectivity. According to Eurostat data, in 2022 internet usage among the 65–74 age group was 61%, compared to 99% in the 16–29 age group (Eurostat, 2023). In Turkey, TÜİK data from 2023 show that internet usage among the 65–74 age group was only 37.4% (TÜİK, 2023). In the context of smart cities, the increasing digitalization of public services makes this access inequality more visible. For instance, Estonia's e-Estonia model, while being a global leader in digital public services, has revealed that 23% of older adults still lack regular internet access (Kalvet, 2012). From the perspective of age-friendly cities, Barcelona's Vincles BCN project represents an exemplary initiative to address digital poverty. The program aimed to eliminate material access barriers by providing socio-economically disadvantaged older adults with free tablets and internet access (Ajuntament de Barcelona, 2020).

Ensuring physical access to technology alone is not sufficient for effective use. Van Deursen and Van Dijk's research categorizes internet skills into four dimensions: operational (technical use), formal (navigation and structural understanding), informational (searching and evaluating), and strategic (using technology to achieve personal goals) (Van Deursen & Van Dijk, 2014). The skill gap faced by older adults is not only a matter of technical insufficiency but is also linked to cognitive load and the complexity of user interfaces. Laboratory studies by Czaja and Sharit demonstrate that older adults spend 40–60% more time and make 30% more errors than younger adults when performing multi-step digital tasks (Czaja & Sharit, 2013). This finding underscores the need for age-oriented usability principles in interface design.

The practical implications of skill inequality in smart cities are evident in e-municipality services. A study conducted in the Netherlands revealed that 52% of individuals over 65 experienced difficulties using e-government services, while 38% avoided them altogether (Keijzer-Broers & De Reuver, 2016: 223–235). Singapore's Silver Infocomm Initiative program exemplifies a multi-layered approach to digital skill development. Its curriculum ranges from basic device use to social media literacy, digital banking, and cybersecurity (Lee et al., 2019).

The least visible yet most profound impact of digital inequality lies in its outcome disparities across economic, social, cultural, and political domains. For older populations, these outcome inequalities are particularly evident in three areas: access to healthcare services, social connections, and civic participation. During the pandemic, the rapid expansion of e-health services transformed the digital divide into a form of health inequality. Research by Beaunoyer and colleagues in the context of COVID-19 revealed that older adults with low digital literacy were 43% more disadvantaged in accessing health information and 67% more exposed to misinformation (Beaunoyer et al., 2020). At this point, digital inclusion policies are considered essential for overcoming digital inequality. The active involvement of older adults in digital design processes has become increasingly important. The participatory design study by Vines and colleagues demonstrated that including older adults in technology design not only improved usability but also strengthened their sense of ownership (Vines et al., 2015). Amsterdam's Aging in Place Lab represents a living lab model that brings together older adults, designers, technology experts, and care providers (Steen & Van Bueren, 2017). Within the lab, the Circle of Care application was developed to monitor daily activities of older adults and share information with families and caregivers. However, the application was designed with privacy concerns at its core, allowing older adults themselves to decide which data would be shared and with whom (Peek et al., 2016). These examples demonstrate that involving older adults in design processes not only enhances usability and acceptance but is also indispensable for developing technological solutions that are ethical, safe, and needs-oriented. At this very point, artificial intelligence systems based on data-driven decision-making mechanisms and gerontechnological applications present a new threshold in supporting the daily lives of older adults; however, designing these technologies in an age-friendly manner requires the integration of participatory design principles into AI development processes.

3. ARTIFICIAL INTELLIGENCE AND GERONTECHNOLOGY APPROACHES

In the rapidly advancing era of digitalization, technology-based solutions are becoming increasingly important for addressing the needs of ageing populations. Particularly at the intersection of smart city policies and age-friendly approaches, innovative practices that support the independence, safety, and social participation of older adults are gaining prominence. Within this context, the field of gerontechnology offers an interdisciplinary perspective aimed at enhancing the quality of life of older adults.

Gerontechnology is an interdisciplinary field that combines geriatrics and technology to improve the quality of life of older adults. It encompasses a range of technologies designed to support independent living, improve health monitoring, and facilitate social interaction among older adults. The integration of smart homes, wearable devices, and assistive robotics exemplifies how gerontechnology can mitigate ageing-related risks such as health decline and social isolation (Colnar et al., 2020; Sale, 2018; Hsu, 2024). These examples demonstrate that involving older adults in design processes not only enhances usability and acceptance but is also indispensable for developing technological solutions that are ethical, safe, and needs-oriented. At this very point, artificial intelligence systems based on data-driven decision-making mechanisms and gerontechnological applications present a new threshold in supporting the daily lives of older adults; however, designing these technologies in an age-friendly manner requires the integration of participatory design principles into AI development processes.

Digital transformation is profoundly reshaping elderly care in all its dimensions. Artificial intelligence (AI) enhances monitoring of older adults in their homes by continuously tracking irregular activities or patterns related to health issues. For example, AI-based systems are critically important in the field of fall prevention, as falls account for more than 50% of hospital admissions due to injuries among individuals aged 65 and above (ITU-T Focus Group on AI for Health, 2021). AI-enabled devices also provide voice assistance to remind older adults of their medication schedules, while AI-supported smart wearables offer an effective tool for monitoring and detecting inconsistencies in biometric data. Virtual reality (VR) technology is likewise employed to improve mental health and combat isolation among older adults. VR allows them to visit favorite places or revisit locations they have experienced before simply by wearing a headset (Rogers, 2020). Feelings of loneliness and isolation have profound effects on the mental health of older citizens, and VR can create new virtual spaces where older adults socialize with family members and friends, engage in activities they may no longer be able to perform in the ageing process, or even re-experience past memories.

Overcoming the challenges associated with ageing populations will continue to require innovative and inclusive approaches that encourage and incentivize industry and governments to deliver services for all (International Telecommunication Union & Pan American Health Organization, 2023). A central element of ITU's collective efforts is collaboration. Everyone must work together to bring all individuals online, regardless of age, gender, education, ability, location, or financial means.

Enhancing digital inclusion and the accessibility of ICTs will directly contribute to the achievement of the United Nations Sustainable Development Goals (SDGs), including SDG 3 (Good Health and Well-being), SDG 8 (Decent Work and Economic Growth), SDG 10 (Reduced Inequalities), and SDG 11 (Sustainable Cities and Communities) (International Telecommunication Union & Pan American Health Organization, 2023). Digital technologies and smart city applications are the key to a societal transformation in which older adults are regarded not as vulnerable but as valuable. When supported by appropriate policies, standards, and inclusive design principles, technology can enable older adults to live independently, healthily, and actively, while positioning them as individuals who make meaningful contributions to society. However, realizing this potential requires the joint efforts of governments, the private sector, academia, and civil society.

4. METHODOLOGY

This study was designed using a qualitative research approach to examine the age-friendly practices of municipalities in Türkiye that have joined the WHO Global Network for Age-friendly Cities and Communities, from the perspective of smart city technologies and gerontechnology. Through thematic analysis, the practices documented in the official records of these municipalities were systematically coded and evaluated within the framework of the eight thematic domains defined by WHO, alongside smart city technologies and gerontechnology approaches.

In this research, each municipality was treated as an independent case, and their practices within the WHO Age-friendly Cities framework were comparatively analyzed in terms of the integration of smart city technologies and gerontechnology applications.

The theoretical framework of the study was built upon three core conceptual structures: the WHO Age-friendly Cities Framework developed in the Global Age-friendly Cities Guide (WHO, 2007), the smart city approach, and the gerontechnology perspective. This multidimensional approach provides a comprehensive basis for evaluating the technological transformation processes of age-friendly cities.

The study group consisted of seven municipalities from Türkiye that are members of the WHO Global Network for Age-friendly Cities and Communities. The sample was determined using criterion sampling (Yıldırım & Şimşek, 2006). The criterion was that municipalities must be officially registered members of the WHO Age-friendly Cities Network and have accessible profile documents published by the network.

The municipalities included in the scope of this study are as follows: Izmir Metropolitan Municipality (Network membership: 2025, Population: 4,479,525, 60+ Population Ratio: 20.0%), Bornova Municipality (2021, 448,737, 14.0%), Seyhan Municipality (2021, 796,000, 11.8%), Beşiktaş Municipality (2019, 167,264, 17.3%), Kadıköy Municipality (2016, 482,571, 19.0%), Muratpaşa Municipality (2014, 521,183, 15.0%), and Mersin Metropolitan Municipality (2018, 1,727,255, 12.0%). The study group represents a total population of 8,622,535, of which approximately 15.6% (1,347,532 individuals) are aged 60 and above.

The research employed the document analysis method. Data sources consisted of two main components: (1) municipal profile documents published on the official website of the WHO Global Network for Age-friendly Cities and Communities, and (2) the comprehensive literature study conducted by Yıldız and Çakıcı (2024). The municipal profile documents accessed from WHO's official site provide detailed information on the services, projects, and policies offered by each municipality in their journey toward becoming age-friendly cities. The data collection process was carried out in November 2025.

The analytical framework of this study was structured around three main dimensions. The first dimension is the WHO Age-friendly Cities Eight Thematic Domains: outdoor spaces and buildings, transportation, housing, social participation, respect and social inclusion, civic participation and employment, communication and information, and community support and health services. The second dimension consists of conceptual categories of smart city technologies, including physical support technologies (smart bus stops, sensors, mobile services), cognitive/communication technologies (digital platforms, e-services), social support technologies (online communities, matching systems), and health/care technologies (telehealth, remote monitoring). Finally, the third dimension is the gerontechnology perspective, which emphasizes the design and application of technologies aimed at improving the quality of life of older adults.

From an ethical standpoint, the research was conducted entirely on publicly available documents, without processing any personal data. Nevertheless, the study has certain limitations: it only covers municipalities that are members of the WHO Global Network for Age-friendly Cities and Communities and therefore does not represent all municipalities in Türkiye. The data are based on official documents reflecting the municipalities' own declarations and do not include independent evaluations of the effectiveness of the practices. Moreover, the study does not provide data on the usage rates or satisfaction levels of older adults regarding these services. The coding process was carried out using a deductive approach, which may have excluded unique practices that fall outside the WHO framework. Despite these limitations, the study offers an analysis of age-friendly municipal practices in Türkiye from the perspective of smart city technologies and gerontechnology.

5. RESULTS

Population ageing and urbanization are two of the greatest social transformations of the 21st century. Cities and communities not only enable people to live longer and healthier lives but also play a crucial role in fostering more equitable and sustainable societies. In the context of the United Nations' designation of 2021–2030 as the Decade of Healthy Ageing, the World Health Organization (WHO) has been working with its member states at both national and local levels to promote the development of age-friendly cities and communities.

WHO also supports the Global Network for Age-friendly Cities and Communities, which encourages and facilitates cities and communities worldwide to become increasingly age-friendly. Established in 2010, the Global Network brings together cities, communities, and organizations across the globe with the shared vision of making their communities great places to grow old. As a response to global population ageing and rapid urbanization, the Network focuses on local-level actions that promote the full participation of older adults in community life and support healthy and active ageing. The mission of the Network is to foster and ensure that cities and communities around the world become progressively more age-friendly. It seeks to achieve this through collaborative initiatives and knowledge sharing. At present, the WHO Global Network for Age-friendly Cities and Communities encompasses 1,739 cities and communities in 57 countries, serving more than 370 million people worldwide (WHO, n.d.).

According to the official website of the World Health Organization's Global Network for Age-friendly Cities and Communities, Türkiye is represented by two metropolitan municipalities and four district municipalities. These are Izmir Metropolitan Municipality and Mersin Metropolitan Municipality, as well as Beşiktaş, Kadıköy, Bornova, Seyhan, and Muratpaşa Municipalities.

5.1. Izmir Metropolitan Municipality

Izmir Metropolitan Municipality joined the WHO Global Network for Age-friendly Cities and Communities in 2025. The city of Izmir has a population of 4,479,525, of which 20% are individuals aged 60 and above. According to the *Advanced Age Izmir Action Plan* prepared by the municipality in 2024, Izmir is the sixth oldest metropolitan city in Türkiye, following Balıkesir, Rize, Aydın, Muğla, and Samsun. However, Izmir has the largest absolute number of older adults among all metropolitan cities. The action plan is structured around five main objectives:

Ensuring inter-institutional cooperation and coordination

Promoting participation in social life

Creating an age-friendly environment

Providing age-friendly services in disasters and emergencies

Ensuring sustainability

When evaluated within the framework of the WHO's eight thematic domains for age-friendly cities, the age-friendly practices of Izmir Metropolitan Municipality encompass all eight domains, with particularly strong examples in the areas of health services, social participation, and transportation. Economic support mechanisms such as the Retiree Solidarity Card provide a distinctive contribution to reducing inequalities within the WHO framework.

WHO Domain	İzmir Practice	Evaluation
1. Outdoor Spaces and Buildings	Accessible design of Zübeyde Hanım Nursing Home, including library, workshops, and sports areas	Enhances physical and social accessibility, supporting safe and active living for older adults.
2. Transportation	Discounted public transport for those aged 60+, free for those aged 65+	Facilitates access to essential services and promotes independent mobility
3. Housing	Nursing home and home care services	Ensures safe and supported living for older adults both in institutions and at home.
4. Social Participation	Healthy Ageing Center, sports, excursions, workshops	Strengthens older adults' active participation in community life and reinforces social ties.
5. Respect and Social Inclusion	Retiree Solidarity Card providing economic support	Reduces inequalities and fosters recognition of older adults' value in society.
6. Civic Participation and Employment	Older adults taking productive roles in workshops and activities	Encourages participation and reinforces older adults' active societal roles.
7. Communication and Information	Information and guidance services at the Healthy Ageing Center	Facilitates access to information and supports digital and social literacy among older adults.
8. Community Support and Health Services	Home Health and Care Service, Alzheimer and Dementia Center	Improves well-being through personalized care, psychosocial support, and health services.

Table 1. Age-friendly Practices of Izmir Metropolitan Municipality within the Framework of WHO's Eight Thematic Domains for Age-friendly Cities

5.2. Mersin Metropolitan Municipality

Mersin Metropolitan Municipality joined the WHO Global Network for Age-friendly Cities and Communities in 2018. According to the most recent census, Mersin has a population of 1,727,255, with individuals aged 60 and above accounting for 12% of the total population. With its mild climate, purchasing power parity, availability of fresh fruits and vegetables, and relatively low housing prices, the city has become an attractive destination for older adults and retirees from other parts of Türkiye. Mersin has prepared a "current status report" providing information on services for older adults across the eight domains: Outdoor Spaces and Buildings, Transportation, Housing, Social Participation, Respect and Social Inclusion, Civic Participation and Employment, Communication and Information, and Community Support and Health Services. In addition, the municipality has planned activities in all of these domains. The "Active Aging House" project of Mersin Metropolitan Municipality stands out as a multidimensional center that integrates health services, social participation, and cultural activities. The projection that Mersin's older population will double within the next decade is considered a critical indicator for the sustainability of these policies. Through its institutional reports and planning, Mersin presents a strong profile as an age-friendly municipality within Türkiye's Age-friendly Cities Network.

WHO Domain	Mersin Practice	Evaluation
1. Outdoor Spaces and Buildings	Hobby gardens and social areas within the "Active Aging House"	Provides safe and accessible spaces for older adults to socialize.
2. Transportation	Centers located close to public transport	Facilitates access to services and supports independent mobility for older adults.
3. Housing	Planning initiatives to improve living conditions of older adults	Housing policies are designed to support independent living for older adults.
4. Social Participation	Music, drama, chess, folk music choir, excursions, picnics	Strengthens older adults' active participation in community life and reinforces social ties.
5. Respect and Social Inclusion	Older adults taking active roles in cultural activities	Promotes recognition of older adults' value and fosters social inclusion.
6. Civic Participation and Employment	Trainings and cognitive skill development programs	Supports older adults in assuming productive roles and active citizenship.
7. Communication and Information	Trainings (healthy living, cognitive development) and counseling services	Facilitates access to information and raises awareness among older adults.
8. Community Support and Health Services	Dental screening, blood pressure measurement, psychosocial counseling	Health services and support programs enhance the well-being of older adults.

Table 2. Age-friendly Practices of Mersin Metropolitan Municipality within the Framework of WHO's Eight Thematic Domains for Age-friendly Cities

5.3. Beşiktaş Municipality

Beşiktaş Municipality joined the WHO Global Network for Age-friendly Cities and Communities in 2019. With a district population of 167,264, older adults aged 60 and above constitute 20.4% of the total. The municipality has developed specific programs to meet the needs of older residents, who represent a significant part of its organizational focus. In 2012, a field study was conducted with residents aged 75 and above, providing insights into their profiles and developmental needs. The survey titled "What are the basic needs in old age?" revealed that 29.8% of participants experienced difficulties with household cleaning and hygiene support, 33.27% reported challenges in personal care and hygiene, and 28.86% indicated that they required assistance with daily activities and self-care or were fully dependent. The municipality's core services for older adults include the Welfare Service, through which municipal staff provide household cleaning and personal care support; the Soup Kitchen Service, which ensures healthy and regular nutrition through free meals; Social Centers, which offer safe and supportive spaces for socialization; and the 65+ Life Office, an innovative unit that positions older adults not only as service recipients but also as service providers, thereby fostering active participation. These services collectively address all eight thematic domains of the WHO age-friendly cities framework. Particularly noteworthy is the establishment of the 65+ Life Office, which represents the first institutional-level Gerontology Office in Türkiye and serves as a pioneering example at the national level. Distinctive initiatives such as the Podiatry Unit and the Gerontomimari Project directly enhance the safety and health of older adults in their daily lives, while social centers and workshops ensure that older residents are engaged not only as beneficiaries but also as active participants and contributors.

WHO Domain	Beşiktaş Practice	Evaluation
1. Outdoor Spaces and Buildings	"Age-Friendly Exercise Area" (Yeşim Park), Gerontological Architecture Project	Reduces fall risks through safe public spaces and home modifications for older adults.
2. Transportation	Patient transfer ambulance, hemodialysis transport service	Facilitates access to health services and supports independent mobility.
3. Housing	Home cleaning, hygiene, and personal care services	Supports independent living for older adults in their own homes.
4. Social Participation	Social Centers (Etiler, Ulus), concerts, seminars, hobby gardening	Strengthens older adults' active participation in community life and reinforces social ties.
5. Respect and Social Inclusion	65+ Life Office, workshops, positioning older adults as service providers	Promotes recognition of older adults' value and enables their participation in decision-making processes.
6. Civic Participation and Employment	"Age-Friendly Beşiktaş Workshop I–II," joint projects with gerontologists and NGOs	Encourages direct contributions of older adults and experts to municipal policies.
7. Communication and Information	Digital literacy trainings (E-Government, E-Nabız, social media)	Facilitates access to information and enhances digital inclusion for older adults.
8. Community Support and Health Services	Home health services, podiatry unit, dietitian support, 24/7 ambulance	Improves well-being through personalized care and comprehensive health services.

Table 3. Age-friendly Practices of Beşiktaş Municipality within the Framework of WHO's Eight Thematic Domains for Age-friendly Cities

5.4. Bornova Municipality

Bornova Municipality joined the WHO Global Network for Age-friendly Cities and Communities in 2021. The district has a population of 448,737, with individuals aged 60 and above accounting for 14% of the total. Bornova is considered one of Türkiye's relatively older districts. The municipality implements two major programs for older adults: the Healthy Ageing Center and the Home Care Service. The Healthy Ageing Center provides services to residents aged 60 and above with the aim of supporting healthier and higher-quality lives. The center brings older adults together and offers sports, arts, and cultural activities that enhance quality of life and foster integration into cultural and social life. In addition, those benefiting from the Healthy Ageing Center have access to free health services provided by nurses, dietitians, and dentists. The Home Care Service, on the other hand, delivers necessary health services to all residents aged 60 and above within Bornova in their home environment, through professional health teams. Older adults with physical limitations that prevent them from leaving their homes are visited regularly, during which their needs are met and blood pressure, blood sugar, and cholesterol levels are monitored (Age-friendly City Bornova, n.d.). An examination of Bornova Municipality's initiatives shows that they address all eight thematic domains of the WHO age-friendly cities framework. In particular, the Home Care Service and the rural-focused " The village- trace/ Köyde- iz" project represent unique and strong examples of age-friendly municipal practices in Türkiye. With the reopening of the Healthy Ageing Center in 2024, social participation and health services have been further strengthened. Bornova thus stands out as a municipality that integrates age-friendly policies at the local level, both in the urban center and in rural areas.

WHO Domain	Bornova Practice	Evaluation
1. Outdoor Spaces and Buildings	Hobby garden, workshops, and sports areas at the Healthy Ageing Center	Enhances physical and social accessibility, supporting safe and active living for older adults.
2. Transportation	Patient transfer services	Facilitates access to health services and supports independent mobility for older adults.
3. Housing	Home care services (bathing, cleaning, health check-ups)	Supports independent living for older adults in their own homes.
4. Social Participation	Sports, music, cinema, reading days, word games, workshops	Strengthens older adults' active participation in community life and reinforces social ties.
5. Respect and Social Inclusion	Involvement of family members in the care process	Promotes recognition of older adults' value in society and strengthens family bonds.
6. Civic Participation and Employment	Older adults assuming productive roles in workshops and activities	Encourages participation and reinforces older adults' active societal roles.
7. Communication and Information	"Köyde İz" project providing health education and information	Facilitates access to information and raises awareness, particularly in rural areas.
8. Community Support and Health Services	Home health services, physiotherapy, dental screenings, Özgül Gündüz Public Health Center	Improves well-being through personalized care and comprehensive health services.

Table 4. Age-friendly Practices of Bornova Municipality within the Framework of WHO's Eight Thematic Domains for Age-friendly Cities

5.5. Kadıköy Municipality

Kadıköy Municipality joined the WHO Global Network for Age-friendly Cities and Communities in 2016. The district has a population of 482,571, of which 19% are individuals aged 60 and above. Kadıköy Municipality defines its mission as follows: "To operate within its duties, authorities, and responsibilities with the aim of creating a participatory, innovative, modern, egalitarian, liberal, and strong society and environment for every individual, particularly children and young people, while ensuring the sustainability of its services." In line with this mission, the municipality embraces the vision of "being a local government that adopts participatory governance and leads in innovation." Within this framework, the development of programs and projects with the active participation of older adults, as well as the enhancement of their involvement in decision-making processes, constitutes the foundation of Kadıköy Municipality's ageing policies. Kadıköy is one of the districts in Türkiye with the highest proportion of residents aged 65 and above, which constitutes one of the main reasons for its strong commitment to becoming an age-friendly city. As a leading local actor in the provision of social services, Kadıköy Municipality adopts specific principles and policies targeting the older population. Among the districts of Istanbul, Kadıköy has the highest share of residents over the age of 65. Since ageing is a priority area in the district, Kadıköy Municipality became the second municipality from Türkiye to join the WHO Global Network for Age-friendly Cities and Communities, thereby attaining a strong position at the international level. Furthermore, in April 2016, the municipality participated in the WHO pilot study on age-friendly environments in Europe, successfully completed its report, and submitted it to WHO. Kadıköy Municipality has also implemented inclusive services such as the Alzheimer Center and the Social Center, which reduce social isolation for both older adults and caregiving families. Kadıköy distinguishes itself by positioning older adults not merely as service recipients but as active actors in decision-making processes, thereby reinforcing its profile as an innovative and participatory age-friendly municipality.

WHO Domain	Kadıköy Practice	Evaluation
1. Outdoor Spaces and Buildings	Social Centers, Alzheimer Center	Provides safe and accessible spaces for older adults to socialize and receive care.
2. Transportation	Emphasis on accessibility in WHO reporting; centers located close to public transport	Facilitates older adults' access to services.
3. Housing	Limited direct housing projects; home care policies supported	Housing policies need to be further developed to support independent living for older adults.
4. Social Participation	Activities at the Social Center; programs supporting daily routines of Alzheimer patients	Strengthens older adults' active participation in community life and reinforces social ties.
5. Respect and Social Inclusion	Older adults' involvement in decision-making; active participation in WHO pilot projects	Promotes recognition of older adults' value and ensures their representation at the global level.
6. Civic Participation and Employment	Programs enabling older adults' participation in municipal decision-making processes	Encourages participation and reinforces older adults' active societal roles.
7. Communication and Information	WHO reporting and participation in European pilot study	Facilitates access to information and aligns with global networks.
8. Community Support and Health Services	Alzheimer Center: health services, psychosocial support, training for families	Improves well-being through personalized care, psychosocial support, and health services.

Table 5. Age-friendly Practices of Kadıköy Municipality within the Framework of WHO's Eight Thematic Domains for Age-friendly Cities

5.6. Muratpaşa Municipality

Muratpaşa Municipality joined the WHO Global Network for Age-friendly Cities and Communities in 2014. The district has a population of 521,183, with individuals aged 60 and above comprising 15% of the total. The municipality identifies its primary objective as improving the health and care standards of older adults. In line with this goal, Muratpaşa has introduced initiatives such as elderly houses that provide spaces for socialization, the Alzheimer Day Care Center, a home care program, the Alzheimer Consultation Line launched in 2018, the Elderly Council established in 2019 to implement participatory democracy, and the innovative Dementia Café. In addition to health and care projects, the municipality also offers parks and sports activities tailored to older residents. Other notable initiatives include programs to strengthen intergenerational relations, the Digital Competence Training Program, internal workshops on age-friendly cities, and research on the psychological impacts of the pandemic. An examination of Muratpaşa Municipality's practices shows that they address all eight thematic domains of the WHO age-friendly cities framework. Particularly, the Alzheimer Day Care Center and the Alzheimer Consultation Line stand out as pioneering examples in Türkiye. The Dementia Café and the Emergency Button projects are innovative practices that reduce social isolation and enhance safety. Muratpaşa thus demonstrates a holistic approach to age-friendly municipal governance, integrating health, social participation, and digital competence.

WHO Domain	Muratpaşa Practice	Evaluation
1. Outdoor Spaces and Buildings	Four Elderly Houses (5,236 members), parks and sports areas; target of ten Elderly Houses	Provides safe and accessible spaces for older adults to socialize and supports active living.
2. Transportation	Ambulance service (home–hospital transfers)	Facilitates access to health services and supports independent mobility.
3. Housing	Home care program (social and health services)	Supports independent living for older adults in their own homes.
4. Social Participation	Alzheimer Day Care Centre, Dementia Café plan, sports and cultural activities	Strengthens older adults' active participation in community life and reinforces social ties.
5. Respect and Social Inclusion	Alzheimer Helpline, Elder Council (2019)	Promotes recognition of older adults' value and enables their participation in decision-making processes.
6. Civic Participation and Employment	Elder Council fostering "participatory democracy"	Encourages older adults' direct contributions to municipal policies.
7. Communication and Information	Digital Competence Training Program, Alzheimer Helpline	Facilitates access to information and enhances digital inclusion for older adults.
8. Community Support and Health Services	Alzheimer Day Care Centre (72 patients), home care, emergency button project	Improves well-being through personalized care and comprehensive health services.

Table 6. Age-friendly Practices of Muratpaşa Municipality within the Framework of WHO's Eight Thematic Domains for Age-friendly Cities

5.7. Seyhan Municipality

Seyhan Municipality joined the WHO Global Network for Age-friendly Cities and Communities in 2021. The district has a population of 796,000, with individuals aged 60 and above comprising 11.8% of the total. In its commitment letter to the Age-friendly Cities Network, the municipality emphasized its priority of transforming the district into a place where people of all ages and genders can live. A pioneering initiative in the region, the mobile personal care service for older adults and persons with disabilities expanded its capacity and reached more than 1,700 individuals in 2020. The personal care team provides services including physiotherapy, personal hygiene, and nursing. Viewing older adults not only as beneficiaries of social services but also as active participants in decision-making processes, the municipality established the "Youngest Elders Council" within the municipal assembly to strengthen and enhance their capacity to engage in governance. This council, composed of retired professionals from diverse fields such as public administration, engineering, architecture, academia, and the private sector, guides the municipal administration in making Seyhan more age-friendly. An examination of Seyhan Municipality's approach shows that it addresses all eight thematic domains of the WHO age-friendly cities framework. In particular, the mobile care services and the "Youngest Elders Council" stand out as innovative and exemplary practices in Türkiye's age-friendly municipal governance. Furthermore, projects such as Active Ageing and the Alzheimer Center provide a holistic vision that meets both the physical and social needs of older adults.

WHO Domain	Seyhan Practice	Evaluation
1. Outdoor Spaces and Buildings	Planned Active-Ageing Centre and Alzheimer Centre; sports facilities, workshops, hobby gardens	Provides strong infrastructure investments to support older adults' active living in safe, accessible, and social environments.
2. Transportation	Centers located close to public transport	Facilitates independent mobility and access to services for older adults.
3. Housing	Mobile personal care services (home physiotherapy, hygiene, nursing)	Supports older adults in maintaining independent living in their own homes.
4. Social Participation	Sports, arts, cultural activities, recreation halls	Strengthens older adults' active participation in community life and reinforces social ties.
5. Respect and Social Inclusion	Priority service desks and helpline for those aged 60+	Promotes recognition of older adults' value and ensures equitable access to services.
6. Civic Participation and Employment	"Youngest-old Council" enabling older adults' involvement in decision-making processes	Positions older adults not as passive service recipients but as active decision-makers.
7. Communication and Information	Dedicated helpline for older adults	Facilitates access to information and provides guidance and counseling.
8. Community Support and Health Services	Mobile care team (serving 1,700 individuals), physiotherapy, nursing	Enhances older adults' well-being through personalized health and care service

Table 7. Age-friendly Practices of Seyhan Municipality within the Framework of WHO's Eight Thematic Domains for Age-friendly Cities

When the local governments in Türkiye that have joined the WHO Global Network for Age-friendly Cities and Communities (GNAFCC) are evaluated, Muratpaşa Municipality is seen to occupy a pioneering position in this field. By joining the network in 2014, Muratpaşa became one of the first municipalities from Türkiye to be a member of this global initiative. The municipality's participation in the WHO Age-friendly Cities Network in 2014 marked an important turning point in the development of age-friendly policies at the local level in Türkiye. A decade of accumulated experience demonstrates that Muratpaşa is not only a pioneer but also a mature local government that has adopted a sustainable service model in this area. This leadership has encouraged other municipalities to join the WHO network in subsequent years and has contributed to the advancement of the age-friendly municipal movement in Türkiye. As a pioneering municipality, Muratpaşa's practices and projects have drawn attention to age-friendly cities in the work of many other municipalities, serving as a source of inspiration for policies shaped around the participation of older adults in urban life and the principle of ageing in place within the framework of participatory democracy.

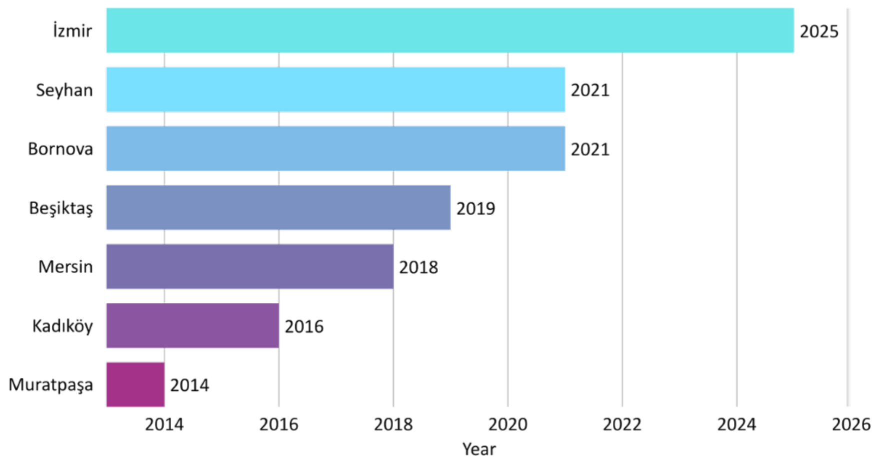

Figure 1. Distribution of Local Governments from Türkiye Joining the WHO Global Network for Age-friendly Cities and Communities (GNAFCC) by Year of Participation

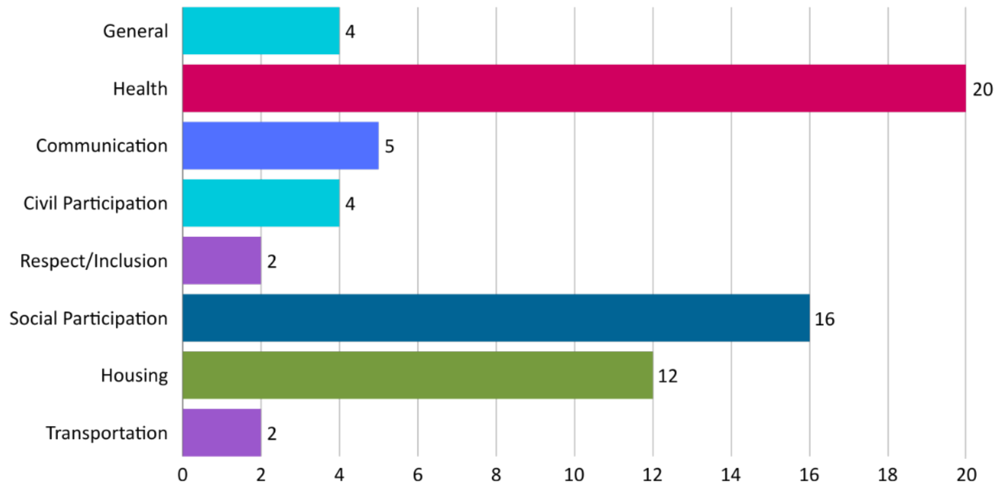

Figure 2. Distribution of Services by WHO Thematic Domains across All Municipalities

The most successful areas of municipal practice are health services, housing, and social participation. Notable examples include Beşiktaş's establishment of Türkiye's first Gerontology Office and podiatry services, Izmir's Zübeyde Hanım Nursing Home with a capacity of 425 residents, Muratpaşa's Elderly House network with 5,236 members and its Alzheimer Day Care Center, and Seyhan's mobile care service reaching more than 1,700 individuals. The diversity and scope of services provided in the field of health are particularly striking. However, significant shortcomings remain in the domains of outdoor spaces and buildings, transportation, respect, and social inclusion. In terms of transportation, although free public transport services for individuals aged 65 and above are currently available in many municipalities across Türkiye, smart bus stops, sensors, and digital information panels are either insufficient or not utilized at all.

It is also noteworthy that municipalities' use of technology has largely focused on traditional service models, while smart city technologies and gerontechnology applications remain limited. Beşiktaş's 24/7 online medical consultation service, digital literacy training programs, and gerontomimari initiatives, as well as Muratpaşa's Emergency Button project, stand out as pioneering technological approaches. Nevertheless, the expansion of gerontechnology solutions such as telehealth, smart home systems, sensor technologies, and mobile applications is necessary. Within this framework, municipal practices and projects have also been evaluated in terms of four technology categories—physical support technologies, cognitive/communication technologies, social support technologies, and health/care technologies—highlighting their role in supporting independent living and strengthening social connections among older adults (Harrington & Harrington, 2000).

Municipality	WHO Domain	Technology Category	Service Description
Beşiktaş	Housing	Health/Care	Home Health Services – medical examination
Beşiktaş	Housing	Health/Care	Home nursing and caregiver services
Beşiktaş	Housing	Health/Care	Home physiotherapy services
Beşiktaş	Housing	Physical Support	Gerontological Architecture Service – prevention of domestic accidents
Beşiktaş	Social Participation	Social Support	Social Centers (Nursing Homes) – Etiler and Ulus
Beşiktaş	Social Participation	Social Support	Psychological Counseling Service
Beşiktaş	Social Participation	Social Support	Organization of concerts, seminars, excursions, and picnics
Beşiktaş	Social Participation	Cognitive/Communication	65+ Digital Literacy Training
Beşiktaş	Social Participation	Physical Support	Age-Friendly Exercise Area – Yeşim Park
Beşiktaş	Communication	Cognitive/Communication	Training on E-Government, E-Nabız, MHRS
Beşiktaş	Communication	Cognitive/Communication	Digital literacy – protection against fraud
Beşiktaş	Communication	Cognitive/Communication	Training on social media use
Beşiktaş	Health	Health/Care	Soup Kitchen – daily hot meals for 75+
Beşiktaş	Health	Health/Care	Welfare Service – cleaning and personal care
Beşiktaş	Health	Health/Care	Podiatry Service – foot health for 75+
Beşiktaş	Health	Health/Care	Comprehensive Gerontological Assessment Project for 80+
Beşiktaş	Health	Physical Support	Ambulance services – 24/7 emergency assistance
Beşiktaş	Health	Physical Support	Patient transfer ambulance
Beşiktaş	Health	Physical Support	Healthy Living Center
Beşiktaş	Health	Cognitive/Communication	24/7 Online Medical Consultation Service
Beşiktaş	Respect/Inclusion	Social Support	65+ Life Office – first Gerontology Office in Türkiye
Beşiktaş	Respect/Inclusion	Social Support	Age-Friendly Beşiktaş Workshops – 2022 and
Bornova	Housing	Health/Care	Home Care Service – for 60+
Bornova	Housing	Health/Care	Blood pressure measurement, blood sugar testing
Bornova	Housing	Health/Care	Bathing services, wound care
Bornova	Social Participation	Physical Support	Healthy Ageing Center – reopened in 2024
Bornova	Social Participation	Social Support	Handicraft workshops, hobby garden
Bornova	Social Participation	Cognitive/Communication	Cinema screenings, reading days
Bornova	Health	Health/Care	Physiotherapy and rehabilitation services
Bornova	Health	Health/Care	Dental examination and education
Bornova	Health	Health/Care	Özgül Gündüz Public Health Center
Bornova	Health	Physical Support	"Köyde İz" Project – mobile health services
Bornova	Health	Physical Support	Patient transfers
İzmir	Housing	Health/Care	Zübeyde Hanım Nursing Home – capacity of 425
İzmir	Housing	Health/Care	Home Health and Care Service
İzmir	Housing	Social Support	Library, sewing workshop, handicrafts
İzmir	Transportation	Physical Support	Discounted public transport – 60+
İzmir	Transportation	Physical Support	Free public transport – 65+
İzmir	Social Participation	Physical Support	Healthy Ageing Center – sports and activities for 55+
İzmir	Social Participation	Social Support	Workshops, visits to historical sites
İzmir	Health	Health/Care	Alzheimer and Dementia Center
İzmir	Health	Social Support	Retiree Solidarity Card – support for water, rent, food
Kadıköy	Civic Participation	Social Support	Participatory governance model
Kadıköy	Civic Participation	Social Support	Inclusion of older adults in decision-making processes
Kadıköy	General Services	General	Various services for 65+ population – 93,887 individuals
Kadıköy	General Services	General	Participation in WHO pilot study – 2016
Mersin	General Services	General	Decision to implement WHO Age-Friendly Cities criteria
Mersin	General Services	General	Status report prepared across eight domains
Muratpaşa	Social Participation	Physical Support	Elderly Houses – 4 units, 5,236 members
Muratpaşa	Social Participation	Social Support	Socialization spaces
Muratpaşa	Social Participation	Social Support	Dementia Café – planned
Muratpaşa	Health	Health/Care	Alzheimer Day Care Center – 72 patients
Muratpaşa	Health	Health/Care	Home Care Program
Muratpaşa	Health	Physical Support	Ambulance services
Muratpaşa	Health	Physical Support	Emergency Button – planned
Muratpaşa	Health	Cognitive/Communication	Alzheimer Helpline – 2018
Muratpaşa	Civic Participation	Social Support	Elder Council – 2019
Seyhan	Housing	Health/Care	Mobile personal care services – reached 1,700+ individuals
Seyhan	Housing	Health/Care	Physiotherapy, personal hygiene, and nursing services
Seyhan	Social Participation	Physical Support	Active Ageing Center – feasibility stage
Seyhan	Social Participation	Physical Support	Alzheimer Center – feasibility stage
Seyhan	Social Participation	Social Support	Planned sports facilities and handicraft workshops
Seyhan	Communication	Cognitive/Communication	Priority service desks planned for 60+ group
Seyhan	Communication	Cognitive/Communication	Establishment of helpline planned
Seyhan	Civic Participation	Social Support	"Youngest-old Council" – participation in decision-making processes

Table 8. Classification of WHO Thematic Domains According to Technology Categories

When the total services provided by the seven municipalities are examined thematically, a clear inequality and divergence of focus can be observed in Türkiye's age-friendly city practices. This situation demonstrates that membership in the WHO Global Network for Age-friendly Cities and Communities alone does not guarantee diversity of services; rather, the vision of the municipality and its allocation of resources are decisive factors.

An analysis of the distribution of practices and projects across the eight thematic domains reveals that health services are the most prominent area, with home health care emerging as the second strongest domain due to its concentration within this field. The domain of social participation stands out through initiatives such as elderly houses, healthy ageing centers, and workshops, while notable gaps remain in transportation, respect, and social inclusion. From the perspective of technology categories, health and care technologies take the lead. However, these applications are largely based on traditional care models, and the integration of advanced technologies remains limited. Cognitive and communication technologies are considered particularly important for eliminating digital inequalities; however, digital literacy and e-service training programs remain limited. From the perspective of ageing in the digital world and social participation, the lack of digital social platforms parallel to cognitive and communication technologies is striking. Although examples of elderly councils and assemblies exist, these mechanisms largely reflect traditional social support structures. In the category of physical support technologies, apart from ambulance services and health centers, smart city technologies such as sensors, smart bus stops, and smart lighting are scarcely utilized. An examination of the practices and projects of the municipalities in Türkiye that have joined the WHO Global Network for Age-friendly Cities and Communities—including Izmir and Mersin Metropolitan Municipalities, and the district municipalities of Beşiktaş, Bornova, Kadıköy, Muratpaşa, and Seyhan—reveals several innovative initiatives. Beşiktaş Municipality's 65+ Life Office, established as an integrated gerontology office, stands out as a pioneering example. Likewise, its gerontomimari service aimed at preventing domestic accidents is another innovative practice. Seyhan Municipality's creation of the "Youngest Elders Council" is noteworthy for framing ageing policies from a different perspective, while Muratpaşa Municipality's Emergency Button project represents a significant example in the field of gerontechnology.

The findings indicate that municipal age-friendly practices are characterized by limited measurement and evaluation indicators, with participation concentrated geographically in metropolitan and western regions. Rather than budget size, the vision and strategic focus of municipalities emerge as the decisive factors. During the COVID-19 period, home care and digital support services came to the forefront, yet many of these initiatives were not sustained. Furthermore, while membership in the WHO Global Network for Age-friendly Cities and Communities has enhanced international visibility, it has not in itself guaranteed diversity of services.

6. CONCLUSION AND RECOMMENDATIONS

This study has introduced a new paradigm for healthy ageing by linking the age-friendly cities approach with the smart city paradigm. Concepts discussed in the literature—such as the Ageing Space Society and the Smart City Paradigm, the transition from digital inequality to digital inclusion, and approaches involving artificial intelligence and gerontechnology—have been concretized through municipal practices in Türkiye within the framework of the WHO's eight strategic domains. This holistic perspective demonstrates that healthy ageing and the smart city vision are two complementary paradigms that mutually reinforce one another. The municipal cases examined reveal that age-friendly city practices in Türkiye are implemented across different scales and contexts. Metropolitan municipalities participating in the WHO network (Izmir, Kadıköy, Mersin, Beşiktaş) tend to provide more institutionalized and comprehensive services, whereas district municipalities (Bornova, Seyhan, Muratpaşa) stand out with local specificities and innovative micro-level interventions. Examples such as Izmir's 65+ Life Office, Kadıköy's Alzheimer Center, Beşiktaş's digital literacy and podiatry services, Bornova's rural access projects, Seyhan's mobile care and participatory council model, Mersin's Active Ageing House, and Muratpaşa's Dementia Café directly correspond to the WHO thematic domains. Nevertheless, most practices are concentrated in areas such as health, social support, and outdoor spaces, while gaps remain in housing policies, digital inclusion, and employment opportunities for older adults. This highlights the necessity of implementing the WHO's eight domains comprehensively and underscores that the age-friendly city approach should be supported not only through service provision but also through principles of social justice and technological inclusivity.

To ensure sustainability, national-level coordination mechanisms should be established, and the WHO's eight domains should be integrated in ways that provide technical and financial support to smaller-scale municipalities. National data collection and monitoring systems should be developed to regularly assess the effectiveness and inclusivity of services. Reducing digital inequalities requires the expansion of digital literacy programs for older adults and the facilitation of access to e-government, e-health, and smart city applications. Artificial intelligence–supported care services, sensor-based safety systems, and gerontechnological solutions should be integrated into municipal services to strengthen older adults' sense of independence and security. As exemplified by Seyhan and Muratpaşa, "elderly councils" that enable direct participation of older adults in decision-making processes should be scaled up nationally; similarly, rural health and social services, such as Bornova's "Köyde İz" project, should become a priority area of national policy. This process requires the creation of multidisciplinary platforms involving gerontologists, architects, urban planners, sociologists, and technology experts, while also incorporating gender perspectives and intergenerational interaction into policy design.

For future research, it is important to examine the capacity of small-scale municipalities to implement WHO criteria and the structural barriers they face, in order to understand the scalability of age-friendly policies. Investigating the impact of AI-based care services on older adults' perceptions of independence and security will reveal the social and psychological dimensions of gerontechnology. Measuring the long-term effects of digital literacy programs on older adults' social participation and access to services will contribute to evaluating the effectiveness of digital inclusion policies. Exploring the role of intergenerational interaction projects in reducing social isolation will highlight the importance of intergenerational relations in age-friendly cities. Comparative analyses of metropolitan versus rural municipalities will make scale-related differences more visible, while examining the long-term financial sustainability of age-friendly city projects and public–private partnership models will provide strategic insights into their future applicability.

Overall, the paradigm of age-friendly smart cities is not merely a demographic necessity but also a strategic orientation in terms of social inclusion, technological equality, and sustainable urbanization. The examples from municipalities in Türkiye demonstrate how the WHO's eight domains are reinterpreted in local contexts to develop policies that enhance older adults' independence, social participation, and quality of life. Addressing existing gaps, ensuring national-level coordination, establishing data-driven monitoring systems, and strengthening multidisciplinary collaboration are critical for the holistic implementation of this paradigm. Future research and policy practices will further consolidate this paradigm, contributing to positioning older adults as active, productive, and valued members of society.

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HEALTHY RESILIENCE EVALUATION MODEL (HREM): TOWARDS A HOLISTIC FRAMEWORK FOR ADAPTIVE AND HEALTH-SUPPORTIVE ARCHITECTURE

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ABSTRACT

In a time increasingly characterized by overlapping and escalating risks, ranging from climate-induced disasters to global public health crises, there is a growing imperative for architectural approaches that holistically integrate human health, energy independence, and multi-hazard resilience within a cohesive and forward-looking framework. This chapter introduces the concept of healthy resilience, reframing architectural performance around the integrated priorities of health-supportive indoor environments, energy efficiency and autonomy, and the capacity to adapt to environmental disruptions. Instead of offering a critique of existing systems, the chapter focuses on identifying key limitations, such as insufficient attention to long-term performance, adaptability under stress, and equitable outcomes, and introduces a comprehensive evaluation model as a response to these challenges. To address these gaps, the chapter introduces the Healthy Resilience Evaluation Model (HREM), a comprehensive and multi-dimensional framework developed to evaluate building performance under both routine conditions and during times of crisis. HREM differs from conventional standards by placing emphasis on how buildings perform across different phases. It highlights participatory design and spatial adaptability as essential elements of resilient architecture. Rather than relying on retrospective case studies, the chapter applies HREM to three hypothetical yet contextually grounded scenarios: low-income rural housing in flood-prone South Asia, focusing on passive design and basic autonomy in the face of infrastructural scarcity; an urban public school in heatwave-affected Central Europe, emphasizing thermal comfort, energy continuity, and emergency refuge capacity; and an emergency health unit in a cyclone-exposed coastal region of Africa, designed for rapid deployment and off-grid operation under unstable conditions. These scenario-based applications demonstrate how human-centered, integrated design can generate systems that anticipate disruption, support psychological and environmental continuity, and enhance adaptive capacity. The chapter calls for a paradigm shift in architectural thinking, moving beyond static sustainability checklists and embracing dynamic systems that prioritize human life, dignity, and the continuous functionality of buildings throughout all stages of disruption and recovery.

KEYWORDS:

Healthy Resilience, Healthy Resilience Evaluation Model (HREM), Post-disaster Recovery, Risk-informed Design, Sustainable Building Design

1. INTRODUCTION

In recent decades, the global built environment has been increasingly challenged by both chronic and acute threats, including climate change-induced stressors such as rising temperatures and prolonged heatwaves, as well as sudden natural disasters such as earthquakes and floods. These hazards are especially pronounced in disaster-prone regions, where socio-spatial vulnerabilities and infrastructural inadequacies intersect. As urban populations continue to grow and climate-related risks become more severe, there is an urgent need to reassess how buildings are designed, operated, and maintained, considering not only environmental performance but also public health and disaster resilience.

The discourse on healthy buildings has traditionally focused on optimizing indoor environmental quality (IEQ) through strategies that support thermal comfort, air quality, daylighting, and acoustic performance. Meanwhile, energy efficiency has been approached largely through technical and regulatory frameworks that emphasize reduced consumption and emissions. However, the growing intersection of health risks, energy demands, and exposure to multiple hazards necessitates a more integrated architectural paradigm that unites sustainability, well-being, and resilience as mutually reinforcing design priorities.

This chapter addresses the critical intersection of health, energy, and risk in architectural design, with a focus on developing spatial and material strategies for buildings located in multi-hazard contexts. Specifically, it explores how healthy building principles can be harmonized with energy-efficient and disaster-resilient design approaches to create adaptable, safe, and inclusive living environments.

By proposing the concept of "healthy resilience," the chapter moves beyond conventional definitions of sustainability and introduces a human-centered, climate-adaptive framework tailored for high-risk geographies. This includes not only technical solutions such as passive cooling and renewable energy integration, but also considerations of psychological well-being, emergency usability, and post-disaster reparability.

The aim is to provide a conceptual and practical foundation for architects, planners, and policymakers seeking to respond to complex and converging urban risks. Through literature analysis, comparative scenarios, and critical reflection on existing standards, this study offers a broader perspective on contemporary building design challenges. It emphasizes the need for approaches that go beyond energy efficiency and carbon reduction to also support human health and resilience in the face of growing environmental uncertainties.

2. CONCEPTUAL FRAMEWORK

This section lays the theoretical foundation for understanding and applying the concept of healthy resilience in architecture. It begins by clarifying the distinct yet complementary definitions of healthy and resilient buildings, then introduces healthy resilience as a holistic design paradigm that integrates indoor environmental quality, energy autonomy, and multi-hazard adaptability. The section also examines the interconnection among spatial, environmental, and social dimensions, emphasizing that buildings should operate not only as protective structures but also as inclusive, adaptable, and health-enhancing environments. Together, these conceptual layers form the basis for the evaluation model and scenario applications presented in the subsequent chapters.

2.1. Defining the Healthy and Resilient Building

The concept of a "healthy building" has evolved significantly in recent decades, shaped by emerging research in public health, environmental psychology, and building science. At its core, a healthy building is one that promotes the physical, mental, and emotional well-being of its occupants through the optimization of indoor environmental quality (IEQ). This includes a combination of measurable parameters such as (Asojo and Hazazi, 2025; Bai et al., 2025; Ilies, 2025; Zhang, 2025; Zheng et al., 2025; Niza et al., 2024; Orman et al., 2024)

Indoor air quality (low levels of CO_2, VOCs, and particulates),

Thermal comfort (appropriate temperature and humidity ranges),

Daylight access (natural light to support circadian rhythms and mood),

Acoustic performance (protection from external and internal noise pollution),

Biophilic and psychological features (connection to nature, visual comfort, privacy, and stress-reducing elements).

These characteristics are increasingly seen not as optional enhancements but as essential determinants of productivity, cognitive function, stress reduction, and overall health, particularly in dense urban environments and vulnerable populations (Dimitroulopoulou et al., 2023).

Concurrently, the notion of a "resilient building" has gained prominence within the field of disaster risk reduction, climate adaptation, and emergency preparedness. Resilience in architecture typically refers to a building's ability to (Tootkaboni et al., 2025; IPCC, 2023; UNDRR, 2022; Baniassadi et al., 2019; Kosanović, 2018; Meerow et al., 2016; Leichenko, 2011; Sassi, 2006; Vale et al., 2005):

Resist and absorb the impacts of environmental hazards (e.g., earthquakes, floods, heatwaves),

Maintain structural integrity under stress,

Function during disruptions (such as blackouts or infrastructure failure),

Recover quickly after a disaster to restore usability and safety resilient buildings are designed with principles such as redundancy, flexibility, robustness, and modularity, enabling them to provide shelter and safety in both immediate and extended post-disaster scenarios. They often include lifeline systems (water, energy, communication) that are either independent or rapidly recoverable.

However, in both theoretical and practical applications, "healthy" and "resilient" design strategies have traditionally been approached in isolation. Health-oriented frameworks primarily focus on ensuring long-term occupant well-being during normal operating conditions. In contrast, resilience strategies tend to emphasize hazard resistance and the ability to maintain functionality during emergencies. This separation fails to consider circumstances where public health risks and physical disasters converge, such as heatwaves occurring in the aftermath of power outages or respiratory illnesses emerging in overcrowded post-earthquake shelters with inadequate ventilation.

This chapter proposes that the convergence of these two paradigms, health and resilience, is not only beneficial but necessary in the face of compound urban risks. The integration of these goals gives rise to the framework of "healthy resilience", which advocates for building systems that simultaneously:

Protect and sustain occupant health under both normal and extreme conditions, Ensure the reliable provision of essential services (lighting, air exchange, temperature regulation),

Support psychological well-being in crises through spatial comfort, light, and security,

Adapt to changing environmental and social conditions through flexible design strategies.

A healthy and resilient building, therefore, is not merely one that withstands disasters or conserves energy; it is one that preserves human dignity, ensures comfort, and maintains usability throughout all phases of disruption, including before, during, and after critical events. This definition lays the groundwork for a new generation of architectural responses to the Anthropocene, where multi-hazard exposure and public health vulnerabilities are increasingly inseparable.

Table 1. Conceptual comparison of healthy building, resilient building, and healthy resilience

Criteria	**Healthy Building**	**Resilient Building**	**Healthy Resilience**
Primary Objective	Enhance individual health and comfort	Ensure structural safety against physical hazards	Provide holistic protection across health and disaster scenarios
Focus	Indoor quality, psychological and physical well-being	Structural safety, functionality, post-disaster usability	User-centered design: safety, health, energy and accessibility
Indoor Environmental Quality (IEQ)	High priority (air quality, daylight, thermal and acoustic comfort)	Often secondary	Maintain healthy indoor conditions even after a disaster
Energy Use	Efficiency (mostly via active systems)	Continuity of energy supply infrastructure	Energy autonomy through passive and renewable systems
Psychological Comfort	Biophilic design, privacy, stress reduction	Generally overlooked	Design elements that support emotional resilience during crises
Disaster Preparedness	Rarely addressed	Central focus (resistance to shocks)	Protection from multiple hazards + usability during crises
Flexibility / Adaptability	Optimized for user behavior	Modularity for functional continuity	Adaptable to both user needs and post-disaster scenarios
Relevant Standards	WELL, Fitwel	RELi, BRRT	Proposed hybrid certification models

Typical Applications	Offices, schools, homes (under normal conditions)	Critical infrastructure, emergency shelters	Residential and public buildings – before, during, and after disasters

Table 1 outlines the fundamental differences between healthy buildings and resilient buildings, highlighting the distinct value of their integration in the concept of "healthy resilience". As illustrated, neither health-centered design nor resilience-centered strategies alone are sufficient. A combined design paradigm is essential, one that ensures post-disaster comfort, energy autonomy, psychological well-being, and the continuity of building functions under conditions of compound risk.

2.2. Healthy Resilience: A Synthesis of Health, Energy, and Risk

Healthy resilience is proposed here as a comprehensive and integrated design paradigm that brings together three interdependent architectural priorities: *health-supportive indoor environments*, *energy autonomy and efficiency*, and *multi-hazard resilience*. In disaster-prone and climate-sensitive regions, these dimensions must not be treated as separate goals but as mutually reinforcing strategies that ensure the building's ability to safeguard occupant well-being before, during, and after hazardous events.

A key foundation of healthy resilience lies in the design of indoor environments that actively support occupant health. Indoor Environmental Quality (IEQ), which encompasses factors such as air purity, thermal comfort, daylight access, humidity regulation, and acoustic performance, has been shown to significantly influence both physical and mental health outcomes (Zheng et al., 2025; Riva et al., 2022). Especially during crises, such as heatwaves or post-earthquake displacement, indoor environments can become critical determinants of public health. Poor ventilation, elevated indoor temperatures, or lack of daylight exacerbate stress, respiratory illnesses, and cognitive fatigue. Recent research emphasizes that strategies such as natural ventilation, daylight optimization, and biophilic design are not optional enhancements but essential measures for public health, particularly for vulnerable groups and emergency shelter settings (Bellomo et al., 2025; Lima et al., 2025; Mewomo et al., 2023) .

Closely connected is the need for energy autonomy and efficiency. In disaster contexts where power outages are frequent, the concept of passive survivability becomes critical, referring to a building's ability to sustain livable indoor conditions without relying on external energy sources (Lambertini et al., 2025). Passive design strategies, such as cross-ventilation, thermal massing, solar orientation, and natural shading, significantly reduce reliance on active mechanical systems. Complementarily, renewable energy technologies like rooftop photovoltaics with battery storage ensure continued access to critical functions such as lighting, refrigeration, and communication. Such systems are particularly vital in facilities that accommodate high-risk populations, such as schools, hospitals, and elderly housing, where the ability to sustain essential operations during disruptions can be a matter of life and death (Izadinia et al., 2023).

The third pillar of healthy resilience is multi-hazard resilience. This refers to a building's ability to withstand and remain functional under various environmental threats, including earthquakes, floods, extreme heat, and long-term stressors such as persistent humidity or vector-borne diseases. Traditional resilience often prioritizes structural integrity, but recent frameworks such as the RELi Standard (RELi 2.0, 2017) emphasize the need for integrated systems that also support usability, repairability, and community support functions. For example, flexible spatial layouts, modular construction, and decentralized infrastructure systems enhance both psychological stability and rapid recovery after a disaster. Moreover, resilience in this context must extend beyond technical robustness to encompass spatial equity, ease of access, and psychological comfort, which are often neglected in conventional disaster planning (Meerow et al., 2016).

By synthesizing these three dimensions, the concept of healthy resilience moves architectural discourse beyond siloed standards. It invites a holistic design approach that prioritizes human well-being, reduces emissions, improves health, and anticipates as well as responds to future uncertainties. In the context of the Anthropocene, characterized by compounding risks and environmental volatility, such an integrated design ethos is not merely aspirational but essential.

The concept of healthy resilience becomes more clearly articulated when its three foundational components are examined in relation to one another. These components include health-supportive indoor environments, energy autonomy and efficiency, and multi-hazard resilience. As summarized in the Table 2 below, each dimension addresses a distinct yet interconnected aspect of architectural performance in risk-prone contexts. Health-supportive design focuses on maintaining optimal indoor environmental quality, which is vital not only for everyday comfort but also for physical and psychological well-being during crises such as confinement after disasters. Energy autonomy ensures that critical building functions such as lighting, ventilation, and temperature regulation can be sustained even during prolonged power outages by employing passive strategies and integrating renewable energy systems. Meanwhile, multi-hazard resilience emphasizes structural safety, spatial adaptability, and post-disaster usability, enabling buildings to serve as protective and functional spaces under extreme environmental stress. While each of these domains offers unique contributions, their true potential lies in their integration. A building that performs well in only one dimension may still fail under compound stressors. As outlined earlier, healthy resilience integrates health, energy, and risk dimensions into a unified strategy to safeguard well-being in both routine and crisis contexts.

Table 2: Comparative overview of healthy resilience components

Dimension	**Primary Focus**	**Key Design Strategies**	**Function During Crisis**	**Relevant Standards Literature**
Health-Supportive Indoor Environments	Enhancing physical and mental well-being through indoor environmental quality	Natural ventilation, daylighting, thermal comfort, acoustic control, biophilic elements	Reduces illness, stress, and discomfort in confined or overcrowded settings	Goldman et al., 2025; Kumar et al., 2025; Liao et al., 2023; Evans et al., 2002; Ulrich, 2000; Hartig et al., 1997
Energy Autonomy and Efficiency	Ensuring functionality during power loss and minimizing	Passive cooling/heating, solar energy, thermal mass,	Maintains livable indoor conditions (light,	Terlouw et al., 2025; Campbell et al., 2023; Maestre et al., 2022

	energy dependency	shading, energy storage systems	temperature, air) during blackouts	
Multi-Hazard Resilience	Withstanding and adapting to multiple environmental hazards	Modular design, seismic/flood resistance, flexible layouts, rapid repairability, decentralized infrastructure	Protects occupants, preserves usability, enables sheltering and recovery after disasters	Mahato et al., 2025; Glade, 2024; Bianchi, 2023; Komendantova et al., 2023; Roy and Matsagar, 2023; Forzieri et al., 2018; Kappes et al., 2012; Tilio et al., 2012

2.3. Interdependence of Spatial, Environmental, and Social Dimensions

Resilient and healthy buildings should not be viewed merely as engineered entities optimized for environmental performance. Instead, they must be understood as complex socio-spatial systems that are designed and embedded within networks of human interaction, material circulation, and urban infrastructure. In this regard, the spatial, environmental, and social dimensions of building design are deeply interdependent and must be addressed in an integrated manner to support health, equity, and resilience, especially in disaster-prone or resource-constrained contexts.

Spatial design plays a critical role in supporting both everyday accessibility and emergency responsiveness. Features such as wide circulation routes, clear egress paths, adaptable floor plans, and universal design principles can facilitate rapid evacuation and ease of access for vulnerable populations, including people with disabilities, the elderly, and children. Moreover, spatial modularity enables buildings to be adapted for temporary shelter or emergency care during crises, thereby sustaining functionality and promoting psychological resilience (Bellomo et al., 2025; Smolova and Smolova, 2021).

Material choices are equally influential in shaping both environmental outcomes and post-disaster repairability. The use of low-carbon, locally sourced, and non-toxic materials helps reduce the overall ecological footprint of the building. Additionally, these materials allow for easier sourcing and replacement after hazard events, supporting long-term sustainability and resilience. Lightweight or modular construction systems, for instance, allow for faster and more cost-effective reconstruction processes, particularly important in regions with limited financial and logistical resources (Ngo, 2025; Zohourian et al., 2025). Furthermore, materials that support thermal mass or passive survivability also reinforce health-supportive conditions in the absence of mechanical systems.

At the community scale, socially inclusive and participatory design can significantly strengthen collective resilience. Layouts that include shared courtyards, communal kitchens, or multipurpose gathering spaces can foster social interaction and mutual support. These spatial arrangements help reduce social isolation and contribute to improved psychological well-being during disruptive events (Meerow et al., 2016). Engaging residents in the planning and design process ensures that spaces are culturally relevant, functionally appropriate, and more likely to be maintained over time, thus enhancing long-term adaptability and resilience (Charlesworth and Fien, 2022; Wolff et al., 2021).

Taken together, these interdependencies suggest that healthy resilience is not solely a function of structural robustness or technological efficiency. It also depends on how buildings support social life, cultural practices, and ecological accountability. An integrative design approach that aligns spatial configurations, material strategies, and community engagement is essential for creating buildings that are not only sustainable and disaster-resistant, but also equitable, inclusive, and life-affirming under conditions of uncertainty.

2.4. From Concept to Framework: Establishing the Basis for Healthy Resilience Evaluation

The accelerating convergence of climate-induced disasters, public health crises, and infrastructure vulnerabilities demands a fundamental transformation in architectural thinking. As cities increasingly face overlapping risks such as heatwaves following earthquakes or floods disrupting energy and sanitation systems, addressing health, energy, and resilience as separate issues is no longer adequate. Instead, a forward-looking design paradigm must recognize these domains as deeply connected and mutually reinforcing. This section calls for a shift toward a holistic design approach that is integrative, adaptive, and anticipatory in nature.

Historically, architectural practice has operated within segmented frameworks. Certain rating systems emphasize energy efficiency, while others prioritize indoor environmental quality. In parallel, structural safety is typically regulated by building codes that address specific hazards such as earthquakes or fires. This often results in siloed design priorities that overlook holistic resilience (Song et al., 2023). Although useful in specific domains, such fragmented systems frequently overlook the interrelated and dynamic challenges encountered in practice. A building may be certified as sustainable and healthy under normal operating conditions, yet become uninhabitable during a crisis due to cascading failures such as overheating during a power outage or loss of ventilation in a sealed structure. Moreover, when energy conservation is prioritized through the use of airtight envelopes, other essential features may be overlooked. This can negatively affect natural ventilation and reduce a building's ability to maintain livable conditions without external energy supply.

These limitations reveal a critical need to reconceptualize the role of buildings in contemporary design thinking. Rather than viewing them as static physical objects, buildings must be understood as dynamic and adaptive systems. They operate within and respond to complex ecological and social networks. A holistic paradigm reframes architectural performance through three interwoven lenses: anticipating future uncertainties (including climate shifts, pandemics, and demographic transitions), engaging with urban systems at multiple scales (such as water cycles, energy sharing, and public space networks), and fostering interdisciplinary collaboration among architects, engineers, planners, health experts, and community stakeholders. Such collaboration enables the co-production of spatial solutions that are not only technically sound but also socially meaningful and culturally grounded.

Some emerging certification frameworks, such as RELi (RELi 2.0, 2017), represent important steps toward this integrated logic. RELi blends sustainability metrics with resilience indicators, covering topics such as emergency preparedness, thermal safety during power loss, and social equity. Despite its relevance, adoption is still limited. Most systems fail to comprehensively address sustained usability, mental well-being, or how buildings perform across extended periods of disruption.

What is ultimately required is not a mere revision of existing tools, but the development of a new generation of design models that embed human well-being, environmental stewardship, and risk adaptation into a unified structure. These models must prioritize performance that addresses user needs under both normal and extreme conditions; offer flexible, locally appropriate solutions; and incorporate time-sensitive assessments that reflect a building's behavior throughout the stages of disruption, recovery, and reoccupation. Importantly, they must address the realities of vulnerable geographies, where risks are both acute and chronic, and resilience involves not only survival but also the preservation of dignity, equity, and basic livability in the aftermath.

This chapter introduces the Healthy Resilience Evaluation Model (HREM) as a direct response to this challenge. Building on the principles explored above, HREM serves as a practical framework for assessing how buildings can support physical and psychological well-being, ensure access to basic services, and remain usable across multiple hazard contexts. By translating the conceptual integration of health, energy, and resilience into a multi-dimensional model, HREM offers a tool that is both structured and adaptable, making it suitable for real-world application across diverse risk-prone environments.

Figure 1 illustrates how a holistic architectural paradigm integrates three mutually supportive priorities: indoor environmental health, energy autonomy, and multi-hazard resilience. Together, these elements form a unified foundation that responds to user needs and supports long-term adaptability.

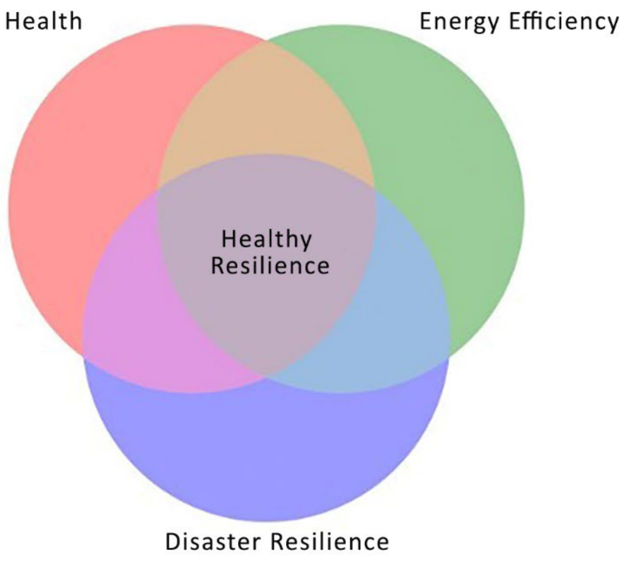

Figure 1. Conceptual framework of "Healthy Resilience" as the intersection of health-supportive design, energy efficiency, and disaster resilience

By adopting such a paradigm, architecture becomes a proactive agent of societal resilience. Rather than responding to crises as isolated failures, it prepares built environments to absorb shocks, adapt to change, and support life under volatility. In doing so, the discipline aligns itself with broader goals such as climate justice, health equity, and sustainable development, thereby contributing to urban environments that are not only more robust but also more humane.

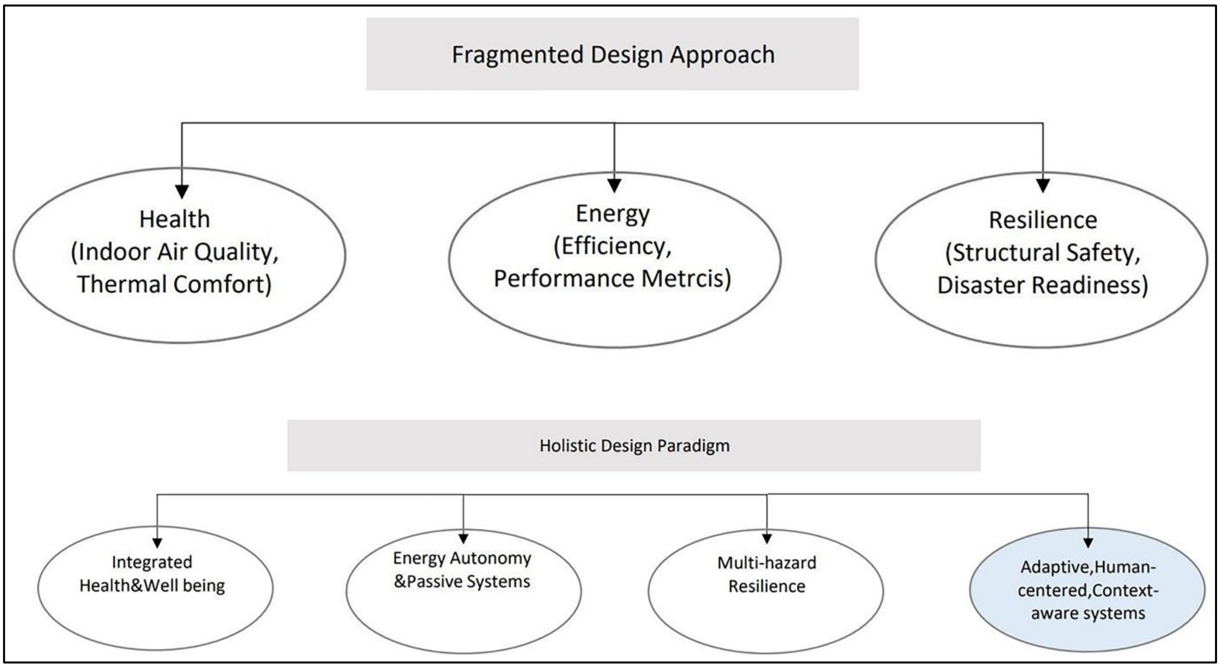

Figure 2. Integrative design logic for healthy resilience

These diagrams (Figure 2) visualize that in the fragmented approach, health, energy, and disaster resilience are addressed separately; whereas in the holistic approach, these elements are integrated within systems that are responsive to human needs and contextual conditions.

3. METHODOLOGY

The Healthy Resilience Evaluation Model (HREM) is developed and illustrated through a combination of qualitative inquiry and architectural design methods. Rather than relying on empirical measurement alone, the methodology emphasizes **conceptual synthesis, scenario development,** and **comparative analysis** to explore how health, energy, and disaster resilience can be integrated within architectural design.

The HREM framework was constructed through an interdisciplinary literature review covering architecture, public health, building performance, climate adaptation, and disaster risk reduction. Key concepts such as indoor environmental quality, passive survivability, social equity, and post-disaster usability were critically reviewed and organized into six evaluation domains.

To test the applicability and flexibility of the HREM, three **hypothetical risk scenarios** were formulated across diverse geographical and socio-economic contexts:

Scenario 1: Low-income rural housing in flood-prone South Asia with infrastructural and energy constraints,

Scenario 2: Climate-adaptive public school in Central Europe addressing extreme heat and energy outages through resilient design,

Scenario 3: Rapid-deployable health unit for cyclone-prone coastal Africa with autonomous operation and post-disaster resilience.

Each scenario was evaluated through the lens of the HREM domains, allowing for a comparative understanding of how buildings can proactively support health, adaptability, and usability under different forms of disruption.

Rather than providing prescriptive solutions, the methodology seeks to guide design thinking through **context-sensitive, anticipatory,** and **human-focused** strategies. This flexible and qualitative framework allows architects, planners, and policymakers to reinterpret resilience not as a fixed outcome, but as an evolving design ethic informed by risk, equity, and care.

4. THE HEALTHY RESILIENCE EVALUATION MODEL

Conventional certification systems often operate within narrow scopes. While some emphasize energy efficiency, others focus on indoor health or general sustainability metrics. However, these fragmented approaches fall short in addressing the complexities of an increasingly volatile world, prompting a growing demand for a more integrated and responsive evaluation framework. The Healthy Resilience Evaluation Model (HREM) emerges as a response to this gap, proposing a holistic approach that aligns environmental sustainability, occupant well-being, and multi-hazard resilience into a unified structure. Rather than assessing buildings solely under optimal conditions, HREM enables planners, architects, and policymakers to evaluate how spaces perform across a spectrum of normal and disruptive scenarios.

At its core, HREM is grounded in the understanding that buildings are not static artifacts but complex socio-technical systems. Traditional assessment models often treat performance metrics in isolation, evaluating health, energy, and risk as independent domains rather than as interconnected components of a unified system. However, real-world crises such as heatwaves, floods, or earthquakes often expose the fragility of this fragmented logic. A building may excel in energy conservation yet fail during a blackout; it may meet indoor air quality standards, but lack structural flexibility in an emergency.

To address these shortcomings, HREM introduces an integrated paradigm where health-supportive environments, energy autonomy, and hazard adaptability are seen not as competing priorities, but as interconnected design imperatives. This model promotes moving beyond isolated evaluation tools and encourages holistic thinking that accounts for the full life cycle and real-world functionality of buildings in challenging conditions. In doing so, it aligns architectural performance with broader objectives that include public health, climate resilience, and social equity. This perspective positions the built environment as an active contributor to community well-being, not only in daily life but also during periods of disruption.

Recognizing the complexity and interdependence of real-world risks, HREM is structured around three foundational dimensions that collectively shape how buildings contribute to environmental stewardship, user well-being, and risk adaptability. These dimensions form the conceptual backbone of the model, guiding the evaluation of architectural performance not only in steady-state conditions but also across the fluctuating stages of disruption, recovery, and long-term usability.

4.1. Three Core Dimensions of Healthy Resilience

At the heart of the Healthy Resilience Evaluation Model (HREM) lie three interrelated dimensions that collectively determine how buildings perform in terms of occupant well-being, functional reliability, and ecological responsiveness. These dimensions are not isolated components but form a cohesive structure through which healthy resilience is understood and operationalized.

The first of these dimensions, Indoor Environmental Health, encompasses both physical and psychological parameters essential to human well-being. It includes air quality, thermal comfort, daylighting, noise reduction, and sanitation, as well as less tangible yet equally critical aspects such as stress reduction, spatial privacy, and sensory comfort. Under normal conditions, these factors enhance comfort and productivity. During periods of crisis, however, they play a critical role in maintaining psychological and physiological stability, especially for vulnerable groups exposed to overcrowding, isolation, or health-related stress.

The second dimension, Energy Autonomy and Efficiency, addresses a building's capacity to function independently of centralized energy systems. This includes passive strategies such as orientation, shading, and thermal mass, which reduce reliance on mechanical systems, as well as active systems like photovoltaics and battery storage that provide power continuity during disruptions. By ensuring access to lighting, ventilation, and communication, even during blackouts or extreme climate events, this dimension safeguards basic life-support functions and enhances long-term usability.

The third dimension, Multi-Hazard Resilience, expands the conventional understanding of structural safety to include adaptability, reparability, and operational readiness under diverse risk scenarios. It emphasizes the importance of modular layouts, seismic safety, accessible circulation, and the potential for sheltering or medical care functions in times of emergency. This dimension ensures that buildings are not only resistant to damage but also able to support essential activities and recovery efforts in the aftermath of disasters.

Together, these three dimensions form the foundation of a holistic performance baseline (Figure 3). This framework enables the evaluation of how buildings support life, dignity, and sustainability across both stable and disrupted conditions. Their integration within the HREM framework enables designers and decision-makers to move beyond static checklists, advancing toward truly responsive and resilient built environments. These three dimensions are not assessed in isolation. HREM evaluates performance under both normal and crisis conditions to highlight design strategies that offer protective, restorative, and adaptive qualities.

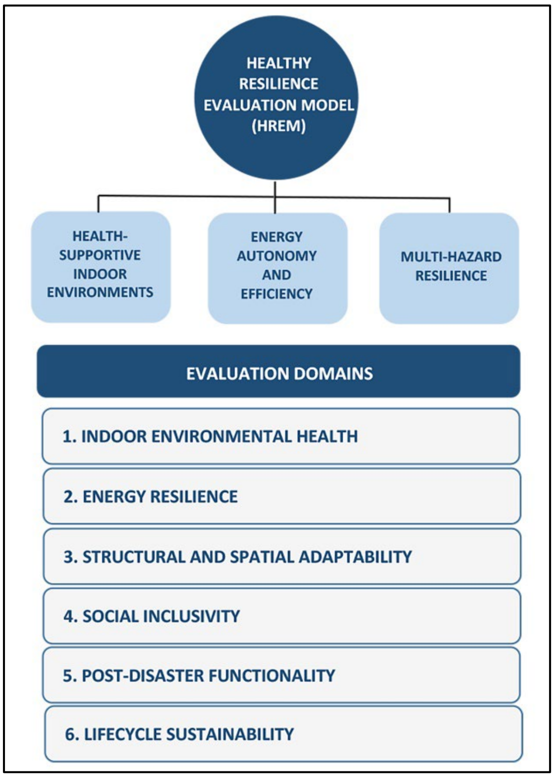

Figure 3. HREM (Healthy Resilience Evaluation Model)

4.2. Evaluation Domains and Criteria

To operationalize the three core dimensions, HREM is structured around six interrelated evaluation domains. Each domain encompasses a set of qualitative and quantitative indicators that capture both technical performance and user experience (Table 3).

TABLE 3. HREM DOMAINS AND FOCUSES

Domain	**Evaluation Focus**
1. Indoor Environmental Health	Daylighting, ventilation, toxicity, acoustic comfort, biophilia, mental health
2. Energy Resilience	Off-grid capacity, renewables, thermal autonomy, system redundancy
3. Structural and Spatial Adaptability	Modularity, seismic safety, shelter use, flexible programming
4. Social Inclusivity	Accessibility, user participation, gender-sensitive and age-inclusive design

5. Post-Disaster Functionality	Emergency services continuity, sanitation, information access, public spaces
6. Lifecycle Sustainability	Carbon footprint, local materials, reparability, end-of-life circularity

Together, these six domains provide a holistic framework for assessing the capacity of a building to support well-being, function under stress, and minimize environmental impact throughout its lifecycle. Although each domain addresses a distinct aspect of performance, from indoor comfort to energy autonomy and long-term sustainability, they are structured to function in a mutually reinforcing and dynamic manner. For example, enhancing indoor environmental quality through natural ventilation may simultaneously reduce energy demand and improve post-disaster habitability. Likewise, incorporating user participation within the design process (as part of social inclusivity) can improve outcomes across multiple domains by aligning spatial and technical solutions with local needs. By using both quantitative metrics (e.g., thermal autonomy, off-grid energy supply) and qualitative indicators (e.g., user perception of safety or comfort), HREM enables a nuanced evaluation that can inform design decisions, policy frameworks, and community engagement strategies alike.

4.3. Strategic Flexibility, Evaluation Logic, and Applications of HREM

To ensure broad applicability across diverse geographies and building types, the Healthy Resilience Evaluation Model (HREM) is designed as both structured and flexible. Each of its six evaluation domains can be assessed using a multi-level rating system, Basic, Enhanced, and Optimized, allowing for nuanced performance benchmarking that aligns with local risks, resource availability, and user needs. Rather than prescribing a rigid formula, HREM enables adaptive weighting schemes that respond to climate, socio-economic, and cultural variability, making it suitable for urban, peri-urban, and rural contexts alike.

What sets HREM apart from conventional assessment tools is its integrative design logic. Instead of approaching resilience as an additional criterion layered onto environmental performance or health standards, HREM embeds resilience considerations into the very core of architectural decision-making. It recognizes that meaningful resilience cannot be retrofitted post-design; it must be co-developed with all other performance goals from the outset.

Temporal flexibility is another key innovation of the model. HREM does not simply evaluate buildings at a single point in time but considers their behavior across different phases: before a disruption, during acute events, and throughout recovery. This temporal lens helps reveal performance gaps that may otherwise remain hidden under normal operational conditions.

In addition, the model promotes participatory engagement. It encourages the involvement of end-users, local communities, and multidisciplinary stakeholders during the design and evaluation process, ensuring that local knowledge, needs, and vulnerabilities inform resilience strategies. This inclusive approach strengthens social cohesion and fosters ownership over the built environment.

Importantly, HREM is not intended to replace established certification systems such as LEED, WELL, or BREEAM. Rather, it serves as a complementary framework that adds value, particularly in contexts where multiple and overlapping risks challenge the adequacy of conventional assessment approaches. Its applications are diverse: municipalities can adopt it to audit the resilience of public infrastructure such as schools and health centers; humanitarian organizations may use it to inform post-disaster reconstruction and recovery strategies; architectural educators can embed it into design curricula as a resilience-oriented framework; and policy-makers or project developers may incorporate it into funding proposals for climate-adaptive infrastructure.

Ultimately, HREM seeks to reframe architectural practice around proactive resilience, emphasizing spaces that are not only sustainable and functional, but also protective, reparable, and dignified. By grounding resilience in human experience and contextual awareness, the model offers a forward-looking guide for navigating architectural challenges in an increasingly volatile world.

5. SCENARIO-BASED APPLICATION OF THE HEALTHY RESILIENCE EVALUATION MODEL

Building upon the conceptual and structural pillars of HREM defined in the previous chapter, this section applies the model to three simulated environments to test its applicability under diverse real-world conditions. Rather than relying on empirical case studies, three hypothetical yet plausible scenarios are developed to evaluate the adaptability, comprehensiveness, and utility of the HREM framework across varying geographic, socioeconomic, and hazard contexts. Each scenario corresponds to a different building typology and risk profile and is assessed according to the six core domains of the HREM.

5.1. Scenario A: Low-Income Rural Housing in South Asia

In a flood-prone rural region of South Asia, where infrastructure is sparse and electricity unreliable, a low-income housing project is envisioned to serve vulnerable communities. Here, resilience begins with simple yet vital spatial interventions. Operable windows allow for effective cross-ventilation. Locally sourced, low-emission materials help reduce indoor pollutants and improve daylight access, contributing to psychological well-being. Passive cooling strategies such as thermal mass, shaded verandas, and optimal orientation help reduce reliance on mechanical systems. Raised foundations offer basic flood protection, and flexible interior layouts accommodate the evolving needs of extended families. While accessibility and cultural appropriateness are considered, inclusivity remains limited by resource constraints. In the event of a disaster, these structures can be easily repaired, and shaded communal courtyards serve as recovery hubs. Lifecycle sustainability is supported by dry construction techniques and the use of regional materials. Within the HREM framework, this scenario aligns strongly with indoor environmental health and lifecycle sustainability, but demonstrates only basic to moderate performance in energy resilience and social inclusion.

For instance, a prototype home in this context might feature a raised bamboo or compressed-earth plinth. It could also include a steeply pitched roof to deflect monsoon rains and louvered wooden shutters that enhance airflow while providing shade. A communal solar hub with limited battery storage may power lighting and charge phones, providing basic energy autonomy for communication and safety. The courtyard not only supports climate regulation and social cohesion but can also function as a temporary medical or distribution point during emergencies.

5.2. Scenario B: Urban Public School Facility in Central Europe

Set in a dense urban district increasingly affected by extreme summer heat, a public school facility in Central Europe is designed to serve dual functions: education and emergency refuge. The building envelope is designed to provide strong thermal and acoustic performance. In addition, daylighting strategies are implemented to support both learning outcomes and cognitive well-being. Rooftop solar panels and high-efficiency HVAC systems ensure the school remains operational during grid strain or outages. Passive shading and insulation reduce peak energy demands. Classrooms are designed with spatial flexibility in mind, allowing them to be converted into shelter zones or medical stations when needed. The infrastructure is designed to ensure universal accessibility. Inclusive restrooms and clear signage further support equitable use by all users. In crisis situations, designated multipurpose zones and emergency plans ensure access to food, sanitation, and shelter. A modular material strategy supports easy maintenance and adaptation over time. Evaluated through the HREM, the school demonstrates high performance across nearly all domains, highlighting its potential as a resilient, multi-functional public asset.

A typical application of this concept might include a U-shaped school plan that encloses a shaded central courtyard used for both learning and emergency gathering. Facades are equipped with operable, triple-glazed windows and automated external louvers that respond to solar gain. Classrooms are fitted with movable partitions, allowing for rapid transformation into dormitory-style shelter spaces. A separate solar-powered wing includes basic medical care units and refrigerated storage for medicine. Rainwater harvesting and greywater recycling systems support hygiene services during utility outages, and wall-integrated thermal mass helps stabilize indoor temperatures during prolonged heatwaves or blackouts.

5.3. Scenario C: Emergency Health Unit in a Coastal African Region

In a tropical coastal area susceptible to cyclones and power disruptions, a temporary health unit is designed to operate independently during emergencies. The facility employs mineral-rich materials that resist mold and integrates generous cross-ventilation and daylighting to support safety and comfort in unstable conditions. Energy autonomy is achieved through off-grid solar power paired with battery storage, enabling continuous operation of medical equipment. Roof overhangs and open-air design principles reduce internal heat buildup. The structure comprises modular units that can be deployed quickly and reconfigured as needed, enabling rapid response in diverse locations. Interior zones are arranged with cultural sensitivity in mind, and sanitation is gender-segregated to enhance privacy. Standalone sanitation systems, waste management units, and mobile communication facilities enhance post-disaster functionality. Lightweight components and low-carbon transportation ensure ease of assembly and disassembly. According to HREM criteria, this facility demonstrates strong performance in terms of post-disaster functionality and adaptability. However, its alignment with long-term sustainability and energy redundancy remains relatively limited.

An illustrative configuration might feature a modular cluster of units arranged around a shaded open-air triage courtyard. The layout enables clear circulation paths for patients, staff, and supplies. Each unit includes wall panels that can be opened for natural airflow. Insect screens are also used to reduce exposure to disease-carrying vectors. The medical ward includes ceiling fans powered by solar energy, evaporative cooling pads, and daylight tubes to illuminate operating areas. Composting toilets and hand-washing stations are fed by a rainwater harvesting system with first-flush diverters. A prefabricated communications kiosk supports internet access and solar-powered refrigeration for vaccines and medications. Materials such as fiber cement panels and bamboo flooring are selected for their resistance to humidity, rapid installation, and low embodied carbon.

Beyond the hypothetical scenarios, various real-world architectural experiments offer valuable parallels that can further validate the principles proposed in the HREM framework. For instance, the Arcadia Education Centre in flood-prone Bangladesh demonstrates how raised platforms and local bamboo construction can support both resilience and community well-being in climate-vulnerable areas (Bilgiç, 2019). Similarly, Gando Primary School in Burkina Faso employs passive cooling, daylighting, and community construction methods to address health and sustainability goals with minimal infrastructure (Archdaily, 2016). In the aftermath of disasters, modular housing prototypes in cities like New York and post-wildfire Maui have shown how rapidly deployable structures can balance energy efficiency, basic health requirements, and social dignity (Architectural Digest, 2014). These examples, while contextually diverse, echo the foundational priorities of HREM and offer transferable lessons for future pilot applications. If further contextualization is desired, the Quinta Monroy project in Chile provides a useful reference. It focuses on incremental and community-driven housing improvements, offering valuable insights into socially inclusive and adaptable design strategies (Barker, 2025). Likewise, climate-responsive school designs in the Philippines highlight how passive strategies and renewable systems can simultaneously enhance learning and resilience (United Nations Environment Programme, 2021; Abbu 2015). Collectively, these global cases underscore the feasibility of integrating health, energy autonomy, and multi-hazard preparedness into practical architectural action, especially when grounded in local knowledge, participation, and scalable design logic.

These three scenarios represent diverse geographic, environmental, and social contexts. Together, they demonstrate how the Healthy Resilience Evaluation Model (HREM) can be applied across varying risk profiles and building typologies. By examining rural housing, an urban school facility, and an emergency health unit, the evaluation spans a broad spectrum of environmental and socio-institutional conditions. To extract cross-cutting insights and assess the model's strategic relevance, the following section synthesizes findings across six key domains that form the backbone of the HREM framework.

5.4. Synthesis and Strategic Insights from Scenario-Based Evaluation

These three contrasting scenarios illustrate how the HREM can flexibly assess building performance across diverse contexts. While none of the scenarios achieves uniformly optimal performance, each reveals specific strengths shaped by local risks, functions, and resource conditions. The rural housing case foregrounds material sustainability and health-supportive design but struggles with energy autonomy. The urban school performs strongly across most domains, benefiting from institutional support and multifunctionality. The emergency health unit, though temporary in nature, exemplifies agile response and adaptability, crucial in high-risk, resource-constrained environments.

Collectively, these examples demonstrate that healthy resilience is not about maximizing all metrics simultaneously, but about strategically prioritizing what matters most in each setting. From multi-use flexibility to passive survivability, these scenarios underscore the necessity of a holistic, context-sensitive design approach. They further confirm the value of HREM as both an evaluative and strategic tool for architects, planners, and policymakers working at the intersection of risk, health, and sustainability (Table 4).

Table 4. Summary evaluation of scenario-based applications across HREM domains

Domain	**Scenario A**	**Scenario B**	**Scenario C**
Indoor Environmental Health	Enhanced	Optimized	Enhanced
Energy Resilience	Basic	Optimized	Intermediate
Structural/Spatial Adaptability	Intermediate	Intermediate	Optimized
Social Inclusivity	Basic	Optimized	Intermediate
Post-Disaster Functionality	Intermediate	Enhanced	Optimized
Lifecycle Sustainability	Enhanced	Optimized	Basic

The comparative table illustrates how each hypothetical scenario performs across the six core domains of the HREM framework. Scenario A, representing rural housing, demonstrates strengths in indoor environmental health and lifecycle sustainability, yet shows limitations in energy autonomy and social inclusion due to resource constraints. Scenario B, the urban school, achieves optimized scores across most domains, reflecting its institutional capacity and multi-functionality. Scenario C, the emergency health unit, excels in post-disaster functionality and adaptability but reveals challenges in long-term sustainability. Together, these profiles underscore the flexible yet rigorous nature of the HREM, highlighting the importance of context-specific priorities and the trade-offs that emerge when balancing resilience, health, and energy goals in different building typologies.

These results highlight that each scenario engages with core principles of healthy resilience. However, none of them achieves consistently high performance across all evaluation domains. This underscores the importance of **context-specific trade-offs,** such as prioritizing off-grid energy in medically critical settings or emphasizing modularity and reparability in rural housing.

From a strategic perspective, the scenarios reveal several actionable insights for practitioners and policymakers:

Interconnected Priorities: Resilience is not additive but integrative. Passive design, energy autonomy, and inclusive spatial planning must be addressed in concert to avoid performance fragmentation.

Design for Multiple Use States: Buildings must be conceived not only for daily operations but also for emergency response and long-term recovery. This calls for reconfigurable spaces, material reparability, and decentralized service infrastructure.

Scalability and Local Adaptation: The HREM framework is applicable at multiple scales, from single units to district-wide infrastructure, and is adjustable to local cultural, climatic, and resource conditions.

Tool for Planning and Policy: HREM can serve as a design rubric, funding eligibility criterion, or institutional benchmark to guide reconstruction, retrofitting, and new construction in climate-vulnerable regions.

By offering a structured yet adaptable model, HREM bridges the gap between theory and implementation, promoting a proactive approach to resilience that prioritizes people's safety, health, and usability in the built environment. This integrative approach enables stakeholders to move beyond prescriptive checklists and toward a more nuanced understanding of architectural performance under both normal and disruptive conditions.

6. CONCLUSION

The increasing convergence of health, energy, and disaster risk in the built environment demands a fundamental transformation in how architectural performance is conceptualized, assessed, and practiced. In response to this paradigm shift, this chapter introduces the Healthy Resilience Evaluation Model (HREM). The model presents a holistic framework developed to evaluate how buildings can support occupant well-being, ensure functional autonomy, and adapt effectively to a variety of environmental threats. Unlike traditional certification systems that tend to compartmentalize sustainability, health, and resilience into separate evaluation metrics, HREM adopts a more comprehensive framework. This integrative, multi-domain approach acknowledges the interconnected and evolving nature of contemporary risk landscapes.

One of the key strengths of the HREM lies in its multidimensional structure, which allows for both technical and experiential evaluation across six core domains. By incorporating dimensions such as indoor environmental health, energy resilience, spatial adaptability, and post-disaster functionality, the model shifts the evaluative lens from static compliance toward dynamic usability under both normal and crisis conditions. Moreover, its scenario-based application logic enables stakeholders to visualize trade-offs and synergies in real-world contexts, thereby facilitating strategic decision-making tailored to local needs and resource constraints.

Another notable advantage of the model is its temporal flexibility, which remains a frequently overlooked feature in many existing standards. HREM accounts not only for a building's baseline performance but also for how it behaves during acute disruption and long-term recovery. This temporal perspective helps reveal hidden vulnerabilities and supports the development of more durable and equitable architectural solutions. Furthermore, its emphasis on participatory design and context-specific adaptation encourages the co-production of spatial strategies that are both socially inclusive and culturally appropriate, especially in marginalized or risk-prone settings.

Despite these strengths, the HREM also presents inherent limitations that must be acknowledged. First, although the model is grounded in interdisciplinary theory and supported by hypothetical scenarios, it remains at a conceptual stage. Its real-world implementation will require further empirical testing and refinement. Factors such as data availability, regulatory alignment, and institutional capacity may create significant barriers to widespread adoption. This challenge is especially pronounced in regions that lack sufficient technical infrastructure or governance support. Some HREM indicators are qualitative, which makes the model flexible. However, this flexibility can also lead to subjective or inconsistent results without clear guidance or benchmarks.

Moreover, the comprehensive scope of the model, which includes six domains and numerous indicators, can be considered both a strength and a challenge. For practitioners working under time or budget constraints, applying the full framework could prove demanding without streamlined tools or simplified versions tailored to specific building typologies or project phases. Thus, operational scalability and integration into existing policy or funding instruments will be critical areas for future development.

In terms of future directions, the HREM offers a rich foundation for comparative studies, policy integration, and tool development. Empirical application in real-world projects, such as schools, health centers, and public housing, can provide valuable insights. These implementations help reveal the model's strengths and limitations across varying climatic, cultural, and risk-related contexts. Digital tools or scoring systems based on the HREM domains may enhance accessibility. These tools could support wider dissemination and practical use by non-specialist actors, including local governments, NGOs, and community organizations. Furthermore, the model could be extended to assess building clusters or urban districts, facilitating multi-scale resilience planning that bridges architecture and urban design.

In conclusion, the Healthy Resilience Evaluation Model represents not just a methodological innovation but also a conceptual reframing of what it means to design and evaluate buildings in the Anthropocene. It moves beyond prescriptive sustainability metrics and toward an anticipatory, human-centered approach that aligns with the complexity of our time. While further refinement and testing are needed, HREM offers a strong foundation for a new generation of architectural practices defined by proactive and integrated approaches. Rather than reacting to isolated risks, they aim to safeguard health, dignity, and long-term continuity in the face of both chronic and acute disruptions.

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MOBILITY HUBS FOR HEALTHY CITIES: ARCHITECTURAL DESIGN STRATEGIES

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ABSTRACT

The rapid growth of the global urban population and the reduction of urban spaces bring new sustainability challenges in terms of spatial planning and transportation systems. Urban growth and urbanization lead to environmental degradation caused by factors such as traffic congestion, high energy consumption and greenhouse gas emissions, resulting in air quality problems, loss of efficiency and side effects that negatively affect human health. In this context, ensuring sustainable transportation systems and mobility constitutes a significant challenge worldwide. The current study aims to address, in conceptual terms, how mobility hubs emerging in response to these issues and enabling the efficient integration of different transportation options contribute to the vision of healthy cities. In the current study, the definition of mobility hubs, their typology, design strategies, their relationship with healthy city principles, opportunities created and challenges encountered by them are examined in a holistic manner. The theoretical framework, which is based on the World Health Organization's (WHO) healthy city approach, is correlated with sustainable urban mobility across environmental, social and economic dimensions. The literature review highlights the role of criteria such as accessibility, inclusivity, environmental efficiency and user comfort in the urban planning process by revealing the design and functional differences of mobility hubs. In the design strategies section, the importance of physical, digital and democratic integration is explained based on universal design principles. It is argued that these hubs are not merely transfer points, but multifunctional spatial systems that support social interaction, safety and health. For these systems to be successful, elements such as wayfinding systems, biophilic design, lighting, cleanliness, accessibility and digital information infrastructure that improve the user experience come to the fore. In the implementation challenges section of the study, problems such as lack of unity in design, economic sustainability, user habits, inadequate administrative coordination and costs of electric mobility infrastructure are discussed. To address these challenges, it is argued that policymakers, local authorities, urban planners, the private sector and citizens need to work in a coordinated manner within participatory governance mechanisms. In addition, concrete strategies such as charging infrastructure powered by renewable energy, the use of recyclable building materials and life cycle cost analyses are proposed to improve the environmental performance of electric mobility hubs. In conclusion, the study reveals that mobility hubs are not merely transport-oriented infrastructures but also strategic spatial components in the construction of sustainable, inclusive and healthy cities. The success of these hubs depends on an integrated planning approach based on interdisciplinary collaboration, social participation and energy efficiency.

KEYWORDS:

Mobility hubs, healthy cities, urban transportation, multimodal transportation, architectural design strategies

SAĞLIKLI ŞEHİRLER İÇİN MOBİLİTE MERKEZLERİ: MİMARİ TASARIM STRATEJİLERİ

Küresel şehir nüfusunun hızla artması ve kentsel alanların azalması, mekânsal planlama ve ulaşım sistemleri açısından yeni sürdürülebilirlik sorunlarını gündeme getirmektedir. Kentsel büyüme ve kentleşme, trafik sıkışıklığı, yüksek enerji tüketimi ve sera gazı emisyonları gibi çevresel bozulmalara yol açarak hava kalitesi sorunları, verimlilik kaybı ve insan sağlığını olumsuz etkileyen yan etkiler yaratmaktadır. Bu bağlamda, sürdürülebilir ulaşım sistemleri ve hareketliliğin sağlanması dünya çapında önemli bir zorluk teşkil etmektedir. Çalışma, bu sorunlara yanıt olarak ortaya çıkan ve farklı ulaşım seçeneklerinin verimli entegrasyonunu sağlayan mobilite merkezlerinin sağlıklı şehir vizyonuna nasıl katkı sunduğunu kavramsal boyutlarıyla tartışmayı hedeflemektedir. Çalışmada, mobilite merkezlerinin tanımı, tipolojisi, tasarım stratejileri, sağlıklı şehir ilkeleriyle ilişkisi, fırsatları ve karşılaşılan zorlukları bütüncül biçimde incelenmiştir. Dünya Sağlık Örgütü'nün (WHO) sağlıklı şehir yaklaşımını temel alan kuramsal çerçeve, çevresel, sosyal ve ekonomik boyutlarda sürdürülebilir kentsel hareketlilikle ilişkilendirilmiştir. Literatür taraması, mobilite merkezlerinin tasarım ve işlev farklarını ortaya koyarak, erişilebilirlik, kapsayıcılık, çevresel verimlilik ve kullanıcı konforu gibi ölçütlerin kent planlama sürecindeki i rolünü vurgulamaktadır. Tasarım stratejileri bölümünde, evrensel tasarım ilkeleri temel alınarak fiziksel, dijital ve demokratik entegrasyonun önemi açıklanmıştır. Merkezlerin yalnızca aktarma noktaları değil; sosyal etkileşimi, güvenliği ve sağlığı destekleyen çok işlevli mekânsal sistemler olduğu savunulmuştur. Bu sistemlerin başarılı olabilmesi için, kullanıcı deneyimini geliştiren yön bulma sistemleri, biyofilik tasarım, aydınlatma, temizlik, erişilebilirlik ve dijital bilgi altyapısı gibi unsurlar öne çıkarılmıştır. Çalışmanın uygulama zorlukları kısmında, tasarımda birlik eksikliği, ekonomik sürdürülebilirlik, kullanıcı alışkanlıkları, yönetimsel koordinasyon yetersizliği ve elektrikli mobilite altyapısının maliyetleri gibi sorunlar ele alınmıştır. Bu zorlukların çözümü için, politika yapıcılar, yerel yönetimler, kent plancıları, özel sektör ve vatandaşların katılımcı yönetişim mekanizmaları içinde eşgüdümlü biçimde çalışmaları gerektiği belirtilmiştir. Ayrıca, elektrikli mobilite merkezlerinin çevresel performansının artırılabilmesi için yenilenebilir enerjiyle beslenen şarj altyapısı, geri dönüştürülebilir yapı malzemeleri ve yaşam döngüsü maliyet analizleri gibi somut stratejiler önerilmiştir. Sonuç olarak çalışma, mobilite merkezlerinin yalnızca ulaşım odaklı altyapılar değil, aynı zamanda sürdürülebilir, kapsayıcı ve sağlıklı şehirlerin inşasında stratejik mekânsal bileşenler olduğunu ortaya koymaktadır. Bu merkezlerin başarısı, disiplinler arası iş birliği, toplumsal katılım ve enerji verimliliğine dayalı bütüncül bir planlama yaklaşımına bağlıdır.

Anahtar kelimeler: *Mobilite merkezleri, sağlıklı şehirler, kentsel ulaşım, çok modlu ulaşım, mimari tasarım stratejileri*

1.INTRODUCTION

According to United Nations data, the share of the global urban population was 25% in 1950 and reached approximately 50% in 2020. It is expected to gradually rise to 58% over the next 50 years (UN-HABITAT, 2023). Cities hosting large populations have been exposed to the effects of globalization, which has created the necessity either to design and construct new cities or to improve existing ones. With the increasing population, the amount of available space has shown a tendency to decrease (Weustenenk & Mingardo, 2023). The steadily decreasing spaces make the implementation of urban designs more difficult and put liveable areas under pressure. Congresses, conferences and summits are being organized to promote the design of more sustainable cities.

In this context, rapidly growing urban populations and shrinking urban spaces raise new sustainability challenges not only in terms of spatial planning but also transportation systems and policies.

Urban growth and urbanization, along with the continuously increasing demand for transportation, lead to traffic congestion, high energy consumption and greenhouse gas emissions. Transportation accounts for 75% of CO2 and greenhouse gas pollution and is expected to have an even greater impact on global greenhouse gas emissions by 2050. Urban growth and urbanization have led to a tremendous increase in motor traffic congestion, which, in turn, is causing environmental degradation, air quality issues, loss of productivity and health-reducing side effects in our built environments (Nikitas & Bakogiannis, 2024). Research on environmentally sustainable transportation systems has become increasingly important (OECD, 1996), while ensuring and managing sustainable mobility continues to pose significant challenges worldwide (Zawieska & Pieriegud, 2018). These global trends have also drawn the attention of international organizations and, as emphasized in the climate change report published by the United Nations in 2024, have revealed the decisive role of cities in greenhouse gas emissions (WMO, 2025). The report emphasizes that increasing shared mobility, as part of broader systemic transformations in the way we live and travel, can play a critical role in combating climate change. Cities, in turn, are seen as priority spaces for implementing innovative approaches that can test different policy scenarios and contribute to a reduction in vehicle use in line with net-zero emission targets from transportation in the coming years. Limiting vehicle use in cities emerges as one of the most effective methods for reducing greenhouse gas emissions. Restricting vehicle use in cities is seen to be as one of the most effective methods for reducing greenhouse gas emissions (Kuss & Nicholas, 2022).

With the advancement of Information and Communication Technologies (ICT) and innovations in vehicle technology, new mobility options such as car and bicycle sharing have emerged (Miramontes vd., 2017). The use of mobility hubs, which provide multimodal transportation options for short distances and facilitate seamless transfers between modes, is being proposed by researchers, project developers, governments, passenger transport companies and other professionals as a potential solution (Anderson et al., 2017; D. Bell, 2019; Tran & Draeger, 2021). Mobility hubs are also socially significant, as they enhance economic productivity and efficiency by enabling each segment of a journey to be completed in the most cost-effective manner (Anderson et al., 2017). However, there are various challenges regarding mobility hubs that must be considered. In line with increasing human needs, mobility services go through a paradigm shift, moving from traditional forms of public transport to smart mobility solutions (Arsenio et al., 2016; Mulley et al., 2018; R. R. da Silva et al., 2022). Many regions in Europe have started to implement mobility hubs. Examples include eHUBs in the Netherlands, mobil.punkte in Germany, WienMobil in Austria and Hoppinpunten in Belgium.

The current study aims to conceptually examine the contributions of mobility hubs, as multimodal transportation nodes, to the vision of healthy cities. In this regard, the definitional and typological framework of the concept of mobility hub is presented, while design strategies, opportunities and challenges are discussed within a theoretical context. In terms of scope, the study comprehensively evaluates the definition of the concept, its typology, its relationship with the healthy city approach, design strategies, implementation benefits and challenges.

2.HEALTHY CITIES

The evolution of the concept of healthy city has been shaped by the intersection of urban planning, community engagement and public health policies. The World Health Organization (WHO) launched the Healthy Cities Program in 1986 to promote health as a guiding principle for sectoral policies and urban plans in participatory cities (Ziafati Bafarasat et al., 2023). The WHO defines healthy cities as "cities that place health, social well-being, equity and sustainable development at the centre of local policies, strategies and programs, based on the core values of the right to health and well-being, peace, social justice, gender equality, solidarity, social inclusion and sustainable development and that are guided by the principles of health for all, universal health coverage, intersectoral governance for health, health in all policies, community participation, social cohesion and innovation." (WHO, 2022).

The eleven key features defined by the World Health Organization (WHO) provide a universal framework for the planning of healthy cities:

1. A clean, safe and high-quality physical environment (including housing quality).

2. A sustainable, stable ecosystem in the long term.

3. A supportive, strong, solidarity-based society.

4. High level of public participation and involvement in decision-making processes.

5. Meeting the basic needs of all individuals (food, water, shelter, security, income, employment).

6. Access to a variety of resources, experiences, interaction and communication opportunities.

7. A vibrant, innovative and resilient urban economy.

8. Maintaining links with cultural and biological heritage.

9. Urban form compatible with health and sustainability principles.

10. Accessible public health and treatment services for every individual.

11. High level of health (high positive health and low disease rate) (WHO, 2025).

This approach demonstrates that the concept of healthy city cannot be reduced solely to the health system; rather, it emphasizes the need for an integrated consideration of multiple sectors such as environment, housing, urban planning, participation, economy and public health (Hu & Kuo, 2016; Ramirez-Rubio et al., 2019).

Over time, this Europe-centred initiative has become a paradigm shaping urban health strategies worldwide. In response to increasing health issues such as air pollution, physical inactivity and social isolation, the healthy city approach leads the development of multisectoral policies that mitigate the impacts of urbanization (Sharma & Nam, 2017; Wang et al., 2025). In particular, the integration of technological innovations has emerged as a contemporary extension of this movement. Smart city initiatives strengthen data-driven decision-making in healthcare delivery and environmental sustainability, addressing short-term health needs while supporting long-term resilience (Deng et al., 2024; Huang et al., 2019). Moreover, the inclusion of community participation in planning processes is a key factor that enhances the effectiveness of health policies, as local engagement is directly associated with improved health outcomes and increased social satisfaction (Hu & Kuo, 2016).

Within the framework of the Sustainable Development Goals (SDGs), the healthy cities approach plays a fundamental role as cities strive to achieve health improvements alongside environmental and social equity initiatives. Policies aligned with the SDGs aim to design inclusive urban spaces that promote active lifestyles while enhancing access to health, education and employment (Alderton et al., 2021; Wang et al., 2025). Differences in urban environmental conditions further increase the importance of this approach. The variations observed in air pollution, noise, temperature, UV radiation and access to green spaces in cities are explained by the built environment, individual behaviours and the interaction between them (Beelen et al., 2013; Dell et al., 2014; Eeftens et al., 2012; Krämer el al., 2000; Nieuwenhuijsen & Khreis, 2016). In addition, factors such as building density, road network, traffic flow, speed and load, intersections and acoustic and meteorological conditions determine noise exposure (M. C. Bell & Galatioto, 2013; Foraster et al., 2011; Zuo et al., 2014).

Recent studies have revealed that long-term exposure to air pollution in urban areas may lead to an increase in mortality rates, a higher incidence of lung cancer and cardiovascular diseases, reduced lung function in children, a rise in respiratory infections during early childhood and low birth weight (Beelen et al., 2014; Cesaroni et al., 2014; Raaschou-Nielsen et al., 2013; Shah et al., 2013). These findings also confirm the results of previous studies on the health problems caused by exposure to air pollution both within and between cities (Brook et al., 2010; Eeftens et al., 2014; Gehring et al., 2013; Pedersen et al., 2013).

Making cities healthy requires more than merely reducing CO_2 emissions. Since many components of the natural ecosystem are uniquely intertwined with the social, economic, cultural and political components of the urban system, a systematic approach should be adopted toward urban and transportation planning as well as environmental and energy issues. A sustainable city should have attractive open public spaces and promote sustainable, inclusive and healthy mobility. Non-motorized mobility should be made more attractive and multimodal public transportation systems should be preferred. Traffic-related exposures including air pollution, greenhouse gases, noise, increases in local temperatures and decreasing green spaces create stress factors for the environment and, consequently, for the health of the population (Nieuwenhuijsen, 2016).

In the face of the ongoing climate crisis, the transformation of existing societies has become increasingly urgent; this situation requires new measurement methods, policies, tools and behavioural changes. Increasing population, shrinking urban space and growing car usage are deepening inequalities in transportation and putting pressure on public spaces (Attard, 2020). Therefore, it is important to examine alternative models that could transform car-dominated cities. One of the main challenges of urban planning is to promote a shift to sustainable modes of transportation, such as walking, cycling and public transit, by reducing private car usage (Banister, 2008). Sustainable mobility is currently an important policy goal for both the European Union and individual nations. In this transformation process, policymakers and urban planners play a key role in developing mobility hubs, which are among the new solutions supporting sustainable urban mobility (Trygg & Grundel, 2025).

Given the environmental and health impacts of urban transportation, spatial solutions that support sustainable and healthy mobility have become increasingly critical. In this context, mobility hubs, which integrate different modes of transportation, reduce environmental burdens and promote active travel, come to the fore as a practical tool for implementing the vision of sustainable cities.

3.MOBILITY HUBS FOR HEALTHY CITIES

Although mobility hubs have recently attracted attention, research on this topic is still in its early stages (Martinez et al., 2024). Many studies have focused on defining, categorizing and identifying the typologies of mobility hubs (Geurs et al., 2024; Rongen et al., 2022; Roukouni et al., 2023; Weustenenk & Mingardo, 2023). Geurs et al. (2024) emphasize inclusivity as one of the key factors to be considered in the development of mobility hubs. Martinez et al. (2024) examined the usage needs of mobility hubs in urban transportation for disadvantaged groups and developed policy and practice recommendations for inclusive designs.

Many researchers have developed approaches to identify the most suitable locations for implementing mobility hubs (Anderson et al., 2017; Aono, 2019; Aydin et al., 2022; Blad et al., 2022; Frank et al., 2021; So et al., 2023; Stadnichuk et al., 2024; Tran & Draeger, 2021). Anderson et al. (2017) focus on transportation equity by including indicators particularly relevant to disadvantaged populations, while Frank et al. (2021) develop a decision support tool that combines accessibility- and optimization-based modelling criteria to help rural policymakers identify locations for mobility hubs. Aydin et al. (2022) used fuzzy multi-criteria decision-making methods to identify the most suitable location for a mobility hub on the Anatolian side of Istanbul and found Kadıköy as the optimal choice.

By focusing more on user profiles, Bösehans et al. (2023) worked with four groups with the aim of identifying potential users. Bell (2019) aimed to develop the typology of intermodal mobility hubs based on user-centred approaches in urban and rural public transportation systems and to identify the spatial requirements and potential user profiles of multimodal transportation systems. Tran & Draeger (2021) are developing a new assessment framework and algorithm to evaluate the dimensions of transportation equity and sustainability in cities by analyzing the effects of the location and investment strategies of urban mobility hubs on multimodal transport, accessibility and inequalities among income groups.

Nikitas & Bakogiannis (2024) conducted a systematic literature review, addressing mobility hubs from all perspectives. CoMoUK (Collaborative Mobility UK) (2021) has published a comprehensive guide for mobility hubs. Rongen et al. (2022) analyzed the concept of mobility hubs in the Netherlands within a historical policy context. Nair & Miller-Hooks (2016) presented a two-level network design model for implementing mobility hubs to minimize total travel time and costs. In this model, decisions regarding the placement of one-way shared services are considered, along with factors such as vehicle inventory and station capacity.

Miramontes et al. (2017) conducted a pilot study examining the use of multimodal mobility hubs in Munich and implemented an online survey to assess the opinions of stakeholders and the public on these hubs. The

South East Scotland Transport Partnership (SEStran) is running a project aimed at improving the transportation system in Southeast Scotland, ensuring the efficient operation of businesses and providing better access for all residents in the region to healthcare, education, public services and employment opportunities (GOSEStran, 2025).

A simple visual of how CoMoUK (2021) mobility hubs integrate different modes of transport (public transport, cycling, walking, shared vehicles) is shown in Figure 1.

Figure 1. Visual of a small mobility centre (CoMoUK, 2021)

The reviewed literature presents case studies on location selection, definition, typology, user needs and requirements of disadvantaged groups in the context of mobility hubs. However, the critical role of mobility hub systems in creating healthy living spaces has not been adequately evaluated.

3.1.Definition

The concept of mobility hub has been defined in many different ways over the years. The first recorded example of the concept, according to Rongen et al. (2022), is linked to the introduction of the Park-and-Ride system in the Multiannual Passenger Transport Plan (1976–1980). Large-scale investments in highway networks since the 1960s have increased car ownership, while the fragmented distribution of residential and employment areas has contributed to rising traffic congestion and environmental problems. These developments have triggered a shift from the existing car-oriented facilitation paradigm toward promoting public transportation. Policymakers assumed that Park-and-Ride facilities established near train stations would encourage car users to opt for public transportation for part of their journey (Rongen et al., 2022).

In recent years, its popularity has increased significantly due to the growing emphasis on more sustainable travel measures aimed at reducing carbon emissions in urban areas (Geurs et al., 2024)

The concept of mobility hubs essentially addresses the general principles of integration in urban transportation strategies, as defined by (May et al., 2006). The study suggests that the integration of policy instruments can be achieved in four general ways: (1) integration between policy instruments involving different modes; (2) integration between policy instruments covering infrastructure provision, management, information and pricing; (3) integration between transport measures and land-use planning measures and (4) integration with other policy areas such as health and education (May et al., 2006). The main added value of the concept of mobility hub lies in its aim to provide a transportation planning approach that integrates all four of these types of integration simultaneously (Geurs et al., 2024).

Table 1 presents the definitions of the concept of mobility hub as found in the literature.

Table 1. Definitions of mobility hub

Author	Year	Definition
Hochmair	2015	Mobility hubs are key transit access points and an integrated part of multimodal transportation planning efforts.
Miramontes et al.	2017	Mobility hubs are multimodal transportation points that facilitate intermodal transfers by offering different mobility options within close proximity.
CoMoUK	2021	A mobility hub is a recognizable location offering different and connected transportation modes, supported by enhanced facilities and information features designed to attract and benefit passengers. Mobility hubs can be seen as an interface between the transportation network and the spatial structure of a region.
Navratilova et al.	2021	Mobility hubs are transfer stations that form the backbone of public transportation and connect regional centres to one another.
Aydin et al.	2022	Mobility hubs are centres designed to serve as focal points in the transportation network, ensuring safe and comfortable transfers for passengers between different modes.
Rongen et al.	2022	Mobility hubs are clusters of new, shared or electric mobility services located in areas with high travel demand and capable of being integrated with traditional public transportation services.
Nikitas	2024	Mobility hubs are visible, accessible and integrated areas where public, shared, micro-mobility and active travel modes are co-located and function together, alongside public space enhancements and new infrastructure facilities such as charging and sharing stations.
Blad et al.	2022	A shared mobility hub is a location where multiple sustainable transportation modes come together, providing seamless connections between modes; it offers not only public transportation but also various shared mobility options and may include additional amenities such as retail shops, workspaces or parcel delivery points (e.g., lockers).

GOSEStran	2025	A mobility hub is a recognizable and easily accessible location that integrates different transportation modes and is supported by enhanced facilities, services and information, aiming to promote more sustainable travel, create a sense of place and improve journeys and travel options.

Although definitions of the concept vary in the literature, common characteristics of mobility hubs include enabling multimodal transfers and serving as focal points in the transportation network. In addition, due to the nature of their locations, they interact intensively with surrounding land uses, which elevates them beyond being mere transportation nodes and makes them significant components of the urban spatial structure. Moreover, mobility hubs are regarded as strategic areas that enhance comfort in the travel experience, promote active travel modes that support users' health and generate positive environmental impacts.

3.2.Design strategies

Architectural design plays a significant role in shaping environments that either promote or hinder health-promoting behaviours. For health-promoting mobility hubs, specific design strategies can significantly influence users' participation in active transportation and contribute to overall well-being.

The development of health-promoting mobility hubs requires the integration of design principles from multiple disciplines. In this context, the physical integration that connects multiple transportation modes, land-use integration that defines the relationship of mobility hubs with public spaces and points of interest and the digital and participatory integration that incorporates the needs of users and stakeholders into the design process are all important dimensions (Geurs et al., 2024). In the design of these hubs, it is important to reduce environmental stress, promote physical activity, strengthen social interactions and lessen cognitive load.

The accessibility and inclusivity of mobility hubs are critical issues that must be carefully addressed, particularly for disadvantaged users who may face barriers in using the facilities and vehicles. Martinez et al. (2024) identified the needs of disadvantaged groups at mobility hubs across eight categories, noting that three of them are essential. The first is the design of the physical elements of mobility hubs, such as built infrastructure and vehicles; the second is the availability and reliability of services and infrastructure and the third critical aspect of mobility hubs is the increasing digitalization of transportation services.

Universal design principles are used as the basis for assessing whether a design is inclusive. Universal design (Story, 2001) goes beyond current and future legal requirements, aiming to provide accessibility for everyone without the need for infrastructure or services specifically adapted for disadvantaged groups. Seven design principles stand out in universal design (Table 2).

Table 2. Application of universal design principles (Dostoğlu et al., 2009) to mobility hubs

Universal Design Principle	Application in Mobility Hubs
Equitable Use	It ensures that all users (including those with disabilities, the elderly, children, etc.) can use it equally and without discrimination; it is aimed that the design is accessible to everyone.
Flexibility in Use	It offers flexible transportation options and services that accommodate different user preferences and needs.
Simple and Intuitive Use	The hub's layout and wayfinding should be easily understandable by everyone; it should include clear, intuitive design elements and signage.
Perceptible Information	It ensures that users can access necessary information even if they have sensory limitations, utilizing tools such as audio and visual information systems, Braille and tactile surfaces.
Tolerance for Error	It offers a safe environment that minimizes risks arising from user errors; for example, it aims to prevent accidents by reducing complex transitions and by providing safe pedestrian paths and protective measures.
Low Physical Effort	The hub is designed to require minimum physical effort for use; long distances and barriers are eliminated, and ramps, elevators and resting areas are provided.
Size and Space for Approach and Use	Sufficient space is provided for smooth use of various sized vehicles and devices, such as wheelchairs and strollers; entrances, pathways and waiting areas are designed with appropriate dimensions.

Universal design principles require not only spatial arrangements but also a holistic approach to the user experience. Therefore, evaluating these principles alongside the physical, digital and participatory integration dimensions should be regarded as a fundamental element in ensuring accessibility and inclusivity (Geurs et al., 2024) (Figure 2).

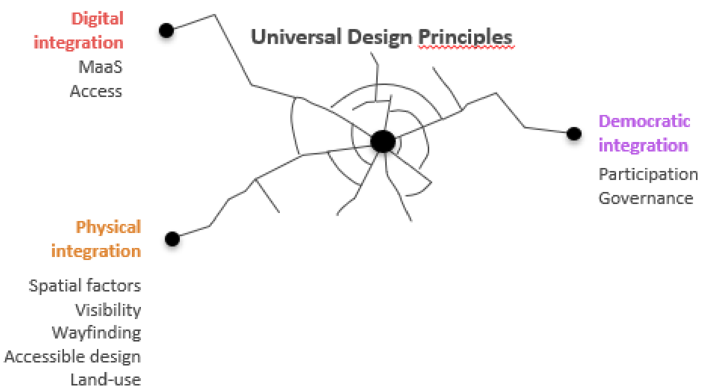

Figure 2. Dimensions of Integration in Universal Design

Physical integration refers to the effort to bring together mobility and sedentary services within public spaces. Adherence to universal design principles and, in addition to physical proximity, visibility and access without physical barriers increase usability and accessibility (Geurs et al., 2024).

A core feature of mobility hubs is providing seamless transfers between different transportation modes, which can be achieved through the physical integration of these modes. In physical integration, spatial factors, the distance between different transportation modes, visibility, accessibility and place-making strategies are emphasized (Geurs et al., 2024).

When spatial factors are considered, land use, points of interest, demographic characteristics and existing public transit, walking and cycling infrastructure should all be evaluated together. In addition to population density, the intensity and diversity of land use can influence the function and scope of a multimodal hub (Nielsen et al., 2005). The proximity of mobility hubs to essential services such as educational institutions and hospitals can significantly enhance their accessibility. Spaces where people can interact increase social interaction, while short distances between transit stations and safe pedestrian and cycling infrastructure can also promote shared use (Chidambara, 2019; L. M. C. da Silva & Uhlmann, 2021). Mobility hubs designed near the first or last stops of public transportation vehicles can also help prevent traffic congestion (Blad et al., 2022; Miramontes et al., 2017; Nielsen et al., 2005; L. M. C. da Silva & Uhlmann, 2021).

The maximum walking distance between different transportation modes, travel times, or intermodal transfer durations should be arranged to accommodate all users. Walking routes should be free of obstacles, include necessary signage and be easily accessible (Aono, 2019; Blad et al., 2022; CoMoUK, 2021). The improvement of various infrastructures to increase bicycle usage is also frequently emphasized in the literature. In this regard, the diversity of bike-sharing programs, parking facilities and the integration of different types of bicycles are considered important (Aono, 2019; Miramontes et al., 2017).

Clear wayfinding and readibility within the area are also very important. Intuitive layouts, clear signage and visual cues efficiently guide users within the facility and toward active transportation options. When users can easily understand and navigate an area, they may feel more comfortable and confident in exploring active travel modes (Koszowski et al., 2019). In addition, making data accessible online and providing Wi-Fi access within central facilities further facilitates the travel planning process for users (Schemel et al., 2020; SUMC, 2019). Real-time data access is an important part of the travel process.

Creating a physically accessible environment for everyone requires the presence of certain relevant elements such as boarding equipment, ramps, escalators, bicycles, wheelchairs, strollers and stair aids. Tactile surfaces and the presence of support staff when necessary are also required (Aono, 2019; Nielsen et al., 2005).

To strengthen the connection between people and centres, placemaking can maximize shared value and enhance acceptance and use among residents. It can enhance people's sense of belonging and comfort; that is, the feeling of being safe in a clean and pleasant area where they can meet others and engage in activities (Geurs et al., 2024).

Biophilic design, which aims to connect mobility hub users with nature, is also important. Interior gardens, courtyards and natural elements such as ventilation and natural light have been shown to reduce stress, improve cognitive function and enhance mental well-being (WHO, 2022). In addition to architectural design, integrating sidewalks, green spaces and attractive, recognizable waiting areas is important for creating an enjoyable environment for users (CoMoUK, 2021). Design features that enhance social safety and comfort include providing adequate lighting and avoiding placing waiting areas in isolated sections (Aono, 2019; CoMoUK, 2021; SUMC, 2019). In addition to all these factors, the importance of cleanliness in hubs has been emphasized in many studies. Lack of maintenance and cleaning can lead to poor acceptance and perception by the public (Chidambara, 2019; Nielsen et al., 2005).

In addition to physical accessibility, digital accessibility is becoming increasingly important, as new mobility services often rely on digital interfaces for planning, booking, payment and information provision. Digital mobility solutions are based on the assumption that interaction occurs between the user and a digital interface, such as a smartphone, screen, computer or electronic display. Today, digital technologies have become indispensable in the use of shared mobility and public transportation services, and they are among the key factors determining the potential usage of services offered at mobility hubs. Digital integration is a process that consolidates information on a single digital platform and enables different information systems to access this data using a standard format. In this way, users can easily and comprehensively access data from multiple service providers through a single digital platform (Geurs et al., 2024).

Democratic integration is based on participatory governance principles that involve citizens in the planning and development processes of mobility hubs, aiming to create more inclusive hubs that meet the needs of diverse user groups. This approach emphasizes the rights and responsibilities of both users and service providers, allowing the process and its outcomes to be evaluated in a more holistic and multifaceted manner (Geurs et al., 2024).

Universal design principles require not only the physical arrangements of mobility hubs but also the holistic shaping of the user experience. The coordination of physical, digital and democratic integration dimensions provides a fundamental framework for ensuring accessibility, inclusivity and user satisfaction. Physical integration enhances user comfort and safety through elements such as spatial proximity, visibility, wayfinding, biophilic design and safe pedestrian and bicycle infrastructure, while digital integration facilitates the mobility experience by enabling real-time data flow, online access and the integration of multi-provider systems on shared platforms. Democratic integration, on the other hand, ensures active user participation in planning processes and offers a fair and inclusive governance model that takes everyone's needs into account. This triple integration allows mobility hubs to move beyond serving solely as transportation facilities and enables them to become sustainable urban nodes that adopt universal design principles and combine social interaction, environmental awareness and technological innovation.

3.3. Modes of transportation

Single-mode shared mobility services, such as car or bike-sharing systems, provide users with flexible access to vehicles, reducing the need for individual car ownership (Jochem et al., 2020; Martin et al., 2010). Particularly in rural areas, such shared mobility applications have the potential to prevent social exclusion by eliminating the need for individuals to bear all the costs associated with vehicle ownership.

While multimodal hubs can broadly be defined as the repeated use of multiple transportation modes, intermodality is a subset of multimodality that refers to the combination of different transportation modes within a single journey (Nobis, 2007). Mobility hubs integrate different transportation modes (Roukouni et al., 2023), encompassing everything from walking to high-speed trains. In addition to traditional public transportation options such as intercity and urban railways, metro or bus, local bus and tram services, mobility hubs may include shared-use mobility options like car-sharing and bike-sharing, all of which can be accessible within walking distance (Geurs et al., 2024). More innovative solutions include electric car-sharing, micromobility and even on-demand autonomous mobility (Arnold et al., 2023; Bösehans et al., 2023; Stevens et al., 2022). It is not necessary for all these transportation modes to be available; implementation can start with at least two options (Blad et al., 2022). The most suitable characteristics for the empirical classification of mobility hubs have been identified as the primary transportation mode, location, scale and the services and facilities offered (Weustenenk & Mingardo, 2023) (Figure 3).

The primary transportation mode is a key variable in examining empirical patterns, as clearly seen in the typologies of train stations and airports (Kazda et al., 2020). The primary transportation mode determines the services and facilities offered, the location and accessibility and consequently the scale of a mobility hub. For example, a hub with intercity trains as the primary transportation mode generally provides more services and facilities and operates on a larger scale than a mobility hub where shared bicycles are the main mode (Weustenenk & Mingardo, 2023).

Services and facilities are the second most frequently considered characteristic by experts in empirical classification. While every mobility hub possesses basic services and facilities, their quantity and complexity vary across hubs. As larger-scale hubs serve more users, their offering additional services such as retail shops becomes more viable. Mobility hubs located in urban centres generally offer more services and facilities than hubs in rural areas. The type and level of services are also directly related to the main mode of transport because the mode determines the scale (Weustenenk & Mingardo, 2023).

Location is another classification criterion frequently emphasized in the literature (Mashhoodi & van Timmeren, 2020). The location of a mobility hub includes both its location in the transportation network (e.g., node of a line) and its geographic context (e.g., urban, suburban, or rural area). While location in the transportation network generally exhibits empirical regularity according to transportation mode, geographic location is more associated with scale and service diversity.

Scale defines the service area and accessibility level of a mobility hub. This characteristic is closely related to the physical size of a hub and is commonly used in empirical grouping. In some typologies, scale is defined based on market service area. Scale determines the local, regional, or national reach capacity of a hub. Furthermore, the literature indicates a linear relationship between the level of network connectivity and the scale of hubs: those with high connectivity are generally larger in scale and more multifunctional in structure (Onstein et al., 2021; von Ferber et al., 2008).

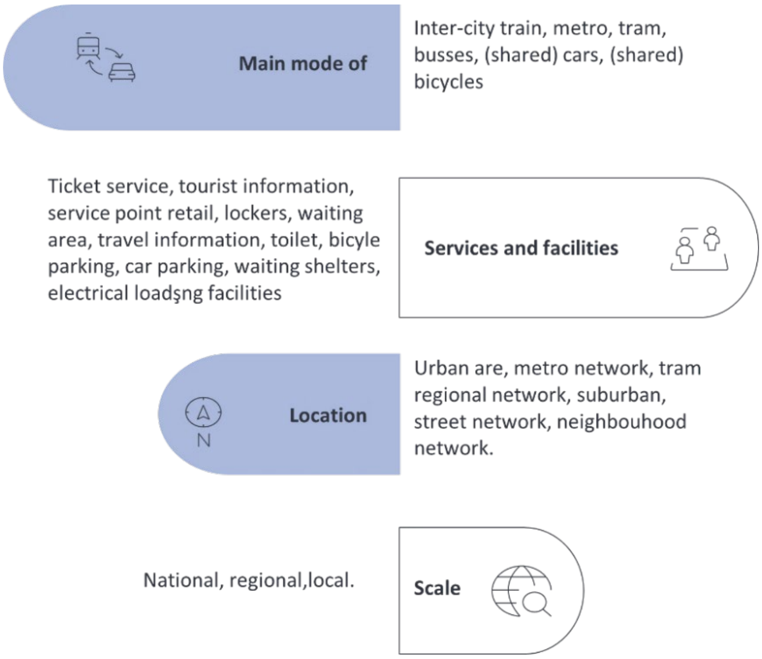

Figure 3. Grouping of mobility hubs

The diversity and integration of transportation modes are among the key factors that determine the spatial and functional efficiency of mobility hubs. While single-mode shared systems reduce private vehicle ownership and encourage social participation, especially in rural areas, multimodal and intermodal structures form the core of sustainable urban transportation. In the classification of mobility hubs, variables such as the main transport mode, location, scale, services and facilities play a decisive role in terms of urban accessibility and social equity goals. The scale and service level determined by the main transport mode directly affect the user profile and economic sustainability of the hub, while the relationship between location and scale shapes access capacity and functional diversity within spatial networks. The literature indicates that the linear relationship among these factors lays the groundwork for the formation of multifunctional, integrated and sustainable transportation ecosystems, particularly in highly connected hubs. Therefore, addressing multimodality systematically in the design and planning of mobility hubs is a strategic necessity in terms of both environmental and social sustainability.

3.4. Typology

The typology of mobility hubs varies considerably depending on their urban context, existing infrastructure and community needs. In the study by Weustenenk & Mingardo (2023), mobility hubs were classified into six categories based on scale and functional differences: community, neighbourhood, suburban, city edge, city district and city centre hubs (Figure 4).

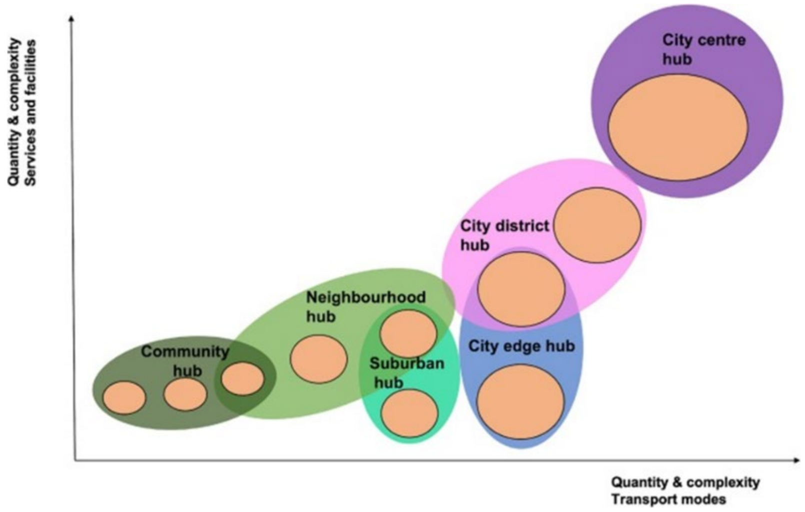

Figure 4. Types created in the conceptual framework (Weustenenk & Mingardo, 2023)

Community hubs are structures that serve specific user groups in small-scale privately owned areas and focus on shared vehicles. Neighbourhood hubs are buildings accessible by foot or bike, have public transport connections and offer local services. Suburban hubs are located in low-density areas, generally provide parking facilities and have basic public transport links. City edge hubs are urban areas where multimodal transport comes together and supports redevelopment and densification. City district hubs serve as transition points between the city and its surroundings, facilitating the transition from private cars to public transport through park-and-ride systems. At the highest level are city centre hubs with high accessibility and density, offering a wide range of services, facilities and transportation options (Weustenenk & Mingardo, 2023).

In addition to this scalar approach, shared mobility hubs are also considered in different types according to their functional contexts. Aono (2019) and Van Gils (2019) categorize shared mobility hubs into three different types based on their urban context and roles within the transportation system. Hubs that provide shared mobility services only to local residents and are not integrated with the public transportation system are defined as residential shared mobility hubs. On the other hand, urban and regional shared mobility hubs are integrated with public transportation services and serve multiple user groups. The main difference between these two systems lies in their urban context. Urban shared mobility hubs are typically located in dense city centres, whereas regional hubs are situated in urban outskirts with lower population density or in non-urban areas. Therefore, regional hubs generally contribute to the formation of intermodal transportation chains by providing parking facilities.

Blad et al. (2022) classified hubs at the residential, urban or regional level, considering urban context, transportation modes offered at the hub, transportation function and potential user groups as the key dimensions in each category. In this classification, the residential category is noted to be consistent with the neighbourhood level in other studies.

Roukouni et al. (2023), on the other hand, considered urban context as a key dimension and emphasized that it is the most commonly used criterion for distinguishing hub types in the existing literature. Researchers have broken down urban context into sub-dimensions such as transportation function (destination, transfer), spatial scale of mobility (neighbourhood, city, region), size of shared mobility hubs (small, medium, large) and proximity to public transportation. In addition, they have categorized urban context as city centre, emerging urban growth centre, historic centre, suburb and major destination.

The typology of mobility hubs is addressed within a multidimensional framework, including urban context, scale, function and level of integration, and a holistic assessment of these elements strengthens sustainable mobility systems in cities.

3.5. Mobility Hub Benefits and Opportunities

The regular use of mobility hubs has been shown to change the attitudes of frequent users toward private cars and increases the likelihood of avoiding owning or acquiring a car (Arnold et al., 2023; Czarnetzki & Siek, 2023). This shift stems from hubs' capacity to facilitate intermodal transfers by offering a wide range of transportation options such as traditional public transit, car/bike sharing, micromobility and on-demand autonomous mobility at a single location (Blad et al., 2022; Roukouni et al., 2023).

In an effective transportation scenario, mobility hubs are positioned not merely as transit points but as part of a multi-layered network that operates in an integrated manner (Roukouni et al., 2023; Tran & Draeger, 2021). This network structure allows for the diversification of different hubs in terms of scale, composition and target audience, contributing to the development of a holistic transportation system across the city. Thus, mobility hubs enhance the efficiency of multimodal transportation by facilitating access to an increasing range of transport options at the station level (Deschaintres et al., 2021). In this way, they provide smoother and easier transfers within a single journey (Blad et al., 2022; Frank et al., 2021).

However, intermodal travellers generally prefer modes of transportation that offer the shortest travel time or provide service at a speed competitive with private cars (Lunke et al., 2021). Therefore, the success of mobility hubs depends not only on physical accessibility but also on the effectiveness of information flow. Hubs provide real-time information systems and digital wayfinding tools to facilitate transfers between transportation options and meet users' expectations for time efficiency (Arnold et al., 2023; D. Bell, 2019).

The information support provided at mobility hubs consists of two main components: passenger information systems and wayfinding systems (Hernandez & Monzon, 2016). Bell (2019) emphasizes that passenger information systems should include large and legible timetables, interactive screens, live announcements, digital maps, and, when necessary, staff-assisted information points. Wayfinding systems, on the other hand, should enhance users' spatial awareness through signs, colour coding, station maps, directional panels and architectural landmarks (Arnold et al., 2023). The holistic design of these elements contributes both to the improvement of the user experience and to the enhanced functionality of multimodal transportation.

The success of mobility hubs depends not only on the integration of transportation modes but also on users' perception of safety and spatial comfort. In this context, the presence of video surveillance systems and security stations is among the key elements that enhance user safety (Hua & Lee, 2023). Moreover, design principles that avoid isolated, dark, or physically separated areas play a crucial role in reducing safety concerns, which are frequently expressed by shared mobility users (Nikitas et al., 2025).

Moreover, mobility hubs are not limited to transportation functions; by incorporating various commercial and social services, they enrich the user experience. The facilities within these hubs such as retail shops (Seker & Aydin, 2023), food and beverage services (Blad et al., 2022), shared mobility service offices

(Krüger & Altrock, 2023), maintenance facilities for private and shared vehicles, charging stations (Arnold vd., 2023), parking areas (Seker & Aydin, 2023), parcel delivery lockers (Blad et al., 2022), and even everyday services like laundries or dry cleaning (Taborda vd., 2023) increase user engagement with the hub and attract travellers from beyond the immediate vicinity.

These amenities, in particular, provide long-distance travellers and those arriving early at transfer points with the opportunity to spend their waiting time more efficiently. Moreover, through storage or delivery facilities that reduce the burden of carrying luggage, users can make more comfortable use of the infrastructure offered by the hub (Hua & Lee, 2023). Such holistic arrangements transform mobility hubs into not only transportation-focused but also liveable urban centres, contributing to urban sustainability goals as multifunctional spatial structures (Rüger, 2019).

Mobility hubs not only integrate transportation modes but also have the potential to create more liveable urban environments by contributing to the reorganization of public space for the benefit of non-motorized users (CoMoUK, 2021). Czarnetzki & Siek (2023) reported that private cars remain unused for an average of 95% of the time. This indicates that parking infrastructure exerts excessive pressure on urban space. It particularly reinforces positive societal attitudes toward reclaiming public space in densely urbanized areas (Krüger & Altrock, 2023). In this context, mobility hubs are considered a strategic tool that reduces parking issues and limits car dependency. In cases where parking infrastructure is insufficient, smart parking applications can enable travellers to easily locate nearby parking facilities (Seker & Aydin, 2023). By reducing reliance on private cars, it allows for more efficient use of public spaces. Thus, the optimization of urban land use can be achieved through the transformation of areas previously allocated to vehicles.

Urban mobility networks can extend beyond city limits to regional-scale Park & Ride facilities (Rongen et al., 2022; Weustenenk & Mingardo, 2023). This multi-layered structure strengthens both local mobility and regional accessibility, transforming the urban transportation system into a more sustainable and integrated structure.

At their core, mobility hubs, which are based on multimodality, aim to reduce the cognitive load and complexity associated with multimodal journeys. In this context, Mobility as a Service (MaaS) further reduces cognitive effort by digitally facilitating users' travel planning, booking and transitions between transportation modes (Lyons et al., 2019). The accessibility of timetables, real-time traffic information, public transit data and mode locations through a single application provides users with dynamic route planning and real-time issue management capabilities (Miramontes et al., 2017). MaaS enables the digital integration of multimodal transportation at hubs by not only sharing information but also consolidating booking, ticketing, payment and bundling processes in a digital environment (Blad et al., 2022). Such integrated systems provide users with a smoother, more comfortable and attractive travel experience while also facilitating transitions between different modes of transportation (Geurs et al., 2024). The integrated structure of MaaS and mobility hubs carries the potential to build a user-centred, flexible and sustainable transportation system by strengthening both the physical and digital infrastructure of multimodal transportation.

Mobility hubs are not only infrastructural elements that facilitate transportation but also spatial components that shape the aesthetic, social and cultural experiences of urban life (Ye-Kyeong & Hye-Jin, 2015). Typically considered part of a larger architectural whole, these hubs serve as visual and spatial focal points for urban residents. The design of interior and exterior spaces plays a decisive role in shaping the meaning and identity of mobility hubs by influencing users' perceptions of safety and environmental awareness (Lois et al., 2018).

Another element that enhances the aesthetic value of mobility hubs and promotes community interaction is the integration of green spaces. Green spaces provide a more comfortable user experience during the transfer process by enhancing the visual quality of waiting areas (Taborda et al., 2023). Moreover, when located near public transportation networks, they serve the community as areas for relaxation and recreation (Seker & Aydin, 2023). These areas encourage social interactions and provide the psychological and physical health benefits associated with contact with nature (Jezzini et al., 2023; Nieuwenhuijsen, 2018; Zhou & Rana, 2012).

Mobility hubs are also supported by shared workspaces, positioning them as venues for both working and socializing. Mobility hubs also provide an inclusive living space for tourists. Facilities such as cafés, restaurants, retail units and playgrounds facilitate daily routines while offering tourists opportunities for relaxation and exploration (D. Bell, 2019; Taborda et al., 2023).

Economically, mobility hubs generate not only transportation convenience but also value capture opportunities. The increase in the share of shared transportation creates an expanding user and customer base both within and around the hubs. The areas surrounding the hubs become attractive for residential and commercial investment, potentially providing developers with additional financial benefits through tax revenues (Gupta et al., 2022; Kapustkina, 2023). Furthermore, mobility hubs can generate a sustainable revenue model through advertising, commercial leases and operating permits (Coenegrachts et al., 2021).

CoMoUK (2021) details the benefits of mobility hubs as strengthening sustainable transport planning, facilitating ease and integration in transportation, enhancing connectivity in public transit, improving safety, increasing visibility and awareness, promoting accessibility, supporting area density and urban regeneration, enhancing the quality of public spaces and managing shared mobility services. This approach, which aligns with other studies, defines mobility hubs not merely as infrastructural nodes that strengthen integration between transportation modes but also as multifunctional urban spaces directly linked to sustainable urbanization, social inclusivity and environmental quality. In this context, when mobility hubs are evaluated based on accessibility, safety, comfort, integration and environmental efficiency criteria, they emerge as the spatial embodiment of sustainable urban mobility policies.

Mobility hubs, an important tool in supporting sustainable urban mobility, provide various economic, social and environmental benefits by reducing travel distances. These hubs not only facilitate mode changes but also promote cycling and walking, contributing to sustainable transportation goals by offering low-emission alternatives such as car and bike sharing (Canitez et al., 2020; Frank et al., 2021).

3.6. Challenges Encountered in the Implementation of Mobility Hubs

Weustenenk & Mingardo (2023) provided insights into the conceptual use, implementation and challenges of mobility hubs. Four main challenges can be encountered in the implementation of community hubs: First, the lack of consistency in design creates uncertainty for users and weakens the adaptability of hubs. Second, the economic sustainability of shared mobility remains weak, particularly in rural and suburban areas with low demand; therefore, different transportation modes need to be supported equally. Third, a balance must be established between users' expectations for reliable transport options and providers' need for flexibility.

Finally, although policy documents present mobility hubs as key to sustainable urban transport, in practice their integration into planning processes is weak, often left to the initiative of local project developers, resulting in a lack of coordination between areas (Weustenenk & Mingardo, 2023).

The integration of electrification is considered critical to strengthening the impact of mobility hubs on carbon reduction. eHubs or electric mobility hubs, which include zero-emission vehicles and e-bikes, have the potential to increase environmental benefits (Bösehans et al., 2023). However, even though exhaust emissions are eliminated, the life-cycle emissions of electric vehicles still present a certain carbon burden. Moreover, the environmental performance of electric vehicles varies depending on factors such as the emission intensity of the power grid and patterns of vehicle use. Similar to traditional mobility hubs, eHubs can sometimes redirect public transport users toward car sharing and even replace walking trips, thereby limiting their net emission reduction potential. In addition, the high costs and spatial requirements of charging infrastructure, along with the mismatch between supply and demand, make it difficult to expand electric mobility hubs (Nikitas et al., 2025).

Both electric and traditional forms of mobility hubs may also lead to environmental issues such as high energy consumption, increased noise, water usage and waste generation (Kapustkina, 2023). This creates the risk of being perceived by users as polluted or disturbing (Taborda et al., 2023). Therefore, the use of recyclable and demountable building materials, along with the maintenance of energy efficiency and cleanliness standards, is of great importance for these hubs to be recognized as sustainable and environmentally friendly facilities (Seker & Aydin, 2023).

One of the most significant challenges faced by mobility hubs is that, despite their potential to promote sustainable travel behaviours, their level of user adoption remains limited. User disengagement stems not only from a lack of information but also from habit-based behaviour patterns. The repetitive nature of travel behaviour reinforces individuals' tendency to stick to their existing modes of travel (Matyas & Kamargianni, 2019).

While the transfer function enhances the efficiency of mobility hubs, it can also lead to negative outcomes such as overcrowding (Pibrac & Farooq, 2017). Overcrowding can extend waiting times and thus negatively affects users' perceived comfort and stress levels (Taborda et al., 2023).

Walking distance plays a decisive role in the attractiveness of mobility hubs (Guo & He, 2020). Since most transfers are made on foot, the distance between access points for different modes affects the total transfer time (Pibrac & Farooq, 2017). Moreover, long walking distances from neighbourhoods to mobility hubs, combined with complex infrastructure connections, can negatively influence user preferences (Hua & Lee, 2023).

Natural environmental conditions can also pose a significant barrier to accessing mobility hubs. Adverse weather conditions and extreme temperatures can reduce users' willingness to reach the hub on foot or by bicycle (Gao et al., 2023). Similarly, topographic challenges limit both perceived and physical accessibility (Ceder et al., 2015). Uphill walks, particularly at hubs located at higher elevations, can lead to low usage rates and rebalancing issues for micromobility vehicles (Mateo-Babiano et al., 2016). In conclusion, factors such as transfer comfort, pedestrian accessibility, environmental conditions and topography directly shape the functional effectiveness and user acceptance of mobility hubs. Topography, in particular, is a variable often overlooked in the literature but is critically important for service planning and operational sustainability (Ceder et al., 2015).

These challenges indicate that mobility hubs are not merely an infrastructural planning issue but also a matter of institutional, managerial and social coordination. The lack of inter-area coordination and the fragmented nature of planning processes weaken the long-term sustainability of mobility hubs. Therefore, policymakers, urban planners, local authorities, private sector actors and citizens should be supported by concrete structures that enable collaboration within joint management mechanisms. Such structures may include city-level mobility management boards, cross-stakeholder data-sharing platforms and participatory planning workshops as multi-layered collaboration tools. A governance framework of this kind would facilitate not only coordination in planning processes but also the alignment of user behaviours with sustainable transportation goals.

Moreover, maximizing the environmental benefits of electric mobility hubs and eHubs is possible by directing the energy supply chain toward low-carbon sources, establishing charging infrastructure powered by renewable energy and adopting decision-making processes based on life-cycle cost analysis. These approaches will ensure that electric mobility becomes sustainable not only in terms of emission reduction but also regarding resource management and energy efficiency.

4.CONCLUSION

Mobility hubs are not merely physical transfer spaces that integrate transportation modes; they are multifunctional spatial systems that shape the aesthetic, social and cultural experiences of urban life, support sustainable urban development, environmental efficiency and social inclusivity and thus hold strategic importance in creating healthy living environments. This strategic role positions them as a critical tool in transforming cities into more liveable, low-carbon and resilient transportation ecosystems.

In alignment with the World Health Organization's (WHO) definition of cities placing health, social equity and sustainable development at the centre of all local policies and managed through cross-sectoral collaboration, mobility hubs represent the spatial embodiment of the healthy city concept. This approach is not limited to healthcare services; it requires a holistic consideration of multiple sectors, including the environment, urban planning, energy, education and community engagement.

Within the vision of sustainable cities, mobility hubs reduce environmental impact and promote active transportation by integrating different modes of travel. Studies highlight four core integration principles: (1) integration of transportation modes, (2) integration of infrastructure and pricing, (3) integration between transport measures and land-use planning and (4) alignment with other policy areas such as health and education, together forming a multidimensional planning approach.

When the opportunities offered by these hubs are evaluated;

In terms of environmental opportunities, mobility hubs reduce dependence on private vehicles, lower carbon emissions, increase energy efficiency and contribute to the improvement of urban ecosystems. The integration of green infrastructure and biophilic design practices supports user health and enhances environmental quality through elements such as natural lighting, ventilation and open green spaces. Thus, new environmental opportunities emerge for the reclamation of public spaces and sustainable land use.

Social opportunities are associated with the promotion of inclusive and equitable transportation policies. Mobility hubs developed in line with universal design principles facilitate the active participation of disadvantaged groups such as people with disabilities, the elderly, women and low-income individuals in urban life. Lighting, wayfinding systems, safe pedestrian and bicycle infrastructure and accessible facilities enhance users' sense of safety, while social interaction areas and the quality of public spaces support social cohesion.

From an economic opportunities perspective, mobility hubs not only provide transportation convenience but also transform into multifunctional spaces that support economic vitality. Retail units, food and beverage areas, co-working spaces and maintenance facilities diversify the user experience while creating employment and contributing to the local economy. The increase in surrounding property values attracts investor interest and supports financial sustainability in urban transformation projects.

Technological opportunities are related to digitalization and the integration of MaaS. Real-time data sharing and the development of reservation and ticketing systems through mobile applications make transportation planning more efficient for users.

Governance opportunities, on the other hand, support planning processes based on user participation within the framework of democratic integration principles. Involving citizens in decision-making ensures that hubs become not only technical infrastructures but also spaces where social participation and local governance are achieved. This governance dimension also supports the long-term sustainability of mobility hubs.

It is evident that the success of mobility hubs is not limited to technological and infrastructural integration; it also depends on adopting a multi-level, interdisciplinary planning approach that holistically addresses managerial, economic, behavioural and environmental dimensions. However, under current conditions, various structural and operational barriers prevent these hubs from fully realizing their potential within urban transportation systems.

To overcome the challenges mentioned in Section 3.6 of the study;

-Design standards should be established to ensure that they are easily perceivable and recognizable by users.

-To address the issue of low demand in suburban and rural areas, mobility hubs should be integrated with demand-responsive transportation systems.

-Funding mechanisms should be established through public-private partnerships.

-The social acceptance of the hubs should be enhanced through community engagement and local awareness campaigns.

-Multistakeholder governance mechanisms should be established to reduce fragmentation in planning processes and ensure coordination across different areas.

-City-level mobility management boards should be established, comprising local government, private sector, universities and civil society representatives, to support joint data sharing and strategic decision-making processes.

-Participatory planning workshops and joint decision-making mechanisms should be implemented in the planning processes.

-Charging infrastructure should be powered by renewable energy sources, and energy efficiency should be considered through life cycle analysis (LCA).

-At the policy level, carbon-neutral operational standards and energy efficiency indicators should be defined.

-Modular, recyclable building materials should be used and dismantlable systems should be preferred in the construction.

-Inclusive and climate-responsive design principles should be adopted.

-Performance indicators for the hubs (e.g., user satisfaction, energy consumption, carbon reduction) should be defined.

In conclusion, the ability of mobility hubs to achieve sustainability and healthy city goals depends on a holistic, multi-level planning approach encompassing behavioural, spatial and environmental dimensions. The success of this process requires participatory and coordinated collaboration among policymakers, urban planners, local authorities, private sector actors and citizens. Only through such collaboration can mobility hubs become a fundamental component of the healthy city vision, promoting active mobility, reducing environmental impact and enhancing social inclusivity.

ABBREVIATIONS

WHO: World Health Organization

MaaS: Mobility as a Service

ComOUK: Collaborative Mobility UK

SEStran: South East of Scotland Regional Transport Partnership

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ATTRIBUTES OF PLACEMAKING MATRIX IN BUSINESS IMPROVEMENT DISTRICT

PALLAVI DALAL

ABSTRACT

Urban placemaking - a transformative process in which public spaces are turned in to vibrant, inclusive and resilient spaces which foster community activity and enhance urban life. Places that are either neglected or ignored in the multi-dimensional architecture and urban development process can be dealt through placemaking. Identifying the intervention needs with an intensive study of the current situation is the initial step that initiates the formulation of the strategic objectives of urban placemaking.

This study incorporates Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis into the Strategic Position and Action Evaluation (SPACE) matrix framework to create a full-fledged strategic planning framework for urban placemaking practices. Planners can establish the strategic posture (aggressive, conservative, defensive, or competitive) that is most appropriate for a particular urban setting by evaluating internal (strengths and weaknesses) and external (opportunities and threats) factors and charting them on the SPACE matrix. This integrated approach facilitates a nuanced understanding of the spatial dynamics and socioeconomic conditions that influence public spaces.

KEYWORDS

Urban Placemaking, SWOT analysis, Strategies, BID(Business Improvement District)

1. INTRODUCTION

The collaborative process of creating public areas that emphasize community needs and encourage social interaction is referred to as urban placemaking. Instead of aiming for static results, it accepts the dynamic character of urban life and acknowledges that cultural, social, and temporal factors continuously shape the areas. Effective placemaking mixes top-down planning with grassroots activities and incorporates a variety of tactics, from ephemeral exhibitions to large-scale improvements. Participatory design, which actively engages community people in influencing their surroundings, is essential to this process. Placemaking turns unused spaces into lively, significant locations that represent the identities and goals of the communities they serve by emphasizing inclusivity, adaptability, and the human experience. In contrast to the disciplines of architecture, planning, and urban design, placemaking is a broad, continuous strategic process that integrates a variety of professional as well as civic perspectives (City of PortPhilip 2018-2021, Duhl 2005, Lepofsky & Fraser 2003, McCann 2002, Shaw 2013). In this perspective, the planning process should be interwind with the decision-making process. The assessment of the urban transformation scenarios represents a complex decision problem that calls for different conflicting aspects, including the definition of shared goals for possible solutions and their effects according to different development scenarios. (5) The project proposal aims at creating a model to identify and assess urban placemaking spaces to be given high-priority intervention. The model will be used to activate the public spaces in BKC, Mumbai, along with social and sustainable elements necessary for urban placemaking.

SWOT Analysis is adopted as a strategic planning tool to evaluate internal and external influences on the vision or specific goal.it is a tool for a company or organization to assess its capacity to execute a plan or achieve an attainable goal. (6) (SWOT Analysis Report, , Accessed 23 Dec 2020) Although the origin of SWOT analysis is uncertain, there is a long historical background about its uses to facilitate the decision-making process in every complex environment. The final result of a SWOT analysis can be presented in a matrix which is a combination of the four factors and determines strengths and weaknesses that a company involves, with opportunities and threats that it may face. This article provides a study of SWOT analysis fundamentals and discusses practical insights on how to provide a SWOT matrix. ((Taherdoost, April 2021)

External opportunities and external threats-refer to economic, social, cultural, demographic, environmental, political, legal, governmental, technological, and competitive trends and events that could significantly benefit or harm an organization in the future. Opportunities and threats are largely beyond the control of a single organization -thus the word external. Internal strengths and internal weaknesses are an organization's controllable activities that are performed especially well or poorly. They arise in the management, marketing, finance/accounting, production/operations, research and development, and management information systems activities of a business. Identifying and evaluating organizational strengths and weaknesses in the functional areas of a business is an essential strategic management activity. Organizations strive to pursue strategies that capitalize on internal strengths and eliminate internal weaknesses (David, 2003: 10-11)

SWOT ANALYSIS

In the present situation, the decision is a procedural one that is spread out across time rather than a one-time event. There are numerous potential solutions from which choices can be made. Given the current situation in public planning and policymaking, it is clear that there are many conflicting issues and interests, and that the social worth of the outcomes of public choice is not exclusively determined by the market system. Therefore, it implies that new evaluation techniques must be used in physical planning. When evaluating urban placemaking initiatives, SWOT analysis is a more effective technique. The SWOT analysis's strengths and weaknesses are the site's characteristics, which may be beneficial or detrimental to the project's chances of success. While weaknesses are undesirable aspects that need to be addressed in the strategy and concept, strengths are positive aspects that require enhancement. Future effects on the location could include both opportunities and risk factors. Opportunities are innate enhancements and advantageous circumstances that the project will aim to achieve. The most likely obstacles that can cause projects to fail are threats. In particular, the first step involves formulating the decision problem in order to offer plausible alternative alternatives for accomplishing the objective. In particular, the first step involves formulating the decision problem in order to offer feasible alternatives choices for accomplishing the objective. The SWOT analysis is created at this stage.

A final assessment of the internal and external elements influencing the community's comprehension in a four-quadrant table is the SWOT analysis. The SWOT analysis's ability to address multiple problem aspects and stakeholders makes it a great tool for the rehabilitation of brown fields. It helps identify specific suggestions within the strategic plan and draws attention to both internal and external factors. It establishes priority areas and improvement initiatives. By meeting the intended end-state, the SWOT analysis can be used in any decision-making scenario.

External opportunities and external threats- refer to economic, social, cultural, demographic, environmental, political, legal, governmental, technological and competitive trends and events that could significantly benefit or harm an organization in the future. Opportunities and threats are largely beyond the control of a single organization -thus the word external. Internal strengths and internal weaknesses are an organization’s controllable activities that are performed especially well or poorly.

3. STUDY AREA-BKC,MUMBAI

Among the world's largest cities, Mumbai is a good example of megacity expansion and mixed economic climate. The growth of India's business economy is highly dependent upon Mumbai's role in its growth. Since Mumbai is a city and state capital of Maharashtra in west India. It is the headquarter of Mumbai City district and Mumbai Suburban district. It is a prominent economic and cultural hub, well connected by National Highways 48 and 66, possessing land, rail, air, and sea connectivity with the rest of India. The other prominent city of Maharashtra, Pune, is located about 150 km south-east of Mumbai.

The Mumbai local planning area covers around 60,000 hectares of different administrative and planning areas under the Municipal Corporation of Greater Mumbai (MCGM) jurisdiction. A planned population of over 1.24 crore (12.4 million) was considered while planning the Development Plan 2034 (Municipal Corporation of Greater Mumbai, n.d.). India's gateway to the country's future economy is the Mumbai Metropolitan Region (MMR). Mumbai is the capital city of Maharashtra and one of India's most important urban hubs located on the western coast of India along the Arabian Sea. The city was once called Bombay, and the name is an English adaptation of the ancient fishing settlements lived in by the Kolis. Mumbai rose to prominence under the local rulers in the 14th century before becoming a strategic Portuguese outpost, and the city was named Bombaim by the Portuguese. The British Crown received it in 1661 as part of the Portuguese dowry and later developed quickly under British colonial rule to become a major port and commercial hub.

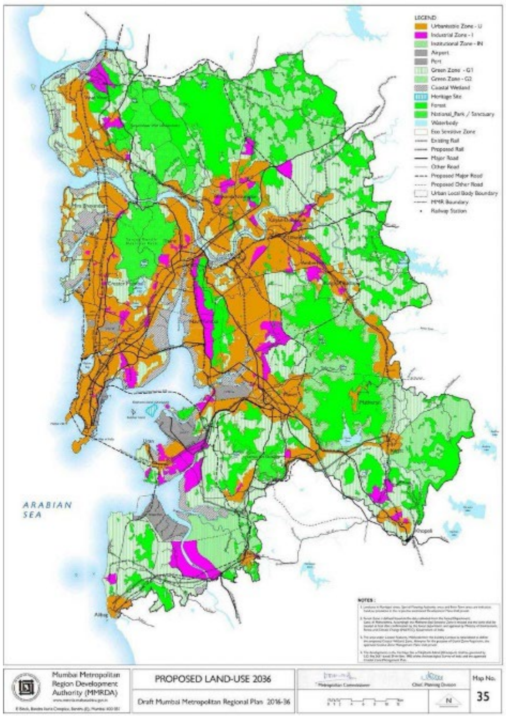


Figure 1.Mumbai Development plan 2034(Source: MMRDA)

There was an urgent need to clear the congestion in Nariman Point, and south Mumbai as a whole, where the majority of the economic activities of the city were centred. It was one of the major growth drivers of BKC as a top business hub. The Mumbai Metropolitan Region Development Authority (MMRDA) is the government agency that develops BKC.

About six lakh employees work in BKC at present, where some of the leading corporate houses of the area have offices. Several residential and commercial complexes have already been established, and some are nearing completion.

To make it easier to understand, BKC's development has been split into two phases. In 1977, BKC was formed to reduce traffic congestion, and from there until around 2014, it was simply a real estate development, with big developers coming into the picture to construct offices, workspaces, schools, and other infrastructure. With the launch of the second phase in 2014, which was designated as "Smart," the focus changed from only constructing office space and high-rise skyscrapers to actually making the surroundings smart and innovative by integrating technology and innovation. As soon as the companies began to realize the development and the increases in the BKC area other companies began coming in and constructing their company buildings.

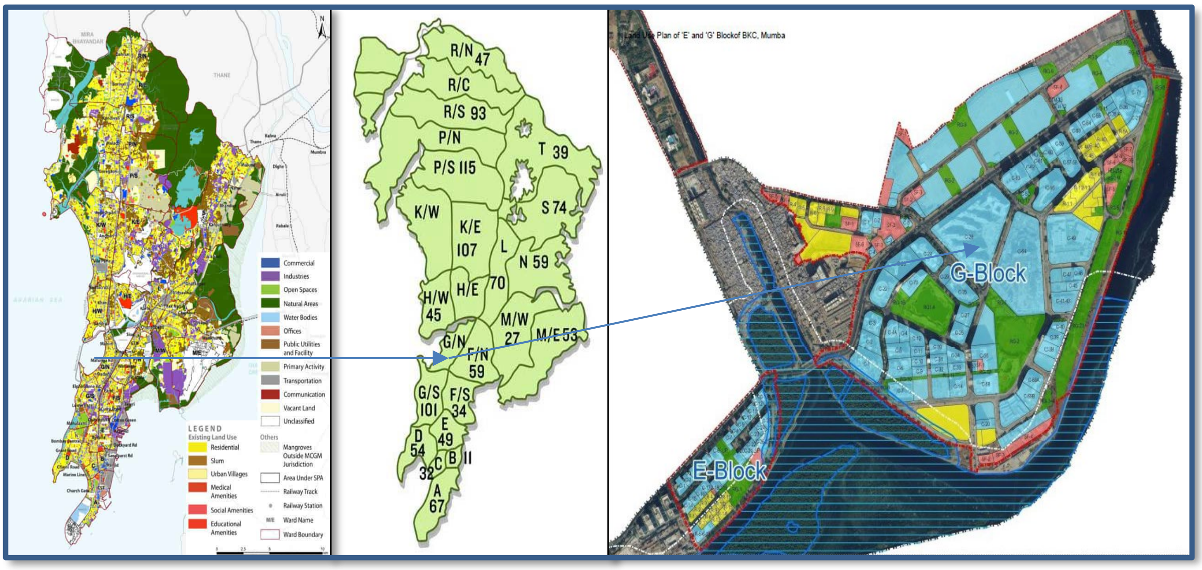


Figure 2.Figure 1.Map of MMR (Source: Draft Mumbai Metropolitan Regional Plan 2016-2036) (MMRDA, 2016), Location plan of BKC,Mumbai

The chosen site is G-Block of the Bandra-Kurla Complex (BKC) in Mumbai, as shown in Figure 2. Situated at the core of BKC, G-Block is presently a central point for commercial and institutional transactions in Mumbai's metropolitan area. The site is interesting in that it accommodates the headquarters of several corporate houses, consulates, financial institutions, and high-end commercial complexes, expressing the planned character of urban planning in the city. In spite of its high visibility and planned nature, G-Block suffers from various urban development issues, such as traffic, poor pedestrian infrastructure, and the need for improved public realm activation. Additionally, the site offers great potential for urban placemaking, especially for public space improvement and green urban design strategies.

Mapping the SWOT factors on the base map by the researcher

Bandra Kurla Complex (BKC) is a major central business district in Mumbai, designed with the vision to redistribute South Mumbai's commercial activity. In order to increase its urban sustainability and to enable inclusive placemaking, a Spatial SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis can be very informative.

4. METHODOLOGY:

Identification of SWOT Factors: Evaluate internal strengths and weaknesses, and external opportunities and threats related to BKC's urban position.

Spatial Mapping: Position these objects on a base map of BKC to display their geographical distribution and relationship.

Evaluation and Interpretation: Impose numerical values on all variables depending on their relevance and significance, thereby gaining a deeper insight into dynamics in the region.

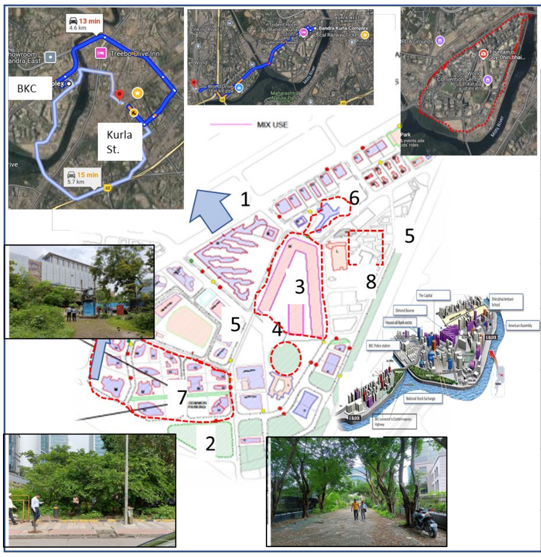
We need to apply the Strategic Position and Action Evaluation (SPACE) matrix to determine strategic orientations—aggressive, conservative, defensive, or competitive—for various BKC industries.

4.1. Mapping the SWOT Factors on Base Map

The advanced SWOT framework addresses the weaknesses of the traditional approaches by adding three key components. In the first place, it connects the SWOT framework to strategic objectives of urban placemaking projects. In the second place, it leans on existing tools like Google Earth in order to obtain accurate spatial data. Thirdly, it employs a multidimensional framework, analysing economic, social, environmental, physical, and mobility dimensions.

By considering these five dimensions, the analysis responds to major issues, thus triggering the development of corresponding solutions that reinforce strategic goals. In-depth analysis of sub-criteria in each dimension allows the development of comprehensive goals at macro and micro levels. Linking these components with regional plans facilitates better comprehension through the explicit correlation of issues with physical planning considerations.

Figure 3.Area Base Map for Strengths factors

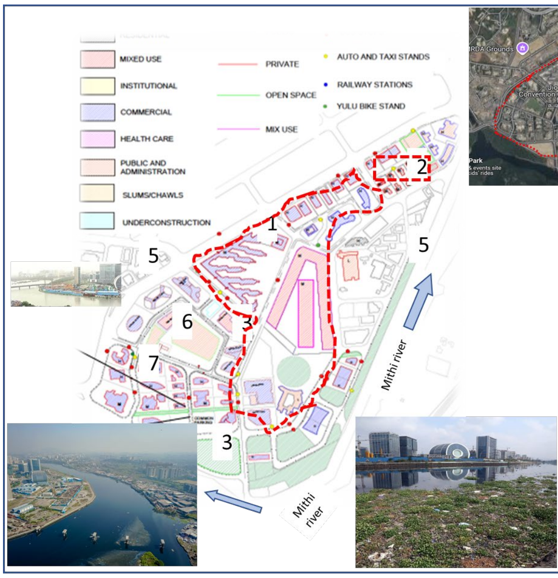


	WEAKNESS
1.	Poor Accessibility to train station/5km Kurla station/4km.bandra station
2.	Inaccessible open spaces, privately own
3.	High-rise inward Building with no connection to surrounding
4.	Jio Garden/PRIVETLY own green space
5.	Broken cycle/footpath/No interaction or community spaces
6.	No Eatery or Hawkers zone /NO Social Infrastructure,toilet,seating area
7	Not maintained intertwin spaces of building/NO parking spaces
8	Very less residential area

Figure 4.Area Base map for WEAKNESS Factors

	opportunities
1.	Expand last-mile connectivity
2.	Install shaded seating, water stations, and Wi-Fi zones.
3.	Commission murals/public art
4.	Foster community engagement, Night market/smart parking solution
5.	Balance affordability and vibrancy
6.	Foster residential zone
7	greenery coverage, use of in-between spaces
8	Eatery or café or Hawkers zone

Figure 5.Area Base map for OPPORTUNITIES Factors



	Threats
1.	Participatory planning challenge
2.	Insufficient Parking lot in zone
3.	Underutilized open spaces
4.	Overcrowding and traffic issues in peak time
5.	Less café/eatery on go
6.	Overdevelopment
7	Economic Fluctuations/rents
8	Competition from Emerging Districts/abandoned after working hour

Figure 6. Area Base map for THREATS Factors

The resulting spatial SWOT maps, depending on policy frameworks and contextual subtleties, are found to be highly effective for stakeholder engagement. They provide an entry point for learning, enable the integration of diverse viewpoints.

4.2. Appropriating scores to the various factors-

Table 1.Attributes of placemaking

Uses and Activities			Sociability		
Sustainable	Unique	Vital	Diverse	pride	Interactive
Experience	Useful	Celebratory	Cooperative	satisfactory	Welcoming
Comfort & Image			Context & Site Interpretation		
safe	local identity	Visually pleasant	Contextually Integrated	Aesthetically Appealing	Informative
clean	sense of place	scale	Human oriented	Memorable	
Access and Linkages					
connected	confinity	Walkable			
Proximity	Readable	Accessible	convenient		

The different factors of the four quadrants (strengths, weakness, opportunities, and threats) were scored by the researcher on a scale ranging from 0 to 5, based on their importance, with 5 as the highest score and 1 as the lowest score. The mean score of each of the four factors of SWOT was the score to be adopted for finding the location in the corresponding quadrant.

The average of the internal factors (strengths and weakness) and external factors (opportunities and threats) subsequently plotted on the SPACE matrix facilitated, calculation of some of the strategic objectives of the Urban Placemaking Intervention.

4.3. Identification of design strategies

The points placed in the appropriate quadrant were joined together. The quadrant in which the area covered by the obtained figure is maximum and that is the strategy determined by that quadrant as per the SPACE matrix principles of aggressive, conservative, defensive, and competitive.

5. THE PROCESS CARRIED OUT

5.1. Mapping the SWOT factors/rating

Table' 2.Strength (Mapping and tabulation on Base map by Author)

'

Category	Strengths	Nature of Strength	Scores
Physical			1-4 score scale
Area and Identity	Planned network	Grid design with several sidewalks, flyovers connecting important corridors, and broad, well-kept arterial roadways,lobal corporate hubs	3
Streets & Squares	Modern built environment	Street furniture that is well-organized, pedestrian plazas, and broad, well-maintained roads	3
Building Forms	Iconic high-rise architecture, LEED-certified structures, adaptive reuse potential	Contemporary mixed-use and high-rise office buildings with fully functional, dependable utilities (power, water, sewer, and telecom networks)	3
Environment			
Green spaces	Extensive green spaces	closed proximity to maintained parks and gardens (Reliance Jio Garden, MMRDA grounds, Mahim Nature Park) provide urban greenery and recreation	3
Built Environment	Modern built environment	Street furniture that is well-organized, pedestrian plazas, and broad, well-maintained roads	3
Sustainable feactures	Iconic high-rise architecture, LEED-certified structures, adaptive reuse potential	Contemporary mixed-use and high-rise office buildings with fully functional, dependable utilities (power, water, sewer, and telecom networks)	3
Economic			
Image and Identity	Premier business district	Premier financial hub hosting MNCs, stock exchange, and international events	3
Resource Mobilization	Premium real estate & investment	Strong public-private partnerships, FDI influx, and innovation hubs	3
Major employment center	Job/Employment centre for Mumbai	Planned to accommodate ~2 million jobs (400,000 already employed); sustained commercial growth attracts high investment	3
Social			
Accessibility	Vibrant cultural events	Large event venues (MMRDA Grounds, Jio World Garden) host international concerts, festivals, and exhibitions	2
Connectedness	Quality social infrastructure	Proximity to Bandra, airports, and residential hubs; digital connectivity	2
Scale and Safety	Lifestyle and entertainment	Gated communities, and vibrant spaces for social interaction	2
Mobility			
Bicycle/E.V	Dedicated tracks	Integrated transport (buses, taxis), walkability to key nodes	2
Pedestrian	Shaded walkways	Dedicated cycle lane (planned 2011) and wide, well-kept sidewalks promote walkability and non-motorized travel	2
car	Efficient traffic management,	Gated communities, and vibrant spaces for social interaction,Sign Board,Signal system	2
Public Transport	Dedicated stop	Bus servies form station,auto or taxi services	2
		TOTAL AVARGE	3.5

Table 3.Weakness(Mapping and tabulation on Base map by Author)

Category	Weaknesses	Nature of Weakness	Scores
Physical			1-4 score scale
Area and Identity	Lack of mixed-use development	Overemphasis on commercial zones; lack of affordable housing and local cultural integration	-2
Streets & Squares	Limited activites	Monotonous streetscapes; limited street activation after business hours	-2
Building Forms	Monotonus building form with glass façade	Homogeneous high-rise architecture reduces visual diversity; limited heritage preservation	-2
Environment			
Green spaces	Underutilize	Heat island effect due to concrete dominance; inadequate tree canopy coverage	-1
Urban Microclimate	Limited biodiversity grid pattern	lake of squares,Landscaped green spaces,lack ecological richness or native planting strategies	-1
Waste Management	No proper channeling,weaste goes in Mithi river	Overburdened systems during peak hours; limited public recycling infrastructure	-1
Economic			
Affordability	High profile office spaces	High rental costs exclude SMEs and startups; elitist economic ecosystem	-2
Resource Mobilization	Corporate,No local business	Over-reliance on corporate sectors; vulnerability to global market fluctuations	-2
Equity	Scarcity of housing restricts long-term community development and place identity	Limited opportunities for informal/local businesses in formalized spaces	-2
Social			
Accessibility	Car-centric planning	Wide roads and parking dominate streetscape, discouraging walkability and non-motorized travel	-2
Connectedness	Weak last-mile connectivity	Limited access to metro, bus stops, and shared mobility for internal travel	-2
Scale and Safety	Poor pedestrian experience, isolated pockets during non-peak times	Fragmented sidewalks, long crossings, and poor shading impact walkability	-2
Mobility			
Bicycle/E.V	Inadequate infrastructure	Sparse cycling networks beyond core areas; inadequate bike parking	-2
Pedestrian	Inadequate infrastructure	Overcrowded walkways during rush hours; lack of universal accessibility features	-2
car	Inadequate infrastructure	Traffic bottlenecks at entry/exit points; insufficient EV charging infrastructure	-2
Public Transport	Inadequate infrastructure	Overcrowded metro/buses during peak hours; last-mile connectivity gaps	-2
		TOTAL AVARGE	-2.6

Table 4.Opportunities(Mapping and tabulation on Base map by Author)

Category	opportunities	Nature of Opportunities	Scores
Physical			1-4 score scale
Adaptive Reuse	Scope for adaptive reuse	Repurposing vacant/underutilized plots for mixed-use hubs (e.g., coworking, retail)	2
Smart Infrastructure	IOT	Integrating IoT-enabled utilities, smart lighting, and digital public services	2
Heritage Integration	Integration with waterfront	Blending historic elements (e.g., old warehouses) with modern design	2
Environment			
Green spaces	Urban greening strategies	Scope for increasing tree cover, shaded paths, and biodiversity corridors	1
Circular Economy	Green building policies	Scope for increasing tree cover, shaded paths, and biodiversity corridors	1
Climate adaptation potential	Climate Resilience	Open land allows incorporation of water-sensitive urban design (WSUD) and heat mitigation strategies	1
Economic			
Innovation Ecosystem	Public-private partnerships (PPP)	Attracting startups and R&D centers through tax incentives and incubator spaces	2
Tourism Potential	Event-driven economies	Capitalizing on cultural landmarks and events to boost leisure/ MICE tourism	2
Local Entrepreneurship	Infrastructure avalibility	Creating affordable kiosks/markets for artisans and SMEs in public spaces	2
Social			
Accessibility	Potential for placemaking campaigns	Scope to include diverse stakeholders in co-creation efforts	2
Connectedness	Promoting inclusive public life	Placemaking can support more women-friendly, age-friendly, and accessible spaces	2
Scale and Safety	Arts and culture integration	Art installations, performances, and local heritage storytelling can enhance public engagement	2
Mobility			
Accessibility	Metro and transit expansion	Sparse cycling networks beyond core areas; inadequate bike parking	2
Pedestrian	Non-motorized transport (NMT) push	Policies can favor cycling and walking infrastructure enhancement	2
Smart mobility adoption	Inadequate infrastructure	Digital tools and apps can improve shared transport, cycling, and walkability initiatives	2
		TOTAL AVARGE	3

Table 5.Threats(Mapping and tabulation on Base map by Author)

Category	Threats	Nature of Threats	Scores
Physical			1-4 score scale
Infrastructure Strain	Real estate speculation	Overcrowding and overuse of public amenities leading to rapid wear-and-tear	-2
Urban Sprawl Risk	Encroachment risks	Peripheral expansion threatening BKC's compact, transit-oriented design	-2
Heritage Integration	Integration with waterfront	losing local identity	-2
Environment			
Pollution	Construction pollution	Rising air/noise pollution from dense traffic and construction activities	-1
Climate Vulnerability	Waste management challenges	Flood risks due to inadequate drainage; heat island effect exacerbation	-1
Green Space Loss	Heat stress	Encroachment of parks for commercial projects	-1
Economic			
Rising inequality	Market Dependency	Wealth concentration may marginalize local populations and vendors	-2
overdependence on finance sector	Cost Escalation	Economic downturns in this sector can impact footfall and vibrancy	-2
Gentrification risks	Global Competition	Rising rents may push out diverse social groups and cultural life	-2
Social			
Exclusionary planning	Gentrification	High-end developments may lack inclusivity for all social classes	-1
lack of community engagement	Social Fragmentation	Placemaking decisions dominated by elite institutions	-2
Scale and Safety	Workforce Transience	Lack of street-level activity after office hours raises safety issues	-2
Mobility			
Accessibility	Traffic Congestion	Sparse cycling networks beyond core areas; inadequate bike parking	-2
Pedestrian	Pedestrian Safety	Rising accidents due to poor enforcement of walkability norms	-2
Last-Mile Challenges	Inadequate infrastructure	Digital tools and apps can improve shared transport, cycling, and walkability initiatives	-2
		TOTAL	-3

5.2. Appropriating scores to the various factors

See Figures Figure 3.Area Base Map for Strengths factors, Figure 4.Area Base map for WEAKNESS Factors, Figure 5.Area Base map for OPPORTUNITIES Factors, Figure 6.Area Base map for THREATS Factors

& Tables Table 2.Strength (Mapping and tabulation on Base map by Author),Table 3.Weakness(Mapping and tabulation on Base map by Author),Table 4.Opportunities(Mapping and tabulation on Base map by Author),Table 5.Threats(Mapping and tabulation on Base map by Author)

5.3. Mapping of the space matrix

The analysis and intervention approach are derived from the strategic position and action evaluation (SPACE). External factor scores are plotted on the y-axis and scores on the x-axis in the four quadrants that make up the SPACE matrix. On the positive and negative sides, the scores range from 0 to 5 and 0 to -5, appropriately.

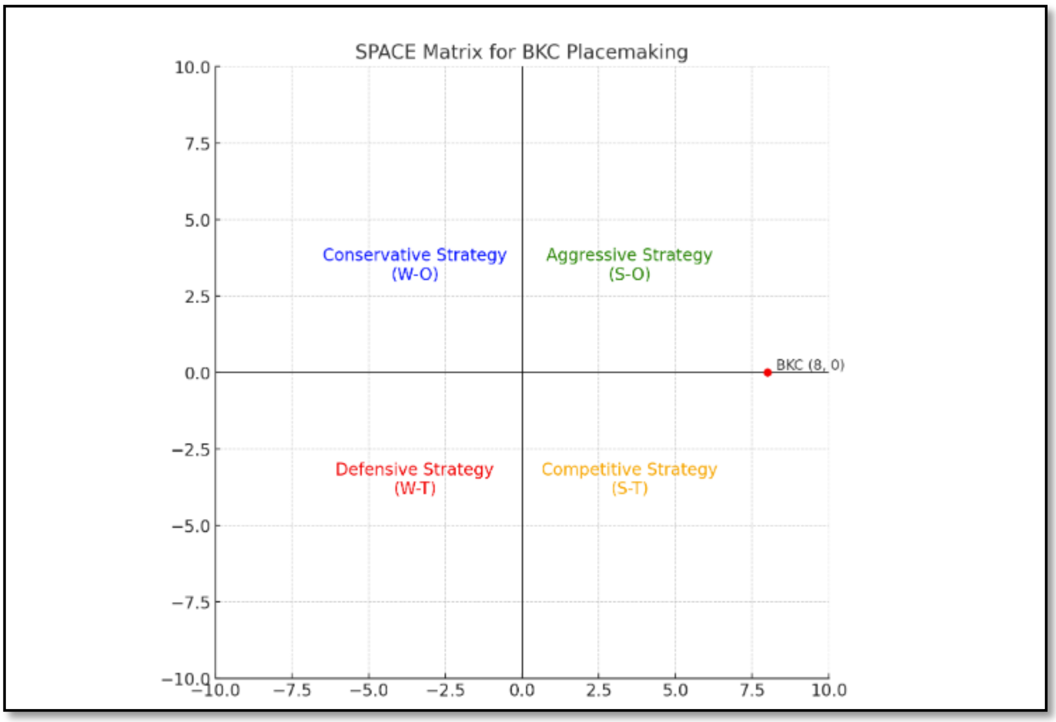
Table 6. Average Scores and Axis Value

SWOT Dimension	Average Score
Internal Factors	
Strengths	3.5
Weaknesses	2.6
Internal Average	**3.05**
External Factors	
Opportunities	3
Threats	3
External Average	**3**
Overall SWOT Average	**3.025**
Axes:	
Y-Axis (Internal Strategic Position): *Strengths (3.5) – Weaknesses (2.6) = **+0.9***	
X-Axis (External Strategic Position): *Opportunities (3.0) – Threats (3.0) = **0.0***	

5.4. Results

The strategic positions for the four quadrants are as follows. Having both internal strength and external opportunities, an assertive position is the first quadrant. A conservative position with external opportunities but internal weakness is the second quadrant. Having both external threats and internal weaknesses, the defensive position is in the third quadrant. Having internal strength and external dangers, a competitive position is the fourth quadrant. The design strategy to be employed is a conservative one, as can be seen here below with the graphing of the average of Internal and External components score (Equation 1.)

Equation 1.Scores on axis (position of Strategy or quadrant with respect to AREA map)



6. DISCUSSIONS AND CONCLUSIONS

This positioning indicates that BKC has considerable internal capacity and resources that can be managed to make the most of external possibilities. To this end, the suggested path is to undertake proactive and transformative placemaking.

Objective Positioning: The matrix indicates your calculated position from the actual values derived from your internal/external factor scores.

Strategic Focus: Determines your most important strategic stance (Competitive Strategy) for targeted decision-making.

Borderline Cases: Your coordinates (0.22, -0.2) are close to the axes, showing:

Weak external advantage (just positive X)

Key internal vulnerability (negative Y)

Aspect	Analysis	Action Required
Competitive Posture	Use strengths to counter threats	Leverage BKC's infrastructure/global status to mitigate pollution, gentrification
Internal Warning	Weaknesses (-2.8) > Strengths (2.6) → Y = -0.2	Urgent improvement in social equity, mobility, and community engagement
External Edge	Opportunities (2.62) > Threats (2.4) → X = 0.22 (slim advantage)	Aggressively exploit green corridors, tourism, and innovation ecosystems

7. RECOMMENDATIONS:

Short-Term:

Launch quick-win projects to convert threats (e.g., use green tech to reduce pollution).

Address critical weaknesses (e.g., improve pedestrian safety, affordable amenities).

Long-Term:

Pivot toward Aggressive Quadrant by:

Boosting strengths (Y-axis) through infrastructure upgrades.

Amplifying opportunities (X-axis) via PPP models for innovation hubs

Monitoring:

Track the X-axis balance monthly – a small dip could push you into Defensive quadrant.

Prioritize Y-axis improvement – even +0.5 shift would position you competitively.

BKC's robust infrastructure, economic strength, and city potential naturally place it in an Aggressive strategy stance — implying that placemaking must be bold, pro-active, and opportunity-driven.

This paper presented an approach to comprehensively understand the effectiveness of SWOT in the evaluation phase of the urban placemaking strategic planning phase. The SWOT tool although effective in the general identification of the strength's weakness, opportunity and threats appears ineffective as a tool in the process of determining the strategic goals of urban placemaking. Thus, the limitations have been realized and changes were suggested to re-engineer the conventional tool of SWOT by application of SPACE matrix. Spatial SWOT analysis baseline mapping is said to be the initial step in comprehending the urban problems. The baseline map helps in enlightening the stakeholders. The grading of the different factors facilitates strategic position of SPACE matrix.

the constraints of the work have been that it has not emphasized on the dynamic spatial elements inherent to urban placemaking plan.it gives a promising future direction for research involving factors of microanalysis of the area. With adding dynamic spatial factors such as the daily changes in the area and conducting the SWOT analysis of the area in a more detailed level, a holistic approach to spatial swot analysis can be achieved.

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ATATÜRK FOREST FARM AS A SPATIAL MANIFESTATION OF THE HEALTHY CITY IDEALS IN THE EARLY REPUBLICAN PERIOD

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ABSTRACT

With the Industrial Revolution, forms of production began to change, and social and spatial problems quickly followed. The rapid transformation of cities, population growth, and environmental degradation created conditions that allowed many epidemics to spread. This situation brought hygiene to the forefront and made public health policies a key element in urban planning and architecture. In the following years, the outbreak of the World Wars also revealed how health policies began to affect the human body, shaping the state's biopolitical approach to sport. The public policies observed in Europe and Russia, based on improving public health and disciplining the body, found their counterparts in Turkey during the Republican period. Within this framework, policies were developed to raise healthy citizens, seen as an essential part of building a modern nation-state. As a result, these policies took both ideological and spatial form in Ankara, the new capital. Consequently, the planning of the capital began as a comprehensive effort to reflect the ideals of the Republic and to set an example for other cities. In this planning process, approaches such as the garden city model were adopted to promote healthy urban development. Within this context, Atatürk Forest Farm (AFF), which first appeared in Lörcher's and later Jansen's early plans without a detailed resolution, and was later redesigned with Egli's involvement, was seen as one of the most comprehensive spatial reflections of this ideology. This unique planning approach, which combines the principles of healthy urbanisation with the state's health and body policies, makes the Atatürk Forest Farm (AFF) a valuable site for exploring the Republic's biopolitical spatial structure. This study examines the relationship between the concept of a healthy city and body politics, using Atatürk Forest Farm as a case study. It examines how the AFF established the Republic's biopolitical order through its agricultural and industrial production, green spaces, sports facilities, and leisure activities. The research aims to provide a holistic evaluation by analysing the spatial manifestations of various healthy city policies within a single area. The findings suggest that the AFF was conceived as a modern, microcosmic city. In this model, production, nature, sport and recreation coexist within a unified vision of healthy urban living.

KEYWORDS

Atatürk Forest Farm, Ankara, health, sport, natural spaces

1. INTRODUCTION

Beginning in the late eighteenth century, the Industrial Revolution transformed modes of production while also introducing new social and spatial challenges such as rapid urbanization, population growth, and environmental degradation. These conditions, particularly throughout the nineteenth century, created fertile ground for the spread of epidemics such as cholera, typhus, and tuberculosis across European cities. This wave of transformation and disease brought the notion of hygiene to the forefront, turning public health policies into one of the core components of urban planning and architectural practice. In the years that followed, the world wars accelerated the shift of health policies toward forms of control and regulation over the human body, extending the state's biopolitical interventions even into the realm of sport. During this period, not only the creation of healthier cities but also the disciplining, strengthening, and directing of the human body became central to public policy. This mode of governance, which appeared in different forms across European countries such as Germany, Italy, and Russia, was reflected in the modernization ideology of the newly established Republic of Turkey through its own distinctive interpretation. For the Republican administration, eager to distance itself from the Ottoman past, which was internationally known as the "sick empire" by the late nineteenth century, the cultivation of healthy citizens was seen as a fundamental condition for building a strong and modern state (Bozdoğan, 2012). Following the establishment of the Republic, this vision was realised in both ideological and spatial terms within Ankara, the newly designated and purpose-built capital.

A comprehensive planning process was initiated for the newly established capital with the aim of reflecting the ideology of the Republic and setting an example for other cities. Within this framework, the German planner and architect Carl Christoph Lörcher was first commissioned to prepare an urban plan, followed later by Hermann Jansen. Both plans were influenced by contemporary European planning approaches ,particularly the "garden city" concept, and sought to create spatial conditions for healthy living through principles such as air circulation, sunlight access, and the continuity of green areas (Cengizkan, 2004). Therefore, the issue of health was addressed not only in a medical context, but also from a spatial perspective. Although not elaborated in detail within these initial plans, Atatürk Forest Farm (AFF), later emphasised and jointly designed by Jansen and Ernst Egli, emerged as one of the most comprehensive spatial manifestations of this vision. This unique planning approach, which integrated the principles of healthy urbanisation with the state's health and body policies, makes AFF a valuable case study for understanding the biopolitical spatial framework of the Republic.

There are numerous studies in the literature on Atatürk Forest Farm. These studies, which have intensified since the 2000s, cover a wide range of disciplines, including architecture, planning, agriculture, politics, landscape architecture, history, and law. One of the earliest examples of these studies is the book Atatürk Forest Farm by historian İzzet Öztoprak (2008). Öztoprak examined the farm in terms of agriculture, water needs, land conditions, construction processes, and industrial and livestock activities; he also included historical narratives about the establishment period. Alpagut (2012), on the other hand, focused on the architectural establishment of the area and examined the decisions made by Egli and Jansen in the area.

Beyond general historical and spatial narratives, researchers have interpreted the farm in various ways within the conceptual frameworks of their own disciplines. For instance, Keskinok (2008) viewed the farm's production spaces and contemporary public areas as part of a project of emancipation. Landscape planner Çavdar Sert (2017) examined the farm as a heritage site, focusing on its transformation process.

Aycı (2017) analyzed the changes in the management and production structure of the Atatürk Forest Farm (AFF) between 1925 and 2017 through its spatial transformation. Architect Kaçar (2015) focused on the establishment period of AFF and interpreted its early phase through cultural production. Similarly, Demirtaş (2013) and Türkyılmaz (2015) explored the site in relation to social life and leisure time, evaluating the Marmara and Karadeniz pools within the farm as instruments for the creation and transformation of modern social life.

Discussions on healthy bodies have mostly been addressed in the literature through physical education policies; these policies have been examined in the context of the city of Ankara and the modern sports facilities built there. Theoretically, studies focusing on physical education policies stand out, particularly in the disciplines of history and sports history. These studies address the establishment of modern sports (Yarar, 2014), the place of sports in education, sports clubs and recreational activities, and the formation of the modern individual (Ertürkmen-Aksoy et al., 2022), while treating the ideal of the healthy individual as an indicator of national identity and modern citizenship (Lüküslü & Dinçşahin, 2013; Doğan, 2024), while also discussing the body, especially the female body (Cantek & Yarar, 2009; Çağlı, 2011; Pfister & Hacısoftaoğlu, 2016; Demir & Öztürk, 2023), as a representational space where the ideology of the Republic gained visibility. In this sense, official days such as May 19 Sports Day have also been among the topics studied in terms of the performativity and representational power of sports (Tozoğlu, Kaymaz & Sezen, 2022; Özdemir, 2004). Most of these studies have been approached within the framework of Foucault's concept of biopolitics. According to Foucault, modern power operates on both bodies and populations with the aim of making life productive, orderly, and manageable; while disciplining individuals on the one hand, it regulates society through statistical, medical, and spatial tools on the other (Foucault, 1995; Foucault, 2003). This study also evaluates the early Republican period through a biopolitical reading based on this theoretical framework.

Beyond this, it examines the spatial counterparts of these policies, namely the spatial manifestations of these ideals in the city, such as the 19 May Stadium and the Hippodrome (Özdemir, 2004; Bican, 2009; Korkmaz, 2009, Saner, 2014; Doğan, 2024; Alpagut, 2017), the Karadeniz and Marmara pools (Türkyılmaz, 2015), and the Ankara Tennis Clubs (Özgenel, 2017). However, despite the common ground shared by these studies in terms of modernisation and interpretations of public life, it is evident that the relationship between the ideal of a healthy city and body politics in the context of the farm has not been sufficiently discussed. In this context, the study examines how Atatürk Forest Farm (AFF) establishes the Republic's biopolitical order in space through its production (agriculture and industry), extensive green space, and sports (leisure) functions. The primary objective of the research is to present a comprehensive assessment by addressing the spatial counterparts of different healthy city policies through a single region. The existing literature on AFF has focused on agriculture or industry; this study aims to offer a more comprehensive reading by interpreting the field from a health perspective and to contribute to the literature from this viewpoint.

The study is based on a qualitative analysis approach that evaluates the spatial design of the AFF within a health-centered framework; within this scope, an interpretive reading has been conducted through plan drawings, period documents, and visual materials. Within this scope, the study first examined the policies designed for healthy urbanization in Europe and the spatial transformations and constructions carried out within the scope of these policies. In order to understand the context of the study's research subject, it was necessary to examine Ankara's planning decisions and the counterparts of the concepts of health and hygiene in these decisions. AFF was then re-read through the perspective of health. This study reveals that Atatürk Forest Farm is a microcosm of the Republic's understanding of healthy urbanisation. This area, where production, nature, sports and recreation come together, is evaluated as a spatial model of modern life designed around the ideals of clean air, healthy nutrition and a fit body.

2. THE DEVELOPMENT OF THE CONCEPT OF HEALTHY CITIES WITHIN THE CONTEXTS OF INDUSTRIALISATION AND EPIDEMICS

By the late 19th century, as industrialisation accelerated, the concentration of the working-class population in England brought serious hygiene issues to the forefront in cities. In industrial cities in northern England such as Manchester, Liverpool, Leeds, and Birmingham, rapid urbanisation coupled with inadequate infrastructure made it impossible to resolve issues such as sewage and factory waste, making the spread of cholera and other epidemics inevitable. The reform movement gained momentum with the 1842 Report on the Sanitary Condition of the Labouring Population of Great Britain by Edwin Chadwick, a doctor and social reformer based in Manchester. Chadwick's work caused a major shift in public opinion, directly contributing to the drafting of the 1848 Public Health Act. The law ensured that services such as clean water supply, sewage, waste collection and street cleaning in cities were brought under state control. Local Boards of Health were established, for the first time linking urban management and health policy. In terms of location, the law promoted planning principles such as ventilation, sun exposure, and the preservation of green spaces (Porter, 1999). In the mid-19th century, Paris' medieval streets were characterised by poor air quality and substandard hygiene, contributing to the spread of epidemic diseases such as cholera. These conditions led to significant mortality rates. In this sense, Haussmann, appointed by Napoleon to manage and modernise the city, played a significant role in its transformation. To this end, Haussmann designed a number of key infrastructure projects, including wide boulevards, open spaces, a new sewer system and public squares. This approach enabled effective air circulation and increased sunlight, contributing to the growth and development of the plants. While it is frequently emphasised that Haussmann's reforms were designed to prevent street conflicts and demonstrations, these initiatives can also be regarded as significant milestones in the development of healthy cities (Harvey, 2003). The Haussmann reforms, implemented in Paris during the mid-19th century, addressed concerns about hygiene and health while also influencing the spatial organisation of social order and the control of power (Harvey, 2003).

Following the early examples of urban revitalization, the 1927 Werkbund–Weissenhof Siedlung exhibition made the transformation of hygiene visible on an international stage, this time at the residential scale. Curated under the direction of Mies van der Rohe, the exhibition explored themes of modern, healthy, and functional living. It also reflected its strong connection with industry by introducing ideas of industrial production and serial construction systems into the realm of housing. In this context, an image of ideal and healthy housing for the working class was presented. The vision of hygienic and health-conscious housing was expressed through architectural solutions such as flat roofs, open plans, transparent façades, modular structures, serial production, and washable wet areas (Weissenhofmuseum, n.d.; Frampton, 2006). While the Weissenhof exhibition emphasised modern and sanitary domestic spaces, sports facilities simultaneously took on the mission of shaping healthy bodies for a modern and hygienic urban life. From the late nineteenth century onwards, the establishment of sports grounds in European cities was associated not only with leisure and recreation but also with public health. As populations grew in working-class neighbourhoods, these facilities offered a response to hygiene and health concerns, serving as tools for both disciplining and improving the physical well-being of workers (Clark et al.). Sports fields soon became indispensable elements of modern urban planning. This transformation unfolded alongside the ambition to create open and green hygienic spaces, as seen in London and other centres of modernist urbanism. The ideal of the healthy city that had emerged in nineteenth-century Europe also found expression in the Netherlands. In cities such as Amsterdam and Rotterdam, sports fields became integral to urban design. Large stadiums and community sports grounds, often situated near factories and schools, spread widely. Similar developments took place in Germany, where modern sports facilities, like those in London, were designed around the ideal of "hygienic spaces." Throughout the twentieth century, playgrounds in Germany evolved in parallel with urban growth and social transformation (Clark et al.).

3. HEALTH POLICY IN THE EARLY REPUBLICAN PERIOD

The establishment of the Ministry of Health in 1920, and the subsequent implementation of Law No. 1593 on Public Health in 1930, which is regarded as the foundation stone of modern Turkish health services, marked the inception of a comprehensive health policies framework in the early years of the Republic (Ak, 2021). However, other significant measures in the context of health included physical education policies aimed at cultivating modern, healthy individuals through physical discipline, as well as measures to improve the health of cities and the planning of cities along these lines. Following the establishment of the Republic in 1923, this understanding was formalised at the urban planning level in the new capital city of Ankara. A comprehensive planning process was initiated with the aim of reflecting the ideology of the Republic in the city and creating an exemplary model. Within this framework, Carl Christoph Lörcher and then Hermann Jansen were commissioned to prepare city plans for Ankara (Tekeli, 1998). Following Ankara's designation as the capital, the city underwent restructuring to become a modern capital. The reasons for this were similar to the problems we see in European cities. Cengizkan (2003) provided an assessment of Ankara's current state, as outlined in the "Current State of the City" segment of the Lörcher report, the city characterised as "scattered, unhealthy, fire-damaged, remote from water sources, lacking in transportation infrastructure and planning integrity" (Cengizkan, 2003). During this period, Ankara experienced challenges related to poor hygienic conditions, comparable to those observed in European cities. The inadequacy of water resources and infrastructure systems contributed to health concerns. It is also important to note that there were issues with drinking water and sewage in Ankara during this period. The urban fabric consisted of narrow, confined streets that were unwelcoming and unhealthy. The housing was of a compact nature and the layout was irregular, with inner courtyards that were not well-lit or ventilated. In light of this situation, Ankara was required to be redesigned as a modern and exemplary capital city, offering healthy urban and hygienic living conditions. The 1924 Plan was devised to address the need to rebuild the capital from scratch as a contemporary, healthy, planned, and orderly city (Cengizkan, 2003).

With this intention, the German architect Dr. Carl Lörcher proposed a two-stage plan for Ankara. (Figure 1). The first was the 1924 Old City Plan, and the second was the 1925 New City Plan. According to these proposals, the old city would be preserved through small-scale interventions and improvements focused on public health, while the new city centre would be planned with a modern and healthy infrastructure based on more direct design decisions. It was also to be connected to the old city through wide boulevards and public spaces (Burat, 2011). In other words, the city was conceived in two parts: the “Old City,” encompassing the Citadel and its surroundings, and the “New City,” a modern capital designed and built from the ground up.

The city is located at the point where the Ankara River and the İncesu Stream meet. These two waterways form a natural green belt around the city. In the plan, this belt was proposed to be preserved as a “natural park perimeter” surrounding the urban area. Looking at Ankara in 1924, the city’s only green space was the Millet Park in Ulus. To expand this, Lörcher proposed a “series of consecutive green spaces,” integrating sports and recreation areas into this system (Cengizkan, 2004). At the same time, the plan aimed to ensure the continuity of green areas by “extending them inward from the outer edges of the city as far as possible” (Cengizkan, 2003). The “garden city” idea, originally proposed by Baron Haussmann as a solution to Europe’s urban problems, was introduced to Turkey in a comprehensive way for the first time through Lörcher’s report. In his plan, the city was described as a “living organism,” with streets serving as its “lifelines.” At that time, Ankara had almost no public squares, open spaces, or parks. Therefore, in line with the garden city approach, Lörcher proposed house gardens for residences, parks to ensure the continuity of green areas, and tree-lined promenades for walking and recreation. The connection between the old and new parts of the city was only partially developed in the plan. Elements such as wide streets, squares, and parks, features largely absent from Ottoman urban design, were introduced into Ankara, the new capital, giving shape to the Republic’s administrative centre and producing new urban meanings (Cengizkan, 2010). The Lörcher Report, in its section on “Open Spaces,” recommended the creation of sports areas for the physical education of young people and parks for the elderly, arrangements suited to a modern and contemporary city. These proposals were inspired by European principles of protecting public health (Cengizkan, 2003). Based on the idea that “to achieve full physical development, young people must use their bodies regularly and intensively,” the plan highlighted the role of open spaces in improving public health. It also promoted the design of green areas to enhance air circulation and sunlight within the city (Cengizkan, 2003). The health-related decisions introduced at the urban scale in the Lörcher Plan paved the way for the planning of the Atatürk Forest Farm (AFF) as a public health and recreation area. In this sense, the Lörcher Plan laid the foundation for establishing the AFF by incorporating healthy city principles into urban planning. After the implementation of the 1924 plan, Ankara expanded rapidly, and population growth, along with the demand for new housing, exceeded the plan’s capacity. According to Cengizkan (2003), although the Lörcher Plan strongly influenced Jansen’s later work, it remained a preliminary scheme since it lacked a long-term development strategy.

The Atatürk Forest Farm was founded in 1925. Therefore, it was not included as a spatial decision in Lörcher’s report but rather emerged between the two plans as an early Republican urban initiative. Nonetheless, the AFF represented an important potential within Jansen’s plan for realising the Republic’s healthy city policy.

Figure 1. Lorcher Plan (METU Department of Urban and Regional Planning, Map and Plan Documentation)

By the late 1920s, Ankara had been divided into two distinct zones: the old city and the new. Construction during this period was largely fragmented, unplanned, and uncontrolled, further constrained by the economic difficulties of a nation still recovering from war. Construction increased in the New City area, but this development deviated from the garden city layout. The green connections between residential areas weakened. Industrial areas became intermingled with residential areas. This situation demonstrates that the city was becoming increasingly disconnected from the decisions that were made regarding its health. The size of the planned areas and the rapid increase in population created a need for a new development plan. In this context, an international competition was held with the participation of Jansen, Brix, and Jausseley, architects and planners who were influential in the planning of cities in Europe (T.C. Ankara Şehremaneti, 1929; Tankut, 1993; Burat, 2011). In the competition brief, it was stated that the new plan should include running tracks, areas reserved for a stadium, and various gardens and green spaces, while the zoo and public park to be built in Gazi Forest Farm were expected to cover a large area. The inclusion of elements such as running tracks, stadiums, and green areas in the plan indicates that physical education policies had already begun to find a place within the urban fabric. At the same time, during the Early Republican period, the idea of public parks emerged as a spatial policy tool that went beyond ensuring the physical health of modern society. These parks also addressed the growing needs of modern daily life, particularly leisure time and access to public spaces. In this sense, they can be understood not only as parts of the city's green structure but also as centres of recreation and body training (T.C. Ankara Şehremaneti, 1929).

The competition held in 1928 concluded with Hermann Jansen winning first place, and the detailed final plans were approved in 1932. In his reports, Jansen described Ankara as a city that had grown irregularly and lacked sufficient green space. To address this, his plan divided the city into functional zones: administration, commerce, housing, industry, education, recreation, and green areas (Jansen, 1937). The main idea behind this zoning was to create an urban structure that supported healthy living conditions. Health was one of the key themes of the plan. Jansen aimed to design a city where residents, especially young people, could grow up as healthy individuals through exercise and outdoor activity. For recreation and sports, he proposed artificial lakes and pools (Jansen, 1937), as well as sports fields near housing areas and schools, and open grounds and large gardens surrounding children's dormitories.

The Jansen Plan (Figure 2) was based on the urban planning movements of its time, particularly the principles of the green belt and garden city. Hermann Jansen sought to adapt the balance between city and nature that he had developed in Germany to the conditions of Ankara (Jansen, 1937). The core element of his plan was the green belt system—an interconnected sequence of open and green spaces surrounding the city. He envisioned these green corridors as the main connectors within the urban fabric. Another key aspect of the plan was the creation of a green network that included rivers, lakes, forests, groves, and valleys (Burat, 2011). Parks, green valleys, agricultural areas, and the Atatürk Forest Farm were all considered parts of this green belt (Jansen, 1937). The green valleys were intended to provide both clean air within the city and spaces for recreation. Residential areas with green backyards were connected to parks, sports fields, schools, recreation zones, and farmlands through "green corridors" (Burat, 2011). In his 1937 report, Jansen emphasized that these corridors should run across the entire city. By organizing circulation in this way, vehicle traffic was separated from pedestrian routes, supporting the ideal of a healthy city where residents could walk free from exhaust fumes. Jansen also suggested that the green corridors should be framed by the gardens of nearby houses, allowing residents to easily reach green and recreational spaces through these "green paths." This would ensure the physical continuity of the green network throughout the city (Jansen, 1937). At the residential scale, the Bahçelievler district represents a direct application of this idea. Jansen also proposed agricultural and recreational uses along riverbeds, integrating them into the city's green system. He planned the establishment of nurseries with irrigation systems in İncesu and designed a tree-lined pedestrian boulevard along Atatürk Boulevard (Burat, 2011).

Another key component of the green space system was the inclusion of parks and sports fields, which were designated for the recreational use of city residents. In his planning reports, Jansen emphasised the importance of physical education, and as a reflection of this idea, his 1932 master plan included sports complexes and facilities of varying sizes. He regarded sports areas as an essential element of healthy urban planning and aimed to create a network of green spaces that would allow the public to spend their free time outdoors (Jansen, 1937). In addition to the provision of sporting facilities at educational institutions, he advocated for the establishment of rectangular open areas that would not be dedicated to any specific sport. These spaces were open to the public but primarily intended for use by schoolchildren and student clubs (Burat, 2011). In addition, he designed playgrounds, football fields, tennis courts, indoor sports halls, and both indoor and outdoor swimming pools to serve a wider range of age groups. He referred to these spaces as "sports fields where the youth engage in body training." One such project was the Cebeci Field, where he envisioned an integrated arrangement combining school facilities with public sports areas. He described Cebeci as "the district where sport, education, and health facilities converge." In addition, Jansen incorporated the Hippodrome (Koşu Mahalli) into his plan, characterising it as "a substantial expanse intended for public festivities and equine racing events". In his report, he located the Hippodrome in the city's western part, within the green belt, close to the centre but separated from residential zones as part of a chain of recreational areas. Jansen (1937) referred to this area as "a large green field that will serve as the city's breathing space." Its design was not solely for horse racing events, but also as a location that would influence citizens' leisure habits during the construction of the modern city (Ertürkmen-Aksoy et al., 2022). In the vicinity of the Hippodrome, Jansen proposed a substantial sports and stadium complex intended for national ceremonies, sports competitions, and youth festivals. The 19 May Stadium, which was later constructed, was located within this area proposed by Jansen. It occupies a significant position within the urban planning scheme of the Jansen plan. The stadium was closely tied to the Republic's physical education policies and was significant as a venue where Atatürk engaged with the public (Korkmaz, 2007). The 19 May Stadium was the first stadium in Turkey to meet international standards. This stadium has historically been a venue for national holidays, representing the symbols of the republican regime. Young women, men, and children dressed in traditional attire, along with military personnel, participated in official parades in Ankara, the newly established capital city. This event is recognized as a significant symbol of the nation-state (Yarar, 2014). The stadium has hosted various sporting events, including football, boxing, athletics, handball, and tennis (Ertürkmen Aksoy et al., 2022). The hippodrome area, constructed during the same period, was utilised for races and events such as Republic Day rallies and physical education festivals. These areas were designed as public sports venues within nature and symbolic performance spaces (Alpagut, 2017; Sert, 2023). Sports were regarded as a symbol of body training and modernity during this period. As stated by Alpagut (2017), sports were given a central place in the national design to create a "fit, healthy and moral" youth for the republic. Güvenpark, Gençlik Parkı, Meclis Bahçesi, and Fidanlık (today's Kurtuluş Park) are important focal points for the green spaces proposed in the 1932 urban plan. Jansen left the recreational areas long used by the people of Ankara unchanged; he stipulated that no structures be built on the recreational areas or hilltops. He recommended that these areas be solely forested (Jansen, 1937; Uludağ, 1998). The green space structure that Jansen envisioned for the city, ensuring continuity in life, is of great importance. This structure of human-nature-city interaction encompasses the modern and healthy citizen's journey from the green path connecting a home garden to schools, workplaces, sports areas, and the city scale (Burat, 2011).

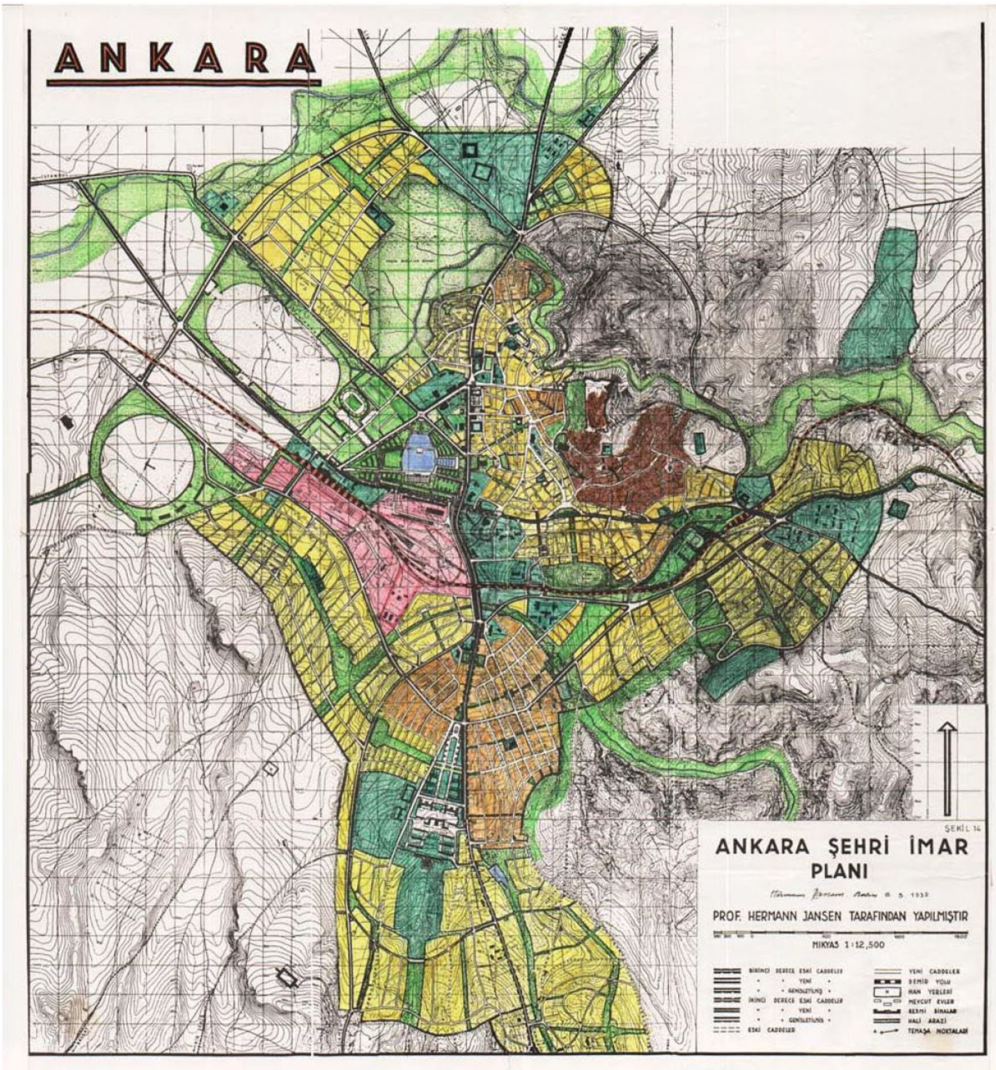

Figure 2. Jansen Ankara Plan, 1937 Source: Jansen, Ankara Urban Development Plan Report, 1937

The Jansen Plan aimed to create a city that met the standards of a modern and healthy urban environment. Within this framework, it proposed re-establishing the connection between the Atatürk Forest Farm (AFF), which was then considered a rural area, and the city. To achieve this, Jansen designed tram and road connections to prevent the farm from becoming isolated from the urban centre. This development brought a significant change to the nature of the farm, transforming it from a separate agricultural zone into a valuable part of the capital city (Alpagut, 2017). As previously mentioned, the fourth section of Jansen's report was devoted to sports fields, and the AFF was evaluated under this category as an urban space. Within the green belt system, the Atatürk Forest Farm was designated for functions of public health, physical education, and recreation (Jansen, 1937). It was conceived both as an urban landscape that offered the residents of the city clean air, open space, opportunities for exercise, walking, and rest, and as a production area focused on greenery.

The farm is not included in Jansen's Master Plan for Ankara, but at Atatürk's request, Jansen was commissioned with a new project to develop the AFF after 1936. The objective of this project was to plan the AFF not only as a farm, but also as a key component of the city's green belt (Alpagut, 2017). As Sert

(2017) explains in his thesis, this situation is as follows: Jansen highlighted the crucial role of the AFF in Ankara's green infrastructure. Jansen's AFF plan aligns with Atatürk's visionary approach, conceptualising this area not only as a space in contact with nature but also as an urban area where modern citizens can engage in physical activities and breathe (Sert, 2017). In view of Ankara's hot summer climate, the AFF also served as an escape point for city dwellers. The green space productions in Jansen's plan, all parks and sports areas, are tools that plan the city dweller's free time and prioritize the nation-building project. The modern living conditions that emerged during the early Republican era are evident in the plans. The "everyday" green spaces that are part of the natural flow of city life are the most obvious example of this (Burat, 2011). As Bozdoğan (2012) points out, the greenways and sports fields included in the plans represent a departure from the previous administration's policies and lay the foundation for the development of a contemporary and healthy young generation.

4. ATATÜRK FOREST FARM AND HEALTH

The Atatürk Forest Farm was established in 1925 as a state initiative under the name Gazi Forest Farm. The farm presented an exemplary model of public space that combined areas for agricultural, industrial, and production activities with public zones for leisure time activities, recreation, and picnicking. Seen as a "small urban model" of the modernisation project of the Early Republican period (Alpagut, 2010), the settlement not only carried an agricultural production programme but also offered the people of Ankara, living in its arid steppe environment, recreational and social spaces, sports areas, and educational facilities within a green oasis. (Figure 3) In selecting the location for the farm, proximity to Ankara's main water sources such as the Çubuk Stream, İncesu, and Hatip Stream, as well as the accessibility provided by the railway, played an important role. Although the early stages of the settlement lacked a clear spatial organisation, by the 1930s it had undergone a planned and modern transformation, defined by a grid of intersecting streets (Alpagut, 2010).

Keskinok (2000) summarizes the farm's founding objectives as follows:

"Land improvement and organization, beautification of the environment, research on native and foreign animal breeds, development of the most suitable ones, research on new varieties for the improvement of cereal crops, their promotion and distribution to the public, encouragement of animal husbandry, research on new breeds and varieties, promotion of successful ones to the public, processing and marketing of agricultural products, production of domestic and foreign fruit varieties suitable for climatic conditions, demonstration and promotion of these varieties to the public, development and promotion of viticulture, encouragement of cooperatives, demonstration of their importance to the public, joint projects with neighboring villages, scientific afforestation, creation of groves and forests, encouraging afforestation nationwide, establishing nurseries for the production of fruit and vine seedlings necessary for farms and the region, organizing activities and production based on relations with domestic and foreign markets, opening representative offices in different regions of the country, improving agricultural methods, increasing production, and developing villages using methods appropriate to this example, the development of agricultural arts, the establishment of workshops for the production of agricultural tools and machinery necessary for the transition to mechanized agriculture, the dissemination of agricultural education to the public through practical lessons and internships, the provision of cheap and healthy food to the public, and the provision of public areas for recreation and relaxation."

Atatürk Forest Farm was an example of the republican ideology's concept of developing a "modern citizen" model (Sert, 2017). Under Atatürk's leadership, AFF was designed as a versatile space representing the ideals of urbanisation, social transformation and body training policy in the early years of the Republic. It was the private property of Mustafa Kemal Atatürk. His goal in founding the farm was to promote social modernization, education, and scientific agriculture in the newly formed republic (Sert, 2017). The architect and urban planner Hermann Jansen and Ernst Egli planned Atatürk Forest Farm as an urban form that included agricultural industry, dairy factory, winery, brewery, fruit juice factory (Doğan, 2025). Jansen's plan included a restaurant, hotel, large garden with terraces, tennis courts, and an amusement park in the large area south of the brewery as a comprehensive recreation and leisure center. Subsequent projects for the brewery, residences, baths and restaurant were swiftly initiated through the Jansen-Egli collaboration. The site plan, devised by Egli, (Figure 4) incorporates a variety of structures including a brewery, bathhouse, employee and worker residences, a post office, an elementary school, a restaurant, an administration building, and a repair workshop. These buildings were designed to support a modern lifestyle focused on hygiene and personal cleanliness for the workers. At the same time, a regular road system was developed, with trees and park and garden arrangements. The housing offered comfortable living spaces for farm workers and solved their accommodation problems. This was not merely about building housing to solve the accommodation problem; the comfortable and communal living arrangement also contributed to increasing solidarity within the institution and developing loyalty to state ideals. It introduced spatial approaches that treat housing as a contemporary, healthy, and high-quality living object (Alpagut, 2010).

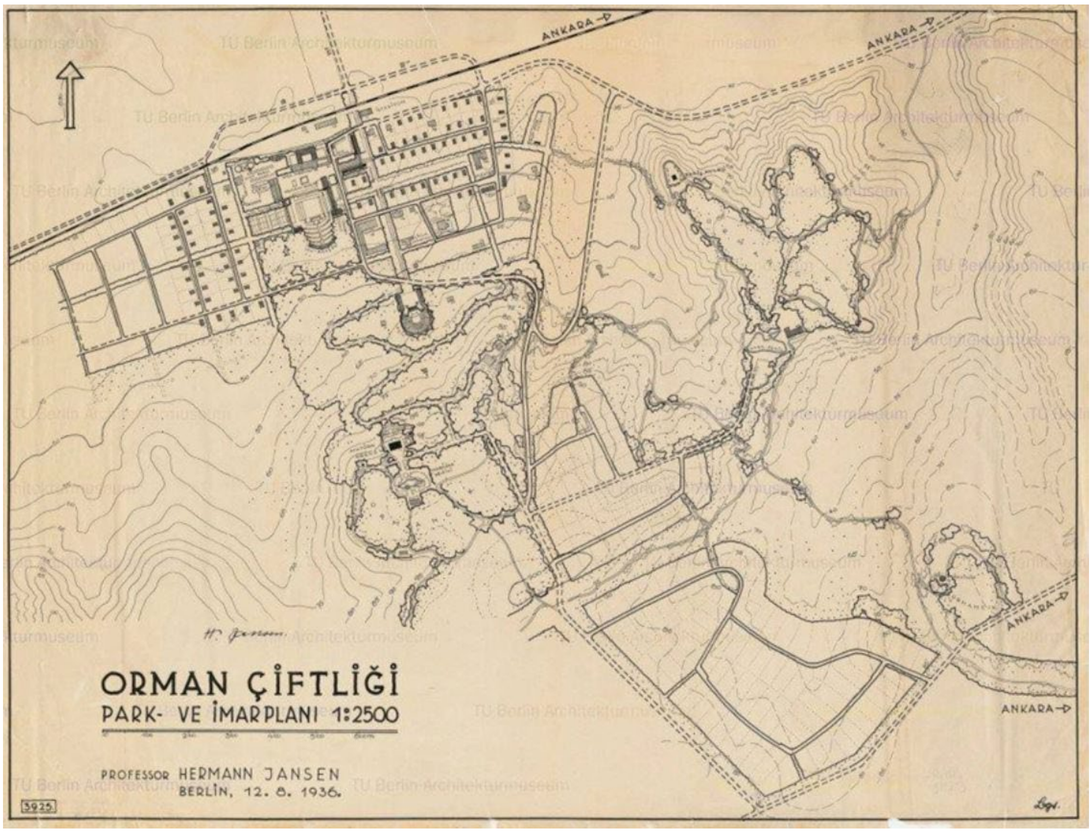

Figure 3. Jansen's AFF Plan (Architekturmuseum der TU Berlin (n.d.)

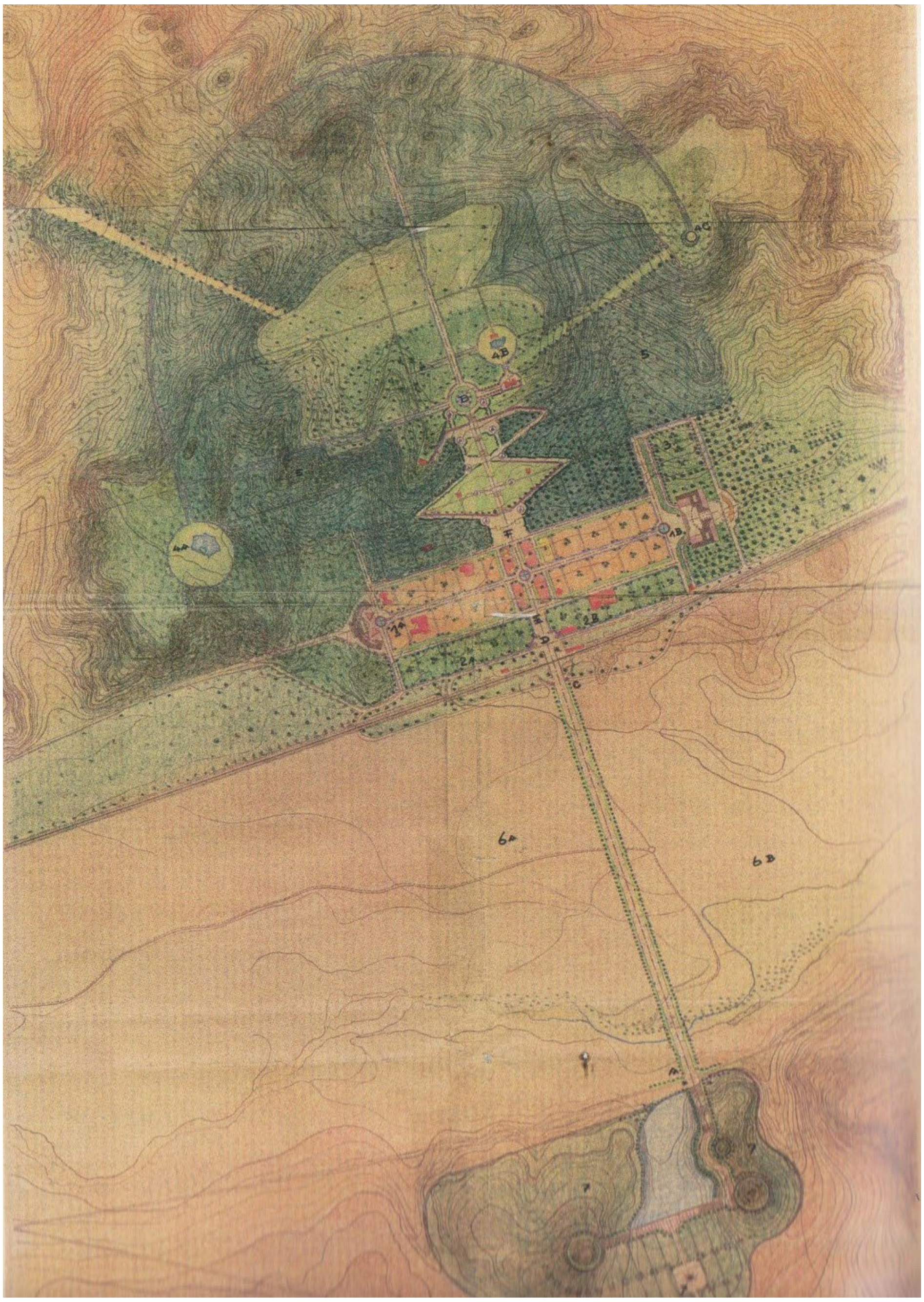

Figure 4. Gazi Farm Renovation Sketch (Ernst Egli, 1934, CAA 17.184-6.7.6; cited by Alpagut, 2010)

The agricultural and industrial production facilities formed the core of the Atatürk Forest Farm (AFF). The agricultural industry not only supported production but also aimed to raise public awareness. Agricultural education, the internship requirement of the Faculty of Agriculture, and experiences in mechanisation completed the educational dimension of this industrial infrastructure (Aycı, 2020; Keskinok, 2000, 2008). Considering the agricultural policies of the Early Republican period, the AFF was not only a production site but also an exemplary modernisation project where scientific agricultural education was taught and practiced, with the goal of promoting social development. Some of the areas allocated for agriculture in the farm consisted of barren steppe and swamp land, but through the effective use of science and human effort, these lands were transformed into fertile agricultural zones. This transformation represented one of the most significant reflections of public entrepreneurship in the Early Republican era (Keskinok, 2000). From its foundation onward, the AFF developed in close connection with industrial branches related to agriculture, such as milk, beer, wine, and fruit juice production. The farm's integrated production process was embodied in the transformation of barley grown in its fields into industrial products. The production areas were not treated as isolated industrial zones but existed alongside other spaces such as the zoo, beer garden, sports facilities, and leisure areas (Alpagut, 2010). The Atatürk Forest Farm (AFF) also functioned as an educational centre for agricultural production. It played a key role in studying and promoting scientific approaches to agriculture across the country. During the drought of 1928, the farm contributed to national research on dry farming through experimental fields established on different soil and climate types (Tekeli, 2015). Through agricultural production carried out under Atatürk's direct supervision, with the use of modern machinery and contemporary production techniques, the public received the necessary training for modern farming. As an original project of the Republic, the AFF represented an "exemplary farm project" where agriculture, industry, and education activities were integrated (Aycı, 2017; Çavdar, 2017). The fertile alluvial lands of the Ankara River within the historical core were cultivated as orchards during the Early Republican period (Aycı, 2017; Çavdar, 2017). The cultivation of fruit, one of the basic food resources, on the most suitable parts of the AFF's land also created an important spatial potential for achieving the ideals of a healthy city.(Figure 5).


TAN

Ziraî Kombina Nedir?

Orta Yaylada Modern bir Kombina nümunesi Ankara orman çiftliği

Hükûmetimizin köş iktısadiyatımız için hazırlamakta olduğu inkılâbın esasını:
1 — Toprak reformu
2 — Ziraat kombinaları
teşkil etmektedir.

Figure 5. From the newspaper reports of the period: Atatürk Forest Farm, Source: TAN Daily Newspaper, 1937

The dairy, yogurt, wine, beer, and fruit juice factories that formed the spatial core of the Atatürk Forest Farm (AFF) not only met the society's basic food needs but also embodied the ideology of a healthy body–healthy nation. (Figure 6) During Atatürk's period, these production facilities were designed both as sites for the practice of modern agriculture and as educational spaces for the public. As Aycı (2020) states, the milk and yogurt factories established within the AFF secured food production under the principle of a "self-sufficient national defense economy." Considering the conditions of the period, the significance of a self-sufficient national economy can be understood through Braudel's observation (1985/1979) that "despite the low-calorie diet of Turkish soldiers, mainly based on bread and yogurt, they remained a strong army." The industry composed of milk and yogurt factories can therefore be viewed in close relation to the defense industry during wartime. Although these sectors differed in their production purposes, they complemented one another within the broader context of the war economy (Cengizkan, 2017).

The ideal of raising healthy generations, rooted in the body politics of the Early Republican period, was closely linked to the founding purpose of the milk factory, to ensure that urban residents had regular and healthy access to milk and dairy products. The technologies used in these factories were consistent with contemporary European examples, demonstrating that production was carried out through scientific methods (Aycı, 2020). Milk production was directly connected to livestock farming within the AFF; the milk obtained from the farm's cows was processed in the factory. Animal husbandry was one of the main activities conducted alongside agricultural production. Both cattle and sheep were raised on the farm, and products derived from livestock, such as milk and yoğurt, met not only the farm's internal needs but also the nutritional requirements of the city's residents (Aycı, 2020). (Figure 7) The Çiftlik Restaurant, which used products from the farm, evolved beyond serving as Atatürk's personal kitchen and became a dining venue that brought farm products to the people of Ankara (Aycı, 2020). In other words, the Çiftlik Restaurant of the AFF provided healthy meals for the capital's residents.

Figure 6. Farm milk from newspaper reports of the period, Source: Ulus, 1937

Figure 7. Newspaper reports of the period, Source: Vatan, 1934

Since its establishment, Atatürk Forest Farm has not been considered solely as a production centre; it has also been planned as an area where the public can spend their leisure time, have fun, and engage in sports activities (Aydoğan, 2012). The Forest Research Institute, established within the AFF, has supported the potential for Ankara and its citizens to have a public landscape area that focuses on clean air, a healthy environment, sports, and recreation as a programme that produces forest policy for Ankara (Aycı, 2017). The farm has played an active role in Ankara with its public recreation areas. It has been part of the cultural policies of the young Republic by introducing its users to new sports opportunities and leisure time activities (Aycı, 2017). In the Republic's ideology, body training was regarded as a means of achieving national discipline and promoting the health of the modern individual. It was also possible to observe the spatial manifestations of this understanding at AFF. The most striking example of this spatial manifestation is the construction of the Karadeniz and Marmara Pools, which were designed as leisure and recreation spaces for the residents of Ankara. In her thesis, Çavdar (2017) describes these facilities as "places where the modern body is trained in harmony with nature." During Atatürk's era, such spaces transformed the discourse of a "strong body, healthy nation" into tangible physical practices. Green areas, shaded spots, seating zones, and pathways were also arranged around the pools (Türkyılmaz, 2015). The pools, frequently mentioned in the newspapers of the time, were featured in the Hakimiyet-i Milliye in 1933, where the photograph of the Karadeniz Pool was accompanied by the following caption:

"In the past, the most desired yet nearly impossible thing to find in Ankara during the summer was shade. Now, however, Ankara has become a city where shade is no longer something to be sought after—it is encountered at every step. As for water, although it may not fully replace the seaside for those accustomed to summer sea bathing, the Karadeniz Pool beautifully satisfies the needs of anyone who loves Ankara. Our photograph captures a lovely view of the Karadeniz Pool at a quiet hour. With its form and rippling waves reminiscent of large reservoirs, the Karadeniz Pool resembles a beach where all the people of Ankara eagerly gather during the summer days." (Hakimiyet-i Milliye, 1933).(Figure 8).

Hakimiyeti Milliye

7 Ağustos Pazartesi 1933

No. 4328 14 ÜNCÜ SENE. Her yerde (5) kuruş Adres değiştirmek 50 kuruş

Onuncu Yıl İçin.

Hazırlıklar Seferberlik Hızıyle Devam Ediyor.

Boğazköy Hafriyatına Yeniden Başlandı.

Ankara'ya Kıymetli Eski Eserler Getirildi

Avcılar Kongresinde.

Figure 8. Karadeniz Havuzu, newspaper reports of the period (Hakimiyet-i Milliye, 1933)

Ankarada yeni inşa edilen Karadeniz havuzu açıldı

Havuzda çocuklar, acemiler ve yüzme bilmiyenler için kısımlar var

Ankarada halk havuza ve etrafındaki plâj ile ağaçlığa çok rağbet ediyor

Figure 9. Karadeniz Havuzu, newspaper reports of the period (Akşam, 1932)

The Karadeniz Pool's provision of water and shaded areas to Ankara is an important contribution to public health. On the other hand, the sports facilities were conceived with the intention of introducing Anatolian people to sporting activities with which they were unfamiliar. (Figure 9,10,11) Karadeniz and Marmara Pools are the most significant examples of this phenomenon (Alpagut, 2017).

The Havuzlu Yol and the evening promenade (Figure 12) were among the first spaces in the city to incorporate outdoor exercise into daily urban life (Aycı, 2020). These areas demonstrated that the farm was not only a site of production but also contained public spaces that encouraged social interaction and community life. Within the boundaries of the farm, a zoo was also established during the İnönü period. Initially a section housing Atatürk's own farm animals, it was later transformed into a zoo, allowing the public to observe animals, learn about nature, and spend leisure time there. The zoo functioned as a public space that combined education and entertainment, fostering people's connection with other living beings and nurturing a love of nature. It was planned together with the other green and recreational areas of the farm (Aycı, 2020). The farm also included picnic areas, walking routes, and landscaped parks around the beer factory. These picnic zones and the Beer Garden (Figure 13, 14) were places where the modern citizens of Ankara could gather, share social experiences, and spend time together (Aycı, 2020). Another public face of the AFF was the Marmara Köşk and the open areas surrounding it. With Atatürk's participation, these spaces hosted national celebrations such as the Republic Day on 29 October and the National Sovereignty and Children's Day on 23 April, as well as public gatherings, concerts, and various entertainment events throughout the 1930s. According to Aycı (2020), the pavilion and its surroundings served as "a public therapeutic space where the modern individual engaged with everyday life practices." The common purpose of these ceremonies and recreational activities was to strengthen social unity, solidarity, and emotional renewal. These spaces supported the Republican ideal of not only physically but also mentally healthy citizens.

Figure 10. Boat Ride at Atatürk Forest Farm Marmara Pool (VEKAM archive)

Figure 11. Karadeniz Pool (VEKAM archive)

Figure 12. Atatürk Forest Farm, The Havuzlu Yol (VEKAM archive)

27 MAYIS 1936 ÇARŞAMBA ULUS

Foto Amatör İsleri Temiz, Ucuz, ve çabuk olarak Kendi atölyemizde yapılmaktadır. Halil Naci M...

Ekmek Eksiltmesi

Afyon C. M. U, liğinden :

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(1106) 1—2052

Elektrik tesisatı eksiltmesi:

Bartın Belediye Riyasetinden :

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MÜJDELER

DÜNYANIN GÜZEL BİRALARI KADAR GÜZEL OLAN ORMAN ÇİFTLİĞİNİN SAF VE HİLESİZ

YAZLIK ANKARA BİRASI

ANKARA GAZOZU

ANKARA SODASI

ÇIKMIŞTIR

HER YERDEN ARAYINIZ

Figure 13. Newspaper reports of the period (Ulus, 1936)

Figure 14. AFF Beer Park (VEKAM Archives)

The AFF serves as an equal and accessible spatial model in the daily lives of the city's residents, advancing the path toward becoming urban citizens, reimagining leisure time, and developing a new social life. In the early stages, the people of Ankara slightly distanced themselves from AFF after all, Ankara was seen as a steppe town in Anatolia during this period. However, new areas offered by the farm to the public soon became popular. It provided a modern environment where people could spend their free time, featuring parks, pools, restaurants, a zoo and walking areas. These areas created opportunities for socialisation for citizens. Atatürk Forest Farm, which embodies the core principles of the Republic of Turkey's development model, has been an important stage for the Republic not only in terms of agriculture and production, but also in terms of creating modern, healthy citizens (Aycı, 2017).

5. CONCLUSION

The health problems and epidemics that emerged in rapidly urbanizing cities during the Industrial Revolution led to new health policies and a re-evaluation of the concept of hygiene. With the onset of global wars, these developments took a different direction, and the idea of the “healthy modern individual” began to be understood through the disciplining of bodies. In this context, the biopolitical interventions of states came to the forefront, transforming not only state governance but also citizens’ perceptions of health and sport. The public policies that spread across Europe, focused on improving public health and disciplining the body, found their counterparts in Turkey during the Early Republican period, shaped by the vision of replacing a “sick empire” with a healthy and modern republic. The spatial policies of the Early Republic were grounded in a holistic planning approach that aimed at social transformation, class integration, and the reproduction of social justice through space. The outcomes of these policies became visible both spatially and ideologically in Ankara, the newly established capital. In the process of building a healthy city, the general decisions first taken by Lörcher and later by Jansen ensured the preservation of the Old City’s historical fabric, while small-scale improvements, such as the widening of streets, contributed to the area’s rehabilitation. Meanwhile, in the newly built part of the city, large-scale urban decisions were made in line with the major planning movements of the period, such as the garden city and green belt principles. These planning strategies not only shaped Ankara's urban identity but also established it as a model for other Anatolian cities.

In this study, the Atatürk Forest Farm (AFF), which serves as the main subject of research, appears as a trace within the aforementioned urban plans; However, its detailed design was carried out later, with the involvement of Ernst Egli. Focusing on production (agriculture and industry), the organisation of green areas, sports, and leisure activities within the context of public health, this study identifies the AFF as one of the most comprehensive examples where the principles of healthy urbanisation and the state's health and physical education policies were spatially integrated. The study reveals that the Atatürk Forest Farm, parallel to the transformation of Ankara into a modern capital shaped by the Republic's vision of healthy urban development, represented a microcosm of modern life where production, nature, sport, and recreation coexisted; built upon the ideals of clean air, healthy nutrition, and physical vitality. As one of the key spatial policies reflecting Turkey's healthy city ideals, the AFF stands as an essential component of the Republic's public health strategy through its architectural and urban spaces. The model established with the AFF brought together production, housing, culture, and social services within a single spatial composition, creating a foundation for the realization of healthy city ideals through the design and experience of a space like the Atatürk Forest Farm.

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PARKLARIN KENTSEL YAŞAM KALİTESİNDEKİ ROLÜNÜ ARTIRICI BİR YOL OLARAK BİTKİSEL TASARIMLARDA MEYVE TÜRLERİ KULLANIMI

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ÖZET

Açık yeşil alanlardan biri olan parklar, kentsel yaşam kalitesi için hayati öneme sahiptir. Park alanlarının tasarım özellikleri, parkların kalitesini ve işlevlerini pekiştirir ve bitkisel tasarımlar bunu sağlamanın yollarından birini oluşturur. Bu çalışma ile parkların sağlıklı kent yaşamına katkılarının, bitkisel tasarımlar yolu ile geliştirilmesine odaklanılmaktadır ve bu kapsamda park alanlarında yenilebilir özellikli meyve türlerin kullanımı ele alınmaktadır.

Çalışma kapsamında, yenilebilir peyzajlara ilişkin literatür okumaları yapılarak, kentsel ortamda yenilebilir meyve türlerinin kullanımına ilişkin tasarım detayları ile avantaj ve dezavantajları araştırılmıştır. Çalışma sonuçları yenilebilir peyzaj bileşeni olarak meyve ağaçlarının ekonomik, ekolojik, sosyal, kültürel olmak üzere çeşitli avantajlar sağlayabileceğini, bununla birlikte kentsel ortamda belirli hususlar dikkate alınarak kullanılabileceklerini göstermiştir.

Parkların bitkisel tasarımlarında yenilebilir meyve türlerinin kullanımını odağına alan bu ön çalışma ile meyve türleri ile peyzaj konusunu çeşitli yönleri ile anlamaya dönük bir çerçeve oluşturulması amaçlanmıştır. Bu çalışma ile sağlıklı ve sürdürülebilir kentsel yaşam açısından, park alanlarında meyve türlerinin kullanımının belirli kurallara bağlanarak yaygınlaştırılması hedeflenmektedir.

ANAHTAR SÖZCÜKLER:

Parklar, yenilebilir peyzajlar, işlevsel peyzajlar, yenilebilir meyve ağacı.

USE OF FRUIT SPECIES IN PLANT DESIGNS AS A WAY TO INCREASE THE ROLE OF PARKS IN URBAN LIFE QUALITY

ABSTRACT

Parks, one of the most important open green spaces, are vital to the quality of urban life. The design features of parks reinforce their quality and functionality, and planting is one way to achieve this. This study focuses on improving the contribution of parks to a healthy urban life through planting design, and within this scope, the use of edible fruit species in parks is discussed.This study examines the literature on edible landscapes, exploring the design details, advantages, and disadvantages of using edible fruit species in urban environments. The study results demonstrate that fruit trees, as edible landscape components, can provide various economic, ecological, social, and cultural advantages, and that they can be used in urban environments with specific considerations.

This preliminary study, which focuses on the use of edible fruit species in the planting designs of parks, aims to create a framework for understanding the various aspects of fruit species and landscape.

***KEYWORDS**:*

Parks, edible landscapes, functional landscapes, edible fruit tree.

1.GİRİŞ

Bitkiler görsel ve işlevsel özelliklere sahiptir ve bu özellikleri sayesinde kentsel yaşam kalitesine katkıda bulunurlar. Bitkilerin çok yönlü katkıları giderek yoğunlaşan kentsel ortamda artan çevresel kaygılardan dolayı daha önemli hale gelmektedir. Oksijen sağlama, gürültü ve kirlilik azaltma, iklim iyileştirme, hava ve su arıtma, enerji tasarrufu, biyoçeşitlilik için habitatlar ve karbon tutulması bitkilerin sağladığı önemli yararlar arasında yer almaktadır (Turner-Skoff ve Cavender2019).

Kentte yaşayan insanların doğaya yakın olma isteklerinde park alanları önemli temas noktalarıdır. Parklarda yapılan bitkilendirmeler, parkların işlevsel ve görsel etkilerini artırmak için yol sunar. Parkların işlevsel değerini artırmak için kullanıcı ihtiyaçlarını önceden kestirmek ve çevreyi bu ihtiyaçlara göre şekillendirmek önemlidir (Aksoy ve Akpınar, 2011). Son dönemlerde kentsel ortamda yapılan bitkisel tasarımlarda kullanıcı ihtiyaçlarını yansıtan yeni eğilimler görülmektedir. 21. yüzyılda yaygın hale geldiği düşünülen 'yenilebilir bitki tasarımları' bunlardan biridir ve popülaritesindeki artış, bazı raporlara göre dünya genelindeki gıda fiyatlarındaki istikrarsızlığın bir sonucu iken, bazı raporlara göre ise, kentleşme ve artan çevresel sürdürülebilirlik endişeleriyle ilişkilidir. 'Yenilebilir bitki tasarımları', yenilebilir bitkileri peyzaja entegre etmeyi ifade eden bir terimdir ve yenilebilir bitkilerin besin değerlerinin yanı sıra estetik özellikleri ile de değerli olabileceğini gösterirler. Kökeni, antik çağda Mezopotamya, Roma, Aztekler'in meyve bahçeleri ile ünlü bahçelerine uzansa da, akademik alanda yeni bir kavramdır. Bu terimi akademik alanda ilk olarak 1980'lerde, peyzaj tasarımcısı ve çevre bilimcisi Robert Kourikc kullanmış, Rosalind Kreasy ise 1982 yılında yayınladığı "Yenilebilir Peyzaj Düzenlemesinin Tam Kitabı" adlı eseri ile önemini artırmıştır (Rajani ve Rachapally,2023).

Yenilebilir peyzaj, yeşil altyapının önemli bir parçasıdır. Görsel güzelliği gıda üretimiyle birleştiren bu yaklaşım, mekanların dekoratif potansiyelini genişletirken gıda güvenliğine, halk sağlığına, biyolojik çeşitliliğin korunmasına ve kentsel sürdürülebilirliğe katkıda bulunur (Ornelas, 2025). Tasarımlar, süs amaçlı türlerden ziyade yenilebilir sebze, meyve ağacı, çalı meyvesi, çiçek ve ot türlerini içerir. Yenilebilir bitki tasarımları, tasarım planının, gıda güvenliğini artırma, besin değeri yüksek gıdaların gelişimini geliştirme ve sürdürülebilir yaşamı teşvik etme gibi çeşitli avantajlar sağlar. Birçok bitki türünün kullanılabildiği bu tasarımlar geleneksel bir peyzaj kadar çekici olabilmekte, hem özel hem de kamusal alanlarda kolaylıkla uygulanabilmektedir (Rajani ve Rachapally,2023).

İyi bir besin kaynağı olan meyve türleri 'yenilebilir peyzaj tasarımları' için önemli bileşendir (Rasouli ,2012). Görsel ve işlevsel özelliklere sahip olan yenilebilir meyve türlerinin kentsel ortamda yer alan park alanlarına dahil edilmesi, yeşil alanların kalitesini ve çekiciliğini artırarak kentsel yaşama katkı sağlayabilir (Abdollahi, 2011).

2. YENİLEBİLİR PEYZAJ TASARIMLARININ BİLEŞENİ OLARAK MEYVE TÜRLERİ

Kentsel meyve bahçeleri, ihtiyaç duyan insanlara sürekli olarak ücretsiz veya düşük maliyetli, besin açısından yoğun gıda sağlamanın etkili bir yolu olabilir. Yenilebilir meyve ağaçları, çevrenin estetik değerini geliştirir, ekolojik ve sosyal hizmetler sunar, zihinsel, psikolojik sağlığın ve sosyal refahın iyileştirilmesinde dolaylı rol oynar (Larinde ve Oledale ;2014). Yenilebilir peyzaj, ekonomik kazanç sağlama amacı olmadan hem estetik değer hem de besleyici gıda değeri olan bitki türlerini içinde bulundurur. Yenilebilir süs bitkilerinin peyzaj tasarımlarında kullanılması, üretici bir toplum bilinci oluşturulması yönünden önemlidir. İnsanların ve özellikle de çocukların bitki gelişim aşamalarını bizzat takip etmeleri, tüketici olmaktan ziyade üretici olmaya yönelmelerini sağlar **(Yalçınalp vd., 2018).** Çocuklar, gençler ve yetişkinler için aynı anda sosyalleşebilecekleri, eğlenebilecekleri, rahatlayabilecekleri ve egzersiz yapabilecekleri bir ortam sunarak doğa ile yeni bir bağ kurmalarını destekler. Yenilebilir peyzajlar, şehrin yeşil altyapısına daha iyi entegre edilirse, çok çeşitli ekosistem hizmetlerine katkıda bulunabilirler (Çelik, 2017).

Meyveler, yenilebilir peyzaj tasarımlarının önemli bileşenleridir. Birçok işlevlerinin yanı sıra çiçek, meyve ve gövde özellikleri ile peyzaj tasarımları açısından görsel etkiye sahiptirler. Yenilebilir bitki tasarımlarında; meyve güzelliği, kuş, sincap vb. türler için çekicilik oluşturmaktadır. Meyve türlerinin böceklerle beslenen bazı kuşları çekmesi, böcekler için pestisit kullanımını da önlemiş olur (Fetouh, 2018). Doğru belirlenmiş meyve ağaçları, iyi konumlandırıldıklarında gölge sağlar, tozlayıcıları çeker ve biyoçeşitliliğe katkı sağlar. Mekan kullanıcılarına taze meyveler sunarak bahçeleri üretken ve uyumlu alanlara dönüştürür. Yerel meyve türlerinin kullanımının gıda güvenliğini artırabileceği ve iklim değişikliğinin olumsuz etkilerini azaltabileceği bazı çalışmalar tarafından ortaya konulmuştur (Ornelas, 2025). Yenilebilir bitkiler yerel kültürün önemli bir bileşeni ve dolayısıyla toplumsal kimlik oluşumunun da değerli bir parçasıdır (Ertuğ, 2014). İnsanların park alanlarında meyve toplamak için bir araya gelerek sinerji oluşturması ve eğlenmesi, paylaşımlarda bulunması toplumsal kimliklerini besleyen bir yönüdür.

Ülkemizin konum olarak kuşların göç yollarının üzerinde yer alması ve Anadolu'da tarihin ilk çağlarından itibaren çeşitli medeniyetlerin var olması ülkemizde meyve çeşitliliğini artırmıştır (Güneş, 2018). Ülkemiz zengin meyve çeşitliliğine sahiptir ancak son dönemlerde bazı meyve türleri yok olmaktadır. Örneğin, Gümüşhane'nin ünlü 25 elma çeşidinin yetiştiği bahçelerin kaldırılmış olması meyve türlerini tehdit eden bir uygulamadır. Benzer şekilde, ülkemizde 1933 yılında Rus ziraat uzmanı Zhukovsky ve 17. Yüzyılda Fransız gezgin Toumefort tarafından kaydedilen birçok türün nesli tükenmiştir (Işın, 2006). Buna karşılık, bazı illerimizde yerel çeşitlerin korunmasına yönelik çalışmalar yapılması, tür zenginliğimizin korunması açısından umut vericidir. Bu anlamda Van İl Tarım ve Orman Müdürlüğü tarafından 'kaybolmaya yüz tutmuş 16 meyve ve 5 sebze çeşidi' koruma altına alınmış, Kent genelinde geçmişten beri yetiştirilen bazı yerli meyve ağaçları ücretsiz aşılanarak, korunmaya çalışılmaktadır (URL 1). Nitekim, Meyveler, gelecek nesiller için biyolojik miras değeri taşımaktadır ve korunup geliştirilmesi gereken türlerdir (Bulut vd., 2010).

Yoğun kent nüfusu ve giderek genişleyen sınırları ile büyük bir kent olma özelliği taşıyan İstanbul, yenilebilir peyzajlar için talep ve ihtiyaçların yoğun olduğu bir kenttir. Kentsel açık alanlarda bostan ve bahçe üretiminin teşvik edilmesi ve halk katılımının sağlanmasına yönelik plan ve uygulamalar yaygınlaşmaktadır. Bu faaliyetler ağırlıklı olarak kentsel tarım, nostalji bahçeleri, meyve bahçeleri gibi başlıklar altında yürütülmektedir. Bu uygulamalardan, direk olarak park alanlarında meyve türleri kullanımını yansıtan örnekler olmasa da, Bağcılar Belediyesi tarafından farklı yıllarda meyve dikim etkinlikleri ile oluşturulan 'Nostalji Bahçeleri' ile Beykoz Belediyesi tarafından uygulanan 'Paşamandıra Meyve Bahçesi', kentsel mekanda meyve türlerinden oluşan önemli örneklerdir. Meyve türlerinin biyokültürel miras değeri ve kimliği pekiştirici bir özelliği de vardır. Örneğin; İstanbul'un Beykoz ilçesine bağlı Polenezköy mahallesi ile Sarıyer ilçesine bağlı Zekeriyeköy mahallelerinde, kiraz ağacı miras değeri ile öne çıkmaktadır. Bu mahallerde her yıl yaz aylarında düzenlenen Kiraz festivalleri Kiraz meyvesi ile miras değeri üzerinden kurulan bağın yansıması olarak görülebilir. Kentlerde meyve ağacı kullanımına ilişkin uygulamaların artırılarak park alanlarını da kapsayacak şekilde genişletilmesi ve bu konunun resmi planlama sistemine dahil edilmesi önemlidir. Bunun için Yenilebilir peyzaj ve bu kavram içerisinde yenilebilir meyve türleri ile peyzaj konusunun iyi anlaşılması, uygulanabileceği alanların belirlenmesinden tür seçimine kadar bazı hususların iyi ayırt edilmesi gerekmektedir.

2.1.Park alanlarında Meyve Türlerinin Kullanımı ve Bazı Yönleri

Kentsel yeşil alanlardaki meyve ağaçları, şehir sakinleri tarafından takdir edilen kentsel bahçecilik ve yenilebilir peyzaj için alternatif bir yöntem haline gelmektedir. Artan meyve ağacı sayısı, yeşil meydanların biyoçeşitliliği ve yenilebilir peyzajın gelişimi üzerinde olumlu etki yapmaktadır. Varşova'nın Mokotów ilçesindeki meydanlardaki meyve ağaçlarının belirlendiği bir çalışmada; parklardaki ortalama meyve ağacı oranı %24,5 seviyesinde tespit edilmiştir. Bu oran, son yıllarda kentsel yeşil alanların bitki örtüsünün şekillendirilmesindeki genel eğilimlerle ve yerel topluluğun yenilebilir bitkiler yetiştirmeye olan artan ilgisiyle uyumludur; aynı zamanda şehirlerin sürdürülebilir kalkınmasını ve kendi kendine yeterliliğini desteklemektedir (Kimic ve Lewandowski, 2024).

Meyve türleri görsel, ekolojik, ekonomik yönleri ile kentsel ekosisteme katkı sağlarlar ve son dönemlerde kentsel alanlarda yaygınlık kazandıkları görülmektedir. Ancak, gerek kullanım alanları gerekse seçilen tür özellikleri ile ilişkili bazı hususların dikkate alınması gerekmektedir. Örneğin, yoğun trafik ve kirlilik bulunan alanlarda yetiştirilen bitkiler ağır metal içerdikleri için tüketimi sağlık açısından risklidir. Şevik (2020)'nin, Ankara kent merkezinde bulunan 4 tür (elma, badem, dut, kiraz) üzerindeki Cu birikimi ile ilgili yaptığı araştırma sonucunda, özellikle Dut olmak üzere bazı meyve türlerinde belirlenen Cu konsantrasyonlarının oldukça yüksek olduğu tespit edilmiştir (Şevik, 2020). Bu nedenle yenilebilir peyzaj çalışmaları için trafik yoğunluğunun az olduğu alanlar alternatif olarak değerlendirilebilir. Park alanları ise bu amaçla kullanılabilecek uygun yerlerdir (Angotti, 2015). Dikim yapılacak alanların iyi belirlenmesi, bitki seçimlerine dikkat edilerek bölgeye uygun türlerin seçilmesi ve gerekli önlemlerin alınması durumunda meyve bitkilerinin peyzaj tasarımları için çok avantaj sağlayacağı görülmektedir.

Bazı türler iyi ürün verebilmek için sulama, budama, gübreleme veya haşere yönetimi gibi konularda özenli bakım gerektirmektedir (Çelik, 2017). Bu bakımdan iklim koşullarına ve yerel bitki örtüsüne uyumlu tür seçimi, adaptasyon ve dayanıklılığı sağlamak için çok önemlidir. Bu türlerin dayanıklı olması kimyasal ilaç veya gübre kullanımını sınırlandıracağından veya gerektirmeyeceğinden çevreye olumlu katkı sunarlar. Ülkemizde estetik nitelikleri yüksek ve sağlığa yararlı olan çok sayıda doğal tür bulunmaktadır. Bunlar arasında elma, kiraz, erik, kayısı, karayemiş, kocayemiş, Trabzon hurması ve bazı türler meyve güzelliği ile öne çıkan ve ülkemizin birçok bölgesinde yetişen türlerdendir. Bazıları çiçek, meyve ve gövde özellikleri ile peyzaj tasarımı açısından önemli bir potansiyele sahiptir.

Ülkemizde yetişen türlerden kocayemiş bitkisi, çiçeklenme döneminin uzun olması ve çiçek–olgun meyvelerini aynı anda üzerinde bulundurması nedeniyle hem görsel hem de işlevsel etkiye sahiptir (Güler vd., 2017). Nar bitkisi, gösterişli meyveleri ve sonbahar rengi gibi kullanım amaçlarıyla peyzaj düzenlemelerinde tercih edilir ve aynı zamanda görsel perdeleme, rüzgar kıran, tıbbi bitki/kozmetik, yaban hayatına destek gibi etkilere sahiptir. Karayemiş, herdemyeşil yaprak özelliği ile fon oluşturmaya uygun, perdeleme özelliğine sahip aynı zamanda sağlıklı ve olgun meyve renkleri ve güzel çiçekleri olan bir meyvedir. Bu ve benzer birçok meyve gibi elma da ülkemizin farklı bölgelerinde yetiştirilmeye uygun çeşitleri olan görsel değer taşıyan bir meyvedir.

Bitkilerin peyzaj tasarımlarındaki katma değerleri türlerine göre değişiklik göstermektedir (Bulut vd., 2010). Bazı türler olumlu etkiler sağlarken bazı türlerin istenmeyen etkileri de olabilmektedir. Bu bakımdan, türlerin seçimi ve bakım işlemlerinin doğru şekilde yapılması önemlidir. Örneğin, meyvelerin dökülerek kaygan zemin oluşturma riskine karşılık dut ve benzer meyve türlerinin yürüyüş alanlarından uzak konumlandırılmalıdır. Ayrıca, sinek ve leke yapabilecek dut, üzüm, incir gibi meyve türlerinin kullanımına da dikkat edilmesi önemlidir. Parklarda çocukların ağaçtan düşme olasılığı ise, önlem alınması gereken diğer bir husustur. Bu durumda meyve ağaçlarının budanarak bakımlarının yapılması veya bitki seçimi sırasında bodur/yarı bodur türlerin tercih edilmesi çözüm sağlayabilir.

3. SONUÇLAR, TARTIŞMA

Kentlerde giderek artan yapılaşmalar ve nüfus baskısı, sağlıklı çevreye ve gıdaya duyulan ihtiyaçları artırmaktadır. Bu çalışma ile parklarda yenilebilir peyzajın bir bileşeni olarak meyve türlerinin kullanımının sağlıklı ve sürdürülebilir kent yaşamına katkıları üzerine durulmaktadır.

Kentlerde, insanları doğa ile buluşturma özelliği taşıyan park alanlarında meyve ağaçlarına yer verilmesi; dirençli, sürdürülebilir ve sağlıklı kent yaşamını destekleyeci bir yaklaşımdır. Bu çalışma ile, böyle bir yaklaşımın park kullanıcıları için görsel etki oluşturacağı, ekonomik ve erişilebilir taze gıda sağlayacağı, park kullanıcıları arasında sosyal bütünleşme ve sinerji sağlayacağı, kentsel ortamda meyve toplama zevkinin deneyimlenmesini sağlayacağı, miras ve toplumsal kimlik değerlerine katkı sağlayacağı bir bakıma parkların işlevlerini daha da genişleteceği sonucuna ulaşılmıştır. Meyveler, gelecek nesiller için biyolojik miras değeri taşımaktadır ve korunup geliştirilmesi gereken türlerdir. Yapılan bitkisel tasarımlarda, meyve türlerinin miras değeri ve tarihsel geçmişi de dikkate alınarak kent kimliğini pekiştirici işlevi de açığa çıkarılmalıdır. Birçok faydalı yönleri nedeniyle, parklarda yenilebilir meyve türlerine yer verilmesinin sürdürülebilir kent yaşamını destekleyeceği açıktır.

Ülkemizde yenilebilir bitki çeşitliliği, peyzaj mimarlığında kullanılmakta olan geleneksel peyzaj bitkilerinin yerini alabilir, peyzaj tasarımlarına kolayca entegre edilebilir ve birçok yeni işlevi yerine getirebilir (Meral ve Meral, 2020). Bu aynı zamanda yok olma tehlikesi yaşayan meyve türlerinin kurtarmak için de etkili bir yol sunacaktır.

İstanbul'daki bazı ilçe belediyelerin yapmış oldukları gibi meyve bahçelerinin artırılması ve bu tür uygulamaların park alanlarını da kapsayacak şekilde genişletilmesi önemlidir. Bunun için yenilebilir peyzaj ve bu kavram içerisinde yenilebilir meyve türleri ile peyzaj konusunun iyi anlaşılması, uygulanabileceği alanların belirlenmesinden tür seçimine kadar bazı hususların iyi ayırt edilmesi konularında çalışmaların artması gerekmektedir. Konunun resmi planlama sistemine dahil edilmesi istikar kazandıracaktır.

Süsten ziyade mantık ve faydaya önem veren Türk bahçe kültürü (Yazgan, 2016) ile uyumlu bir yaklaşım olması ve ülkemizin zengin tür çeşitliliğine sahip olması sebebiyle, yenilebilir meyveler ile yapılacak olan bitkisel tasarımların sağlıklı ve sürdürülebilir çevreler için yararlı olacağı düşünülmektedir.

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