Review

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Smart City Assessment in Developing Economies: A Scoping Review

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Abstract: There are limited research articles focusing on Smart City Assessment (SCA) applications since it is a relatively new field of research and practice. However, numerous studies have been conducted and published to date, particularly in developing countries, with the broad objective of building theoretical frameworks that are centered on smart city assessments. This scoping review systematically provides an examination on the available literature on SCA, with a goal of synthesizing smart city assessments in developing economies. In order to improve the quality and transparency of the reviews and meta-analysis, as well as to reduce the risk of bias, this paper adopted the PRISMA scoping review research design to analyze 25 journal articles. Results showed that conceptual modeling appears to be the most common method identified while industrial development emerged as the most common objective identified in the MFO Model. On the other hand, ISO 37122:2019 was the most prevalent framework used in the collected sample size with 6 journal articles followed by IoT-Enabled Smart City Framework with 5 journal articles while Smart Cities Index Framework obtained 3. Meanwhile, India emerged as a leader in the global Smart City movement followed by Malaysia and Africa. The Qualitative Research Design approach was the most common among the literatures while social science was the most common subject area among the 25 journals being studied. More so, sustainability and renewable energy are the two most important assessment categories in SCA tools. By collating and evaluating different criteria and metrics in existing SCA, cities can learn from their successes and failures, adjust their strategies, and share best practices with other cities. This can foster a culture of continuous improvement and innovation in urban governance, and ultimately lead to more livable, resilient, and prosperous cities for all.

Keywords: Smart City; Smart City Assessments; Developing Economies; PRISMA; Assessment tools

1. Introduction

A city is generally an urban area in which many people live close together having their own separate governments and systems for maintaining and providing utilities and transportation. Smart Cities are urban communities where information and communication technologies (ICT) are applied to address local issues and promote social, economic, and environmental sustainability [1,3,8,21]. These cities are those who adopt scalable solutions that take advantage of information and communications technology (ICT) to increase efficiencies, reduce costs, and enhance quality of life [2,5]. The lack of global standards for Smart Cities as some dimensions, measures, and indicators are absent, represent negative internal dimensions in smart communities themselves [3,17]. Smart City is defined as a designation given to a city incorporating ICT to enhance the quality and performance of urban services, such as energy, transportation and services in order to reduce resource consumption, wastage and overall costs and yet meet the goals of industries. Recently, Smart Agriculture and Smart Health were included in the concepts of Smart City technology. [31]– [33]

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Smart Health was noticeable during the pandemic with the introduction of online consultations and modern medical technologies The Smart City technologies are also relevant in the development of city logistics to ensure efficient levels of services of a city's intermodal logistics network system. There are several references on the concepts of Smart City technologies. Albeit the benefits of Smart City, there are some concerns that need to be addressed, such as the following: infrastructure, security and hacking, privacy concerns, educating and engaging the communities and social inclusiveness. Perhaps, the tool that this study is looking at may be relevant in addressing the main issues in Smart City developments, notably in developing economies. Likewise, it may also be useful in ascertaining what in-deed will be appropriate for urban areas or cities. This section would now further elaborate on the approach used in this study.

There are several stages to Smart City processes, including starting, planning, project development, assessment, and evaluation, as well as communication of data and information related to the Smart City strategy with each phase having its own unique activities that characterize and serve each phase. To further understand the concept of Smart City technologies, the SCA tool may be employed in order to evaluate the performance of a certain indicator in the scope of a Smart City concept implementation [1]– [4]. More so, Smart City tools can also be used to present city rankings, revealing places for certain activities, which in turn can be a central instrument for assessing the attractiveness of urban regions [31,39,40]. In principle, two major approaches to the study of SCA tools can be distinguished; focused on providing an overview of the tools; and, involving more detailed analyses of the tools to better understand their thematic focus and the typology of their indicators [1,2,3]. The assessment of cities' smartness has received much more attention in recent years, but very few studies have analyzed SCA tools and their strengths and weaknesses [31]. There are limited research articles analyzing SCA, the fact that it is a relatively new field of research and practice. [1] Furthermore, SCA established itself as a new scientific field in the year 2009, but despite all the growing number of publications, the concept is far from having a clear and established definition [1]. Although numerous studies were published recently, more particularly in developing countries on different SCA Frameworks [10], its downside includes similarities in creating assessment frameworks and concepts.

At present, developing economies, once referred to as lesser-developed economies are characterized by a poor infrastructure, inferior growth rates, an imbalanced economy, and extremely low personal incomes. These economies lack the knowledge and assets required to shift away from an excessive reliance on production. [41,43]. The perspective of a city in a Smart City in developing economies would be to identify and prioritize areas where Smart City initiatives could improve the city's efficiency and livability. This would include an assessment of the city's infrastructure, transportation, public safety, energy, and water systems [21,47,54]. Smart Cities in developing economies are technology-based urban communities, those measures supporting a city to improve its social, economic, and environmental conditions and provide a better life for the city's residents with their participation in the planning of city projects [6,26]. SCA in developing economies meanwhile can deliver important performance indicators in monitoring for the evaluation of multiple benefits for different actors and stakeholders, such as city authorities, investors and funding agencies, researchers, and citizens. On one hand, Smart City characteristics and components are classified into six major domains: smart economy, smart mobility, smart environment, smart people, smart living, and smart governance [19]. Similarly, the proposed eight core components of a Smart City assessment, included: policy context, governance, management and organization, technology, people and communities, natural environment, economy, and built infrastructure. [8]. The key components of Smart City assessments on the other hand are economy, energy, finance, governance, transportation, urban planning, urban/local agriculture, and information communication technologies (ICT) [10]. The applications of Smart City technologies in urban and regional planning were basically aimed at improving the quality of life (QoL) of the people and preserving the environments of the communities yet ensuring balanced inclusive green growth.

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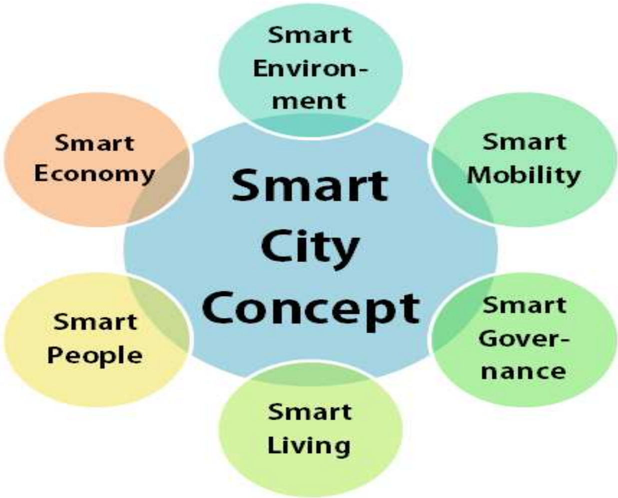

Figure 1. ISO 37122:2019 Smart City Concept.

Figure 1 shows the Smart City concept of ISO 37122:2019. It is a standard developed by the International Organization for Standardization (ISO) that provides a framework for measuring the performance of smart cities. This standard provides a set of indicators that can be used to assess the performance of a city in a range of areas, including economy, environment, mobility, governance, people, and living standards. [4]– [6] The smart economy component intended to measure the city's economic performance, such as Gross Domestic Product (GDP), employment rates, and the number of businesses operating in the city. By tracking these indicators over time, cities can gain insights into their economic strengths and weaknesses and develop targeted strategies to enhance economic development.[6]– [8].

The smart environment component includes indicators related to environmental sustainability, such as air, and water quality, greenhouse gas emissions, and waste management. These indicators help cities to evaluate and identify opportunities for improving environmental sustainability.[8]– [10] Smart mobility component on the other hand refers to the availability and use of public transportation, traffic congestion, and the infrastructure. These metrics are intended to provide perspective on the city's initiatives to support effective and sustainable transportation networks.[11], [12] Smart governance refers to the effectiveness and efficiency of city governance. Indicators in this component include citizen participation, transparency, and the use of technology to improve governance. These indicators are designed to pro-vide insights into the quality of governance in the city and the extent to which it is responsive to the needs of its residents. [13]– [16] Additionally, smart people pertain to equity and social inclusion. This component's indicators include the prevalence of poverty, income inequality, and availability of affordable housing. These metrics are intended to shed light on how much the city is doing to promote social inclusion and combat inequality. [17]– [20]. Furthermore, smart living refers to the standard of living in cities. This component includes indicators for accessibility to facilities such as education, healthcare, and culture as well as safety and security-related factors. These metrics are intended to shed light on the general standard of living for urban residents. [9], [21], [22] Lastly, a smart economy is an economic system that uses technology and data to optimize the allocation of resources and improve efficiency. It involves the use of advanced technologies such as artificial intelligence, blockchain, and the internet of things (IoT) to create new business models, improve productivity, and enhance sustainability. Meanwhile, Dr. Mohan Munasinghe developed the concept of environmentally sustainable development (Figure 2) wherein it focuses on the integration of economic, social, and environmental factors in development planning and decision-making. The concept further stressed that Smart City technologies are found to provide the balance among these three aspects of inclusive growth that is balanced and anchored on green development [23].

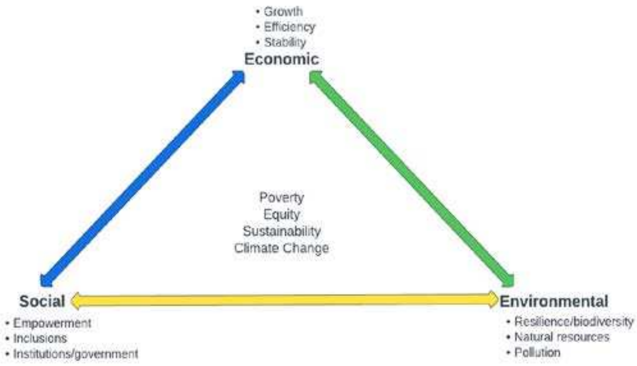

Figure 2. Dr. Mohan Munasinghe's Balanced Inclusive Green Growth.

While the smart city concept focuses on the use of technology and data to improve the quality of life for urban residents while minimizing resource consumption and environmental impact, Dr. Munasinghe's concept of environmentally sustainable development aims to ensure that development meets the needs of the present generation without compromising the ability of future generations to meet their own needs. There is significant overlap between these two concepts, as smart cities can contribute to environmentally sustainable development by optimizing resource use and reducing emissions. For example, smart energy management systems can help to reduce energy consumption and greenhouse gas emissions, while smart transportation systems can reduce congestion and air pollution. In order to fully realize the potential of smart cities to contribute to environmentally sustainable development, it is important to ensure that technology is used in a way that prioritizes environmental and social outcomes over purely economic ones. This requires a holistic approach to planning and decision-making, which considers the needs and perspectives of all stakeholders, including marginalized communities and future generations.

There are many literatures on SCAs, but it lacks synthesis on the scope of SCA frameworks among developing economies. In addition, the lack of frameworks for strategic planning and the economic base of the city and some elements of environmental sustainability is still undistinguished [1,2,8]. Hence, the purpose of this study is to evaluate and compare different methods for assessing the progress and success of smart city initiatives in developing economies. The study aims to provide valuable insights for city administrators, smart city implementers, city planning officers, technology providers, IS researchers and rural and urban planners on how to effectively measure and evaluate the impact of smart city projects on the livability and sustain-ability of urban areas. The study will also identify key indicators and metrics for assessing smart city progress and success and provide recommendations for future smart city assessments. The general objective of this paper is to synthesize the scope of smart city assessment in developing economies. To contemplate expanding the research, the researchers narrowed the objectives and made three specific objectives. Specifically, to synthesize the literature on smart city assessment in developing economies. Secondly, to synthesize the smart city assessment frameworks in developing economies. And lastly, to determine the critical gaps on smart city assessment frameworks for developing economies and provide recommendations for future studies. This study followed a scoping review procedure to evaluate the different smart city assessment frameworks in developing economies. The data that is gathered in the study focuses only on the context of developing economies. The rest of the article is arranged as follows; Section 2 presents the methodology and research strategy applied in the current research. Section 3 introduces the findings of the SCA frameworks in developing economies. Section 4; discusses the gaps identified in the previous literature and future avenues. Section 5; concludes the study.

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2. Research Methodology

2.1. Literature Profiling

A scoping review is a type of systematic examination that aims to map the available literature on a specific topic, by identifying the key studies and gaps in the current research and providing an overview of the current state of knowledge. Scoping re-views are used to identify the key concepts that structure a field, the main sources of evidence, and any noteworthy gaps in the literature [24]. As such, this method allows researchers to gain a broad understanding of the research landscape on a specific topic and to identify areas where further research is needed. This section includes the methods used in gathering and selecting the data, to achieve the goal of synthesizing the articles related to Smart City Assessments in Developing Economies. The re-searchers determined the processes used to generate the sample size literatures, pro-filed the sample sizes, identified the tools used in synthesizing the sample size, and discovered the gaps found on each journal article. This study undertook the struc-tured guidelines of 2020 Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) [73,87,98,100]. To collate and synthesize the studies of SCA in developing economies. This study utilized the Google Scholar database to explore, select, and identify the literatures. The literature search process started on September 23, 2022, and ended on September 29, 2022. The researchers reviewed the references of all the study materials included in the current review as well as the reviews found throughout the search. The researchers also checked the identified papers that mentioned the studies that were included us-ing Google Scholar's tools. When the sample size for the studies' synthesis was final-ized, the researchers saved all the collected material in a literature bank to aid with the journal assessment.

As exhibited in Table 1, there are 4 keywords used in the search string to opera-tionalize relevant studies including, smart city, smart city assessment, developing economies, and assessment tools [1,2,3,21,22]. The selected articles need to match at least one word of each keyword.

Table 1. Table captions should be placed above the tables.

Keywords	Search strings
Smart City [13], [17], [22], [31]	"Smart cities" OR "smart-city" OR "smart-cities" OR "sustainable city" OR "Sustainable urban developments" OR "eco-city" OR "digital cities" OR "intelligent city" OR "livable city"
Smart City Assessment [1,5,13,14,21,62]	"Smart city assessments" OR "sustainable city assessment" OR "sustainable city assessments" OR "urban city assessment" OR "urban city assessments" OR "emerging city evaluations"
Developing Economies [4,13, 22,34,69,77,78]	"Developing economy" OR "developing countries" OR "developing country" OR

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	"developing society" OR "developing societies" OR "middle income countries" OR "emerging city" OR "emerging markets" OR "less developed countries"
Assessment Tools [1,8,13,21,31,62,98]	"Assessment Tool" OR "evaluation tool" OR "evaluation tools"

As depicted below in Figure 3, the key terms were searched in Google Scholar, and a total of 1,830,000 results were found in the cloud database. It was then classified by language and the year published ranging in 2012 to 2022, producing 99,300 results. The collected number of literatures were then narrowed down into having at least 2 or more citations, resulting in 20,200 articles. Other criteria in the search process such as all journal articles and empirical studies with a design ranging from qualitative stud-ies, quantitative studies, and mixed-method studies have been included in the search process, resulting in 17,480 articles. The researchers only incorporated studies with detailed information on the principles, applications, dimensions, and objectives of the smart city in the context of developing economies, as well as the drivers and barriers that it faces [13, 22,34,60,92]. After intensive searching, the number of literatures was finally reduced to 150 articles and were stored in the Literature bank in Google Drive after being modified to match the desired articles' title, abstract, and keywords.

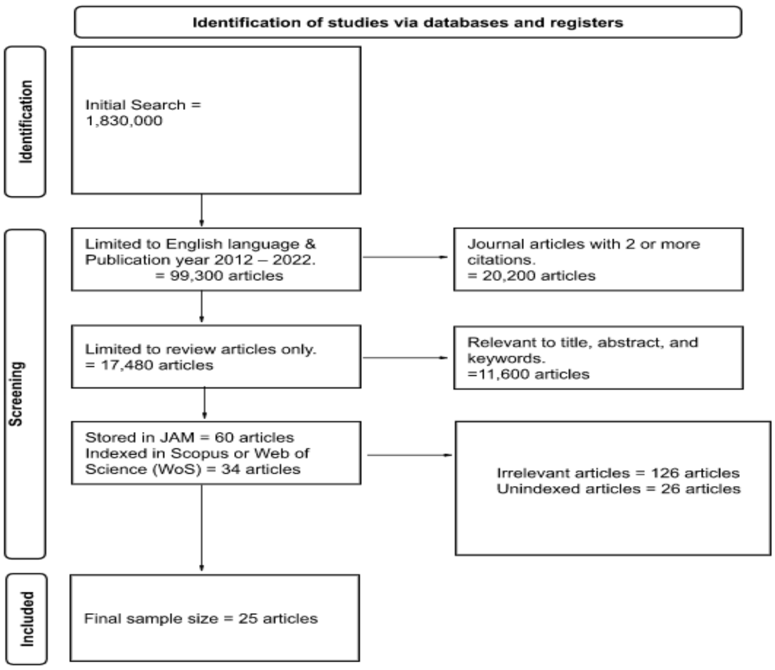

Figure 3. Data Mining Literature using 2020 PRISMA Flow Chart.

2.2. Scoping Analysis

This section outlines the scoping analysis method that was utilized to determine the tools that will enable the understanding of SCAs in the context of developing econo-mies. Based on the results of the tally, the researchers decided to follow the methods used by various literatures and included variables such as used methods, frameworks, and objectives [1], [6], [7], [9], [25]– [27], [36]. The MFO was used in the study in order to distinguish numerous methods, frameworks, and objectives to

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collect signifi-cant indicators for SCA in developing economies. [1], [8], [9], [25], [26] Further, the MFO approach clearly defines the objectives of the scoping review. The approach also ensures that all relevant aspects of the research topic are covered. The methods used to collect data, the frameworks used to analyze the data, and the objectives of the study are all defined in advance, ensuring that the research is comprehensive and covers all the necessary aspects of the topic [29]. The MFO approach helps the re-searchers to identify relevant frameworks that can be used to organize the literature and synthesize the findings.[30], [29], [34], [35] This approach ensures that the re-view is grounded in relevant concepts, which enhances the quality and rigor of the study. After profiling the collected samples, the researchers utilized the combination of inductive and deductive qualitative coding techniques to investigate significant themes and variables.

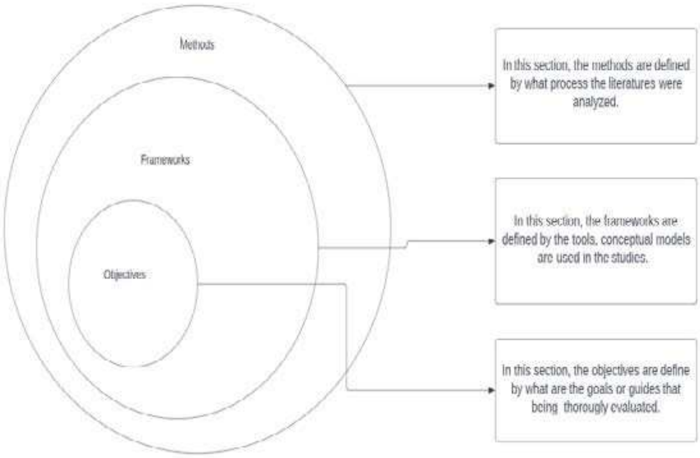

Figure 4. Method-Framework-Objective Model.

As depicted in Figure 4, the MFO approach can help researchers to design, conduct, and report research in a clear, efficient, and accountable manner, while also ensuring replicability and adaptability. The significant methods that were identified in the literature were conceptual, hierarchical, cognitive mapping, best worst method (BWM), and multi criteria decision making (MCDM). [6], [9], [27],[28] The framework was defined by analyzing what type of tools and conceptual models were used in the sample literature. The objectives were the goals or guides to the studies that were being thoroughly evaluated [26]. To summarize, the MFO approach helps in achieving the goal of SCA, which is to identify the key domains of smart city implementations and its indicators.

2.3. Research Gap Analysis

This section discusses the evaluation of each conclusion and recommendations of the collected 25 journal articles and conducts an inductive and deductive qualitative coding and organizes these journals into themes. The initial set of codes was derived from the categorization of information. These codes consist of keywords that appear frequently in the conclusion and recommendation sections of each article. The codes were refined through a thorough re-evaluation of the articles to ensure that they accu-rately reflect relevant knowledge and information about SCAs. Finally, results on these codes will direct this review to highlight significant gaps in the literature related to SCAs as the researchers aligned the problem statement and objectives with the conclusion and recommendations of each paper. In this conducted scoping review of SCA literatures, the researchers identified several gaps after a thorough synthesis of the sample: (i) insufficient studies in scoping review of SCA in developing economies. (ii) most journal articles used similar frameworks. (iii) complicated frameworks. These gaps will serve as a good reference for future research.

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3. Results and Discussions

This scoping review aims to explore the current state of research on SCAs in develop-ing economies. Specifically, the researchers will analyze the results and discuss the implications of existing studies on the feasibility and effectiveness of smart city as-sessments. By providing a comprehensive overview of the current field of research, this review will contribute to the growing body of knowledge on smart cities and in-form future research and policy decisions in developing economies.

In the publication trend exhibited in Figure 5, the earliest identified research ar-ticle about SCAs in developing economies was in 2015, until this year. According to the final sample size of the paper, the greatest number of published articles about SCA was in the year 2019, which resulted in 6 journal articles, followed by the year 2018, which resulted in 5 journal articles. This shows that the study of SCAs in devel-oping economies has been growing steadily over the past 10 years. This may be since smart cities are becoming more popular as a result of technological improvements, which has sparked researchers' interests about the advantages, opportunities, and challenges of smart cities.

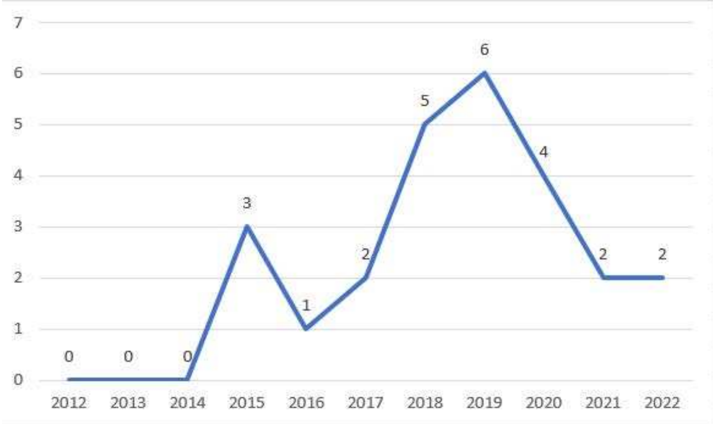

Figure 5. Year Published of the Qualified Journals.

The geographical distribution of the 25 journal articles is thoroughly evaluated, as depicted in Figure 6. The study's finding reveals that out of the 25 sample sizes, India has the most investigated journals, resulting in 5 out of 24. This indicates that most of the smart city assessments in developing countries are based in India. The second highest investigated countries are, Malaysia and Africa, with a result of 3 articles each. Followed by Romania and Turkey with 2 articles each, Indonesia, Vietnam, Thailand, Nepal, Mexico, Iraq, Israel, China, Brazil, and Georgia with 1 article respectively. Various research designs are depicted in Figure 7, including qualitative, quantitative, mixed methods. The collected sample literature in the reviews consists of 18 qualitative articles, 5 mixed-methods, and 2 quantitative studies.

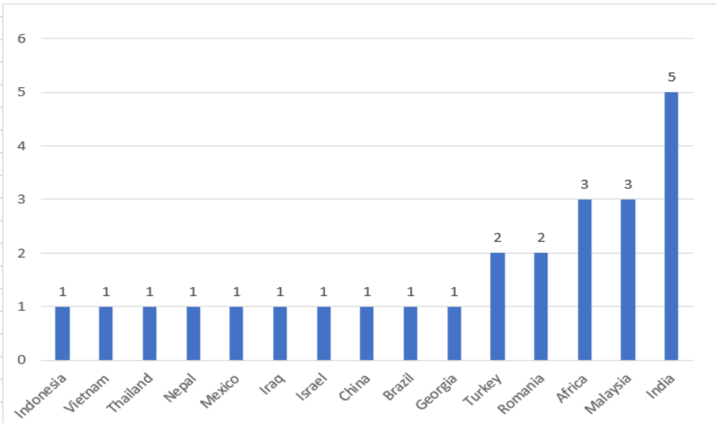

Figure 6. Geographical Distribution in Developing Economies.

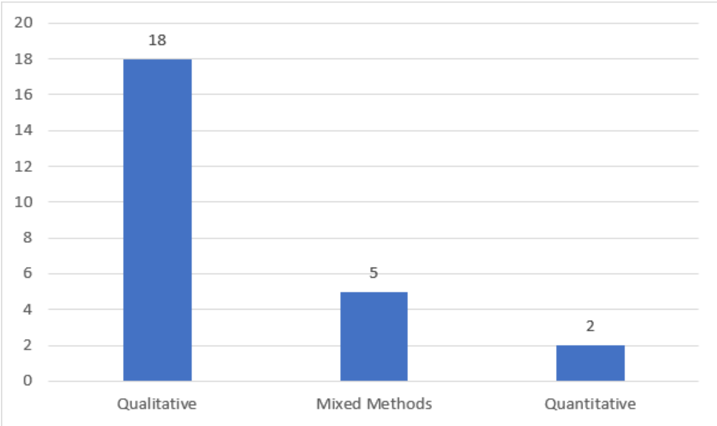

Figure 7. Research Methods of the sample studies.

Table 2 shows the journal publications of the collected sample literature. After an intensive investigation the result shows that Cities have the greatest number of studies identified. Followed by the Journal of Cleaner Production, Sustainable Cities and Societies, Energies, and Technological Forecasting & Social Change, each featuring in 3 journals. The results shows that Urban and Research Practice, IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT IOP, Conference Series: Materials Science and Engineering, Jurnal Teknologi, Journal of Urban Design, City, Culture and Society, Energy Research & Social Science, Land Use Policy, Environmental Impact Assessment Review has the least number of journals identified, featuring only with 1 journal study.

Table 2. Journal Publications of the collected sample journals.

Journal Publications	**Number of Studies**
Cities	4
Journal of Cleaner Production	3
Sustainable Cities and Societies	3
Energies	3
Technological Forecasting & Social Change	3
Smart Cities	2
Sustainability	2
International Journal of Information Management	2
Journal of Urban Technology	2
Urban Research & Practice	1
IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT	1
IOP Conference Series: Materials Science and Engineering	1
Jurnal Teknologi	1
Journal of Urban Design	1
City, Culture and Society	1
Energy Research & Social Science	1
Land Use Policy	1

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Environmental Impact Assessment Review	1

As shown in the figure presented below Figure 8, the collected sample journal articles have been profiled according to its journal publication using SCImago Journal Rank. It is a metric scholarly journals' standing that considers both the frequency of citations a journal article receives and the standing of the journals where they came from. This has been utilized in order to know the subject areas and categories being covered by the different journals that have gathered from the sample literature. The subject area of Social Sciences has the greatest number of journal articles, with a result of 11 journals in which the study focuses on the categories of geography, planning and development, transportation, urban studies, development, and sociology and political sciences. Followed by Engineering and Energy, both with 10 journals. In the field of Business, Management and Accounting, there were 9 journals, indicating a moderate level of research activity in this area. Environmental Science has 8 journals, followed by Computer Science with 4 journals, and Agricultural and Biological Science with 1 journal.

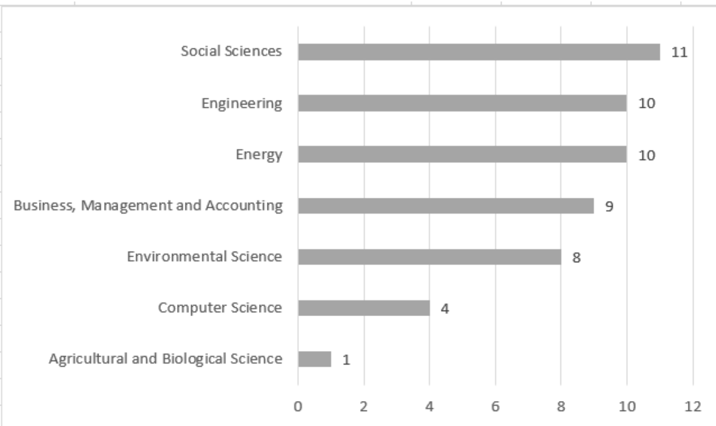

Figure 8. Subject areas of the collected sample journals.

By using SCImago, the researchers conducted a thorough assessment of the categories within the different subject areas referred to in Figure 9. To achieve this goal, a comprehensive analysis of 25 journals from a variety of disciplines was carried out. From the categories provided shown in Figure 9, the most common areas of focus in smart city journals from the collected sample size were Sustainability and the Environment, and Renewable Energy. These categories had the highest number of journals, with 10 journals respectively. The category of Geography, Planning and Development also had a significant presence with 7 journals, followed by Urban Studies with 6 journals. The categories of Management, Monitoring, Policy and Law, and Energy Engineering and Power Technology had the same results of 5 journals each. Information Systems, Computer Science Applications, Environmental Sciences (miscellaneous), Electrical and Electronic Engineering, Industrial and Manufacturing Engineering, Tourism Leisure and Hospitality Management, Strategy Management had the same results of 4 journals each respectively. Information Systems and Management, Sociology and Political Science, Development had 3 journals. Transportation and Civil and Structural Engineering had the same results in 2 journals. Following with 1 journal respectively, Forestry, Nature and Landscape Conservation, Fuel Technology, Management of Technology and Innovation, Business and International Management, Management Information Systems.

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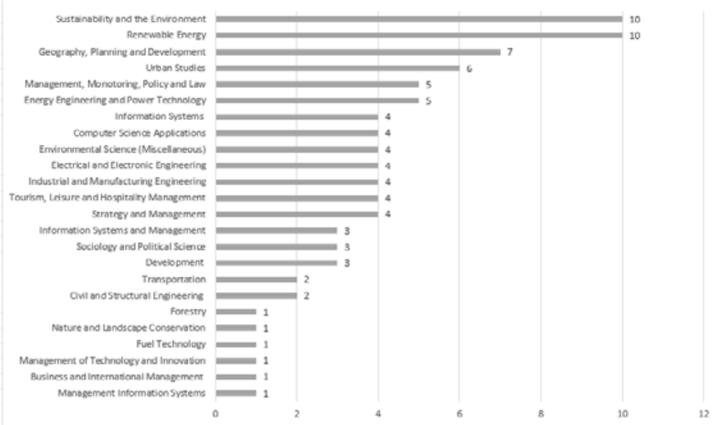

Figure 9. Categories of the Collected Journals.

3.1. Scoping Analysis Result

Objectives of Smart City Assessment

As depicted in Table 3, the result showed that the highest number of journals identified in the collected sample size were both Industrial Development and Enable IoT in cities with 8 journals respectively. Followed by Develop Sustainable Living with 5 journals. Energy Research and Political Engagement had both 2 journals respectively. SCAs are evaluation tools that measure the progress and effectiveness of a city's efforts toward becoming a smart city. The overall objectives of these assessments are to provide cities with a comprehensive understanding of their progress towards becoming a smart city and identify areas for improvement. The objectives of these assessments based on the results can be broadly categorized into 5 main categories: Industrial development, Enable IoT in cities, Develop sustainable living, Energy re-search, and Political engagement.

Table 3. Journal Publications of the collected sample journals.

Objectives	**No. of Journals**
Industrial Development	8 [1], [13], [14], [29]– [33]
Enable IoT in cities	8 [4], [20], [21], [28], [34]– [37]
Develop Sustainable Living	5 [7], [13], [38]– [40]
Energy Research	2 [22], [41]
Political Engagement	2 [35], [42]

Methodologies of Smart City Assessment

As shown in Table 4 there were 9 journals with conceptual models that were identified. [9], [10], [12], [15], [29], [42]– [45]. Conceptual modeling refers to the process of creating abstract representations of complex concepts, processes, or systems in order to better understand and analyze them. It involves the use of theoretical frameworks, diagrams, and mathematical or logical constructs to clarify the relationships between concepts, identify key components and variables, and create a com-prehensive and integrated understanding of the system under study.

In this study, there were 7 journals identified with cognitive mapping methods. [19], [25], [27], [46]– [49] Cognitive mapping: is a process of creating visual representations of an individual's mental models and mental processes. This method allows for the visualization and examination of an individual's perceptions, beliefs, and understanding of a particular phenomenon, problem, or system. Cognitive mapping typically involves the use of diagrams, flowcharts, or other graphical tools to represent the relationships between different elements of a mental model. The purpose of cognitive mapping is to gain insight into the way people think, process information, and make decisions, and to identify areas of confusion, knowledge gaps, or misconceptions.

In this study, there were 4 journals with hierarchical methods identified. [6], [16], [17], [50] Hierarchical method is a technique used to organize and structure data, information, or systems into a hierarchical structure, where elements are organized based on their relative importance or level of abstraction. In a hierarchical system, each element is a parent or child of another element, creating a tree-like structure. This method is used in various fields, including computer science, data organization, and decision making, among others. Three Best Worst Method (BWM) journals were also identified in the study. [9], [22], [51] BWM is a research technique used to elicit preferences or trade-offs between a set of options or alternatives. It involves presenting participants with a set of items or attributes and asking them to select the best and worst options from the set. This method can be used to measure relative importance or to rank order a set of options, and it has been widely used in various fields, including psychology, marketing, and public policy. Also present in the study were the 2 Multi Criteria Decision Making (MCDM) methods that were identified in the literature. [26], [52] MCDM is a mathematical approach used to make complex decisions. It is a process that helps to identify and analyze the most important factors that influence a particular decision and to rank them in order of importance. MCDM is a useful tool for decision-making because it provides a systematic approach to analyzing and ranking alternatives.

Table 4. Journal Publications of the collected sample journals.

Methods Used	**No. of Journals**
Conceptual Modeling	9 [9], [10], [12], [15], [29], [42]– [45]
Cognitive Mapping	7 [19], [25], [27], [46]– [49]
Hierarchical method	4 [6], [16], [17], [50]
Best Worst Method	3 [9], [22], [51]
MCDM	2 [26], [52]

Frameworks of Smart City Assessment

The purpose of frameworks in SCAs is to provide a structured and systematic approach for evaluating the progress and effectiveness of smart city initiatives. Frame-works provide a common set of guidelines, best practices, and metrics for assessing the impact of smart city projects on key indicators such as economic growth, environmental sustainability, and social well-being [12], [26], [38] . As shown in Table 5, after an intensive investigation from the sample size of 25 journals, it was found out that the greatest number of frameworks used in the journal was IoT-Enabled Smart City Framework registering 8 counts. The second highest number of frameworks identified in the literature collected is Smart Cities Index- India Framework with the results of 4 journals, followed by Smart Cities Ranking of European Medium-sized Cities Framework and Community KPIs for the IoT and Smart Cities Framework with 3 journals each. Cities in Motion Index Framework had 2 journals identified. Both China Smart City Performance Framework and Smart City Governments Framework had 1 journal identified respectively.

Table 5. Frameworks Identified in the MFO Model.

Frameworks used	No. of journals
ISO 37122:2019	6 [1], [4], [5], [25], [43], [53]
IoT-Enabled Smart City Frameworks	5 [13], [28], [38], [44], [71]
Smart Cities Index- India	4 [6], [9], [30], [52]
Smart Cities Ranking of European Medium-sized Cities	3 [29], [44], [54]

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Community KPIs for the IoT and Smart Cities	3 [16], [55], [56]
Cities in Motion Index	2 [7], [57]
China Smart City Performance	1 [50]
Smart City Governments	1 [15]

3.2. Research Gap Analysis Results

This section discusses the common conclusions in the sample literature. As shown in Table 6, the results indicated that proposed conceptual models/frameworks were essential in developing SCAs to understand and evaluate the level of smartness of the cities in developing economies. [1], [6], [10], [11], [33], [35], [39], [49] Moreover, it is important that assessment practices should be integrated into official urban planning and management mechanisms and strategies, to ensure that urban development is sustainable, equitable, and responsive to the needs of the community and the environment. [1], [9], [26], [44], [48] Furthermore, Stakeholder engagement is a critical aspect of SCAs. By engaging with residents, local businesses, government agencies, and technology providers, city officials can gain valuable insights into the needs and priorities of the community, build support for smart city initiatives, and gather feed-back on the effectiveness of these projects.

Table 6 shows the common conclusions that were identified by the researchers. The results show that the Proposed conceptual models/frameworks have the highest number of conclusions identified in the collected sample size, featuring 8 journal articles. Followed by Assessment practices are not yet integrated into official urban planning and management mechanisms and strategies, and Performance rankings with 5 journal articles identified. 4 journals identified the need to assess the performance of smart cities in developing economies. Engagement with stakeholders has the least common conclusions identified, featuring 3 journal articles. The common conclusions identified in Smart City assessments in developing economies highlight the need for a comprehensive approach to assessing the performance of smart cities. This includes the development of conceptual models and frameworks, the integration of assessment practices into official urban planning and management mechanisms and strategies, the use of performance rankings, the assessment of smart city performance, and engagement with stakeholders.

Table 6. Common Conclusions Identified.

Common conclusions	**Number of Journals**
Proposed conceptual models/frameworks	8 [1], [6], [10], [11], [33], [35], [39], [49]
Assessment practices are not yet integrated into official urban planning and management mechanisms and strategies	5 [1], [9], [26], [44], [48]
Performance rankings	5 [57], [58], [60]– [62]
Assess the performance of smart cities	4 [30], [37], [41], [63]
Engagement with stakeholders	3 [14], [64], [65]

Over the past few years, there has been a considerable increase in the number of SCA tools developed for assessing the performance of smart city projects and initiatives. Despite this widespread interest in this field, there exists significant assessment gaps in smart cities, mostly in the developing economies.

In this conducted scoping review of SCA literatures, the researchers identified several gaps after a thorough synthesis of the sample.

(i) insufficient studies in scoping review of smart city assessments in developing economies. The SCA established itself as a new scientific field in the year 2009, but despite all the growing number of publications, the concept is far from having a clear and established definition [1] [4], [66] After an intensive digestion of the 150 journal articles collected, the researchers concluded that, there were limited number of studies in SCA in developing economies in the context of scoping reviews. Most of the literature reviews tackled are only structured, systematic and critical reviews.

(ii) most journal articles used similar frameworks. Literature reviews on SCAs have shown that there were similar frameworks being used across various studies. These frameworks aim to evaluate the progress and effectiveness of a city's implementation of smart technology. [1], [16], [26], [37], [52], [60] And lastly,

(iii) complicated frameworks. Due to the lack of standardization of the assessment frameworks of SCAs, the other studies tend to develop complicated frameworks. However, the increased complexity of these frameworks can present a challenge for city administrators, smart city implementers, city planning officers, technology providers, IS researchers, and rural and urban planners. It can be difficult to understand and effectively utilize these frameworks, leading to confusion and inefficiency in the evaluation process. [6], [9], [10], [47], [67].

Table 7. Common Limitations of Research.

Common Limitations	Journal ID
Similar frameworks	10 [16], [22], [32], [34], [39], [40], [61], [62], [68], [69]
Lack of standardization	8 [1], [4], [9], [43], [51], [57], [66], [70]
Limited studies in scoping reviews	4 [5], [12], [18], [59]
Limited sample size	3 [30], [41], [52]

By synthesizing the findings from existing studies, the authors were able to identify common recommendations. These common themes serve as a guide for future re-search as depicted in Figure 10, providing direction and a starting point for further investigation. The researchers highlighted the common recommendations that were based on the literature reviews collected. These recommendations include future studies on SCAs in developing economies, especially in the field of scoping review. Develop standardization of the smart city frameworks, propose new frameworks. The researchers also highlighted the importance of measurable and data-driven recommendations in order to make sure that the newly developed frameworks should be easy to evaluate, and the data will be accurate. Smart cities have been widely recognized as a promising solution for addressing the challenges of urbanization in developed economies [1], [9], [13]. Applications of Smart City technologies, notably in urban and regional planning, including transport, indeed showed the vast possibilities of the technologies in ensuring balanced and inclusive green growth. The same is true also for improving the levels of services of urban intermodal logistics network systems.

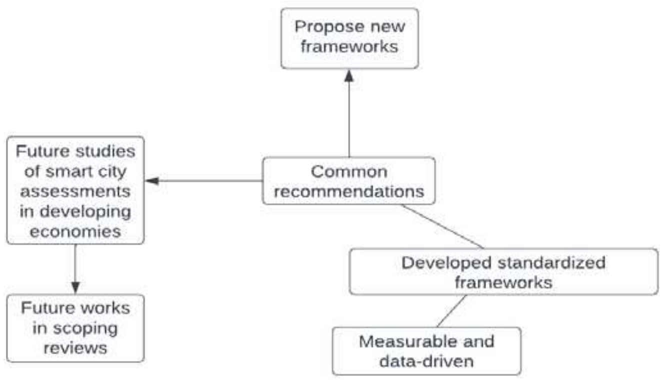

Figure 10. Common Recommendations.

4. Conclusions and Recommendations

India has indeed been at the forefront of the Smart City movement among developing economies and has been recognized for its efforts in this regard. In fact, in 2020, India was ranked as the country with the greatest number of cities that have undergone the Smart City Assessment, according to the Smart Cities Index developed by the Institute for Management Development (IMD) and Singapore Universi-ty of Technology and Design (SUTD). As to research design, the Qualitative Re-search Design approach was the most common among the literatures subject to the study. This approach is useful in SCA as it allows researchers to capture the perspectives and experiences of various stakeholders, such as residents, policymakers, and industry representatives, and to understand the social and cultural factors that in-fluence the success or failure of smart initiatives. However, it is important to note that qualitative research design may have limitations, such as potential biases and subjectivity in data collection and analysis, and the difficulty in generalizing findings to larger populations. Therefore, it is often combined with other research methods, such as mixed and quantitative analysis to provide a more comprehensive understanding of SCA. It typically involves a multidisciplinary approach that encompasses a wide range of subject areas. It was also found out that social science is certainly an important component and the most common subject area among the 25 journals being studied. While social science is certainly an important component of smart city assessment, it is just one of many subject areas that are involved in this complex and multifaceted field. Meanwhile, sustainability and the environment, as well as renewable energy, are important assessment categories in SCAs. Smart city assessments typically evaluate a city's use of technology and data to improve the quality of life for its residents while also minimizing negative impacts on the environment. Sustainability and renewable energy play a key role in creating livable, prosperous, and resilient communities for the future. To wrap up, industrial development is an important objective of SCA identified in MFO, as it can help create a sustainable economic base and improve quality of life for residents. Conceptual modeling appeared to be the most common method identified in the MFO Model for SCA. All other methodologies presented in this study can be used to assess the effectiveness of smart city initiatives and help policymakers make informed decisions. As to the framework, ISO 37122:2019 has been widely adopted by many cities and organizations around the world. This is due to its clear and structured methodology, the ability to measure progress over time, and the ability to benchmark against other cities.

While there are other frameworks available for SCA, the popularity and adoption of ISO 37122:2019 indicate that it is currently the most preferred and widely used framework. However, it's important to note that each framework has its own strengths and weaknesses, and cities may choose to use multiple frameworks or adapt them to their specific needs.

Based on the findings of this scoping review, it is recommended that future research in this field should focus on developing frameworks and methodologies for assessing the feasibility and sustainability of smart city initiatives in developing economies. Additionally, more emphasis should be placed on identifying and addressing the specific challenges and opportunities that arise in different developing country contexts, as mentioned elsewhere in this paper. As the year progresses, the dimensions and indicators of smart cities are possible to rise or recompose. The advancement of smart technology, innovation, and initiative in many operational aspects of cities carried out by many multidisciplinary experts, has significantly contributed to the current and future of smart city development. Measuring the success of a smart city or the level of smartness based on its dimensions and indica-tors will be inconvenient because every city has unique characteristics, development, and challenges. For instance, cities with transportation issues whether com-plex traffic regulation, congestion, parking spaces, or public transportation will benefit from the smart transportation/mobility dimension of the smart city. However, for some cities that are dealing with catastrophe issues, there is a chance that some innovative and innovative disaster management initiatives will emerge. However, for some cities that are dealing with catastrophe issues, there is an opportunity in the future to develop smart disaster management. Similarly, the Sustainable Development objectives have increased from 3 pillars to 17 goals. The level of sustainability in every city is not identified by the ability to achieve all 17 goals. But it is measured by the capacity to prioritize some goals regarding the characteristics of regional, challenges, and community needs. The ability to prioritize dimensions and indicators based on the characteristics of the region or city and people's needs is required to develop a sustainable smart city. Particularly in cities in developing economies with limited investment for smart city development and research needs to determine the scale of priorities. Even though the development of smart cities has increased the effectiveness and efficiency of many operational aspects of cities, it requires a large upfront investment, especially at the initial stage. Therefore, planning involving community participatory and multidisciplinary experts is urgently essential to be able to determine the priority based on the visions of cities, character uniqueness, and the needs of people. Moreover, the success of a smart city development should be measured by the planning process, risk mitigation, and the impact of development. It is hoped that cities in developing economies will not only serve as consumers of the technology required to develop smart cities that can effectively protect real-time data and information. Some potential research in the future is to examine the benefits and impacts of smart city development projects in various cities worldwide in order to conduct research on the assessment of dimensions and indicators of a smart city. A scoping review of the literature on smart city assessments in developing economies has revealed several challenges and opportunities for the successful implementation of smart city initiatives in these contexts. A total of 25 journals were analyzed to provide insights about smart city assessments in developing economies. Additionally, to enhance the robustness of future studies, it is recommended to employ a systematic review methodology, such as PRISMA-scoping review to ensure the transparency and consistency of the review process. Furthermore, it is crucial to conduct a comprehensive and thorough literature search, including both primary and secondary sources, to capture the most relevant and up-to-date studies. Overall, this scoping review of smart city assessment hopes to pro-vide relevant insights for governments, institutions, and researchers of developing economies as the proper starting point of any contextual and localized sustainable smart city initiatives.

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