Smart but Unlivable? Rethinking Smart City Rankings through Livability and Urban Sustainability: A Comparative Perspective between Athens and Zurich

Alessandro Bove * and Marco Ghiraldelli

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Article

Smart but Unlivable? Rethinking Smart City Rankings through Livability and Urban Sustainability: A Comparative Perspective between Athens and Zurich

Alessandro Bove * and Marco Ghiraldelli

Department of Civil, Environmental and Architecture

* Correspondence: alessandro.bove@unipd.it

Abstract: While the 'smart city' concept is central to urban innovation, promising enhanced efficiency and livability, this paper interrogates a critical paradox: can cities be 'smart' yet 'unlivable'? Existing indices, such as the IMD Smart City Index and the IESE Cities in Motion Index, while standard references, tend to prioritize technological and economic metrics, potentially failing to fully capture urban quality of life and sustainability. This study presents a preliminary attempt, based on an analysis of scientific literature, to critically examine current smart city indicators and propose a set of alternative indicators more representative of quality of life (QoL) and livability. The objective is not to overturn the rankings of cities like Zurich (high-ranking) and Athens (low-ranking), but to explore how a livability-focused approach, using more representative QoL indicators, might narrow the perceived gap between them, thereby highlighting diverse dimensions of urban performance. This paper details how these alternative indicators were chosen, justifying their relevance to QoL with scientific support, and maps them to established smart city verticals (Smart Mobility, Smart Environment, Smart Governance, Smart Living, Smart People, Smart Economy). Finally, it outlines future research directions to further develop and validate this human-centric approach.

Keywords: smart city evaluation; urban livability; sustainability indicators; smart city rankings critique

1. Introduction

Urbanization in the 21st century is increasingly characterized by the emergence of the "smart city" paradigm, where urban ecosystems are integrated with advanced technologies to promote sustainability and efficiency. However, this technological enthusiasm and the competitive race among cities risk producing environments that, while appearing "smart" on paper, may indeed become "unlivable" in practice. This concern is underscored by a variety of scholarly analyses indicating that smart city metrics often disproportionately prioritize economic performance and technological sophistication over the social and environmental aspects essential for genuine urban livability (Bibri & Krogstie, 2017; Giffinger & Gudrun, 2010; Shi & Shi, 2023).

This article embarks on a preliminary exploration, grounded in a comprehensive analysis of scientific literature, to critically reassess mainstream smart city indicators. We aim to propose alternative indicators that more accurately reflect urban livability and sustainability. It is crucial to state that the primary objective is not to fundamentally invert the current rankings of cities such as Zurich and Athens. Instead, this study seeks to illustrate how a different set of indicators, centered on quality of life (QoL), can offer a more nuanced understanding of urban performance. Such an approach has the potential to narrow the perceived performance gap between cities with varying technological and economic profiles, bringing to light aspects of livability that are currently underrepresented or overlooked by conventional indices. The preliminary and literature-based

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nature of this investigation is emphasized, intending to stimulate critical debate and lay the groundwork for future empirical research

The concept of smart cities has captivated policymakers, corporations, and urban planners, primarily because it embodies promises of efficiency, sustainability, and enhanced quality of urban life. However, much of the discourse surrounding smart cities hinges on quantifiable data that measure technological integration rather than a holistic understanding of what makes a city livable (Bibri & Krogstie, 2017; Giffinger & Gudrun, 2010). As cities adopt various smart city ranking systems, it becomes crucial to critically evaluate these methodologies, which frequently reveal underlying biases focused on corporate interests rather than comprehensive urban development strategies that embrace social equity and community needs (Giffinger & Gudrun, 2010; Shi & Shi, 2023).

For instance, Bibri and Krogstie contend that the definitional frameworks employed in smart city discourse are heavily influenced by corporate agendas, which may overlook critical socio-environmental factors necessary for sustainable urban living (Bibri & Krogstie, 2017; Shi & Shi, 2023). In essence, these frameworks can lead to an oversimplified understanding of urban ecosystems, failing to acknowledge the intricacies involved in community engagement and ecological health. Giffinger and Gudrun further amplify this critique by arguing that the prevailing emphasis on technology can overshadow the equally important social and environmental considerations that underpin successful urban strategies (Giffinger & Gudrun, 2010; Shi & Shi, 2023). Thus, while cities that score high on technological metrics may appear to demonstrate superior intelligence, they may inadvertently marginalize the qualities that enhance the livability of urban environments.

Moreover, a thorough investigation into the methodologies behind smart city assessments raises pertinent questions regarding their relevance and effectiveness in promoting livable urban ecosystems. Tools for assessing the performance and "smartness" of cities often prioritize metrics such as economic outputs and technological infrastructures, potentially sidelining qualitative dimensions like cultural vibrancy and social cohesion (Bibri & Krogstie, 2017; Patrão et al., 2020). This point is especially relevant when considering the context of cities such as Zurich, recognized for its high ranking in smart city indices, contrasted with cities like Athens, which, despite lower rankings, exemplify important attributes such as strong social networks and cultural heritage (Bibri & Krogstie, 2017; Shi & Shi, 2023).

The investigation of these dynamics reveals substantial limitations in contemporary smart city evaluations, underscoring the need for a more comprehensive set of indicators that align with genuine urban experiences. For example, Giffinger and Gudrun have argued for a composite understanding of urban competitiveness that transcends quantitative metrics. Their work suggests that capturing resident experiences and qualitative aspects is vital for promoting not just technological advancement, but also the richness of urban life (Bibri & Krogstie, 2017; Giffinger & Gudrun, 2010).

In considering sustainable solutions, the methodology adopted in evaluating urban livability offers promising avenues for reconceptualizing how smart cities assess their effectiveness. Correlation studies and alternative indicators that integrate social justice and environmental sustainability can substantially reformulate how urban intelligence is defined (Mora et al., 2017; Shi & Shi, 2023). Recent studies have showcased that genuine urban resilience is deeply tied to quality of life improvements that foster inclusive participation, highlighting the pressing need for urban planners to acknowledge the collective well-being of city dwellers alongside technological integration (Beck et al., 2022; Bibri & Krogstie, 2017).

Additionally, researchers advocate for a reevaluation of the methodologies underpinning these rankings in the context of citizen engagement and social inclusion. Mora et al. emphasize the growing body of literature around smart cities, noting the need to bridge the gap between theoretical frameworks and practical applications, thereby ensuring that urban policies are not merely reactive, but proactive in addressing community needs (Bibri & Krogstie, 2017; Mora et al., 2017).

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To substantiate this transformative dialogue, case studies from cities like Zurich and Athens become imperative. Zurich's technological achievements may not fully capture the vibrancy and cultural richness inherent in urban life, while Athens, though lower on the smart index scale, demonstrates resilience in community-driven initiatives that prioritize citizen engagement over mere technological deployment (Bibri & Krogstie, 2017; Mora et al., 2017). Adopting practices that highlight the importance of social identity and ecological balance emerges as fundamental in redefining urban success and what it means to be a smart city.

In analyzing future trajectories of urban development, it becomes clear that an integrative approach to smart city frameworks—one that accounts for qualitative data alongside quantitative assessments—can enrich the urban experience (Bibri & Krogstie, 2017; Patrão et al., 2020). This necessary evolution underscores the importance of citizen voices in the planning process, ensuring that urban environments support vibrant, thriving communities rather than just high-tech imagery. Such frameworks can better address pressing urban realities and mitigate potential pitfalls associated with a rigid technological focus that neglects the underlying socio-environmental contexts contributing to livability.

Furthermore, it is critical to harness interdisciplinary collaboration to facilitate a more nuanced understanding of urban ecosystems. By incorporating diverse perspectives and methodologies that account for socio-environmental realities, stakeholders can develop more holistic criteria for evaluating smart cities that genuinely enhance urban livability (Patrão et al., 2020. This constitutes a pivotal shift away from rankings driven solely by investment attraction or technological integration towards a model that fosters equitable and sustainable urban ecosystems.

In essence, reevaluating the metrics defining smartness in urban settings requires stakeholders to engage with citizen experiences, quality of life indicators, and ecological sustainability (Bibri & Krogstie, 2017; Shi & Shi, 2023). As cities around the world navigate the complexities of urbanization amidst technological changes, it is paramount that the dialogue surrounding smart cities reflects a comprehensive understanding of livability, harmonizing technological advancement with profound respect for community well-being. The dialogue continues to advocate that urban assessments embrace broader implications for life quality, aligning with the foundational notions of sustainable development that prioritize people alongside technologies.

The structure of this paper is as follows: First, we will review the evolution of the smart city concept and critically analyze leading smart city ranking indices. Subsequently, we will delve into the concept of urban livability and detail the methodology for selecting alternative, QoL-focused indicators, providing scientific justification for each. These proposed indicators will then be mapped to the established verticals of a smart city (Smart Mobility, Smart Environment, Smart Governance, Smart Living, Smart People, Smart Economy) to demonstrate their relevance within existing urban development frameworks. A comparative re-evaluation of Athens and Zurich through this new lens will illustrate the potential of this approach. The paper will conclude with a discussion of the implications of these findings and outline promising future research directions to further refine and empirically validate this human-centric perspective on smart city assessment. This approach aims to position our contribution as a conceptual and critical endeavor, preparing the ground for subsequent empirical investigations, driven by the observation that current metrics may not fully capture what makes a city truly 'intelligent' in a holistic and human-centric sense.

2. From Tech-Driven to People-Centered: The Evolution of the Smart City Concept

The evolution of the "smart city" concept has undergone a significant transformation over the past decades, transitioning from an initial focus on technology-centric strategies to a more comprehensive, people-centered approach that emphasizes sustainability, inclusivity, and quality of life. This evolution is vital for understanding contemporary discussions regarding smart cities, particularly as they relate to existing ranking systems. Giffinger et al. trace the origins of smart city

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frameworks back to the integration of Information and Communication Technologies (ICT) into urban governance, which saw notable implementations in cities like Los Angeles and Singapore during the late 20th century (Giffinger & Gudrun, 2010). During this period, technologies began to be recognized as more than mere tools; they were integral to urban development, reflecting a form of technological determinism that characterized the early smart city discourse (Bibri & Krogstie, 2017).

The pivotal shift in the smart city narrative began around 2005, marked by rising interest from technology corporations such as IBM and Cisco. These entities envisioned cities as "instrumented, interconnected, and intelligent" systems, aiming to optimize urban services through extensive data analytics and pervasive sensor networks (Zanella et al., 2014). Although this technological focus promised increased operational efficiency, it also introduced a narrow perspective of urban improvement, primarily measured by efficiency metrics. This inclination towards technological expansion inadvertently marginalized essential components such as human and social capital, which are crucial for fostering sustainable urban living (Patrão et al., 2020). For example, Albino et al. argue that an ideal smart city must blend physical, digital, and human systems, thereby enhancing citizens' overall well-being and effective governance (Al-Thani & Furlan, 2020).

Early definitions of smart cities often emanated from this tech-centric phase. Influential contributions from scholars like Caragliu and Bo have pointed out that cities embody "smartness" when they prioritize investments in human capital and sustainable governance alongside technological infrastructure (Caragliu & Bo, 2019). However, these definitions have not gone without criticism. Vanolo, in his critical analysis, raised questions about whether cities branded as "smart" genuinely reflect urban innovation and resilience or simply display high-tech entrepreneurship (Vanolo, 2013). His critique has prompted significant reevaluation within smart urbanism discourse, emphasizing the need to include social inclusion and equity within these frameworks.

As cities began to embrace more community-oriented principles, scholars like Malek et al. have highlighted the importance of investigating the motivations behind smart city initiatives and their implications for social equity (Malek et al., 2021). They argue that these motivations should promote responsiveness to citizens' needs rather than solely prioritizing efficiency. The subsequent transition towards what has been termed the "livable smart city" model encapsulates this evolution by integrating community engagement and quality of life alongside digital infrastructures (Mora et al., 2017). The emphasis on a holistic approach to urban management is clear in international guidelines by organizations such as the United Nations, which promotes the need to harmonize technological innovations with cultural and environmental dimensions of urban living through initiatives like UN-Habitat (Giffinger & Gudrun, 2010).

Key developments in the smart city discourse can be summarized into distinct phases:

- the *Tech-led phase* (2000s) focused on ICT investments and efficiency gains;
- the *Data-centric phase* (2010s) which included digital services and IoT for environmental management;
- the *People-centered phase* (2010s–present) that emphasizes inclusivity, sustainability, and citizen well-being (Patrão et al., 2020).

Recent literature has documented these complexities and the limitations inherent in current ranking frameworks, suggesting that such rankings often fail to capture the comprehensive nature of urban innovation (Al-Thani & Furlan, 2020; Correia, 2023).

To address these shortcomings, comprehensive frameworks advocating participation from diverse stakeholders in governance and planning processes have emerged as vital (Malek et al., 2021). By shifting focus to citizens' experiences, this paradigm shift acknowledges that being a truly smart city encompasses more than merely technological integration; it requires a nuanced understanding of the lived realities of its inhabitants. This emerging perspective encourages a redefinition of smart city metrics to prioritize livability, inclusiveness, and ecological sustainability, challenging existing frameworks that primarily consider quantitative evaluations of urban performance (Malek et al.,

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2021). The recent literature strongly advocates that successful smart city initiatives must encompass the needs of diverse stakeholders and prioritize genuine citizen engagement (Malek et al., 2021).

Moreover, scholars like Meijer and Bolívar bring attention to the changing nature of governance in smart cities, contending that smart governance should be adaptive, inclusive, and participative (Malek et al., 2021). This perspective resonates through analyses that emphasize an integrative approach, combining traditional success metrics with qualitative indicators reflecting social capital, economic resilience, and environmental sustainability. For instance, the measurement of citizen-centric smart city indicators suggests that governance structures should support resident engagement and address local urban challenges directly (Correia, 2023). Such frameworks not only signify a discourse shift but also a practical adjustment in designing and implementing smart city strategies.

In summary, the evolution of the smart city concept from a technology-oriented framework to a holistic and inclusive approach reflects significant shifts in both theoretical and practical realms. The ongoing complexities of urban living, amplified by global challenges, necessitate that smart cities embody the aspirations of their citizens and prioritize ecological health, inclusivity, and participative governance. The discussions surrounding smart cities must persist in acknowledging their multifaceted nature, urging a critical understanding of both historical and contemporary trajectories for fostering effective engagement strategies and interventions in urban contexts (Mora et al., 2017).

3. Ranking the Unmeasurable: A Critical Review of Major Smart City Indices

The increasing visibility of smart city initiatives has been paralleled by a growing prominence of global rankings aimed at measuring urban "smartness." Indices such as the IMD Smart City Index (SCI), the IESE Cities in Motion Index (CIMI), the Juniper Research Smart City Rankings, and the U4SSC Key Performance Indicators led by the International Telecommunication Union significantly influence policy decision-making and shape public discourse on urban development. However, a critical evaluation of these ranking methodologies reveals substantial concerns regarding their validity and implications for the characterization of smartness in cities. These indices often promote a skewed narrative that inadequately addresses sustainable urban living (Correia, 2023; Patrão et al., 2020).

A comparative overview of selected smart city rankings and their methodological critiques is provided below. These indices were selected based on their prominence in policy and academic discourse, as well as their appearance in the critical literature reviewed in this paper.

Table 1. Comparative overview of selected smart city rankings.

Index	Organization	Key Dimensions	Methodology	Criticism Highlight
IMD Smart City Index	IMD & SUTD	Health, Safety, Mobility, Opportunity, Governance	Based on surveys of ~100–120 residents per city	Limited sample size; perception-based data; lack of transparency; technocentric orientation.
IESE Cities in Motion Index	IESE Business School	Economy, Human Capital, Environment, Connectivity, Governance	Combines 114 indicators from varied sources; weighting varies	Methodological opacity; arbitrary weights; strong economic and corporate bias; limited focus on social equity.
Juniper Research Smart City Rankings	Juniper Research	Energy, Transport, Public Safety, Smart Infrastructure	Technology deployment-centric	Overemphasis on infrastructure and tech adoption; neglect of social and environmental dimensions; supply-side bias.

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U4SSC Key Performance Indicators	ITU (UN-led consortium)	Economy, Environment, Society & Culture, ICT	Based on ISO standards and SDGs; cities self-report data	Under development; limited global adoption; questions about comparability and implementation in Global South contexts.

This table illustrates how even the most prominent smart city rankings, despite their influence on urban policy, often embody methodological shortcomings and ideological biases. These include a lack of transparency, limited citizen representativeness, excessive reliance on technology deployment, and insufficient integration of equity and sustainability considerations.

The IMD Smart City Index, for instance, employs a survey-based approach focused on residents' perceptions in key areas such as health, mobility, and governance. This involves a sample size of approximately 100-120 residents per city, which may not adequately represent the complexity of urban populations and their diverse experiences (Gerli et al., 2022). This methodological limitation raises questions regarding the reliability of the data collected and the subsequent conclusions drawn regarding urban smartness (Gerli et al., 2022). Furthermore, Mora et al. emphasize that many rankings, including those produced by the IMD, exhibit a lack of clarity in their methodological statements and often amalgamate data from disparate sources without adequate transparency, complicating efforts to analyze their findings accurately (Mora et al., 2017). Such opacity diminishes the credibility of these indices, making it increasingly challenging to substantiate their assessments reliably.

Additionally, a fundamental concern surrounding smart city rankings is their implicit preference for technologically deterministic solutions, where the presence of advanced technologies is equated with urban sophistication. This focus on "supply-side" metrics, such as the availability of technologies, often neglects the "demand-side," which pertains to how these technologies serve residents' needs and contribute to their quality of life (Giffinger & Gudrun, 2010). Juniper Research, for instance, emphasizes technological deployments within its frameworks, which can detract from crucial social and environmental contexts that define urban livability and resilience (Mora et al., 2017). Bibri and Krogstie contend that assessments based centrally on technological criteria threaten to produce a one-dimensional vision of what smartness involves, overlooking qualitative aspects related to citizen engagement and sustainability (Bibri & Krogstie, 2017). Consequently, this reliance on technology-centric methodologies may lead to misrepresentations of the nature of livable urban environments.

Moreover, methodologies employed across various rankings frequently rely on economic proxies to approximate well-being, conflating indicators of economic vitality with genuine improvements in quality of life. Many indices, such as the IESE CIMI, employ approximately 114 indicators related to economy, governance, and social cohesion. While these dimensions are indeed essential, they often fail to sufficiently spotlight social equity and environmental sustainability as primary criteria (Caragliu & Bo, 2019). Fernández-Añez et al. emphasize the importance of a deeper analysis of the impacts and perceived outcomes of smart city initiatives, arguing for a more robust linkage of urban challenges with appropriate strategies (Fernández-Añez et al., 2018).

The actors developing these influential rankings often include multinational corporations, consultancy firms, and educational institutions, each with their own vested interests in shaping urban development agendas. For example, the participation of the IESE Business School in crafting the CIMI raises concerns regarding the interplay between academic research and corporate interests, potentially biasing definitions of smart urbanism to align with market imperatives (Pereira et al., 2018). This dynamic indicates a reinforcement of narratives that prioritize technological solutions, potentially sidelining the needs and perspectives of local communities (Caragliu & Bo, 2019).

The systemic drawbacks of smart city rankings become remarkably evident when considering their impact on cities in the Global South. Many of these frameworks, with their focus on

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technological advancement and economic indicators, inadequately account for the distinct challenges faced by these regions—often characterized by infrastructural deficits and varied socio-cultural contexts. Cities rich in social capital and resilience may find themselves at a disadvantage in these rankings, leading to a distorted global narrative of urban progress (Fernández-Añez et al., 2018). This misrepresentation can undermine localized developmental strategies, restricting access to critical investment and policy support essential for addressing urban challenges effectively.

To enhance the credibility and applicability of smart city rankings, recalibrating foundational metrics is essential. Incorporating qualitative indicators associated with social inclusion, equity, and environmental health can yield a more comprehensive understanding of urban complexity and resilience (Pereira et al., 2018). This integrative approach aligns with calls for blending community-driven practices with formal technological innovations, thereby fostering a genuine sense of smartness in cities. Shifting the narrative of "smartness" necessitates moving beyond conventional reliance on technology as the main arbiter of urban success and placing emphasis on the lived experiences of residents alongside sustainable practices specific to their locales (Malek et al., 2021).

While it is evident that smart city rankings significantly influence urban narratives, understanding their methodologies and recognizing inherent biases is vital for constructive urban planning. The trajectory toward sustainable urban development must favor frameworks that incorporate multi sectoral participation and emphasize local knowledge and context over simplistic technological evaluations. Such a shift can catalyze the emergence of more inclusive cities—those that not only leverage technologies but also center human and environmental considerations in their growth trajectories.

In conclusion, the discourse surrounding smart cities and their assessment tools necessitates a nuanced understanding that incorporates diverse urban experiences and objectives reflecting the essence of livable, resilient, and sustainable environments. By adopting frameworks prioritizing human-centric indicators while addressing the specificity of local contexts, urban planning can evolve into a more participatory and just endeavor. This evolution will better align with the aspirations of residents and the realities of diverse urban ecosystems. Given the profound limitations and inherent distortions present in existing smart city ranking systems, there is an urgent need for the development of a new approach grounded in urban livability and sustainability.

4. What Makes a City Livable? Proposing a New Set of Indicators

To address the critiques of conventional smart city indices and offer a new perspective on evaluating urban performance, it is crucial to develop a redefined framework centered on the multidimensional concepts of livability and sustainability. This framework should reflect the true quality of life experienced by urban residents, emphasizing a holistic understanding of the urban environment. Establishing a clear conceptual basis for 'livability' and 'quality of life' (QoL) is essential before proposing indicators, ensuring the latter are grounded in established theories. (Fu & Zhang, 2023; Pan et al., 2021).

A comprehensive definition of urban livability considers several core components, each representing an essential aspect of quality of life in urban environments. According to urban studies, livability is fundamentally linked to sustainable urban planning that prioritizes environmental health, social inclusivity, and economic vitality (Fernández-Añez et al., 2018; Filho et al., 2022). Key features of this perspective include accessibility to amenities, plentiful green spaces, efficient public transport systems, and fostering a strong sense of community. For instance, the Urban Liveability Index developed by Higgs et al. identifies various objective indicators to measure components of livability and demonstrates how these relate to transportation choices, thus showcasing how infrastructure impacts residents' daily lives (Higgs et al., 2019).

Environmental psychology complements the urban studies perspective by exploring how physical surroundings influence behavior, emotions, and overall well-being. This includes principles such as human-scaled environments, biophilic design, walkability, and opportunities for social

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interaction that are essential for psychological health (Filho et al., 2022; Juntti et al., 2021). Urban environments designed with these principles in mind enhance residents' satisfaction and sense of belonging. For example, integrating nature into urban spaces through parks, green corridors, and community gardens significantly contributes to the mental and emotional well-being of citizens (Juntti et al., 2021).

Consequently, we propose integrating a range of objective indicators that reflect these dimensions of urban livability into a comprehensive evaluation framework. Specific indicators could include:

- *Accessibility to Amenities*: This involves quantifying the distance to essential services, entertainment options, and healthcare facilities, ensuring that all residents have equitable access.
- *Public Transport Efficiency*: Metrics related to the efficiency, frequency, and coverage of public transport systems can provide insight into urban mobility and access.
- *Green Space Availability*: Quantifying the area of public parks, green spaces, and recreational facilities per capita will allow for an assessment of residents' access to nature.
- *Social Interaction Opportunities*: Evaluating the presence and quality of community gathering spaces—such as plazas, cafés, and community centers—can help assess opportunities for social cohesion and community building.
- *Safety and Comfort*: Evaluating the perceptions of safety within neighborhoods and public spaces, as well as the provision of features that enhance physical comfort—such as shaded pathways and pedestrian-friendly zones—would greatly inform the livability assessment.

In addition to these indicators, it is essential to incorporate qualitative measures that capture residents' experiences and perceptions. For instance, community surveys can provide insights into public sentiment regarding local environmental conditions, safety, and overall satisfaction with the living environment (Luo et al., 2022; Tang et al., 2022). Engaging local stakeholders in defining these indicators ensures that they are contextually relevant and reflective of diverse community needs, further promoting a sense of ownership and agency among residents (Beck et al., 2022; Malek et al., 2021).

Furthermore, promoting robust governance structures that emphasize collaboration and participation is vital for ensuring that the framework's implementation reflects actual community needs. The emphasis must be placed on citizen engagement in decision-making processes related to urban planning and development (Cardullo & Kitchin, 2018; Pereira et al., 2018). By fostering collaborative governance, cities can better align their smart initiatives with community values and priorities, thus enhancing livability for all residents (Malek et al., 2021; Beck et al., 2022).

The current discourse around smart cities necessitates that we advocate for assessment frameworks that prioritize human-centric indicators, thereby allowing for a more nuanced understanding of urban environments. Moreover, as cities become increasingly interconnected and influenced by technological advancements, it is crucial to delineate the role of technology not as an end itself but as a tool to enhance human experiences and environmental health (Mora et al., 2017).

In summary, an alternative evaluation framework for urban livability focuses on a multidimensional approach that combines accessibility, environmental health, social cohesion, and residents' experiences. This framework not only challenges conventional smart city rankings but also offers a blueprint for cities aspiring to achieve genuine sustainability and inclusivity. By integrating objective indicators alongside qualitative assessments and emphasizing participative governance, urban planning can shift toward more holistic and equitable approaches that reflect

To address the limitations of conventional smart city metrics, this paper proposes an alternative evaluation framework that emphasizes urban livability and sustainability through a series of objective indicators aimed at capturing the essential aspects of daily life and long-term well-being. Urban livability is fundamentally a multidimensional concept influenced by various factors, including health, environment, community engagement, and economic viability. By focusing on

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tangible measures that reflect the lived experiences of residents, this framework aspires to provide a more human-centered assessment of urban performance (Correia, 2023).

4.1. Conceptualizing Urban Livability and Quality of Life (QoL)

Urban livability emerges as an essential concept at the intersection of urban studies and environmental psychology. This notion encapsulates the complex interplay between the built and natural environments and emphasizes the need for enhancing the well-being and satisfaction of residents within urban settings. A solid definition of urban livability recognizes several interrelated components, prominent among them being sustainable urban planning, which prioritizes environmental health, social inclusivity, and economic vitality. Such an understanding is bolstered by the findings of various researchers who assert that resilience to environmental challenges, economic stability, and a socially cohesive community are vital for creating livable urban spaces (Higgs et al., 2019; Pan et al., 2021; Yang, 2024).

Sustainable urban planning exemplifies the proactive measures cities must embrace to cultivate livability. These strategies include the incorporation of accessible amenities, the presence of abundant green spaces, and the development of efficient public transport systems, all of which contribute significantly to the overall well-being of urban inhabitants. By ensuring accessibility, urban planners can mitigate barriers to essential services and improve the quality of life across different demographic segments. This aligns with the findings of Al-Thani and Furlan, who explored integrated design strategies aimed at urban regeneration, emphasizing that an analyzed approach oriented toward livable spaces enhances both the spatial experience of residents and the ecological balance of urban environments(Al-Thani & Furlan, 2020; Juntti et al., 2021).

Furthermore, the World Health Organization (WHO) defines Quality of Life (QoL) as an individual's perception of their place in life, framed by cultural and value systems, and it directly aligns with how livability is perceived in urban spaces. In this regard, urban livability is inextricably linked to environmental formats that alleviate stressors such as air pollution. Studies indicate that air quality directly impacts mental and physical health, thereby influencing resident satisfaction and quality of life (Juntti et al., 2021; Yang, 2024). Moreover, Juntti et al. highlight that access to well-maintained urban greenspaces can dramatically boost the public's emotional and psychological well-being (Juntti et al., 2021).

Critiquing urban livability requires understanding the variables that determine neighborhood selection, encompassing factors such as housing affordability, safety, and community vibrancy. Evidence indicates that these variables combined significantly influence residential choices, while the built environment plays a pivotal role in shaping everyday behaviors and experiences. Housing and transport are fundamental elements that affect how urban dwellers interact with their surroundings, illustrating the critical importance of integrated planning that revamps living conditions into more holistic and inclusive urban ecosystems (Higgs et al., 2019; Luo et al., 2022).

The evolution of smart cities provides an additional layer of understanding urban livability. Smart city initiatives utilize advanced technology to foster greater efficiency in urban services, addressing sustainability and livability. For instance, the implementation of technologies such as wirelessly connected sensors allows for real-time assessments of urban conditions, which in turn inform policy implementation aimed at enhancing livability (Garau & Pavan, 2018; Patrão et al., 2020). These advances not only streamline urban governance but also create an inclusive platform whereby citizens can actively engage in decisions affecting their neighborhoods. Consequently, smart cities become living laboratories for enhanced urban experiences, reflecting a fundamental shift toward intelligence-driven urban management.

Fiscal stability plays another pivotal role in this discourse. Evidence posits that economic development is equally important in defining urban quality Yang, 2024). In essence, urban policies need to evolve in a direction that recognizes economic vitality as complementary to environmental and social objectives. This economic perspective holds that employment opportunities, accessibility

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to services, and supportive local governance are indispensable in bolstering urban satisfaction and overall livability.

As cities reconstruct themselves in the context of environmental change, the challenges posed by climate extremes underline the urgency for urban resilience. In the face of phenomena such as heatwaves and rising sea levels, urban designs must be adaptive, recognizing that the ability to withstand such changes significantly influences urban livability. Addressing these issues through climate-mitigating strategies like urban greening and eco-friendly transportation systems not only contributes to resilience but also enhances emotional satisfaction among residents who increasingly prioritize sustainability in their urban lives (Filho et al., 2022; Yang, 2024).

Researchers find a correlation between social networks and perceptions of urban livability. Robust social ties within communities can serve as protective factors against urban stressors, enhancing individuals' collective experience of their environments (Pan et al., 2021; Yang, 2024). This indicates a vital area for future urban policies aimed at fostering community and connectivity among residents, thereby recognizing that livability extends beyond mere physical infrastructures to include social capital as an asset for urban resilience.

The impact of tourism on urban livability also merits consideration. Tang et al. note that tourism development can yield both positive spillovers and negative effects (Tang et al., 2022). Thus, it becomes essential for urban planners to critically evaluate the potential of tourism not only in terms of economic gain but also regarding its ramifications on residents' everyday quality of living. To yield benefits for all stakeholders, sustainable tourism practices must be embedded within urban governance frameworks, ultimately strengthening both the economy and the urban fabric.

Lastly, security and safety concerns further complicate the dialogue surrounding urban livability. Urban residents' perceptions of safety significantly influence their overall satisfaction levels, with heightened fears of crime leading to a diminished quality of life. Evidence indicates that residents who perceive their neighborhoods as unsafe are less likely to engage with their community, which can erode social ties and exacerbate feelings of alienation. Effective urban policies that incorporate crime prevention strategies alongside community empowerment can play a crucial role in fostering a sense of safety, which is indispensable for true urban livability (Almatar, 2024; Wang et al., 2022).

In conclusion, urban livability is a multifaceted concept shaped by numerous interdependent factors ranging from environmental health and social cohesion to economic vitality and security perceptions. The growing emphasis on sustainable urban planning as a pathway for enhancing livability resonates with the contemporary challenges faced by urban centers worldwide. As cities evolve and adapt to meet the aspirations of their residents amidst climatic and socio-economic upheavals, a comprehensive approach that incorporates technological innovation, community engagement, and sustainable design will be paramount in achieving genuinely livable urban environments. Key indicators derived from both qualitative and quantitative assessments remain crucial for measuring progress in urban livability and ensuring that the diverse needs and aspirations of urban residents are addressed holistically.

4.2. Methodology for Selecting Alternative Livability Indicators

The exploration of urban livability indicators is a critical endeavor that leverages extensive academic research to enhance our understanding of what constitutes quality urban life (QoL). This selection process emphasizes identifying measures frequently referenced in scholarly literature, drawing attention to indicators often overlooked in mainstream smart city frameworks. A pivotal aim of this initiative is to balance quantitative and qualitative measures, thereby ensuring the inclusion of both objective data and subjective experiential insights that reflect the nuances of human-centric urban experiences. The literature indicates that a variety of dimensions must be considered to comprehensively assess urban livability, addressing both the physical environment and the socio-emotional aspects of urban life (Jun et al., 2022; Wang et al., 2022).

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To begin with, objective measures of urban livability often include concrete data regarding environmental conditions, access to public services, and infrastructural efficacy, as these dimensions play a significant role in shaping residents' perceptions of their quality of life. The framework for assessing livability often draws from established metrics like the Urban Livability Index (ULI), which combines various objective exposures and seeks to derive consensus on their relative importance (Fu & Zhang, 2023; Higgs et al., 2019). Researchers have emphasized that ensuring transparency in the selection of these indicators is essential for establishing the credibility of the overall assessment model. For example, employing methodologies such as principal component analysis (PCA) allows scholars to group and weight these indicators, aiding in the clear communication of their relevance to urban livability (Correia, 2023; Tang et al., 2022).

Moreover, qualitative indicators consist of subjective dimensions that encapsulate personal experiences and social interactions within urban contexts. These measures capture the sentiments of residents regarding their living conditions and environments, highlighting how subjective well-being and community connections influence perceived livability. Studies indicate that access to greenspaces significantly boosts mental health and fosters social cohesion among urban populations, thus underlining the importance of including qualitative aspects in livability assessments (Juntti et al., 2021). It is crucial that the proposed indicators adequately reflect the complex interplay between the physical and emotional landscapes of urban life, as this reflection provides a more holistic understanding of livability.

The deliberate choice of alternative indicators is further encouraged by an acknowledgment of public health implications, particularly significant in light of growing urban populations and increasing environmental challenges. Indeed, environmental factors such as air quality significantly affect urban livability and residents' overall health (Jun et al., 2022; Yang, 2024). The context of urban planning and policy development must incorporate these objective health-related indicators while simultaneously addressing qualitative dimensions of life satisfaction and community well-being.

Advocates for a human-centric approach argue that smart cities should prioritize citizen participation and inclusivity as integral components of urban policies. Collaborative governance models are increasingly emphasized, aiming to involve citizens in decision-making processes and create mechanisms that respond to their needs and aspirations (Pereira et al., 2017, 2018). This approach acknowledges that community engagement leads to better urban experiences and facilitates the implementation of livability measures by ensuring that they resonate with the actual experiences of urban dwellers.

Additionally, empirical validation and refinement of the proposed livability indicators are paramount for establishing their practical applicability. As the initial set of indicators is introduced, it is vital to engage in continuous dialogue and assessment, inviting further research and collaboration with various stakeholders (Gerli et al., 2022). Such empirical evaluations clarify the effectiveness of the proposed indicators and demonstrate their integration into urban planning frameworks, thereby enriching the broader discourse on sustainable urban development.

In the specific context of smart cities, there is a critical need to balance technology-driven solutions with the lived experiences of urban inhabitants. As technology increasingly shapes urban infrastructure and services, the focus must remain on enhancing the quality of life for residents. Literature critiques predominant smart city initiatives for often neglecting the personal narratives and qualitative elements that render urban spaces truly livable (Garau & Pavan, 2018; Malek et al., 2021). Moreover, fostering inclusivity and equitable access must continue to guide urban development frameworks to embrace diverse demographic groups and mitigate social inequities.

Research continually supports the premise that fostering community well-being requires a nuanced understanding of environmental and social contexts. Hence, the selected indicators should reflect this profound interconnectivity, augmenting traditional measures of urban quality with those that address sociocultural dynamics and emotional health (Pan et al., 2021). This shift offers insight into residents' perceptions and informs the creation of urban spaces that fulfill both material and aspirational needs.

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In summary, developing alternative livability indicators grounded in sound literature reflects a significant advancement in our ability to critically evaluate urban environments. Through comprehensive assessment methods that incorporate both objective and subjective dimensions, it is possible to iteratively refine our understanding of urban livability. This endeavor underscores the necessity for ongoing dialogue and collaboration within academic, policy, and community contexts to enrich the framework for evaluating urban life and enhance the sustainability of built environments. Ultimately, a concerted effort to blend empirical insights with lived experiences will pave the way for creating urban spaces that genuinely enhance the lives of their inhabitants.

4.3. Proposed Indicators for Urban Livability: Justification and Scientific Support

Based on the conceptualization of livability and the selection methodology outlined above, the following indicators are proposed. For each, a detailed justification is provided, linking it directly to QoL and supporting the claims with scientific references.

- Life Expectancy at Birth:

Justification and Link to QoL: This indicator serves as a fundamental measure of overall population health and the aggregate impact of socio-economic, environmental, and healthcare conditions within a city. It is a robust proxy for a city's success in providing a health-conducive environment and reflects long-term QoL outcomes.

Scientific Support: The WHO recognizes it as a key health indicator. Epidemiological studies consistently demonstrate its association with factors like education, income, environmental quality, and urban development, all crucial for QoL(*Life Expectancy at Birth*, s.d.; Zhang et al., 2025).

- Prevalence of Stress-Related Illnesses:

Justification and Link to QoL: This reflects the mental well-being of the urban population, an aspect often overlooked by techno-centric indices but critical for QoL. Urban environments can be significant sources of stress, and chronic stress impacts both physical and mental health, cognitive function, and overall life satisfaction.

Scientific Support: Urbanization is linked to increased risks for mental health conditions. Measurement can be approached through validated survey instruments like the Perceived Stress Scale (PSS-10), or by combining physiological measures (e.g., HRV, cortisol) with self-reports, as suggested by urban stress measurement reviews. The PSS-10, for example, has been validated in diverse populations and evaluates the degree to which an individual perceives life as unpredictable, uncontrollable, and overloading. (Poddar et al., 2025; Xu et al., 2023)

- Air Quality Index (AQI) and Noise Pollution Levels (Lden/Lnight):

Justification and Link to QoL: These are direct indicators of environmental health, crucial for daily well-being. Air pollution is a major urban health concern with severe impacts. Noise pollution causes annoyance, sleep disturbance, and cardiovascular problems, significantly degrading QoL.

Scientific Support: Standardized metrics like AQI (based on pollutants such as PM2.5, PM10, SO2, NO2, O3) and Lden/Lnight for noise are widely used and recommended by bodies like the WHO and EPA. Research consistently links exposure to poor air and high noise levels with adverse health outcomes and reduced QoL (Hahad et al., 2025; Surit et al., 2023).

- Average Commute Time and Transport Modal Split:

Justification and Link to QoL: Commute time directly impacts daily life, work-life balance, stress levels, and time available for other activities, thus affecting QoL. Modal split reflects the sustainability, efficiency, and health impact of the transport system.

Scientific Support: Studies show longer commutes are linked to lower life and job satisfaction and health issues. Sustainable transport modes (walking, cycling, public transit) are associated with better health and social connection. Modal split is a key indicator for sustainable urban mobility and livability (Lee et al., 2024).

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- Housing Affordability (Rent-to-Income Ratio):

Justification and Link to QoL: Access to affordable housing is a fundamental need and a critical determinant of economic well-being, financial stress, and overall stability, directly impacting QoL. High housing costs strain household budgets, affecting spending on other essentials like health and education.

Scientific Support: The rent-to-income ratio (often using a 30% threshold) is a standard metric for housing affordability used by organizations like HUD and in numerous academic studies. Research validates its link to financial burden and QoL, although some critics suggest a residual income approach for more nuance (Acolin & Reina, 2022; Stone, 2006).

- Public Green Space per Capita (Accessible):

Justification and Link to QoL: Access to green space is critical for recreation, physical and mental health (stress reduction, mood improvement), social interaction, and ecological balance, all contributing significantly to QoL.

Scientific Support: The WHO recommends minimum standards for green space access (e.g., 0.5-1 hectare within 300m). Numerous studies link green space availability and accessibility to improved health outcomes and higher perceived QoL. The emphasis is on *accessible* and *quality* green space (Addas, 2023; Xu et al., 2023).

- Social Cohesion and Civic Engagement:

Justification and Link to QoL: These reflect community bonds, trust, participation, sense of belonging, and collective efficacy, which are foundational to resilient and supportive urban environments and high QoL. Strong social capital is linked to lower crime, better health, and effective governance.

Scientific Support: Measurement can be achieved through validated survey instruments like Buckner's Neighborhood Cohesion Instrument (NCI) or the Civic Engagement Scale (CES), and indicators like voter turnout or community participation rates. These tools have demonstrated psychometric validity in assessing aspects of social capital relevant to QoL (Teo & Chum, 2020).

- Urban Heat Vulnerability and Climate Resilience:

Justification and Link to QoL: This assesses a city's preparedness for climate impacts, particularly extreme heat, which directly affects health, comfort, energy consumption, and long-term QoL. Vulnerability is often socially differentiated, impacting QoL inequitably.

Scientific Support: The Urban Heat Island (UHI) effect is well-documented. Vulnerability assessment methodologies often use an "exposure-sensitivity-adaptive capacity" framework, incorporating demographic data, health conditions, environmental factors (e.g., Land Surface Temperature, vegetation), and infrastructure. Validation often involves correlating indices with heat-related morbidity/mortality data (Mirzaei et al., 2020).

5. Mapping Livability Indicators to Smart City Verticals

To ensure the proposed livability indicators are relevant and integrable into current urban development strategies, it is essential to map them to the established verticals of a smart city. This process demonstrates their applicability within the broader smart city discourse and helps translate abstract QoL objectives into concrete action areas for planning and technological implementation.

5.1. Defining Key Smart City Verticals

Smart cities are typically conceptualized through six interconnected dimensions or verticals (Ulya et al., 2024). While definitions can vary, for this study, we adopt holistic interpretations aligned with a human-centric approach:

- Smart Economy: Refers to an innovative, competitive, and productive economy leveraging ICT, fostering entrepreneurship, and ensuring sustainable economic development and job creation.

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- Smart People: Encompasses an educated, skilled, creative, and inclusive society with high human and social capital, digital literacy, and active participation in public life.
- Smart Governance: Involves ICT-enabled public administration that is transparent, participatory, collaborative, and efficient, engaging citizens and stakeholders in decision-making processes.
- Smart Mobility: Pertains to integrated, sustainable, accessible, and efficient transport and logistics systems, prioritizing clean, shared, and non-motorized options, supported by ICT for real-time information and optimization.
- Smart Environment: Comprises sustainable resource management, pollution control (air, water, noise), smart energy solutions, green buildings and planning, waste management, and climate resilience.
- Smart Living: Relates to a high quality of life, encompassing health, safety, housing, education, cultural vibrancy, social cohesion, and ICT-enabled lifestyles that support well-being.

5.2. Aligning Proposed Livability Indicators with Smart City Verticals

The proposed livability indicators can be mapped to these smart city verticals as follows, recognizing that many indicators are cross-cutting:

Table 2. Proposed Livability Indicators and the six smart city dimensions.

Proposed Livability Indicator	Primary Smart City Vertical(s)	Secondary Smart City Vertical(s)	Justification of Mapping
Life Expectancy at Birth	Smart Living	Smart People	Reflects overall health outcomes influenced by living conditions and population well-being.1
Prevalence of Stress-Related Illnesses	Smart Living	Smart People	Indicates mental well-being and psychosocial impact of urban environment on its people.
AQI and Noise Pollution Levels	Smart Environment	Smart Living	Direct measures of environmental quality impacting health and daily comfort.
Average Commute Time & Modal Split	Smart Mobility	Smart Living, Smart Environment	Efficiency and sustainability of transport, impacting daily life, stress, and environmental footprint.
Housing Affordability (Rent-to-Income)	Smart Living	Smart Economy	Fundamental need for stability and well-being influences labor attraction and economic health.
Public Green Space per Capita (Accessible)	Smart Environment	Smart Living	Ecological benefits, recreation, physical and mental health improvement.
Social Cohesion & Civic Engagement	Smart People	Smart Governance, Smart Living	Social capital, community participation, trust, and sense of belonging essential for governance and QoL.
Urban Heat Vulnerability & Climate Resilience	Smart Environment	Smart Living, Smart Governance	Adaptation to climate change, protecting health, ensuring safety, and resilient urban planning.

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6. Athens vs. Zurich: Smartness or Livability?

To illustrate the divergence between conventional smart city rankings and a more human-centered, livability-focused assessment, this analysis compares Athens, Greece, with Zurich, Switzerland using the proposed set of indicators outlined previously. While Zurich consistently ranks as one of the world's top smart cities due to its technological advancements and effective governance, Athens, despite its rich cultural heritage and ongoing resilience strategies, tends to occupy lower positions in similar indices. By examining both cities through the lens of livability, we can shed light on the strengths and weaknesses each city presents in terms of addressing the holistic needs of its residents.

6.1. City Profiles and Smart City Ranking Positions

Zurich, Switzerland

Profile: Zurich is recognized as a leading global financial center and is widely lauded for its exceptional quality of life, robust economic prosperity, and high level of public service organization. The city has adopted a proactive smart city strategy aimed at enhancing interconnections among individuals, organizations, and infrastructures through digital solutions. Examples include notable projects like the integrated mobility platform and the "Mein Konto" e-government portal. Furthermore, Zurich has made significant investments in digital infrastructure, exemplified by its city-wide LoRaWAN network for IoT connectivity and an Open Data Platform that augments public participation.

Smart City Ranking: Zurich frequently places at the top, or near the top, of global smart city indices. In the IMD Smart City Index, it claimed the #1 position in both 2023 and 2025. In the IESE Cities in Motion Index, Zurich was ranked 12th overall, scoring impressively in categories such as Social Cohesion (7th), Technology (19th), and Economy (15th). This prestigious standing reflects a high acknowledgment of Zurich's governance and innovation initiatives, though it simultaneously raises questions about whether these metrics adequately capture residents' real-life experiences.

Athens, Greece

Profile: Historically significant, Athens functions as Greece's capital and is a densely populated urban center currently dealing with numerous challenges, including urban heat vulnerability, economic pressures, and the necessity for infrastructure modernization while safeguarding its cultural heritage. The city is making strides in resilience through strategies focused on extreme heat management, and initiatives such as "Develop Athens" promote innovation and social cohesion while enhancing urban management and tourism (Vardopoulos et al., 2020).

Smart City Ranking: Generally, Athens holds lower ranks in established smart city frameworks. In the IMD Smart City Index for 2023, Athens was positioned 113th out of 141 cities. Similarly, the IESE Cities in Motion Index placed Athens at 113th based on older data. Unfortunately, this low ranking often leads to Athens being overlooked in discussions about smart urban futures, despite its numerous social initiatives and resilience strategies.

6.2. Comparative Assessment Based on Proposed Indicators

The proposed indicators that capture urban livability pave the way for a deeper understanding of each city's strengths and weaknesses beyond mere technological presence. Here we assess each city across key indicators.

- *Life Expectancy at Birth*: Life expectancy is indicative of the overall health of residents. Zurich's extensive healthcare system, combined with preventive measures and public health initiatives, promotes a higher life expectancy compared to Athens, which faces challenges from economic strains and health service accessibility issues(Economou, 2010; *The Organisation for Economic Co-Operation and Development*, s.d.).

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- *Prevalence of Stress-Related Illnesses*: Mental well-being reflects the urban environment's impact on citizens. Reports suggest that while Zurich benefits from effective work-life balance policies and social support systems contributing to lower rates of stress-related illnesses, Athens may experience higher prevalence due to economic pressures and urban overcrowding (Al-Gobari et al., 2022; *The Organisation for Economic Co-Operation and Development*, s.d.; Voitsidis et al., 2020).
- *Air Quality Index (AQI) and Noise Pollution Levels:* Although Zurich benefits from stringent environmental regulations, resulting in higher air quality and lower noise pollution, Athens struggles with air quality problems exacerbated by heavy traffic and urban density. Noise pollution levels in Athens may hinder daily quality of life, impacting residents' health and comfort (*Europe's Air Quality Status 2023*, s.d.).
- *Average Commute Time and Transport Modal Split:* Zurich's highly efficient public transport system minimizes commute times and encourages diverse modes of transportation. In contrast, Athens faces longer commute times due to infrastructure challenges and an over-reliance on private vehicles, which can detract from sustainable transportation methods.
- *Housing Affordability (Rent-to-Income Ratio):* The financial burden of housing is critical in assessing economic well-being. Zurich's high cost of living leads to a substantial rent-to-income ratio, yet income levels tend to be higher to match those costs. Athens, facing housing affordability challenges among lower income groups, contributes to financial stress among its population, making this an area of concern.
- *Public Green Space per Capita (Accessible):* Zurich excels in providing accessible public green spaces, contributing positively to residents' mental and physical health. In comparison, Athens has made strides to improve access to parks but still lacks the comprehensive green infrastructure that can enhance urban living.
- *Social Cohesion and Civic Engagement:* Zurich's community engagement strategies foster social ties and civic participation, reflecting higher social cohesion levels. Athens, while rich in historical and cultural community initiatives, may struggle with fragmented social networks due to economic and urban challenges impacting local governance participation.
- *Urban Heat Vulnerability and Climate Resilience:* Zurich's robust planning and climate adaptation strategies have effectively addressed urban heat vulnerabilities. Conversely, Athens is actively working on plans to combat the Urban Heat Island effect, particularly during heatwaves, which remain an increasing challenge given climate change impacts. Athens' resilience strategies include community outreach and education, which are vital for long-term adaptation.

This comparative analysis highlights the divergence between conventional smart city rankings, which tend to favor technologically-oriented metrics, and a more holistic approach that encompasses critical indicators of urban livability. While Zurich's prominence in smart city rankings is supported by its technological advancements, Athens, although rich in cultural heritage and innovative strategies for social cohesion, often finds itself inadequately represented. The proposed indicators offer a nuanced perspective that could reshape the discourse around urban development, helping cities like Athens better articulate their strengths and unique contexts. This broader, more integrated approach could catalyze improvements in urban policies that prioritize resident well-being and enhance the overall livability of cities across the spectrum.

To advance urban livability and sustainability, it is increasingly important to develop a comprehensive framework that shifts the focus from conventional smart city rankings to more meaningful indicators that accurately reflect the quality of life experienced by residents. Urban livability is fundamentally a multidimensional concept that encompasses the interactions between built and natural environments, emphasizing contributions to residents' well-being. Within the academic literature, sustainable urban planning has been highlighted as essential to prioritizing environmental health, social inclusivity, and economic vitality. A variety of critical aspects—including access to amenities, green spaces, and an efficient public transportation system—play vital

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roles in community building and overall satisfaction with living conditions (Juntti et al., 2021; Pan et al., 2021; Patrão et al., 2020).

From the perspectives of urban studies and environmental psychology, livability can be articulated through various dimensions that impact individual well-being. Accessible urban environments foster positive physical and mental health outcomes, improve social interactions, and strengthen community ties. Principles of human-scale design and biophilic design, which emphasize the integration of nature into urban settings, are essential for promoting psychological health among inhabitants (Gerli et al., 2022; Liu & Xiao, 2020). Pan et al. advocate for a holistic approach that accounts for both physical and social infrastructures in enhancing urban livability, highlighting the complex interplay of these dimensions (Pan et al., 2021)(Pan et al., 2021). Additionally, numerous studies underscore the significance of walkability within urban environments; creating pedestrian-friendly spaces not only encourages healthier lifestyles but also reinforces community engagement (Tang et al., 2022).

This research responds to the limitations observed in existing smart city metrics by proposing a fresh set of objective indicators focused on human-centered assessments of urban performance. The indicators are designed to capture critical dimensions of daily life and long-term well-being:

- *Life Expectancy at Birth:* This essential indicator reflects the overall population health within a city and can be obtained from national statistical offices (e.g., the Swiss Federal Statistical Office for Zurich or ELSTAT for Athens) and global health organizations like the World Health Organization.
- *Prevalence of Stress-Related Illnesses:* Stress-related conditions such as anxiety and depression are crucial for understanding mental well-being in urban populations. Data can be sourced from health surveys and public health institutions. The inclusion of this indicator provides critical insights into the urban environment's psychosocial impact.
- *Air Quality Index (AQI) and Noise Pollution Levels:* Indicators of environmental health directly affecting quality of life, such as the AQI, which measures air pollution levels (e.g., PM2.5, PM10), are vital for urban assessment. Data can be drawn from environmental protection agencies and municipal monitoring stations. Similarly, noise pollution, assessed through metrics like Lden and Lnight, contributes to understanding living conditions and overall comfort.
- *Average Commute Time and Transport Modal Split:* These indicators can evaluate the efficiency and sustainability of urban transportation systems. Commute times are essential for understanding daily routines, while transport modal split data indicates the effectiveness of the transportation network.
- *Housing Affordability:* Measured via the rent-to-income ratio, this indicator reflects the economic pressures faced by residents and is critical in assessing the affordability crisis many urban inhabitants encounter. Data can be obtained through national statistics and platforms specializing in urban metrics.
- *Public Green Space per Capita (Accessible):* Access to green areas is an essential indicator of livability, reflecting recreational opportunities and health benefits. This measure can be articulated through quantifying publicly accessible green areas divided by the city population and is vital for enhancing residents' quality of life.
- *Social Cohesion and Civic Engagement:* These qualitative dimensions reflect community ties and participation in public life. They can be assessed through surveys measuring trust, social networks, and community involvement, with data sourced from frameworks established by organizations like OECD.
- *Urban Heat Vulnerability and Climate Resilience:* These indicators assess the capacity of urban systems to adapt to climate-related impacts, particularly concerning extreme weather events. Data can be extracted from climate resilience plans and reports prepared by authoritative organizations like the IPCC.

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This proposed framework draws inspiration from existing indices that emphasize broader aspects of well-being and sustainability, including the Happy Planet Index (HPI) and the OECD Better Life Index. The HPI combines life expectancy, experienced well-being, and ecological footprint to present an alternative perspective on societal success. Meanwhile, the OECD Better Life Index facilitates comparisons across multiple life dimensions, including health and environment (Juntti et al., 2021)).

In contrasting the profiles of cities such as Athens and Zurich, we can observe the disparity between conventional smart city rankings and a more nuanced, livability-centered assessment. Zurich's technological advancements and effective governance contribute to its high rankings, while Athens—a city characterized by its historical richness and efforts towards resilience—typically occupies lower positions in these indices. This analysis advocates for an understanding that transcends primary metrics of economic output, emphasizing social, environmental, and qualitative factors to ensure cities can address community needs more effectively.

In conclusion, the proposed indicators represent a comprehensive and human-centered approach to urban assessment, prioritizing residents' lived experiences and aligning with genuine urban welfare. This realignment of focus can facilitate the development of policies aimed at creating urban environments that are inclusive, sustainable, and responsive to the diverse needs of their populations. By advancing such frameworks, urban planners and policymakers can ensure that the multidimensional aspects of livability are adequately represented in future development strategies, leading to cities that foster well-being for all inhabitants.

Comparative Table Using Proposed Livability and Sustainability Indicators:

The following table presents a comparison of Athens and Zurich based on the objective indicators proposed in Section 4. Data has been sourced from the research materials, with efforts made to find the most recent and comparable city-level or relevant regional/national data.

Table 3. Comparison of Athens and Zurich based on the proposed indicators.

Proposed Indicator	Athens (Data + Source)	Zurich (Data + Source)	Brief Comparative Analysis/Insight
Life Expectancy at Birth (Overall)	Attica Region (2023): 81.7 years. National (Greece, 2024 est.): 81.9 years.	National (Switzerland, 2023): ~83.8 years (avg. of M 82.5 & F 86.0). National (Switzerland, 2021 WHO): 83.3 years. Canton Zurich (2008-09): Men >80 yrs.	Zurich (Switzerland) shows a higher national life expectancy than Athens (Attica/Greece).
Prevalence of Stress-Related Illnesses	Greek studies indicate high stress/anxiety/depression among students/nurses. General adult population (inc. Athens): 10.8% depression, 12% anxiety. Blueground Work-Life Balance: 77 (lower rank).	Swiss studies: 28.2% employees job stress (2022); 15% population moderate/severe mental stress. Zurich cohort: high lifetime psychiatric disorder prevalence. Blueground Work-Life Balance: 91.8 (higher rank).	Available data suggests significant stress levels in specific populations in both cities. Zurich scores higher on a work-life balance index, but direct city-level prevalence comparison for the general population is challenging with current data.

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Air Quality Index (AQI)	Real-time "Good" (AQI 40). Annual avg. 2023: 38 AQI.	Real-time "Good" (AQI 23-25).	Both cities generally show "Good" real-time AQI, with Zurich often reporting lower (better) numerical values.
Noise Pollution (Lden >55dB / Lnight >50dB)	EEA data indicates road traffic is a major source in European urban areas. Specific city Lden/Lnight data for Athens needs detailed extraction from EEA portals or local sources.	EEA data indicates road traffic is a major source. Specific city Lden/Lnight data for Zurich needs detailed extraction from EEA portals or local sources (e.g., Swiss country fact sheets).	Both cities are likely affected by transport noise, common in urban areas. Detailed comparable data requires deeper specific extraction.
Average Commute Time (one way)	~30 minutes for a 10km journey.	Switzerland avg. 30.1 minutes for work commuters. Zurich specific studies indicate varied times by mode.	Average commute times appear broadly similar based on available national/regional data, though methodologies differ.
Transport Modal Split (Public Transport %)	~37% Public Transport (PT); another source: PT 33%, Cars 39%.	Zurich Metro Area: 32% transit mode share overall. City: PT 39%. Swiss commuters: PT 31%.	Zurich appears to have a comparable or slightly higher public transport modal share compared to Athens.
Housing Affordability (Rent-to-Income Ratio)	Greece: Highest housing cost overburden in EU cities (40.7% spend >40% income on housing). Numbeo Athens: Avg. salary €983, Rent 1-bed city €583 (~59% ratio). Described as "very low income, very high rent".	Numbeo Zurich: Price-to-income ratio used in some indices. Swiss guidance: Rent ~25-33% of net income. Avg. rent 1-bed city CHF 1650.	Athens faces severe housing affordability challenges, with a very high rent-to-income ratio for average earners. Zurich, while expensive, appears more affordable relative to higher local incomes.
Public Green Space per Capita (Accessible)	EEA (accessible): 15% of city area. LSE: 6.63 m2/person. City of Athens: ~3.35 km2 vegetation for	EEA (Bern): 4% of city area (accessible). Grün Stadt Zürich manages extensive areas; 43% of municipal area is parks/forests. For ~436k	Zurich appears to have significantly more green space per capita, especially when considering total managed green areas,

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	~643k city pop. (~5.2 m2/person).	city pop., this suggests a high per capita availability.	though direct comparison of "accessible public green space per capita" needs precise, harmonized data. Athens has lower provision.
Social Cohesion & Civic Engagement (Qualitative)	Strong tradition of civic participation, active local initiatives (SynAthina, Novoville), Develop Athens programs. OECD: 78% rely on someone in need (vs 91% OECD avg); voter turnout 58% (vs 69% avg).	High ranking in Intercultural Cities Index; strong tradition of public participation. Swiss volunteering rates are high. Recent surveys suggest current social cohesion perceived critically by some Swiss.	Both cities show evidence of civic engagement. Athens demonstrates community resilience and initiatives despite economic challenges. Zurich has strong formal structures for participation and high intercultural ratings, though recent surveys indicate some public concern about overall social cohesion in Switzerland.
Urban Heat Vulnerability & Climate Resilience	High vulnerability; UHI up to 10°C. Resilience Strategy & Heat Action Plan active (greening, cooling). C40 City.	Swiss urban areas are vulnerable to heat. Zurich Climate Resilience Alliance active. Smart city strategy includes environmental aspects. C40 City.	Both cities acknowledge heat vulnerability and are part of C40, actively developing resilience strategies. Athens faces acute, well-documented heat challenges.
Overall Smart City Ranking (IMD/IESE context)	IMD 2023: 113th. IESE (older): 113th.	IMD 2023/2025: 1st. IESE (recent): 12th.	Zurich consistently ranks very high; Athens ranks significantly lower.

The comparison between Zurich and Athens illuminates how smart city rankings can misrepresent urban livability and sustainability. Zurich's high ranking in smart city indices is associated with its advanced digital infrastructure and governance models. The city's official strategy includes projects like an integrated mobility platform and various e-services, demonstrating a commitment to technological solutions and data-driven management. This structured approach allows Zurich to facilitate innovation and invest in robust digital frameworks, including a city-wide Internet of Things (IoT) network for connectivity and an Open Data Platform. Such investments contribute to high scores in indices that focus on technological attributes, suggesting that Zurich's perceived "smartness" derives not only from its technological advancements but also from its

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existing wealth and institutional capacity, which can enhance residents' quality of life (Higgs et al., 2019).

However, this correlation raises important questions about the effectiveness of relying solely on technological metrics to assess livability. The ability to integrate sophisticated technologies often belongs to wealthier cities, which does not necessarily correlate with better performance across all dimensions of livability. For instance, despite Zurich's status as a leading smart city, it grapples with significant challenges regarding housing affordability. The high cost of living burdens residents, even in light of relatively high average incomes, creating a gap between economic performance and citizens' lived experiences.

In contrast, Athens, while ranked lower in smart city comparisons, exhibits strengths in social cohesion, adaptability, and mental well-being. The city's long history of civic participation is reflected in grassroots initiatives and digital platforms for citizen engagement, such as SynAthina and Novoville, alongside formal programs like "Develop Athens," which emphasize community building and social integration (Correia, 2023). These examples illustrate the concept of 'smartness from below,' highlighting community-driven adaptations and local problem-solving capabilities that are vital for urban resilience. This contrasts with top-down models that tend to prioritize technology over human-centered approaches (Tang et al., 2022).

Athens' proactive strategies to address urban heat vulnerability, evident in its Heat Action Plan, showcase its adaptive capabilities in the face of environmental challenges. While direct comparisons of mental well-being across cities are complex, Athens' rich cultural and social fabric—supported by Mediterranean collaborative norms—combined with projects such as the Athens Wellbeing Project, points to resilience often overlooked by traditional metrics (Fernández-Añez et al., 2018). This type of 'contextual smartness' is deeply rooted in social innovation and community responses that existing ranking frameworks may undervalue or neglect.

The analysis of urban livability reveals a paradox in which high-ranking smart cities do not automatically signify a higher quality or sustainability of life. Zurich's technological achievements do not mitigate its challenges with housing costs and its notable carbon footprint, which challenges its image as a sustainable smart city. Conversely, Athens may demonstrate strengths in community solidarity or potentially lower per capita environmental impact in certain areas, supported by evidence suggesting a better carbon footprint for Greece compared to places like Switzerland.

In conclusion, while Zurich excels in technological metrics, this analysis emphasizes the multifaceted nature of livability. A comparative examination illustrates the necessity of frameworks that extend beyond economic and technological metrics to also encompass social dimensions impacting urban life. By broadening the indicators of urban performance to include lived experiences, social well-being, and environmental health, cities can more accurately reflect the complexities of urban citizenship. A city's ranking on smart city scales may capture its capability for technological adoption and economic performance, but it may omit deeper, more nuanced aspects of well-being and ecological balance critical for resident satisfaction.

7. Discussion: Beyond Rankings, Toward Equitable Urban Futures

As urban frameworks evolve, the increasing emphasis on smart city initiatives illuminates the critical need for a more nuanced understanding of urban intelligence, particularly given the limitations of existing smart city indices. Traditional rankings often amplify technological advancements and economic performance, which may lead municipalities to prioritize projects that inadequately address essential social and environmental needs within urban areas. This focus on high-tech solutions—aimed primarily at boosting rankings—can inadvertently divert attention away from critical infrastructure challenges and essential qualities contributing to authentic urban livability (Patrão et al., 2020).

When municipal governments chase improved rankings through technology-centric approaches, they may neglect the broader spectrum of community needs that require attention. For

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example, while the use of Internet of Things (IoT) applications can enhance sustainability efforts, it is essential to adopt a holistic perspective that ensures technology deployment does not compromise essential social considerations. This viewpoint resonates with existing governance challenges seen in smart city implementations, where a lack of coordination, data privacy concerns, and insufficient community engagement often hinder effective outcomes (Higgs et al., 2019).

Critically, unchecked technological deployment can exacerbate existing systemic inequalities and erode public trust. The notion that community-driven initiatives and local solutions are vital for urban resilience is crucial. Ignoring bottom-up models can result in lost insights into how cities can tackle urban challenges (Tang et al., 2022).

The Mediterranean region serves as a compelling case study, showcasing urban forms deeply intertwined with local cultures and specific vulnerabilities. Cities in this region often adopt models that leverage local knowledge and adaptability, particularly in addressing pressing issues like climate change and resource sustainability (Correia, 2023). The potential for small and medium-sized enterprises, alongside community networks, to innovate within this framework is noteworthy, as locally crafted adaptations often prove more responsive and relevant than standardized solutions imposed from external benchmarks (Yang, 2024).

Additionally, integrating local knowledge and community participation is essential for developing effective frameworks for urban development. By prioritizing the voices of local communities in urban planning, cities can cultivate innovative solutions that resonate with diverse perspectives and enhance resilience (Jun et al., 2022).

To cultivate genuinely "smart" urban environments, it is crucial to emphasize participatory evaluation processes that honor localized knowledge while focusing on improving quality of life rather than merely adopting new technologies. Stressing the necessity of a clearer interplay between technology, sustainability, and community participation can foster truly smart cities that bolster livability without compromising equity and inclusion (Fu & Zhang, 2023). This shift towards more resident-focused urban development requires methodological adjustments in evaluation and a significant reorientation of political priorities, challenging existing power dynamics and encouraging more inclusive governance structures.

Ultimately, a shift towards context-specific solutions and a retreat from overly simplified rankings can lead to transformative advancements in urban development. Embracing innovative local approaches and fostering genuine community engagement while ensuring equitable governance structures will enrich urban life and elevate the discourse surrounding what constitutes a resilient and sustainable urban future. By sharing diverse experiences and insights from cities around the globe, a richer, more inclusive, and human-centric narrative can emerge, better capturing the essence of urban livability and sustainability (Al-Thani & Furlan, 2020; Juntti et al., 2021).

8. Conclusion and Future Research Direction

8.1. Summary of Findings and Implications

This paper has critically examined the prevailing discourse surrounding smart cities, revealing a fundamental paradox at the heart of current evaluation mechanisms: the pursuit of 'smartness,' as defined by many global rankings, can lead to cities that are technologically advanced yet fall short in crucial aspects of livability and sustainability, effectively becoming 'smart but unlivable. The central contention—that these indices prioritize technological capacity and investment attractiveness over genuine livability and sustainability—finds considerable support in the analysis of their methodologies and the comparative study of Athens and Zurich. The detailed comparison, utilizing a proposed set of human-centered indicators, reveals a significant mismatch between high "smartness" scores in conventional rankings and the multifaceted reality of urban quality of life and long-term sustainability. Zurich, while a top-ranked smart city excelling in digital infrastructure and governance, faces challenges in areas like housing affordability and environmental footprint. Conversely, Athens, ranking lower on technological metrics, demonstrates strengths in social

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cohesion, adaptability to specific challenges like heat, and potentially a more sustainable lifestyle in certain aspects, underscoring the limitations of current evaluative paradigms.

This research underscores an urgent call for a new, evidence-based, and human-centered evaluative framework for assessing urban performance. Such a framework, as outlined in this paper, must move beyond a narrow focus on technological deployment and economic indicators. It needs to incorporate objective measures of health, environmental quality, social well-being, equity, and resilience, grounded in robust urban theory and reflecting the lived experiences of all citizens. The adoption of such a framework is not merely a technical adjustment; it represents a fundamental shift in how urban success is defined and pursued. This shift is inherently political, requiring a rebalancing of power dynamics from predominantly corporate or top-down governmental influences towards more inclusive, participatory models of urban governance and assessment. For a new framework to gain traction, it necessitates advocacy, broader stakeholder engagement, and the development of participatory mechanisms for defining and measuring what truly constitutes a "smart" and "livable" city.

Ultimately, this paper advocates for reframing urban smartness in terms of long-term sustainability and holistic well-being. True urban intelligence should be defined by a city's capacity to foster equitable, resilient, and thriving communities that exist in harmony with their natural environment. The pursuit of "smartness" should not be an end in itself, but a means to achieve these more fundamental goals. By embracing a more comprehensive and human-centric understanding of urban intelligence, there is an opportunity to catalyze a new generation of urban innovations. These innovations would be more deeply integrated with social and ecological systems, fostering cities that are not only technologically advanced but also wiser, more equitable, culturally richer, and genuinely sustainable for the generations to come, thereby moving beyond the "smart but unlivable" paradox.

8.3. Future Research Directions

The insights and limitations of this preliminary, literature-based study pave the way for several crucial future research directions aimed at developing a more robust and empirically validated human-centric framework for smart city assessment:

- **Empirical Validation of Proposed Indicators:** A primary avenue is the rigorous empirical testing and validation of the proposed livability indicators across diverse urban contexts. This involves developing robust methodologies for measuring complex indicators such as the prevalence of stress-related illnesses (e.g., using validated instruments like the PSS-10 or combined physiological and self-report methods) and social cohesion (e.g., using Buckner's Neighborhood Cohesion Instrument or the Civic Engagement Scale).
- **Development of a Composite Livability Index:** Future work should explore methodologies for constructing a composite livability index from these indicators. This will involve addressing the inherent challenges of weighting individual indicators and selecting appropriate aggregation techniques to create a tool that is both comprehensive and nuanced for comparative urban analysis and policy monitoring.
- **Context-Specific Indicator Refinement:** Research is needed to adapt and refine livability indicators to reflect unique local conditions, cultural values, and resident priorities, particularly for cities in the Global South where socio-economic and environmental dynamics may differ significantly from those in more developed regions.
- **Integration of Qualitative and Quantitative Data:** Developing mixed-methods approaches that effectively combine objective, quantitative data with subjective, qualitative insights from residents' lived experiences is essential for a holistic assessment of urban livability.
- **Policy Impact Analysis:** Investigating how the adoption of human-centric, livability-focused indicator frameworks influences urban policies, planning decisions, and resource allocation in cities will be critical.

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- **Longitudinal Studies:** Conducting longitudinal research to track changes in livability over time in response to smart city interventions and other urban developments will allow for a dynamic evaluation of policy impacts and urban trajectories.
- **Deepening the "Smart People" Dimension:** Further research should explore how aspects like education, digital literacy, community health, and social capital both contribute to and benefit from smart and livable cities, recognizing the central role of empowered citizens.
- **Participatory Methodologies for Indicator Development:** A crucial future direction involves the co-creation and validation of indicators through participatory methods, actively engaging citizens and local stakeholders in defining what constitutes livability in their specific contexts. This will ensure that future frameworks are genuinely human-centric and locally relevant, fostering greater ownership and applicability.

By pursuing these research avenues, the aim is to move beyond theoretical propositions towards the practical implementation of assessment tools that can genuinely guide cities in becoming not only technologically advanced but also more equitable, sustainable, and truly livable for all their inhabitants.

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