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Review

Residents' Quality of Life in Smart Cities: A Systematic Literature Review

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Abstract: Despite its popularity in urban studies, the smart city (SC) concept has not focused sufficient attention on citizens' quality of life (QoL) until relatively recently. The aim of this study is, therefore, to examine the concept of QoL in SCs using a systematic review of 38 recent articles from 2020–2022. This includes definitions and concepts, indicators and domains that are used to measure QoL, and the typical research methods that are used to collect data. The review analyses some of the main themes that emerge from the field of SCQoL which include smart urban governance, sustainability, smart living, participation, and social inclusion. The findings from this SC and QoL research can help city planners to prioritize which domains are the most important or meaningful for citizens and which services to invest in. It has been suggested that smart living is the most important domain of a SC. However, various studies have found that citizens experience SC initiatives holistically and that QoL is quite dependent on context in terms of priorities. Therefore, citizen participation strategies should be tailored and adapted to each respective context. SC governance also needs to be more long-term and strategic with real evidence that citizens are involved in decision making and problem solving and are not just passive recipients.

Keywords: smart cities; quality of life; indicators; citizens; governance; smart living

1. Introduction

The smart city (SC) concept emerged as a new trend to answer challenging issues related to urban development. It has been suggested that the focus of SCs is switching from infrastructure supply-oriented approaches to improving citizens' quality of life and sustainability [1]. Transformation of a city system into a smart system is meant to improve the quality of life for its people and their way of living, its environment, economy, transportation, and governance [2]. It has been argued that innovation for the sake of innovation is not smart, but rather that a SC is intertwined with and responsive to its community [3]. A SC should be an urban area with accessible and secure ICT infrastructures, reliable and efficient physical infrastructures, productive and innovative economy, equal and inclusive society, sustainable and resilient environment, and participatory and transparent governance [4]. Research confirms that the basis of smart cities is the combination of human capital, social capital, information, and communications technology infrastructure in order to generate economic development and improve the wellbeing and quality of life [5,6]. Thus, reference is increasingly made to "quality-life oriented smart cities" [7], "human smart cities" [8], "citizen-centric smart cities" [9], "people-centric smart cities" [10], "happiness driven smart cities" [4], and "smart age-friendly cities" [11,12]. It has frequently been argued that the

enhancement of quality of life, liveability, and wellbeing should be the primary goal of SCs [10,13–16].

However, previous studies have often not focused specifically on quality of life and citizen-centric issues. It has been stated that smart cities did not always reach their objectives because they did not take into consideration the needs of citizens [17]. One systematic review of SCs showed that research on humans was the least important (8.1%) [1]. Our study, therefore, focuses on SCs and quality of life specifically. A systematic review was conducted to identify the main themes and topics that are discussed in recent SC and QoL articles, as well as identifying which tools and indicators are used to research the relationship between smart cities and residents' quality of life.

The structure of the paper begins by discussing the screening process for the collection of relevant articles based on inclusion and exclusion criteria. This is followed by a quantitative and qualitative analysis of the articles based firstly on keywords and abstracts and followed by a closer reading of the selected relevant texts. The main findings of the articles are summarized thematically, and recommendations are made for future research, especially those studies that aim to measure citizens' quality of life in SCs.

2. Materials and Methods

Firstly, a bibliometric review was conducted using the Bibliometrix package and the Web of Science Core Collection. Several keywords were used in addition to 'smart city', including 'urban ICT', 'urban computing', 'urban planning', 'urban design', 'sustainable cities', 'urban sustainability', 'sustainable urban development', and 'smart sustainable cities'. Keywords from 1357 articles were analysed resulting in the identification of the most frequently occurring words dating back to 2005. It could be seen that a large number of articles focused on environmental issues and ecology, but relatively few mentioned quality of life until around 2014, and social sustainability was not a major focus until 2017. This suggests a gap in the research for an analysis of issues that are important to local residents. It was also observed that the term 'quality of life' (QoL) is used much more frequently than 'wellbeing' in SC articles. Recent articles start to emphasize the importance of quality of life from 2018 and 2019 [1]. The systematic review in this article, therefore, aimed to build on but not to duplicate the most recent studies of SCs and QoL. Studies undertaken since 2019 concluded that quality of life had become a central priority in SC studies [18–20]; however, there was still no clear definition of what QoL means in the context of SCs [20].

Following on from the latter studies, the articles selected for systematic review in this paper were published between 2020 and 2022 (i.e., the most recent and up-to-date articles focusing on SCs and QoL at the time when the close analysis began). The screening procedure was conducted with the pre-defined keywords 'smart city' and 'quality of life', and the process was based on the PRISMA model (Figure 1). The titles and abstracts of the collected articles were screened, duplicate items were removed, and irrelevant articles were excluded. The criteria for inclusion and exclusion are discussed below. The review resulted in 38 articles.

The aims of the systematic review were the following:

- To define quality of life in the context of smart cities;
- To observe the main tools and methods used to research quality of life in smart cities;
- To analyse the most important domains and indicators that are used to measure quality of life in smart cities;
- To discuss the main themes that emerge from studies about the relationship between smart cities and quality of life;
- To identify gaps and avenues for future research using the optimum combination of research methods, tools, and indicators.
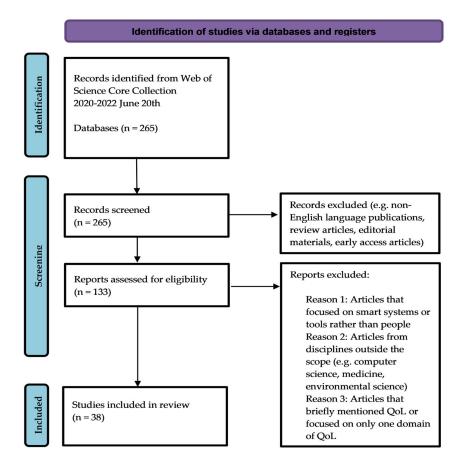
Figure 1. PRISMA model. Source: Authors' own (2023).

This research takes a predominantly social science perspective; therefore, articles were excluded if they were very technical (e.g., from Computer Science journals), or based on environmental or medical science. The articles needed to be focused specifically on citizens or residents and their quality of life and not (only) on smart tools or systems (e.g., those based on cloud computing, sensing gadgets, grids, or the development of mobile applications). Several themes were of particular interest to the researchers:

- Studies of cities that measure and compare factors that affect residents' quality of life in smart cities (SCs);
- Articles about the relative importance of factors and domains of SCs for citizens, including economics, mobility, environment, and governance;
- Articles that include and define 'smart living' (defined as creating liveable and safe cities [7] that enhance lives and tackle social challenges [13]);
- Articles exploring residents' perceptions of usefulness of smart city systems, services, and applications;
- Articles focusing on citizen engagement and participation in smart city developments;
- Articles about social inclusion and under-represented groups in SCs (e.g., aging residents and migrants);
- Articles that analyse the role of citizens in policy making and decision making within smart-city governance;
- Articles that discuss the relationship between SCs, residents' wellbeing and sustainability or resilience.

3. Results

The following section analyses the selected 38 articles in terms of the journal of publication and the geographical location(s) in which the studies were undertaken. It should be noted that some articles are not place-specific, and others compare several

cities globally, regionally, or nationally. It is also common to compare more than one case study in different countries. Some authors refer to good practices in specific cities but do not undertake primary data collection there. The geographical analysis is followed by a discussion of definitions of smart cities and how they relate to quality of life. This is important because many of the definitions include domains and indicators that are used to measure quality of life (QoL) in SCs. The analysis also considers the main research methods and tools that are used to undertake research on QoL in SCs. This is especially useful for future research directions and finding the optimum methods or combination of methods for data collection. Following the research methods, a section is dedicated to domains and indicators that are used to measure QoL. This is important for the design of questionnaires which are statement-based or for comparative analyses and evaluations. The second part of the review analyses the articles thematically based on topics that emerged from a quantitative analysis of Keywords and Abstracts. A closer reading of all 38 articles also confirmed the choice of main themes.

3.1. Place of Publication

Figure 2 shows the journals in which the articles were published. It can be seen that Sustainability is by far the most popular. This may be because of the ease and speed of publication, but it also indicates the close connection between SCs and sustainability. This is also clear from the second most popular journal, which is Sustainable Cities and Society.
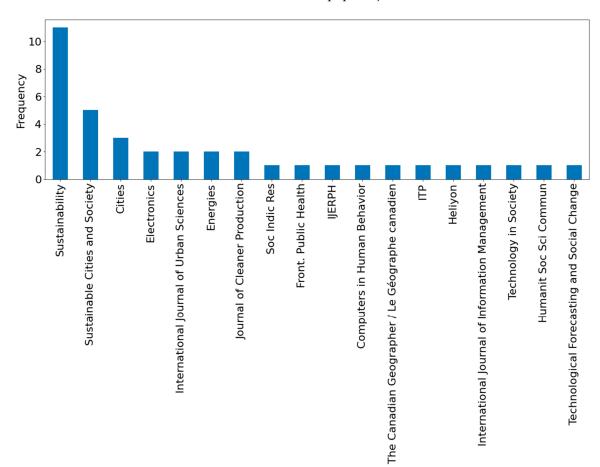

Figure 2. Journals in which the articles were published. Source: Authors' own (2023).

3.2. Location of Studies

The geographical spread of the articles can be summarized according to regions, countries, and specific cities. Worldwide research was carried out in large cities, e.g., a comparison of nine smart cities [21]. Only a few authors undertook research on a global

scale and compared cities worldwide [22,23]. Others provided more general literature reviews or analyses that did not specify location [8,24]. The majority of the research was undertaken in European cities (32) as shown in Table 1. Some of the studies compared a number of European cities; for example, one study analyses forty European cities [7]. Other researchers compared several cities in one country, for example, 78 cities in the United States [25] and 76 Polish cities [26]. The other studies focus on specific cities or compared two cities. Table 1 summarises the exact locations in which the studies took place.

Table 1. Locations of the studies. Source: Authors' own (2023).

Region	Country	City or Cities
Asia	China	Chongqing
Asia	China	Hong Kong
Asia	China	Macao
Asia	China	Shanghai
Asia	Iran	Tehran
Asia	Korea	Cheonan, Jochiwon, Pohang
Asia	South Korea	Seoul
Asia	Qatar	Not specified
Asia	Taiwan	Not specified
Asia, Europe	Taiwan, Holland	Taiwan and Utrecht are cited as good examples
Central America	Colombia	Medellin
Europe	Belgium	Leuven
Europe	Belgium and Sweden	Namur (Belgium) and Linkoping (Sweden)
Europe	Greece, Portugal, Spain, UK	Athens, Lisbon, Barcelona, London
Europe	Italy	116 cities
Europe	Poland	Cracow
Europe	Poland	Olsztyn
Europe	Poland	76 cities
Europe	Portugal	Evora and Cascais
Europe	Portugal	Evora
Europe	Spain	Barcelona, Granada, Madrid, Malaga, and Santander, Valencia
Europe	Romania	30 cities
Europe	Russia	St. Petersburg
Europe	UK	Manchester
Europe	14 countries	40 cities
Europe, North America	15 European countries, USA, Canada	21 cities in Europe; 19 cities in the U.S.; 5 cities in Canada
Europe, North America	USA and 8 European countries	Amsterdam, Barcelona, Berlin, Budapest, Helsinki, London, Moscow, Vienna and New York
Global	Countries from Asia, Australia, Europe, North America, Oceania	44 cities from the Global Power City Index (GPCI) Yearbook
Global	Countries from Asia, Australia, Europe North America	London and Vienna are highlighted as good examples

Table 1. *Cont.*

Region	Country	City or Cities
Global	OECD countries	Not specified (overview of indicators)
Global	Not specified	Not specified (literature review)
Global	Not specified	Not specified (literature review)
North America	Canada	Guelph
North America	Canada	Kitchener
North America	Mexico	Puerta Vallarta
North America	USA	Chattanooga
North America	United States	78 cities
South America	Brazil	Natal

3.3. Definitions of Quality of Life (QoL) in the Context of Smart Cities (SC)

QoL of an individual may be determined by their physical health, psychological state, level of independence, and social relationships [13]. QoL is defined as smart-city services that enhance standards of living [27] using advanced integrated services based on information and communication technologies and the intelligent use of urban infrastructures for improving the QoL of its citizens [28,29]. This can include a number of factors including economic, environmental, transportation, and governance [2], aiming to increase the efficiency and effectiveness of municipal services and facilitating private investment [30]. Other authors added social cohesion and participation, consumption of resources and preservation of the environment, as well as spatial development and building [9]. It is recommended that efficient public governance can help to reach a higher level of QoL by providing a transparent, collaborative, participatory, communicable, and accountable government [13]. Overall, QoL should be a significant goal of smart living, which is influenced by security, education, healthcare, and tourism [23]. Definitions of SCs that refer to QoL are summarized in Table 2.

Table 2. Quality of life-related definitions of smart cities. Source: Authors' own (2023).

Author(s)	Year of Publication	Quality of Life-Related Definitions of Smart City
Edge et al. [30]	2020	"In general, the smart city places innovation at the center of regenerative thinking to optimize urban infrastructure, improve sustainability, and enhance quality of life through the growth and uptake of information and communication technologies (ICTs)" (p. 1).
Ortega-Fernandez et al. [31]	2020	"a successful Smart City must contribute optimally to the improvement of economic competitiveness, quality of life, mobility, and sustainability by its government or public administration" (p. 7).
Szarek-Iwaniuk and Senetra [32]	2020	"A smart city is characterized by sustainable economic development and a high quality of life, which are driven by investments in human and social capital, traditional (transport) and modern (ICT) infrastructure, responsible resource management, and social participation" (p. 4).
Cantuarias-Villessuzanne et al. [2]	2021	"Smart living examines the use of ICT for achieving quality of life in a liveable and safe environment [. . .]. This smart city dimension is mainly divided into four characteristics: Security, education, healthcare, and tourism" (p. 4).
Chen and Chan [13]	2021	"SCD [Smart City Development] seeks to implement smart solutions to improve the public infrastructure and services delivered to citizens, thereby enhancing their lives and tackling social challenges" (p. 264).

Table 2. *Cont.*

Author(s)	Year of Publication	Quality of Life-Related Definitions of Smart City
Csukás and Szabó [21]	2021	"Improving the quality of life of citizens is a central concept, and we assume it to be an ultimate goal of SC developments" (p. 3).
Bielinska-Dusza [33]	2021	"The basic emphasis in the smart city concept is on enhancing the quality of life of a city's inhabitants, improving the city's functioning and on the more effective use of available resources in shaping urban space" (p. 5)
Helbing et al. [16]	2021	"It must also be considered that a merely data-driven approach may eliminate desirable qualities, which may affect anything from human dignity to culture to quality of life" (p. 4)
Ji et al. [10]	2021	"Although global cities have different endowments on SC [Smart City] development and SC services provision, one common theme of SC development has been widely acknowledged: SC development should be people-centric, serving the needs of local citizens with the wider aim of improving their well-being and quality of life" (p. 2).
Ligarski and Wolny [26]	2021	"The quality of life in the city is the whole of the living conditions of individuals and communities, shaped in the social, economic, environmental and awareness dimensions in a specific space of a territorial unit, which in an objective and subjective (quantitative and qualitative) perspective determine the sense of satisfying the needs and fulfilling life aspirations in a given place and time" (p. 4).
Vidiesova and Cronemberger [3]	2020	"Enhancing citizens' quality of life and experience with city services is often regarded as the ultimate goal for smart city initiatives" (p. 3).
Shami et al. [9]	2020	"Urban smartization will ultimately improve quality of citizens' lives (smart living)" (p. 2).
Zhu et al. [4]	2022	"Happiness Driven Smart City (HDSC) can be interpreted as a city guided by the overarching goal of improving human happiness in the prevailing digital transformation brought by technology" (p. 4).

In summary, it can be seen that some definitions emphasize the central significance of QoL in SCs, arguing that it should be the main aim of SC development [9,10,21,34]. Frequently, QoL is positioned alongside other important domains as a major goal of SC development such as sustainability, resource management, economic competitiveness, mobility, or social participation. It is sometimes described as being synonymous with so-called 'smart living' [9], which helps to create liveable and safe cities [7] and to enhance lives and tackle social challenges [13]. Technology is viewed as a tool to improve citizens' lives rather than an end in itself [7,9,30]; indeed, a data-driven approach is seen as being potentially detrimental [16]. Overall, a consensus is emerging that the human factor is more important than the technological factor in SCs [26].

3.4. The Most Common Research Methods used in Quality of Life Research in Smart Cities

An overview of research approaches to SC and QoL studies is provided in Figure 3. Table 3 indicates in more detail some of the most common research methods used. Case studies are often employed because most SC studies focus on a particular context, namely, a smart city or a comparison of smart cities. However, within the case studies, several research methods are used, and it is common to employ mixed methods.

The most common research methods involve either questionnaires with local residents or a form of content or text analysis. It is unsurprising that QoL research often employs questionnaires that focus on subjective wellbeing and citizens' perceptions of domains of SCs. In addition, focus groups and netnography can be used to collect opinions from local citizens. However, it is also important to take into consideration more objective measures and indicators which may be of a quantitative nature. For example, some authors collect and analyse indicators and sub-indicators relating to smart buildings, resource management, energy consumption, transportation systems, healthcare, and smart infrastructure, amongst others [15,35]. Others analyse policy and strategy documents and

reports which connect their research to smart governance, urban planning, management and resilience [14,21,34,36]. Sometimes the document analysis was quite specific, e.g., documents referring to inclusive smart cities [28]. In addition to in-depth interviews, focus groups, workshops, and Delphi studies, other ways of eliciting data from professionals included cognitive mapping research, which involved panel discussions with groups of experts [37–39]. Table 4 provides a summary of some of the main domains and indicators that are included in this research.
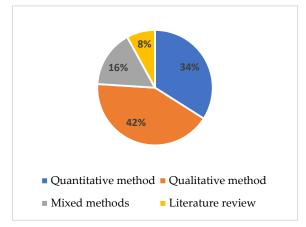

Figure 3. Overview of research approaches. Source: Authors' own (2023).

Table 3. Summary of research methods used. Source: Authors' own (2023).

Methods Used	Number of Papers	Notes
Literature review or systematic review	3	Covering definitions and dimensions of smart cities, as well as policy and values.
Application of theory, a concept, or a model	2	One paper used Maslow's hierarchy of needs; the other developed a Happiness Driven Smart City (HDSC) model.
Content or text analysis	8	Usually involves official document analysis (e.g., policy, strategy, etc.).
Netnography (e.g., social media analysis of comments)	2	Examples include citizens' big data in Seoul and Chinese micro-blog Weibo.
Analyses of indicators, evaluation criteria or rankings (applied to cities)	5	In some cases, the literature is used to create new indicators.
In-depth interviews	4	Interviews are usually with expert stakeholders or officials involved in city development.
Questionnaires with citizens	7	Sample size ranges from approximately 400–800 citizens.
Questionnaires with expert stakeholders	2	Examples include municipal offices and civil servants.
Focus group with citizens	2	For example, with elderly residents and 18+ citizens.
Focus group with expert stakeholders	3	Sometimes includes academics as well as policy makers or businesses.
Delphi study (with experts)	1	Undertaken with 17 tourism specialists.
Other methods, e.g., cognitive maps; the DEMATEL technique; Design Science Research (DSR); the Analytic Network Process (ANP); risk assessment; innovation biography	6	Many of these approaches used mixed methods within the actual research. For example, innovative biography includes document analysis, case studies, network analysis, and interviews with key actors. DSR includes citizen questionnaires, interviews, and thematic content analyses.

Table 4. Summary of smart city domains and indicators. Source: Authors' own (2023).

Domain of Smart Cities	Examples of Indicators
Smart economy	Investment, competitiveness, and entrepreneurship [35] Housing, jobs, and entrepreneurship [15] High levels of innovation [39] Productive and innovative economy [4]
Smart governance	Public services, taxation, and transparency of data [35] Transportation, data monitoring, internet, and WiFi [15] Access to interaction with the government's relevant authorities [40] Supply of goods and services by government agencies and transparency in public administration [39] Participatory and transparent governance [4]
Smart mobility	Public transportation, infrastructure, and safety [13] Sustainable transportation, traffic control, and ICT infrastructure [36] The adoption of sustainable and eco-friendly transportation systems [36]
Smart environment	Pollution, energy efficiency, and green buildings [35] Including green spaces, pollution, and energy use [15] The adequate management of natural resources [39] Sustainable and resilient environment [4]
Smart people	Social welfare and personal development [13] Human and social networks (healthcare, education, and safety) [18] Creativity, social cohesion, and qualifications [35] Social cohesion and participation [9] Community training and the development of key skills for innovative ecosystems [39] Equal and inclusive society [4]
Smart living	Locals' lifestyle choices and quality of life [7] An individual's way of life and community feelings, image, and pride [4] Culture, healthcare, housing, and social cohesion [8] Housing quality, tourism, cultural facilities, citizen security, and social cohesion [5] Healthcare, education, culture, and safety [9] Improvement of healthcare, education, and social services as well as the enhancement of citizens' participation [10] Social indicators that reflect the quality of life of citizens [6] Accessible and secured ICT infrastructures [11] Reliable and efficient physical infrastructures [11]

4. Discussion

The authors undertook a close reading of the 38 articles to identify recurrent themes that are especially relevant to quality of life. These were the following:

- Indicators and measurement of QoL in smart cities;
- Smart urban governance;
- Smart living;
- Citizen participation and social inclusion;
- Sustainability.

The sections below discuss the chosen themes in more depth.

4.1. Indicators and Measurement of QoL in Smart Cities

One of the most important reasons for undertaking a systematic review was to understand better the domains and indicators that are used to measure and research QoL in smart cities. QoL is clearly a composite and complex field of study and requires the incorporation of multiple domains including both objective and subjective indicators. Some authors recommend a holistic approach to measuring the quality of life including objective indicators (measurable with the available statistical data) with subjective indicators related to feelings and assessments in surveys [26]. It is difficult to summarize which of these domains and indicators are the most important, but a close reading of the 38 articles in the systematic review helped to better understand the relative significance of each domain

and related indicators. It can be seen that many of the authors based their research on previously identified domains of smart cities. The consensus seems to be that the main domains are as follows:

- Smart economy;
- Smart governance;
- Smart mobility;
- Smart environment;
- Smart people;
- Smart living.

The research design on QoL and SCs needs to take into consideration all of these domains, but it is also necessary to decide on their relative importance when designing questionnaire statements or evaluation criteria.

The findings from SC and QoL research can help city administrators or policy makers to prioritize which services are needed most by citizens and are, therefore, worth allocating resources to or investing in [39]. It has been suggested that smart living is the most important domain of a smart and sustainable city followed by a smart economy [20]. The latter authors conclude that cities which have good scores in the smart economy and smart living domains also receive good scores in the general ranking of QoL. Smart governance is ranked the least important. Cities that score highly in smart living tend to be perceived as safe with good healthcare and education systems. Some authors also include religion and tourism in smart living [7]. Other authors focus specifically on risk [40]. Some studies have revealed discrepancies in the perceptions towards quality of life and economy spheres [34]. A study showed that citizens in Macau perceive that smart city development has little effect on enhancing the local economy and economic policies [13]. They were more concerned about improving the physical environment, such as crowding and traffic, waste management, water management, urban planning, air quality, and energy saving.

Research in Seoul, South Korea concluded that the three most important topics were traffic, the environment, and culture [41]. The results in three Korean cities indicate that citizens perceive smart cities as a means of improving their safety, convenience, and their local environments [42]. In a comparison of Taiwanese cities, researchers showed that citizens expressed the most concern for smart safety, smart transportation, a smart environment, and smart healthcare [10]. One study concluded that the most important four pillars related to people's involvement in constructing an intelligent, informed, educated society, followed by preserving the environment and managing energy sustainably, as well as mobility, transportation, and sustainable economic development [37]. In Poland, the top four areas that have the greatest impact on QoL were identified as being living conditions in the city, public safety, education, and housing [26]. In Iran, it is thought that using smart equipment, as well as modern and innovative methods in developing society's health and hygiene will have the greatest impact on improving quality of smart living [9]. In the category of safety, it was noted that cybersecurity can be one of the most important perceived risks in cities [42].

At this point, it is important to mention the themes of surveillance and privacy, as they emerge from several of the studies as being important issues that affect residents' security [7,31,34,37]. Some authors emphasize risks associated with data privacy and protection [40]. In the domain of healthcare, it is considered especially essential to ensure information security and strict privacy protection [4]. Positive aspects of surveillance refer to greater efficiency, decreasing crime, or easing government services [21], and to help improve the safety and stability of the social environment [10]. It has been stated (especially in North American studies) that protecting privacy is a requirement of governance 3.25, and that official citywide privacy policies should be developed to protect confidential citizen data [15]. It is rare that privacy is not considered important by citizens [43], but some articles did not specifically refer to surveillance or privacy [44,45]. However, even in some studies that did not include privacy issues, there was an acknowledgement that future research should consider personal privacy and security [13]. Nevertheless, it is clear that

there is more concern about surveillance in Asia, especially in China [46], and among older residents there [12].

It seems from the various studies that QoL is quite dependent on context in terms of priorities [42]. Smart cities cannot reach their objectives if they push technological solutions without taking into consideration the specificities of the territory and the people living in it [17]. It was stated that each city has its own unique characteristics; therefore, citizen participation strategies should be tailored and adapted to each respective context [46]. It is necessary to perceive each city individually and to recognise the interdependence between variables such as elements, standards, systems, and models that affect social behaviour and cultural change [25]. Some authors found that citizens' needs and priorities may even differ significantly from one municipality to the other [28]. Priorities can also vary depending on the questionnaire sample. For example, it was found that the ideal age-friendly city should focus on social participation, communication, and information, followed by employment, housing, and transportation [11].

On the other hand, it has been argued that citizens experience smart city initiatives holistically, meaning that their experiences are integrated or inter-connected and are not specific to a single city service or function (e.g., transport) [33]. One interesting model to consider for the future could be Happiness-Driven Smart Cities (HDSC) which have been described as having the following characteristics [4]:

- A city with an efficient and green physical infrastructure;
- A city with a labour-friendly and innovative economy;
- A city with an inclusive and attractive society;
- A city with a sustainable and eco-friendly natural environment.

According to the priorities identified above, it would be important to include safety, transportation, healthcare, and education within these categories.

4.2. Smart Urban Governance

Smart governance could be defined as the pursuit of the enhancement of citizens' quality of life, involving a high level of citizen participation, public and non-public collaboration, improving accountability, decreasing costs, and providing excellent service [11,22]. It has been suggested that quality of life in SCs is directly related to government actions, including the interaction between public and private sectors with the goal of promoting sustainable development [44]. It is believed that a better quality of urban living can be achieved by unifying public resources, human and social capital, and information and communication technology. For example, the top ranked cities in a study of 116 Italian cities had recently implemented coherent government policies related to sustainability and quality of life [45].

Smart governance values social engagement and innovative technologies along with the consideration of people's needs. Smarter governance should encourage citizen participation through digital platforms and other channels to ensure that their voices are heard and that their visions are implemented [46]. Some studies showed that the local community's perception of governance is directly affected by transparency, collaboration, partnership, communication, and accountability. Transparent smart governance is the unification of efficient communication [22] and communication channels involving citizens in decision making [5] that results in more democratic participation and partnership. Smart governance includes citizen engagement in addition to e-government. It was found that citizens' engagement is dependent on their maturity and participatory habits, as well as effective communication [3].

Effective SC management should enhance technology infrastructure, engage stakeholders, adhere to strategic, tactical, and operational levels via efficient criticism and feedback, and implement a bottom-up strategy [6,24]. An open citizen service operating system that utilizes automatic classification boosts citizens' participation. For example, in Seoul's digital platform (OTMI), relevant authorities directly answer civilians' comments and complaints about different issues such as traffic issues, environmental issues, safety, and

cultural topics. Smart solutions are beneficial in forecasting bus routes, renewable energy, tackling garbage-related problems, and green spaces (i.e., parks) [23]. Similar positive outcomes of electronic portals were found in Saint Petersburg [9].

Overall, it has been suggested that smarter city governance hears inhabitants' voices and creates participatory channels [15]. Although some studies found that technology and governance are less important than other QoL factors, their influence on cities' management and performance can be significant and should be monitored [37]. A successful SC requires the government or public administration to contribute to the improvement of economic competitiveness, mobility, sustainability, and overall QoL [31]. On the other hand, it has been recommended that governance needs to be more long-term and strategic with real evidence that citizens are involved in decision making and problem solving and are not just passive recipients of information [24]. It has been suggested that in order to improve online responsive governance, the urban government should be data-driven with the assistance of machine learning or Artificial Intelligence [41]. It has been noted that there can be mismatches between citizens' expectations and the smart city policies initiated by the government. It was argued that in some cases, government policies can even become 'too smart' and surpass the needs of citizens [46].

4.3. Smart Living

Smart living is sometimes described as being equivalent to quality of life [23]. Many aspects of citizens' lives including their well-being, security, and economy are influenced by smart developments [30]. For example, a study in Tehran, Iran [9], referred to several factors of smart-living quality, including housing and building, culture, the environment, and natural resources. Some authors have referred to 'smart livelihood', which includes a way of life, opportunities to use smart technology, personal life quality, a feeling of belonging in the city, community pride, and citizens' participation in government decision making [13]. Citizen-centric smart city development (SCD) can incorporate elements of QoL with an emphasis on the demands of residents, whereby municipalities offer and design services and infrastructures that are influenced by their attitudes and preferences. Some of these developments can be practical, for example, the installation of road sensors to assess traffic volume and instantly modify stop-and-go times for cars and pedestrians to reduce congestion. Others relate to more intangible and elusive aspects, such as belonging, community pride, or urban image. It has been proven that age and educational background significantly impact people's support for SCD compared to the other demographic characteristics [13]. Research undertaken in different countries can also yield somewhat different results. For example, surveyed participants' QoL in Poland focused mostly on leisure opportunities, safety, living conditions, transportation, communication, sports, and recreation [26]. One example of leisure spaces that are important to residents are urban parks, especially small neighbourhood parks [47].

A study of Happiness-Driven Smart Cities (HDSC) [4] argues that liveability of the environment and life-ability of residents constitute what they term 'happy urban living':

(1)   Liveability of the environment:

- Ecology (air quality, public green space, etc.);
- Society (equity, safety, supportive relationships, etc.);
- Economy (financial status, housing, employment, etc.);
- Culture (culture and leisure, etc.).

(2)   Life-ability of the person:

- Health (physical health, mental health, etc.);
- Education (schooling, skills, etc.);
- Art of living (varied lifestyle, etc.).

Life-ability basically means providing access to enough resources for an urban inhabitant to acquire new knowledge and skills for enjoying life as well as for self-development. Overall, Happiness-Driven Smart Cities (HDSC) are defined as urban territories that ide-

ally have efficient, green physical infrastructures, innovation, social inclusion, leisure, attractions, and a sustainable environment. Other connected features include an efficient transportation system, real-time monitored reliable energy management, an integrated public unity system, labour-friendly employment, entrepreneurship, education system, healthcare, security, air pollution, and water treatment [4].

4.4. Citizen Participation and Social Inclusion

Past studies have found that different cities can have different priorities. For example, one paper identified four clusters of smart urban forms [5]:

(1) The Green City, targeting environmental issues;
(2) The App city, concentrating on technology innovation and providing related mobile applications precisely for inhabitants;
(3) The Socially Sensitive City, spotlighting equality and incorporating disadvantaged groups' needs;
(4) The Participatory City, underlying citizen participation.

It is important to note the emphasis on citizen participation and social inclusion here. Several authors refer to the significance of social justice and connect it to ethics, inclusion, and social equality [16,21] as well as equitable spatial distribution and socio-economic disparities [47]. It has been argued that technology use should not only be about data collection, which can adversely affect human dignity, culture, and quality of life, but it should help to create a participatory system that promotes democracy, fairness, and social innovation [16]. A citizen-centric SC emphasizes a participation orientation and fulfils the expectations of the local community in the design of SC services and systems [10,32,43]. However, there are still some gaps and discrepancies between perceived SCD from the viewpoint of citizens, public servants [33], and the government [34,46]. Some citizens can be sceptical about governments and not trust them, which is why it can be important to also involve citizens in the design of smart systems [33]. SCD is, to some extent, context-dependent [43], and studies have found that the degree of participation can be affected by national digitalization goals, top-down or bottom-up approaches, the government's agenda, the degree of democracy, legal requirements, the social environment, competitiveness, and the maturity of the population in terms of demographic characteristics, educational levels, and employment rates [10,13]. Other studies have also highlighted differences between age groups as well as geographical locations. For example, in Taiwanese smart cities, respondents aged between 41 and 50 showed many positive attitudes towards SC services compared to younger groups. They marginally favour services and applications connected to "hard" domains, such as smart transportation, energy, and safety, including more specifically welfare, social inclusion, car accidents, epidemic prevention, surveillance services, sustainable freshwater supply, distant medical services, and car-parking. For "softer" areas relating to smart living, smart people, and personal growth, they rather favour non-digital approaches. In South Korean cities, it is especially true of those in poor housing circumstances with less economic stability that they respond best to QoL-related smart projects that respect daily issues and economic growth [42].

Social inclusion is characterized by equality, a balanced city development, and shrinking gaps between various groups with respect to economic conditions, education level, and so forth. The aim is to increase wider social justness. Taking an inclusive approach to SC development puts the welfare, needs, and priorities of citizens first, helping to cultivate social and ethical plurality as well as fostering flexibility, creativity, and open-mindedness [25]. It can involve delivering assistance to vulnerable people including the elderly or disabled, as well as effective settlement policies for immigrants [9]. It is important to identify whose voices are missing, whether they are youth, refugees, or the homeless. For example, there could also be lower usage rates of digital participation platforms among migrants because of language barriers or cultural differences [48]. The following question should be asked: "What does 'inclusion' mean for locals?" For example, is the library or food bank offering good services for disadvantaged populations? [30]. Some authors refer to quality of life

through universal accessibility; for example, they propose hiring more disabled personnel in order to achieve greater social integration with the help of teleassistance and monitoring systems [35]. Another measure that they propose is the installation of more traffic lights with acoustic signals for the blind. Other examples can include the following:

(1) Quality e-health services and projects (i.e., rehabilitation therapy);
(2) Digital inclusion, particularly in less urbanized areas or for less affluent people using, for instance, expanded coverage of Wi-Fi network and broadband;
(3) Information accessible via, i.e., open data, public data, and many other websites or platforms;
(4) Offering convenience through real-time public transportation, car parking etc. [18].

Public engagement and participation approaches vary from a strategy of consultations with ordinary community members to networks with key actors in local communities or discussions with selected private and non-private interest parties [49]. Prevailing participation approaches in Poland span direct and indirect public consultations and meetings that can be via online surveys, voting, or referenda. In some cases, the Public Participatory Geographic Information System (PPGIS) and geo-questionnaires have been used, but this method is less familiar and can be inaccessible and unreadable to locals (i.e., they do not know how to use map-based tools) [32]. It has not yet been proven that online platforms significantly engage citizens, although enhanced public awareness and participation culture can accelerate participation rates. According to users, services provided by digital participation platforms should require no fees, a user-friendly interface, accessibility, and cybersecurity [48].

4.5. Sustainability

It was noted that in research on SCs from 1997 to 2020, the definitions of a SC are very close to those of a sustainable city [14]. Another study proposes that sustainability and equity should be the main strategic component of SC development [35]. Sustainable social services and transportation can be especially influential [45]. For example, user-friendly smart solutions are noteworthy for implementing sustainable public transportation [33]. The combined environment of sustainability and smartness can also serve as a stimulus for a knowledge-based economy [39]. Sustainable smart cities or SSC can become a path to innovation [14], especially in so-called knowledge-based cities where attraction and retention of knowledgeable workers and businesses is desirable. It seems that sustainability is one of the crucial elements of creating a 'people climate' in smart cities and enhancing quality of life. It was shown that smart sustainable cities are mainly connected to socio-cultural contexts and smart living considerations, putting people first, with technology being used as a tool to serve citizens [15]. However, it was argued that smart cities are not yet sustainable or liveable enough [16], and other authors note the need to place community and social needs at the heart of the strategic resilience process in urban sustainability management. One study refers to the UN New Urban Agenda 2030, which prioritizes proper planning and management in cities to ensure a high quality of life, healthcare, safety, and economic development. This includes sustainable urban mobility and social participation [33].

5. Conclusions

This study has shown that quality of life issues ideally need to be central to smart city development. Regardless of the discipline, definitions, or dimensions, the quality of life of people should be inherent in the concept of a SC. Citizens tend to have a more positive attitude and a higher level of support for smart city development if they perceive that it will enhance their way of life, develop their local economy, improve infrastructure, transport management and safety, as well as contributing to community image and pride. City planners and other stakeholders need to be sensitive to human values that reflect the interests of a community. This means creating sustainable and equitable cities built on clear ethical principles, citizenship, and social inclusion. Research on the important domains and

indicators of SCQoL, such as this study, can help city developers to prioritize and invest in those services that citizens need the most.

However, it is important to analyse gaps between policies and practice, as there is still a mismatch between citizens' needs and service design. Although smart governance is not always visible to citizens and is, therefore, not ranked as highly in SC and QoL studies as other domains, it underpins urban development, planning, and management and is often responsible for decisions about the design and implementation of smart systems. It is recommended that city authorities should be more visible and transparent in their actions, providing public information that is available both online and offline. There also is a need to engage citizens in the co-design of smart processes and solutions and to plan more long-term and strategically, rather than focusing on real-time and short-term problem solving. It is necessary to create an effective system of urban management, which creates a productive dialogue between government and society, taking into account the opinions of citizens. However, there can still be barriers because the concept of SCs remains vague or diffuses among citizens, or they may be unfamiliar with tools or systems, especially if they are from socially excluded or disadvantaged groups. Technology may be the most suitable means of communication for younger citizens, but less appropriate for older ones or those from more deprived backgrounds without access to relevant devices. Indeed, it is important overall for city planners and developers to decide how far solutions should be technology-related because residents might prefer non-digital approaches in some areas of smart living.

Research can help city authorities, planners, and developers to create efficient SCQoL systems, processes, and models which provide a means of measuring the importance of different domains of QoL, and identifying appropriate indicators and tools for collecting data and prioritizing the allocation of budgets to services. Mixed research methods appear to be the most informative in order to collect objective indicators, subjective perceptions of both professionals and residents, as well as content-analysing policy documents. Research across several cities and comparative work is invaluable, but it is important to note that one model might not work for all cities and that an adaptation to context is essential. Nevertheless, applying global principles of sustainability or good practice in citizen participation can work well in many different contexts.

Limitations and Future Research

The systematic review undertaken in this paper is relatively limited in terms of the number of papers and the time period in which it was undertaken. The database used by the researchers was the Web of Science and other databases such as Google Scholar and Scopus were not used. The keywords used for searching were somewhat limited and synonyms were not been applied (e.g., wellbeing instead of QoL).

Future research should focus on the extent to which global models of SCs and good practice principles (e.g., sustainability, social inclusion, etc.) can be applied to different contexts. There is scope for more comparative studies across different cities, especially those based on subjective and 'soft' domains of QoL [13,42]. More research should also be undertaken with disadvantaged or excluded groups in society.

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