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Comparative review of liveability indices: trends and insights

Meenakshi Pappu [1], Nina Lazar [2]

[1] *School of Architecture, Vellore Institute of Technology, Vellore – 632014, Tamil Nadu, India; meenakshi.pappu@vit.ac.in*
[2] *School of Architecture, Vellore Institute of Technology, Vellore – 632014, Tamil Nadu, India; nina.lazar@vit.ac.in; ninaanna13@gmail.com*

[*] *Corresponding Author*
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Abstract:
The concept of liveability emerged and thrived over two decades, with over thirty global and regional measurable indices developed by various organisations and agencies. All the liveability indices share the overarching goal of analysing urban well-being. There is a significant variation in methodological approach, indicators, weighting percentages, and scope and sampling among the liveability indices. Several studies exist that reviewed and analysed the liveability indices; however, they focus on individual indices in a specific context. This leaves a gap to be acknowledged across the worldwide liveability assessments. Therefore, this research aims to systematically review the existing liveability indices to decode the structural framework. The study is organised into three phases. A detailed review of liveability ranking reports, published literature, and liveability index official websites brought forth a consolidated list of indices. The indices are further grouped based on origin, cluster, methodology, focus domains, sampling, and scope. Further, through a comparative analysis of the structural framework of the indices, the common and specific focus domains were mapped. The findings show that global liveability assessment is dominated by a consultant-driven model, and the core domains aligned with UN SDGs are highlighted as environment, infrastructure, and social equity. The framework must integrate and create context-sensitive assessment and citizen-centric indicators that enable an inclusive assessment to strengthen the quality of life. This research would guide urban planners, policymakers, and researchers in developing transparent and context–sensitive assessment frameworks for urban liveability.

Keywords:
urban liveability; global indices; focus domains; comparative analysis; liveability index; policy making

1. Introduction

During the United Nations' (UN) Habitat II conference held in 1996, the concept of Urban Liveability was emphasised to achieve sustainable urban development and adequate housing for all [1]. To enhance quality of life, the multidimensional construct of liveability, paired with creating habitability for urban residents to provide quantifiable liveable measures, is further accelerated through the liveability indices and rankings [2]. The urban performance is shaped by the global indices through a comparative benchmark in the regional and local context. Indices serve as a diagnostic tool to identify context-specific strengths and drawbacks, align with policy-making and the UN SDGs, and foster citizen-centric planning and development. The evolution of liveability metrics witnessed the inclusion of focus domains such as sustainability, infrastructure, social equity, and governance to measure urban liveability, which is beyond the traditional economic measurements [1]. The liveability indexing agencies have evolved to assess several critical factors based on their credibility, global acceptance, and reach, ensuring a diverse and robust approach to assessing liveability. Despite 30-plus recognised liveability indices, the lack of a unified framework for clustering the focus domain is a significant limitation [3].

A detailed review of the published literature on liveability indices revealed several studies that focused on a single liveability aspect, focusing on a particular regional context. A. Paul and J. Sen [4] critically analysed key urban aspects such as environment, infrastructure, safety, health, social inclusion, and governance, and their quantification in indices such as the Sustainable Cities Index and Global Liveability Index. M. Mihinjac and G. Saville [5] linked perceived safety to spatial layout, which directly feeds into and weaves into the urban form beyond traditional crime indices, with reference to the Global Liveability Index and Safe Cities Index. K. Das and A. Ramaswami et al. [3] provided a validated framework that is data-driven and inclusive of transit accessibility in public spaces with reference to the Urban Equity Index. F. Christy and G. Raissa et al. [6] and S. Nath and R. Karutz [7], based on the user manual Urban Health Equity Assessment and Response Tool (Urban HEART) [8] bring up the community-engaged metrics and the regional nuanced gap, which are attempted to be addressed through local data in indices like the SDG Local Data Action and the City Prosperity Index.

Although several literature reviews exist on liveability indices, few have comparatively analysed multiple indices to understand their structural frameworks and focus domains. A detailed search of the Scopus database revealed only a few studies on the review of liveability indices. Estoque et al. [10] conducted a systematic review of published literature on Quality of Life (QoL) assessment, and a 'QoL-Climate' framework was proposed, explicitly integrating socio-ecological systems and climate impact systems into well-being metrics. Zahra Khorrami et al. [11] reviewed sixty-seven urban liveability studies to identify core domains and highlighted the dominance of methodologies used. Mittal et al. [12] reviewed the QoL assessment tools to identify evaluation criteria and statistical methodologies. Doan and Zhang [15] reviewed urban vitality

studies and systematically highlighted biased results towards seasonality and urban function, questioning the reliance on linear modelling in the construction of Indices. However, no studies have reviewed existing liveability indices and consolidated the major focus areas acceptable for assessing and ranking cities, regions, and countries worldwide.

To meet region-specific requirements, academics, researchers, and policymakers are currently involved in contextualising existing liveability indices. This involves studies by: Sinha et al. [9] who developed a liveability index for seven municipalities in South Twenty-Four Parganas, integrating census data and satellite imagery; Mahanta and Borgohain [13] who constructed a city liveability index for Guwahati using Principal Component Analysis (PCA) and emphasised resident-defined indicators; Fouladi et al. [14] who assessed liveability across the old and new urban fabric in Kashan, employing structural equation modelling, which revealed how infrastructure and economic factors disproportionately affect liveability outcomes; Kash et al. [16], who introduced the Alternatives with Weights of Criterion (AWC) for the spatial ranking of urban districts in Tehran; Elserafi and Aly [17], who proposed a framework that integrates the smart city indicators with principles of liveability at the district scale, which bridges the gap between human–centric and technological metrics outcomes, to list a few.

Hence, it is significant to review and analyse the liveability indices to understand the structural framework and identify the various focus domains, which serve as a foundation for developing similar region-specific liveability indices. Therefore, this study attempts to bridge the gap by categorising the leading liveability indices based on their state of origin, scope, methodological approach, sampling, clusters, and focus domains. The study synthesises urban liveability indices developed by leading agencies and organisations like the UN, intergovernmental agencies, private consultants, academic bodies, and NGOs, to understand the diverse set of focus domains. The study answers the following research questions: 1) What are the common and specific focus domains included in the global and regional liveability indices? 2) What is the structural framework of both global and regional liveability indices? The answers to these research questions would help to decode the structure of the global and regional liveability indices and to arrive at an exclusive list of focus domains. The study's outcomes will help practitioners, policymakers, academics, and researchers develop or enhance existing and new liveability indices.

2. Methodology

The study progresses through three phases: 1) Identification and listing of liveability indices; 2) Categorisation of the liveability indices; 3) Comparative analysis and discussion, as illustrated in Fig. 1. The tasks in each phase are detailed in the subsections below.

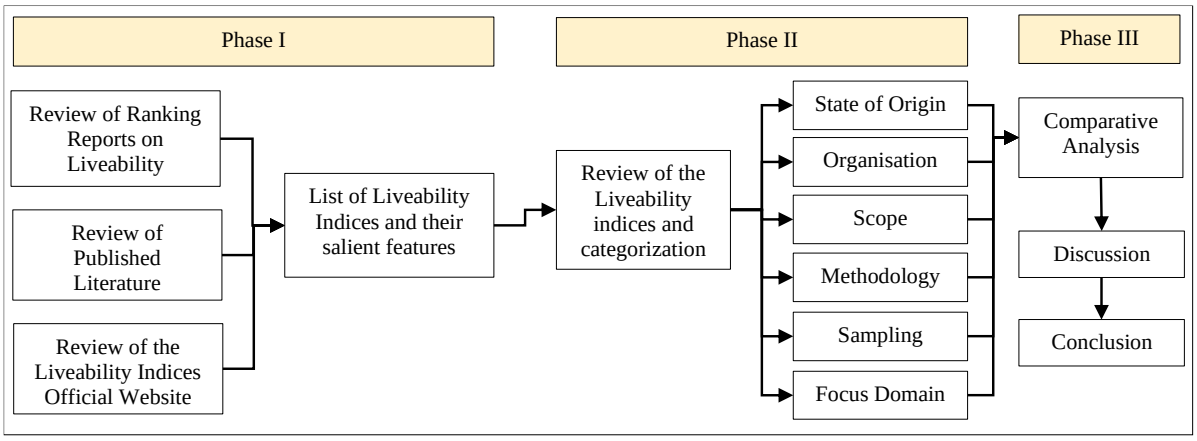

Fig. 1. Methodology flowchart. Source: Author

2.1. Phase 1: identification and listing of liveability indices

Phase I involves examining triangulated data sources, ranking reports, official websites, and published literature on liveability that were published by research institutes, international agencies, and organisations, etc. The ranking reports provide a comparative study of cities across varied dimensions, such as environment, infrastructure, health, safety, education, and economics. Eighteen liveability indices were identified from the liveability ranking reports. The focus was to determine the salient features, such as state of origin, methodology, scope, key findings under each report, and to understand how urban liveability is assessed in different contexts. The official websites of the agencies and institutions that develop liveability indices provide details on the framework, data sources, focus domains, and scoring methodology. Thirty-three liveability indices were identified from the official websites. The published research includes studies on the concept of liveability, its theoretical application, methodological approaches, and the application of liveability indices across domains such as urban design, sustainable design, and public health. Twelve liveability indices were also identified by reviewing the published literature. Further, a consolidated list of liveability indices was developed, redundant indices were filtered, and a final and comprehensive list of liveability indices was arrived at.

2.2. Phase II: categorisation of the liveability indices

Phase II involves categorisation of identified liveability indices based on six aspects, such as state of origin, organisation and agency, scope, methodology, sampling, cluster, and focus domains. The state of origin is critical, as existing regional policies and contextual factors significantly shape the index's framework. Hence, it is significant to understand the structural framework, clusters, and focus domain in light of the contextual requirements. Liveability indices are developed by various organisations and agencies, including government and intergovernmental agencies, research institutions, financial institutions, academic institutions, private consultants, and non-

governmental organisations. The structural frameworks of the liveability indices developed by various organisations and agencies will reflect the specific organisational goals and stakeholder interests. The scope or coverage of the liveability index also influences the structural framework of the liveability index. Depending on the coverage, liveability indices can be of global, metropolitan, city, and neighbourhood scale. The methodological approaches adopted by the various organisations and agencies vary depending on the structural framework. The methodology follows a data-driven approach and is broadly categorised into numerical data models, real ground observations, cloud-sourced data, satellite imagery, and official census databases. The liveability indices can also be classified based on the sampling approach they followed, and the sample type is influenced by the scope and coverage. The cluster and focus domains are critical aspects of the structural framework of a liveability index. Different liveability indices use similar terminology to represent a specific focus domain. The study identifies and categorises liveability indices into similar clusters and focus domains. Thus, at the end of this phase, the liveability indices are classified based on six aspects.

2.3. Phase III: comparative analysis and discussion

Phase III involves comparative and critical analysis of the data and categorisation done in Phase II. This phase critically analyses the inclusion of various focus domains with reference to state of origin, institution cluster, scope and coverage, methodological approach, and sample size. Thus, this phase provides clarity on the rationale behind the divergence and commonality of various liveability indices.

3. List of identified liveability indices

Comprehensive analysis of triangulated data sources - ranking reports, official websites, and published literature on liveability that were published by research institutes, international agencies, and organisations revealed thirty-seven liveability indices, as shown in Table 1. The three data sources reveal numerous core insights on urban liveability, measurement mechanisms, scope and coverage, and multiple focus domains inherent to the liveability indices.

4. Categorisation of liveability indices

The 37 liveability indices identified in Phase I were categorised into six aspects: state of origin, institutional cluster, scope, methodology, sampling, and focus domains. Different liveability indices use synonymous terminology to represent a specific focus domain. The study initially identified the synonymous focus domains and classified them into one primary focus domain, as shown in Table 2. The categorisation of liveability indices based on all six aspects is shown in Table 3 and Table 4. The focus domains are critical aspects of the structural framework of a liveability index.

The 37 liveability indices identified are from different states of origin, including the USA, UK, Kenya, Asia Pacific, Switzerland, Japan, France, the Netherlands, Spain, Serbia, Germany, and the Global level. The state of origin is meant to be the country or area of its initial origin, or the location of the organisation/agencies that developed the liveability indices.

The organisations and agencies that developed the 37 liveability indices were categorised into five institutional clusters, including Academic Institutions, Financial Institutions, Inter-governmental Organisations, Private Consultants, and Research Institutions. The number of liveability indices developed by each institution cluster is 7, 5, 7, 12, and 6, respectively. An academic institution is a cluster of academic consortia, universities, and research departments that design indices through scholarly analysis with peer-review methods. Transparency and methodological rigour are prioritised. The cluster contributes comparative research and evidence based on theoretical development. A financial institution is a cluster focused on climate, economic vitality, and market attractiveness, including investment bodies such as banks and financial media linked to liveability. This cluster of indices provides an assessment of economic resilience and local decisions for potential developers, investors, and the corporation. An intergovernmental organisation is a cluster focused on developing global-level indices. An agreement between countries and multilateral organisations establishes a framework for collecting standardised data that aligns with international agencies and enables benchmarking. Private consultant is a cluster focused on the branding value with market intelligence. Media companies, private research companies, commercial consultants, and professional services combine to produce indices and rankings for the clients. A research institution is a cluster focused on non-government organisations and independent research bodies, research innovations, and advocacy-driven matrices, which usually fill the research gaps left by the official datasets.

The identified liveability indices are also categorised by scope and coverage into four scales: global, national, city, and neighbourhood levels. The number of liveability indices categorised under scope and coverage is 22, 6, 5, and 4, respectively, under each scale. Global-level indices compare hundreds of major cities across different countries and continents. National-level indices compare cities across states or regions within a country. City-level indices compare municipalities within a city boundary in a particular state. Neighbourhood level indices involve analysis of localised areas or a sub-city, which covers a smaller geographical unit, like neighbourhood level, street level, and block level. The neighbourhood-level indices focus on assessing walkability, health, and urban equity, as well as local-level heat.

The liveability indices involve multiple focus domains, such as Environmental quality assessment, Infrastructure, Safety, Cost of living, Healthcare, Education, Cultural vibrancy, Political stability, Climate resilience, Digital connectivity, Tourism, Mobility (Non-motorised), Innovation capacity, and Social-Equity factors, as shown in Table 2. All domains containing environment-related terms, such as ecology, pollution, and environment, were categorised under the major focus domain ‘Environmental quality assessment’. The focus domains, such as infrastructure, public spaces, accessibility, utilities, and connectivity, are brought under the major domain ‘Infrastructure’. This domain integrates the built environment and transport connectivity. The major focus domain ‘Safety’ brings together focus domains such as safety, personal safety and stability, and crime, which capture personal and public security. Cost of living, affordability and prices are explicitly mentioned and clustered under the major focus domain ‘Cost-of-living’. The major focus domain ‘Healthcare’ covers aspects like access to health services, the health of people, and quality outcomes. The major focus domain ‘Education’ encompasses the formal human capital, education, and intellectual capital. The major focus domain of 'Cultural vibrancy' encompasses key aspects such as cultural life, cultural interaction, urban lifestyle appeal, and creative industries, highlighting their interconnectedness and

impact on learning and community development. The major focus domain 'Political stability' focuses on governance quality, policy effectiveness, and institutional stability, all of which are crucial for successful policy implementation. The major focus domain 'Climate resilience' groups terms like resilience, urban resilience, climate action, and climate risk. This domain focuses on capacity-building for environmental shocks. The 'Digital connectivity' focus domain covers terms such as technology, smart systems, urban sensing, and digital safety. The major focus domain 'Tourism' groups terms such as tourism, tourism economy, and destination attractiveness. 'Mobility (non-motorised)' major focus domain groups the terms like walkability, cycling, pedestrian and non-motorised transport. The next major focus domain, 'Innovation capacity', clusters terms such as civic solutions, research and development, and innovation. This domain provides problem-solving and creative capacity. The major focus domain 'Social equity factors' focuses on domains with terms like inclusion, livelihood, wealth, equity, economic inclusion and community engagement.

Table 1. List of liveability indices and data sources. Source: Author

Liveability index	Agency/Organisation	Data source		
		Ranking reports	Official websites	Published Literature
City Prosperity Index (CPI)	UN-Habitat		[18]	[5]
Better Life Index (BLI)	Organisation for Economic Co-operation and Development		[19]	
Global Liveability Index (GLI)	Economist Intelligence Unit	[20]	[21]	[22]
Global Power City Index (GPCI)	Mori Memorial Foundation	[23]	[24]	
Sustainable Cities Index (SCI)	Arcadis	[25]		
Cities in Motion Index (CIMI)	Instituto de Estudios Superiores de la Empresa	[26]		
Smart City Index (IMD-SCI)	Institute for Management Development		[27]	[28]
Urban Liveability Framework (ULF)	World bank		[29]	
Global Cities Index (GCI)	A.T. Kearney		[30]	
Metro Monitor (MM)	Brookings		[31]	
Quality of Living Survey (Mercer QoL)	Mercer		[32]	[22]
Quality of Life Survey (Monacle QoL)	Monacle		[33]	[22]
Quality of Life Index (Numbeo QoL)	Numbeo	[34]	[35]	[36]
Green City Index (SGI)	Siemens Green City		[37]	
Cities of Opportunity Index (COI)	PricewaterhouseCoopers (PwC)		[38]	
City Wellbeing Index (CWI)	Knight Frank City Wellbeing		[38]	
Global Talent Competitiveness Index (GTCI)	INSEAD	[39]		
Urban Mobility Scorecard Centre (UMSC)	World Resources Institute		[40]	
Pedestrian and Cycling Cities Index (P&C Cities)	Institute for Transportation and Development Policy	[41]		
Safe Cities Index (EISC – SCI)	Economist Impact Safe Cities		[42]	
Global City Index (GCI)	Bloomberg		[43]	
Global Destination Cities Index (GDCI)	Mastercard		[44]	
Liveability Index (ULI - LI)	Urban Land Institute		[45]	[1]
C40 Cities	Climate Leadership Group		[46]	
Senseable City Lab (MIT - SCI)	MIT		[47]	
Urban Sustainability Initiative (CUS)	Columbia University Sustainable Earth Institute		[48]	
Urban Liveability Index (ADB - ULI)	Asian Development Bank		[49]	[50]
Urban Liveability Index (UN-ESCAP, ULI)	United Nations Economic and Social Commission for Asia		[51]	[52]
Human Development Index (HDI)	United Nations Development Program		[53]	
Unban Health Equity Assessment Tool (HEART)	World Health Organization		[54]	[36]
Global Urban Indicators Database (GUIA - DB)	United Nations – Habitat		[55]	
City Resilience Profiling Program (CRPP)	World Bank City Level	[56]	[57]	
SDG Local Data Action Initiative (SDG–LDAI)	Sustainable Development Solutions Network	[58]	[59]	
City Sustainability Index (CSI)	Academic Consortia		[60]	
Urban Equity Index (UEI)	UN – Habitat		[18]	[61]
Inclusive Cities Index (ICI)	Ford foundation	[62,63]	[30]	
Urban Innovation Index (UII)	Bloomberg Philanthropies Urban Innovation		[64]	

Table 2. Mapping of synonyms focus domains to major focus domains

Synonyms focus domain	Major focus domain	Associated SDG
• Environment [18,49,60] • Environmental sustainability [25] • Environmental health [48,37,54] • Environmental Quality [37] • Environmental performance [37] • Climate [46] • Pollution [37] • Sustainability [25] • Sustainable Development [51] • Planet-like environment quality [25]	Environmental quality assessment	SDG 14 SDG 15
• Infrastructure [21,49,55,65] • Public services [32] • Mobility [41] • Housing [66,55] • Connectivity [30] • Urban design like urban physical infrastructure [24] • Smart infrastructure [27] • Public space [66] • Accessibility like transportation [30]	Infrastructure	SDG 9
• Stability [21] • Safety [43] • Personal safety [43] • Crime [43]	Safety	SDG 16
• Cost of living [35] • Price like living cost [35]	Cost of living	SDG 10 SDG 11
• Healthcare [19] • Health security [43] • Health equity [19] • Health [19,65] • Social determinants [19]	Healthcare	SDG 3
• Education [19] • Intellectual capital like knowledge and skill building [67] • Human capital like education and skill explicitly [40]	Education	SDG 4
• Culture [19] • Cultural interaction [24] • Urban appeal like urban lifestyle S[26] • Cultural dimension [26]	Cultural vibrancy	SDG 10
• Technology like smart systems and ICT [27] • Urban sensing [47] • Digital safety [43] • Innovation like smart governance [44,46]	Digital connectivity	SDG 9 SDG 17
• Climate action [45] • Resilience [56,59] • Urban resilience [48,56]	Climate resilience	SDG 13
• Mobility like cycling and walking [42] • Non-motorized transport [42]	Mobility, non-motorized	SDG 9 SDG 11
• Political stability [43] • Political implementations [51] • Governance [55] • Political governance [18]	Political stability	SDG 10 SDG 11 SDG 16
• Inclusiveness [49,59,30] • Community engagement • Inclusion [30] • Livelihood like economic social well-being [31,51] • Equity [18,31,60] • Wealth [65] • Economy [60] • Sustainable Development [51] • SDG localization [59] • Prosperity like economic social equity [18]	Social Equity factors	SDG 1 SDG 5 SDG 10

Synonyms focus domain	Major focus domain	Associated SDG
• Tourism [46] • Tourism appeal [46]	Tourism	SDG 8 SDG 12
• Innovation capacity [40] • Innovation [44] • Research and Development [24] • Civic solutions like urban services [18] • Intellectual capital [24]	Innovation capacity	SDG 6 SDG 9 SDG 11

Table 3. Categorisation based on state of origin, institution cluster, scope and focus domain

State of Origin	Liveability Index	Institution cluster					Scope				Focus domains													
		Academic Institutions	Financial Institutions	Inter-governmental	Private Consultants	Research Institutions	Global	National	Metro/City-Level	Neighbourhood	Env. Quality Assessment	Infrastructure	Safety	Cost of living	Healthcare	Education	Cultural vibrancy	Political stability	Climate resilience	Digital connectivity	Tourism	Mobility, non-motorised	Innovation capacity	Social Equity factors
UK	GLI				✓		✓					✓	✓											
	Monacle QoL				✓		✓										✓							
	CWI				✓		✓					✓			✓									✓
	EISC – SCI				✓		✓						✓		✓			✓		✓				
USA	ULF		✓				✓				✓		✓									✓		✓
	GCI				✓		✓					✓												
	MM				✓			✓																✓
	Mercer QoL				✓		✓					✓												
	UMSC					✓	✓					✓												
	P&C Cities					✓	✓															✓		
	GCI		✓				✓													✓				
	GDCI		✓				✓														✓			
	ULI - LI					✓			✓			✓												✓
	SCI	✓							✓											✓				
	CUS	✓							✓		✓								✓					
	CRPP		✓							✓								✓	✓					
	ICI				✓		✓																	✓
	HDI			✓				✓							✓									
	UII					✓		✓															✓	
Kenya	CPI			✓			✓				✓							✓					✓	✓
	GUIA - DB			✓			✓					✓												
	UEI			✓						✓														✓
Asia Pacific	ADB - ULI		✓				✓				✓	✓												✓
	UN-ESCAP ULI			✓				✓			✓													✓
Switzerland	IMD-SCI	✓					✓					✓								✓				
	HEART			✓						✓	✓				✓									
Japan	GPCI					✓	✓					✓					✓						✓	
	CSI	✓							✓		✓													✓
France	BLI			✓				✓								✓								
	GTCI	✓						✓								✓							✓	
Netherlands	SCI				✓		✓				✓													
Spain	CIMI	✓					✓								✓		✓							
Serbia	Numbeo QoL				✓			✓						✓										
Germany	SGI				✓				✓		✓													
Global	COI				✓		✓									✓								
	C40 Cities					✓	✓				✓								✓					
	SDG–LDAI	✓								✓								✓	✓					✓
Total		7	5	7	12	6	21	7	5	4	10	10	3	1	5	3	3	4	4	4	1	2	4	11

Table 4. Categorisation based on state of origin, scope, methodology and sampling

		Scope				Methodology				Sampling	
State of origin	Liveability index	Global	National	Metropolitan / City-Level	Neighbourhood	Weightage composite and expert scoring Indices	Statistical normalisation & composite indices	Perception Driven Indices	Single - specific Indices	Sample bin	Sample Sze
UK	GLI	✓				✓				Medium	140 cities
	Monacle QoL	✓						✓		Low	25 cities
	CWI	✓						✓		High	441 cities
	EISC – SCI	✓				✓				Medium	60 cities
USA	ULF	✓					✓			Medium	100 cities
	GCI	✓					✓			Medium	96 cities
	MM		✓				✓			High	150 cities
	Mercer QoL	✓				✓				High	231 cities
	UMSC	✓							✓	Medium	100 cities
	P&C Cities	✓							✓	Medium	90 cities
	GCI	✓							✓	Low	24 cities
	GDCI	✓							✓	Medium	132 cities
	ULI - LI			✓			✓			Low	30 cities
	SCI			✓					✓	Low	10 cities
	CUS			✓					✓	Low	10 cities
	CRPP				✓				✓	Low	39 cities
	ICI	✓						✓		High	252 cities
	HDI		✓				✓			High	189 cities
	UII		✓						✓	Medium	96 cities
Kenya	CPI	✓					✓			Medium	70 cities
	GUIA - DB	✓							✓	High	200+ cities
	UEI				✓		✓			Low	5 cities
Asia Pacific	ADB – ULI	✓					✓			Low	6 cities
	UN-ESCAP, ULI		✓				✓			Low	26 cities
Switzerland	IMD-SCI	✓						✓		Medium	109 cities
	HEART				✓				✓	Medium	55 cities
Japan	GPCI	✓				✓				Medium	120 cities
	CSI			✓			✓			Low	20 cities
France	BLI		✓				✓			Low	38 OECD
	GTCI		✓			✓				Medium	118 countries
Netherlands	SCI	✓				✓				Medium	100 cities
Spain	CIMI	✓				✓				High	165 cities
Serbia	Numbeo QoL		✓					✓		Medium	143 countries
Germany	SGI			✓					✓	Medium	120 cities
Global	COI	✓				✓				Low	30 cities
	C40 Cities	✓							✓	Medium	97 cities
	SDG–LDAI				✓				✓	Medium	70 local
Total		21	7	5	4	8	11	5	13		

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The thirty-seven liveability indices identified followed different methodological approaches for their development. The urban liveability measurement is shaped by the choice of focus domains and the methodological approach. The data interpretation, weightage, and complexity of the information have a significant impact on the liveability index ranking. Grouping the methodology used in liveability indices will provide a clear understanding of the intended application, data sources and analysis process. Based on the methodological approach, the indices are categorised as 1) Weightage composite and expert scoring indices; 2) Statistical normalisation and composite indices; 3) Perception-driven indices; 4) Single-

specific indices. The Weightage Composite and Expert Scoring Index [13,15] combines expert judgment, incorporating both qualitative and quantitative indicators, with objective data to generate a comprehensive composite score. Statistical normalisation and composite indices [14,68] utilise official statistics to derive quantitative datasets, enabling the creation of comparable indicators that can be adapted across various scales, scopes, and geographies. Perception-driven indices [69,70] rely on public perceptions of their neighbourhood and quality of life and highlight the gap between public satisfaction and the services provided. Single-specific indices [71] focus on in-depth analysis within a specific thematic area, such as climate or environment.

Depending on the methodologies and the scope of the index, the required sample size varies. Sample size is the exact number of samples or data points typically collected, corresponding to the type of units, such as neighbourhoods, cities, regions, and countries. The sample size for liveability indices is crucial, as it directly influences the accuracy and reliability of the results. Statistical reliability and index sensitivity are key to capturing the true conditions of the population. For better understanding, the sample sizes are categorised as low (<50 samples), medium (50-150 samples) and high (>150 samples). The sample size is proportional to the weight of the focus domains and ultimately determines the credibility of the liveability indices.

5. Comparative analysis

The categorisation of 37 liveability indices, identified with respect to State of origin, Institution cluster, Scope, Focus domain, Methodology, and Sample size, is presented in Table 3 and Table 4. From Table 3, it is evident that the indices developed in the UK have considered several focus domains, such as Infrastructure, Safety, Healthcare, Cultural vibrancy, Political stability, Digital Connectivity, and Social equity; however, the environmental quality assessment focus domain is missing from those indices. Notably, all the indices identified in the UK are global in scale and developed by private consultants, given the UK's mostly private-sector economy. Meanwhile, the indices developed in the USA have considered most of the focus domains; however, the focus domains Safety, Cost of living, Education and Cultural vibrancy haven't been considered. It is also noted that in the USA, all institutional clusters are involved in developing liveability indices, covering all scales. In Kenya, only inter-governmental indices are available, at global and neighbourhood scales, covering very few focus domains, such as Environmental quality assessment, Infrastructure, Political stability, Innovation capacity, and Social equity factors. The liveability indices from Switzerland also incorporated four focus domains, such as Environmental quality assessment, Infrastructure, Healthcare and Digital connectivity. In Japan, the liveability indices focused on domains such as Environmental quality assessment, Infrastructure, Cultural vibrancy, Innovation capacity, and Social equity. The liveability indices from France considered only two focus domains: Education and Innovation capacity. The one index identified from the Netherlands has focused on only one domain: Environmental quality assessment. Healthcare and Cultural vibrancy are the two focus domains considered in the liveability index developed in Spain. The liveability index for Serbia includes only one focus domain: Cost of living. The focus domain, Cost of living, is considered only in this national-level liveability index, and the data used for assessment are secondary. The liveability index developed in Germany focuses on Environmental quality assessment, which is a city-level index. The liveability index for the Asia-specific region includes focus domains such as Environmental quality assessment, Infrastructure, and Social equity, with global and national-level coverage. The additional liveability indices, which don't fall under any specific state of origin, are classified as of international origin, and they cover focus domains such as Political stability, Climate resilience, Environmental quality assessment, and Social equity factors.

The liveability indices categorised under academic institutions include global, national, city, and neighbourhood-level indices. The global-level indices focus on Infrastructure, Healthcare, Cultural vibrancy, and Digital connectivity. The national level indices focus on Education and Innovation capacity. City-level indices integrated Environmental quality assessment, Climate resilience, Digital Connectivity and Social equity factors. Neighbourhood level indices consider Climate resilience, Political stability, and Social equity factors. The liveability indices developed by financial institutions were mainly applicable at the global level, with focus domains, Environmental Quality Assessment, Infrastructure, Safety, Mobility (non-motorised), Digital Connectivity, Tourism and Social equity factors. There was one neighbourhood-level liveability under the financial institution cluster, which integrated the focus domains of Political stability and Climate Resilience. Liveability indices categorised under the inter-governmental institution cluster include global, national, and neighbourhood-level indices. Global-level indices focus on Environmental quality assessment, Infrastructure, Political stability, Innovation capacity, and Social equity. National-level indices cover Environmental quality assessment, Healthcare, Education, and Social equity factors. Neighbourhood-level indices focus on Environmental quality assessment, Healthcare, and Social equity factors. The liveability indices categorised under the private consultants cover global, national and city-level indices. Global level indices cover Environmental quality assessment, Infrastructure, Education, Healthcare, Safety, Cultural vibrancy, Political stability, Digital connectivity and Social equity factors. National-level indices concentrate on the Cost of Living and Social equity factors. City-level indices focus on Environmental quality assessment. Liveability indices developed by research institutions are available at global, national, and city levels. Global level indices cover Environmental quality assessment, Infrastructure, Cultural vibrancy, Climate resilience, mobility (non-motorised) and Innovation capacity. The national level concentrates on Innovation capacity, whereas the city level concentrates on Infrastructure and Social equity factors. None of the indices developed by academic institutions include domains such as cost of living, Safety, Tourism, and Mobility (non-motorised). Whereas the indices developed by financial institutions haven't integrated domains such as Cost of living, Healthcare, Education, Cultural Vibrancy, and Innovation capacity. In contrast, liveability indices developed by inter-governmental agencies give due importance to Education and Healthcare. Indices developed by private consultants haven't considered domains such as climate resilience and Tourism. Surprisingly, none of the liveability indices developed by research institutions covered the major focus domains, Education, Healthcare, Cost of Living and Safety. Intergovernmental institutions like the UN provide basic services, equity, and governance, whereas private consultancies like EIU emphasise culture, stability, and amenities.

The liveability indices are classified into four levels based on the scope and coverage. None of the global-level indices covers the Cost of Living. In contrast, the national-level indices prioritise focus domains such as Healthcare and Education,

which reflect the Cost of Living and Social equity factors. City-level indices focus on Environmental Quality assessment, Infrastructure, Climate resilience, Digital connectivity and Social equity factor. At the neighbourhood level, it influences policy and culture and concentrates on focus domains such as Healthcare, Education, Political Stability, Climate Resilience and Social equity factors. Climate resilience and Social equity factors are common in city- and neighbourhood-level indices.

The quantification processes of each liveability agency are data driven. They are broadly categorised into numerical data models, ground observations, cloud-sourced data, satellite imagery, and official census databases. Depending on the methodology adopted, liveability indices are classified into four categories as explained in section 4. The methodologies for indices range from quantitative metrics to mixed-methods approaches. Global-level indices have adopted all four methodologies for developing the liveability index. Global-level focus domains ensure universally measurable aspects and statistical consistency. National-level indices are mainly normalised statistically to derive the composite index. City-level and neighbourhood-level indices adopted single-specific indices. Neighbourhood-level focus on local nuances by participatory mapping, yielding insights and field audits. The analysis of these four methodological groupings reveals that many approaches combine statistical data with surveys, assigning weights to each focus domain. Notably, statistical methods provide transparency into the selection of focus domains and the allocation of weightage. Meanwhile, perception-driven indices effectively capture service satisfaction and public sentiments, while single-specific indices identify targeted interventions for priority areas. The sample sizes are greatly varied depending on the scope and coverage. For global and national-level indices, clear patterns have emerged regarding the sample size, which varies between low, medium, and high. City- and neighbourhood-level indices have sample sizes ranging from low to medium. This section provides a detailed comparative analysis of thirty-seven liveability indices with reference to the inclusion of multiple focus domains.

6. Discussion

The comparative analysis from Table 2 of liveability indices demonstrates the use of synonyms to represent specific focus domains. The study identified fourteen major focus domains, out of which eight focus domains are in direct relation to SDG 9, SDG 10, and SDG 11, and indirectly connected with SDG 6 and SDG 17. Hence, it is evident that the urban liveability assessment aligns with the UN-SDGs and promotes policy congruence, adapting to regional and local needs.

From Table 3, it is evident that the major focus domains like Environmental quality assessment, Infrastructure, Healthcare and Social equity factors are commonly considered in most of the indices, irrespective of their scope and coverage, and have received universal consensus. Additional focus domains, such as Safety, Cultural vibrancy, and Education, also emerged as pillars of the regional liveability framework and are directly connected to the UN-SDGs. These major focus domains serve as the foundation pillars, which are aligned with the UN Sustainable Development Goals [72] such as SDG 14 and 15, SDG 9, SDG 3, and SDG 5 (Gender Equality) and 10, respectively. The comparative analysis also shows that individual indices cover a maximum of four focus domains, such as the Economist Impact Safe Cities, World Bank ULF, and UN-Habitat CPI. The remaining indices focused on fewer than 4 focus domains. The focus domain, Tourism and Cost of living, was solely considered by indices, Mastercard GDCI and Numbeo QoL, respectively. The focus domains considered by the indices are a reflection of the local context, the organisation's goal, and regional priorities. It is also observed from Table 3 that the private consultants and intergovernmental organisations dominate the global urban well-being assessment and ranking. This is giving urban areas the privilege of intensive growth and competitiveness models, at the same time marginalising local, regional, and community-driven practices.

The comparison in Table 4 reveals diverse approaches to scope, methodology, and sampling for liveability indices, ranging from global composite indices to national statistical methods. Similarly, the sampling sizes varied widely, from case studies of a few cities to large-scale datasets. Across varied methodologies and sampling sizes, Environmental Quality Assessment, Infrastructure, Healthcare and Social Equity factors are fundamental pillars for measuring liveability. These four pillars provide a strong foundation for a universal liveability framework that aligns with UN-SGDs, which are linked to urban policy and local contexts.

7. Conclusion

The urban liveability concept has evolved since the 1996 UN-Habitat II Conference, from traditional economic metrics to a broader framework that examines the quality of life in geographic locations. Each liveability index offers valuable insights into urban quality of life, presents its unique vision, and aims to provide a universally accepted framework. The diversity of methodologies and data sources across organisations makes the unification of the liveability assessment framework impractical. In the developing world, urban liveability therefore requires a diverse framework that would address the local, regional, environmental, and cultural parameters in depth and then synthesise them to give a comprehensive overview of quality of life. Additionally, the scope of the framework would be strengthened if inclusivity and the SDGs were integrated into it and helped address the gap in the liveability framework.

The current study aimed to decode the framework of the 37 liveability indices based on their state of origin, organisation, scope and coverage, focus domain, methodology, and sample size. It was noted that each of the indices focuses on a single to a maximum of four focus domains, and sidelines several critical focus domains. The study provides a comprehensive list of 14 focus domains that would serve as a foundation pillar for developing new and enhancing existing liveability indices. The study also identified four critical focus domains adopted by most liveability indices, including Environmental quality assessment, Infrastructure, Healthcare, and Social equity factors. which could serve as a base for additional focus domains to capture local priorities. The study's outcomes would help policymakers, researchers, and academicians consciously select the focus domains while developing frameworks for assessing liveability. The significant findings of the study are listed below:

- The study identified fourteen major focus domains for liveability assessment, such as Environmental quality assessment, Infrastructure, Safety, Cost of living, Healthcare, Education, Cultural vibrancy, Political stability, Climate resilience, Digital connectivity, Tourism, Mobility (non-motorised), Innovation capacity and Social Equity factors.
- The comparative analysis also revealed four common focus domains adopted in all liveability indices,

irrespective of state of origin, institutional cluster, scope and coverage, methodology and sampling, etc.

- The identified focus domains are closely intertwined with the UN SDGs, and this harmonisation moves the process of urban assessment beyond simple ranking and towards policy congruence.
- The clustering of liveability indices into the institutional clusters has demonstrated how urban well-being is influenced by the Liveability indices, which private consultants fund. This dominance shaped global narratives of indices, which often privilege cities with intensive growth models. The community-driven and adaptive practices are marginalised in the process.
- The comparison of scope, methodology, and sampling confirms that while methodologies vary, common focus domains like environment, infrastructure, healthcare and social equity factors consistently emerged as the pillars of liveability assessment that can be directly adopted into universal liveability assessment.

The research highlights the non-neutral exercise of liveability indexing, but also a tool that shapes the global urban areas, which are growing rapidly. The future framework should integrate citizen-centric indicators, moving beyond consultant-driven evaluations that could cater to both overexploitation and the regional-adoptability framework. By recalibrating liveability indices to balance a sustainable environment, adequate infrastructure, social equity, and quality of living can evolve into context-sensitive (regionally specific) and inclusive to achieve urban resilience and Quality of Life (QoL).

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