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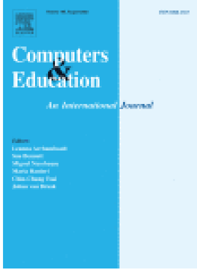

SMART CITIES FRAMEWORK ADOPTION FOR SUSTAINABLE LIVING IN PROVINCE BALOCHISTAN OF PAKISTAN: A SSTEMATIC LITRATURE REVIEW.

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ABSTRACT

Governments and companies are investing in ICTs to build smart cities that can adapt to changes and challenges, such as smart living, competent governance, smart climate, intelligent people, smart tractability, and wonderful economics. To better comprehend the smart city, several scholars have sought to define it and highlight the benefits and drawbacks of constructing intelligent city communities using the Internet of Things. With respect for the smart city system and its activities, city leaders and organizers/designers must distinguish between the two, which smart city implementation advocates must eagerly endorse. Enforcing standards and building collaborations helps inhabitants in smart cities that leverage IoT and cutting-edge innovation-based assets. It also promotes the development of an SLR for smart city framework adoption and behaviour intention, perceived privacy, perceived security, and perceived value, as well as self-efficacy and effort-expectancy of smart cities (Smart Economy, Smart Environment, Smart Government, Smart Living, Smart Mobility and Smart People). According to these findings, two cities in Balochistan Province chose the appropriate path while deploying smart city technologies. 17 UN Development Goals aim to provide peace and prosperity to people and planet (UN SDGs). This study looks at how smart cities may help achieve the Sustainable Development Goals. SLR focuses on Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Environment, Smart Living, and Smart City Adoption and provides a valuable summary of the relevant literature on smart cities framework adoption by reviewing and addressing key findings from research on smart city difficulties. This study's findings may help academics and practitioners explore and construct smart cities.

***Keywords**:* Sensors, IoT, Smart City, Framework, Urbanization, Adoption.

1.0 INTRODUCTION

Global peace and prosperity were at the forefront of the United Nations' Sustainable Development Goals (SDGs) in 2015. Because of this urgent need to action, 17 global objectives have been established. Among the goals this year are SDG 6 (clean water and sanitation), SDG 7 (clean economy and energy), and SDG 11 (sustainable cities and communities) (life on land). Deputy Secretary-General Malcolm Johnson of the International Telecommunication Union (ITU) stresses the importance of the ITU's participation in achieving SDG 11. Cities are home to half of the world's population. By the year 2050, it will be around 70%. Ordinary people face enormous difficulties. ICTs may be useful in various situations. International Telecommunication Union (ITU) officials want to use the vast potential of information and communications technology (ICT) in building more sustainable and intelligent cities. When it comes to alleviating poverty and other inequalities, the Sustainable Development Goals (SDGs) place a high value on health, education, and economic growth.

"Achieves social and economic growth while promoting democratic processes through participatory governance," Smart City states. In order to promote economic, public participation, and government efficiency, smart cities use ICT infrastructures. As far as I can tell, it's 2017

Cities like Busan (South Korea), London (England), and Santander (Spain) are known as smart cities (Spain). Global technology investment in smart city efforts is expected to reach $158 billion by 2022, according to current estimates. Academics and practitioners alike are interested in the idea of "smart cities." There has been an increase in the number of academic journals, publications, and conference proceedings devoted to smart city research and development. Despite past evaluations provide a current overview of the primary problem area, there are obvious gaps in research on the connection between smart cities and UN SDGs. Creating sustainable cities and communities is one of the UN's 17 Sustainable Development Goals, and this study aims to fill a knowledge vacuum in that area. Researchers and practitioners may benefit from this study's results.

SYSTEMATIC LITERATURE REVIEW

1.1 Systematic Literature Review (SLR)

SLRs are a well-established method in ICT research (Kitchenham & Charters, 2007). It is used to evaluate empirical data from various sources to solve a certain issue, topic, or subject of interest. Standard literature reviews differed from SLRs in the deliberate methods and preparation that resulted in scientific value. A systematic literature review covers the literature comprehensively, impartiality, and complete (Hu & Bai, 2014). The present research will also be assessed. A systematic literature review is used to find, evaluate, and analyse all relevant research for specific research topics, subject areas, or phenomena. One of the most common types of systematic reviews is the meta-analysis of studies. It is believed that the findings of a regulated and rigorous bibliographic research process would yield the most relevant themes, gaps, difficulties, approaches, processes, tools, and techniques. A specific and clear formulation of a review procedure during planning, which drives and guides its execution, is a milestone in SLR. Its goal is to decrease researchers' prejudices and assumptions. SLR also helps the researcher organize their findings. The supervisor, IIUM specialist researcher SLR, and two senior researchers from the IIUM Department of Information Systems (DIS) validated the evaluation procedure. This SLR's chronological span runs from 2017 to June 2021. The researcher considered updating the most current historical study release for 2021 to include the Smart City framework adoption.

1.2 SLR on Smart City Adoption

This part aims to conduct a thorough evaluation of the literature to portray the current level of smart city framework adoption. The researcher led a much purer version of an outstanding systematic review based on Kitchenham's technique from 2000. Because of the more systematic, practical, and coordinated procedure for reviewing and synthesizing SLR data, Kitchenham's principles were adopted. Figure 0-1 The actual SLR stage adopted from (Kitchenham & Charters, 2007) displays the flow chart of SLR the procedure assessment.

Figure 0-1 The actual SLR stage adopted from (Kitchenham & Charters, 2007)

The following sub-sections discuss three SLR systematized stages via

1)planning review 2) conduct review and 3) reporting review.

1.2.1 Stage one: Plan review

A plan review included a few processes, including

a) defining SLR research questions (RQ),

b) defining the search string,

c) defining the sources

d) defining the inclusion and exclusion criteria.

1.2.1.1 Define the research questions for SLR.

Defining the research questions (RQ) is critical since it leads to the study's request (Kitchenham & Charters, 2007). PICOC (Population, Intervention, Comparison, Outcomes, and Context): (Roberts, 2006). The study's target group (e.g., people, software, area). The involvement defines the parts of the inquiry or concerns that the researcher is interested in (s). The comparison refers to the aspect of the inquiry the intervention is being compared. The Context provides the context or environment of the inquiry, whereas the Outcomes specify the intervention's impact (Petticrew & Roberts, 2006).

The PICOC structure utilized for the SLR described here is shown in Table 0-1 Summary of PICOC, The intervention in this SLR is smart city framework adoption for sustainable living. The researcher included all empirical studies that looked at Smart city adoption. The following is a summary of PICOC for SLR:

Table 0-1 Summary of PICOC

Population	Smart cities
Intervention	Smart city adoption and smart city initiatives
Comparison	N/A
Outcomes	Smart city development, ICT and IoT usage in smart city
Context	Involved in smart city adoption framework and IoT for sustainable living, this review examines any empirical and conceptual studies

This SLR will present an overview of current research, ideas, advantages of smart cities, performance metrics, and study gaps. The main research topic to the purpose is established. The following are the review questions RQs for SLR formulated guided through PICOC.

- **RQ1.** What is the research purpose for smart city framework adoption?
- **RQ2.** What evidence is there factors for smart city adoption by city planner and citizen?
- **RQ3.** What are the value or benefits of smart city framework adoption?
- **RQ4.** What were the measurement dimensions of smart cities for sustainable living?

1.2.1.2 Establish a search string technique.

Define a search string that will be used to find suitable Smart city framework adoption using the most appropriate and accurate search term. Kitchenham & Charters, 2007 and (Cruz, Brooks, & Marques, 2014) lead the researcher's systematic search technique outlined below.

i. Using PICOC as a reference, derive important key search phrases for use in the review questions. The essential phrases were selected based on elements of intervention and results.

ii. Several additional phrases were discovered and added to the list of other search terms during the search.

iii. There were eight online basket databases, as well as IIUM online databases, that ran the search phrase.

iv. Using alternative phrases, Cruz et al. (2014) directed the building of the final search string.

v. "Boolean operators OR and AND" were used to create the final search phrase to discover the main studies in the database. The main key phrases from Table 0-2 Major search terms, the major key terms from Table 0-3 The alternate search terms, and Table 0-4 using OR AND operator were concatenated using the OR operator and the "AND" operator.

vi. Search hints, including stemming and wild-card characters, were used throughout the search string operation, as determined by different digital library help sites.

Table 0-2 Major search terms

Intervention	Smart city framework adoption and IoT and ICT usage
Outcomes	Smart city dimension, smart city development

Table 0-3 The alternate search terms

Basic Search Terms	**Alternate Search Terms**
Smart city framework adoption	Smart city Performance, competitive advantages
Benefits	Advantages, values
ICT in smart city	Digital city, IoT in smart city, online city service
IoT	Smart cities, smart people, smart governance, smart economy
Country	developing countries, developed economies, low-income countries
Smart city initiatives	Adoption, post-adoption, smart city deployment, IoT usage in smart city

The subsequent is an example of how the search string was built using the AND and OR operators:

Table 0-4 using OR AND operator

(smart city OR smart city adoption) AND (IoT OR ICT OR smart city initiative or Smart city development AND (adoption OR use) AND city performance OR competitive advantages of the smart city) AND (IoT OR ICT OR smart city initiative or Smart city development AND (adoption OR use) AND city performance OR competitive advantages of smart city) or (Smart cities using IoT or IoT usage in smart city or smart city sustainable living)

Finally, the researcher applied a systematic search string for the primary search procedure.

1.2.1.3 Establish research sources.

The major search strategy for finding relevant studies on smart city framework adoption and IoT, ICT use in smart cities for sustainable ling was addressed in this part. This method involved scanning eight separate online databases for academic literature. These resources include major IS journals and peer-reviewed literature. An online database is also useful for researching contemporary issues, such as IoT and smart cities. Due to the long search term, all databases except IEEE Xplore, Emerald Insight, and Google Scholar accepted the query. Table 0-5 Sub-strings shows how the main search term was split down into four sub-strings for improved sensitivity, specificity, and relevance from the search engines

Table 0-5 Sub-strings

Main Search	**Sub -string**
SS1	(smart city adoption OR Smart city post-adoption)
SS2	IoT usage in the smart city OR ICT usage in smart city
SS3	Smart city initiatives AND development

SS4	Smart city framework adoption AND IoT usage performance OR ICT advantages in smart city

On IEEE Xplore, Emerald Insight, and Google Scholar, the researcher ran sub-strings shown in Table 0-7 List Resources. Because Google Scholar has certain limits, such as the number of studies it can obtain becoming unmanageable, the researcher only looked at the first five pages of results. The titles and abstracts of all the research were scrutinized. The outcomes are shown in (Table 0-6 Results by sub-strings), along with the final search phrase created by each operational record.

Table 0-6 Results by sub-strings

Resources Name	No.of studies
.Science- Direct.	20
.Pro-Quest.	20
.Springer link.	21
.ACM Digital Library.	14
.Wiley online library.	12
.SCOPUS.	7

Table 0-7 List Resources

Databases	SS1	SS2	SS3	SS4	Total
IEEE. Xplore.	5	3	10	2	20
Emerald Insight	15	4	33	6	58
Google Scholar	235	11	380	21	647

1.2.1.4 strategy for the secondary search procedure

This step is critical because it entails scrutinizing the validated and appropriate articles to provide a conduct review that ensures useful and robust SLR results and answers the RQs ((Bokolo et al., 2019)). The researcher employed (Lim, S. B., et al., 2021)'s suggested inspection technique to help search for further relevant necessary publications. During the secondary search, 25 more studies were uncovered. Importantly, two of the publications were suggested by Science Direct, which includes a function that suggests related articles to search. Table 0-8 Selected Primary Studies lists the key studies that were chosen.

Table 0-8 Selected Primary Studies

Search Phase	No. of primary Studies
Primary-search	21
Secondary-search	25
Recommended-paper	14
Total	60

Following that, the process of inclusion and exclusion will take place to finalize the articles that are suitable and meet the requirements.

1.2.1.5 Define inclusion and exclusion criteria.

The vast majority of the IS and Scopus journals were represented in the databases. Accordingly, they were deemed comprehensive enough to reflect the current state of Scopus and IS literature on the use of IoT in smart city frameworks. As of 2017 to 2021, papers were selected for the review based on the article's title, abstract, and keywords. Table 2 tenth Listed above are the inclusion and exclusion criteria used to select participants for the current research.

Table 0-9 The set of inclusion and exclusion criteria

Include Criteria	Exclude Criteria
.The organisational level.	At an individual level. '
Qualitative, quantitative, and mixed	Non-Qualitative, Quantitative, and mixed.
Studies were published between 2017 and 2021, starting with those	Research published before to 2016 is not included.
Only English may be spoken.	Various other languages aren't supported.
Text in its entirety.	and any other kind of paper with less than six pages of text.
Only in the framework of the	excludes all non-peer-reviewed research and

Consequently, Table 0-7 List Resources led to the choice to eliminate unsuitable content. The relevance of exclusion criteria in limiting the number of articles in a literature review that the researcher can handle is undeniable. Finally, 60 was calculated precisely for the following step at stage two (i.e., quality checklist and procedures).

1.2.2 The second stage is the conduct review

As stated in subsections 1.2.1.1 and 1.2.1.2, this step includes the quality checklist and data extraction approach.

1.2.2.1 Checklist and method for ensuring quality

The term "study quality" has no agreed-upon meaning (Kitchenham & Charters 2007). Therefore, the researcher utilised Kitchenham & Brereton's (2013) quality checklist, which covers a) design, b) conduct, c) analysis, and d) conclusions.

With a lower level of bias and more internal and external validity, the study satisfied these conditions.

A questionnaire was used to collect data from the publications in order to answer the study questions. A quality checklist sheet may be completed for each article read to ensure that the information is of high quality. Listed below is information for each item in the checklist: The title, publication date, publishing vehicle, authors, nations, research group, keywords, proposal, observations, kind of analysis, adoption, performance, future works from publications, and opinions are all included in this list of information. Research topics and study quality are addressed in the data form's extract data sections. In order to determine research bias, an SLR evaluates the study's quality (Kitchenham & Charters, 2007; Petticrew & Robert, 2006). A study's "internal validity" (the lack of serious methodological biases) may be determined by examining its quality, according to Petticrew and Robert (2006). An SLR's research goals should be carefully examined for each study it includes. Assessment of research design and methodology, as well as outcomes analysis, fall under this category. Table 2 shows the results of using the Kitchenham & Brereton (2013) quality checklist.

Table 0-10 Study Quality Checklist

Question	Answer
1. Was the article cited?	Yes/No
2. Were the research's goals (purpose) properly stated?	Y/N/P

3. Was the suggested procedure well-defined?	Y/N/P
4. Was the data collecting effective? For example, discussing data gathering procedures and how study design may have influenced data collection	Y/N/P
1. What did they say? For example, was the study's methodology detailed so we could trust the results?	Y/N/P
6. Do you have enough data or case studies? For example, different data sources are used instead of critical research?	. Y/N/P

A quality checklist consisting of six generic questions was created based on these questions and was supposed to be answered using the following ratio scale: Partially = 0.5 points; Yes = 1 point; No = 0 points. If the specified quality standards are addressed or detailed in the research, the "Yes" response is provided; if the indicated quality criteria are only partly defined in the study, the "Partially" answer is given. Finally, a "No" response is issued if the research lacked a quality component. As a result, each study's overall quality score varied from 0 (extremely bad) to 7 (excellent) (very good). On the other hand, the quality evaluation had no intention of excluding any research and was merely intended to serve as a quality standard. The exception was research in which we discovered that the quality was so poor that it couldn't offer the SLR with solid evidence. In conclusion, based on the quality checklist and scoring sheet findings, the main study's highest quality score is six.

1.2.2.2 Methodology for data extraction

The researcher directed and followed the data extraction strategy to implement the data extraction technique as the data extractor for this study, according to Kichenham & Charters, 2007. Each chosen piece has been assigned an identifying code or prefix, such as SCA for serial number articles and the number 'n' as a postfix. The SLR RQs and study quality standards created a data extraction form. The researcher's supervisor has evaluated and confirmed the extraction data as a data checker. As a consequence, the researcher altered the identification code from paper one (P1) to Smart City Adoption (SCA1+N) for study categorization reasons and categorized systematically by topic using the Grounded Theory (GT) approach. The data extraction procedure was then carried out in Mandalay utilizing the SCA-ASLR folder that had been established. Finally, the data extraction for 60 publications is complete, and the results may be analyzed throughout the review process. Using Mandalay software and manually used in MS word. A list of extracted articles with code was constructed. Appendix A contains a list of accessible retrieved studies.

1.2.3 Stage three: Result Review

A comprehensive and well-organized presentation of the SLR's evidence synthesis is provided in this part, which represents the last step of the result review process. The researcher should follow a few procedures, including presenting a summary of the study and responding to review questions (RQ). It will be described how to synthesize smart city frameworks and how to use IoT as proof of SLR in this part, which will go into further depth about the findings of the SLR research topics. This is why the stage is so critical, as it requires the researcher to conduct an exceptional evaluation of the capacity to arrange, analyze and present the results in a condensed and clear manner while maintaining coherence.

The adoption and use of IoT in smart city frameworks are being studied in various ways in the scientific literature. This study attempts to create an acceptable categorization for smart city efforts and the use of IoT in smart cities to better understand the previous academic contributions to these initiatives and the use of IoT in smart cities. The categorization of the 60 articles was accomplished via a bottom-up grounded theory (GT) methodology. The GT technique has been determined to be appropriate and beneficial for conducting the rigorous literature evaluation. The 60 evaluated publications are categorized using a GT technique, which stands for generalized classification when analysing the literature. The researcher employs a GT strategy when studying the literature, which encourages them to "reach a full and theoretically relevant examination of a subject" (Wolfswinkel, Furtmueller, & Wilderom, 2013).

For this reason, the GT strategy proposed by Wolfswinkel et al. (2013) was used in this investigation, which was based on four essential elements, namely

1. Improve "representation," which is defined as "the capacity to derive sufficient meaning from underlying facts" (Leech & Onwuegbuzie, 2007).
2. Improve the transparency of the research process by doing the followed by (Leech & Onwuegbuzie, 2007).
3. Allow for the results of a paper to be appropriately put in the context of the rest of the reviewed text, allowing for identifying research aims.
4. Can identify and cover notions and hypotheses that have been unburied.

In particular, this involves using qualitative coding methods to obtain a synthesized meaning and purpose of study from a sample of 60 articles. The literature is analyzed as a collection of qualitative data in this context. In qualitative research, researchers must be able to articulate, analyze, find themes, interpret, make meaning of the data, and recognize patterns in the data to be successful. The conversation is naturally organized by a succession of responses to the four research questions (RQs).

1.2.3.1 (TOE) factors

Tornatzky et al. (1990) claim that certain TOE features may influence the organizational acceptability and implementation of innovations. The three variables are technology, organizations, and the environment. Table 2 12 defines these qualities in further detail. Moreover, the TOE framework says that when an organization considers both internal and external factors, it will effectively implement an innovation (Tornatzky et al., 1990). It discusses just a few aspects affecting adoption without addressing the components that impact each component independently. Because researchers may pick and choose components of each dimension according to the characteristics and characteristics of innovation and organization, the TOE Framework is typically flexible, as demonstrated by the work of (Amelia et al.,2016). The table below lists the particular research that has employed the TOE and the study's construct.

Table 0-11 Past research TOE for smart city

Technology	Organization	Environment
An innovation's adoption may be affected by a technology's structure and quality, as well as its unique qualities.	Organizational elements like as structure, culture, objectives, size, resources, and decision-making procedures may support or impede the adoption of creative ideas..	The demands of an innovation, the capacity to finance and support it, and the execution of that invention are all determined by stakeholders outside of a corporation, such as rivals, suppliers, consumers, governments, and communities.
Relative advantages Cost Complexity Compatibility Trialability	Decisiveness Cloud-based decision-making Knowledge of employees Intensity of	Competitive Pressure External Support
advantage Compatibility Observability SECURITY AND	Culture of sharing and cooperation IT resources in organizations	Pressure from Competitors Influence of others
Comparative Benefits Complexity of Compatibility	The ability of an organisation education and training Support from the highest echelons of the organisation	Competitive pressure and the backing of your trading partners

1.2.3.1.1 Technological readiness:

Local government willingness to accept the smart city idea is known as its "technological readiness" (Yang et al.2015). In order to meet government and public requirements, data and information might be merged into other systems or devices and evaluated (Berst2013). According to Berst (2013), a number of elements serve as technological enablers for the development of smart cities. Intelligent technology should be able to gather, integrate, and analyse data, as shown by these technological enablers. Instrumentation and control, connection, interoperability, data management and analytics, and security and privacy are all parts of the technological enabler. Inhabitants' health and activities are monitored and controlled via instruments and controls. The smart city's sensors are its eyes and ears. All social events are recorded and monitored using sensors and CCTV. Public use of any technical gadget necessitates the use of a control feature. An important smart technology feature is that anybody may readily access systems or devices thanks to connectivity. Data and information may be readily exchanged amongst all systems or devices for analysis or strategic decision-making. Consumer data should be protected by all intelligent technology. These five technological enablers must be implemented. It is also possible to use these five technological enablers to develop a technology list for the implementation of smart cities (Berst2013).

1.2.3.1.2 Organization readiness:

The capacity of a local government to offer and manage all of the resources required to implement a smart city idea is characterised as organisational preparedness (Yang et al.2015). According to Yang et al. (2015), the availability of IT specialists, top management support, and a fair budgetary plan are all essential elements that may be used to measure the readiness of a firm. The availability of IT professionals demonstrates an organization's expertise and preparedness in integrating technology, particularly when embracing new innovation (Lee & Shim2007; Sucahyo et al., 2016). In addition, the adoption process may be accelerated by properly preparing to work with consultants, academics, and IT practitioners (Xin &

Levina2008). In addition, as more IT professionals become accessible, the desire to implement smart cities will increase.

1.2.3.1.3 Readiness for the Environment:

"Environmental preparation" refers to how well a local government has prepared external stakeholders (such as businesses) to assist and aid one another in the adoption of smart cities. "Smart cities" need not just internal organisation support and commitment but also engagement with specific external parties, according to (Achaerandio et al., 2012). People's well-being and comfort are the fundamental goals of smart city adoption. Smart city adoption necessitates the use of smart technology, as we all know. To reap the benefits of a smart city, everyone must be well-versed in the concepts of smart technology and know how to put it to good use. It is thus possible that public acceptability of the smart city idea may be affected by citizens' ability to use computers.

1.2.3.2 Year by year, the number of primary studies has increased.

Figure 0-2 depicts a chronological overview of research by year of publication. The previous research, which was released in 2017, from the year 2017 to 2018, decreased equilibrium steadily from 2018 to 2019. In typical conditions, more studies than the previous year's research smart city adoption, resulting in an increase in the number of articles in the years 2020 and 2020 to 2021, declined. However, just a few articles cover July 2021 to bring SLR up to date for 2021. As a result, it offers a complete picture of research efforts for the whole year of 2020.

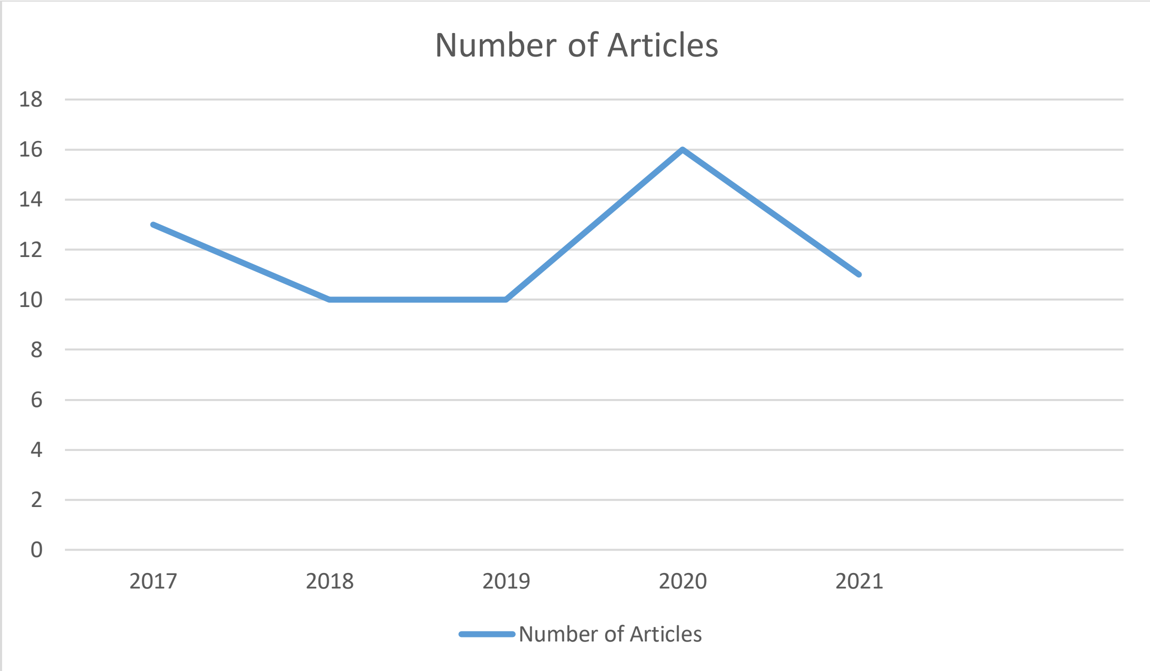


Figure 0-2 Number of articles and years

1.3 Result of SLR

This part aims to respond to the RQ1-RQ4 questions posed using PICOC. The researcher utilized the retrieved data in data files to respond and explain studies for each RQs, as mentioned below.

- **RQ1.** What is the research purpose for smart city framework adoption?
- **RQ2.** What evidence is there factors for smart city adoption by city planner and citizen?
- **RQ3.** What are the value or benefits of smart city framework adoption?
- **RQ4.** What were the measurement dimensions of smart cities for sustainable living?

1.3.1 Attempting to answer Review Question No. 1:

RQ1. What is the research purpose for smart city framework adoption?

Since designing the methodology, the SLR stage has defined and led the high-quality literature reviews to ensure that they are rigorously and completely recorded. RQ 1 was completed by evaluating 60 published publications on the smart city framework during five years (2017-

2021). This sample period is long enough to understand how smart city framework adoption is progressing.

60 publications must then be categorised by the student. It follows that in order to address urban problems and build a long-lasting digital infrastructure, Smart Cities use ICT to create new development approaches and apply, market and publicise them. Smart cities employ software, user interfaces, communication networks, and the Internet to connect the public and private sectors. (IoT). There is nothing more vital than the Internet of Things (IoT). Data is exchanged between devices that are connected to the Internet of Things. Home appliances and street sensors are all examples of this. Public and private sector efficiency improves as a consequence of the data gathered from these devices stored in the cloud or on servers. Edge computing is used by many IoT devices to guarantee that only relevant data is sent across the network. Besides protecting, monitoring, and controlling data flow from the smart city network, the IoT network of the city's data platform is also protected by this system. Sophisticated urban planning relies on the integration of new technologies such as artificial intelligence (AI) and the Internet of Things (IoT). There are a number of ways that smart parking may assist vehicles find parking spaces and collect digital payments.

To ease traffic congestion, smart city infrastructure can support ride-sharing services and smart traffic management can monitor traffic flow and alter traffic lights. When no one is around, lights are dimmed to save electricity. Everything from day-to-day operations to long-term strategic planning is covered. Internet-connected garbage cans, dumpsters, and fleet management systems might help smart cities combat climate change, air pollution, and squalor. Smart cities also incorporate security measures such as monitoring high-crime areas and deploying sensors to identify natural catastrophes such as floods, landslides, storms, and droughts, in addition to services. Using real-time space management and structural health monitoring may help you decide when repairs are needed. It is possible for sensors and/or persons to discover infrastructure concerns such as water pipe leakage.

Smart city technologies offer the potential to improve a variety of areas of city life, including energy efficiency. In smart cities, residents may have access to a broad range of services. Smart cities integrate IoT and other technologies in four levels to improve the quality of life and the economy. The best thing you can do is: Real-time data is collected by smart sensors. Analysis of municipal services and operations is done using data. Decision-makers get the findings of the data analysis.

Operating efficiencies, asset management, and the general well-being of city dwellers are all enhanced.

The ICT system collects real-time data from linked assets, objects, and equipment. Citizens may participate in smart city ecosystems via a variety of means, including mobile devices, connected autos, and smart buildings. An integrated system of technology and municipal infrastructure may save money and improve sustainability while reducing traffic congestion and enhancing the air quality.

Cities presently contain 54% of the world's population, and that number is expected to rise to 66% by 2050, adding an additional 2.5 billion people to the global population. The demand on natural, social, and economic resources rises as the world's population increases. Local governments and the public may work together to develop and implement smart city initiatives. The goal of a smart city is to provide a high standard of living for its residents while also fostering economic growth. In order to do this, packaged services must be provided while infrastructure costs are kept to an absolute minimum. This is critical in light of the projected growth in urban populations and the need to make effective use of existing infrastructure and resources. In order to make these developments possible, smart city services and applications will be necessary.

There are several ways in which smart city modifications might add value to existing infrastructure and save money for the government and the people who live there.

Sustainability is critical to the success of smart city initiatives aimed at improving efficiency and the quality of life for residents. While cities may help the environment by reducing the amount of land they use, they are also powered by fossil fuels. Emissions may be reduced by the implementation of innovative strategies, such as the use of electric vehicles to move people and goods. Automobiles powered by electricity may help regulate the grid's frequency while not in use. Autonomous cars are predicted to reduce the number of individuals who need to own a car as a result of such environmentally friendly modes of transportation. Sustainable and resource-efficient living are only two of the advantages that people all over the world may enjoy as a result of a global network of smart cities. To find these solutions, the federal government, private enterprise, and local governments must all work together. The Internet of Things (IoT) may be used in smart cities to improve people's lives and offer linked living solutions for the growing global urban population, with the right support and infrastructure. For 60 publications or research, a holistic approach is utilised to analyse the purpose of the article category.The categorization aim of the investigations is shown in Table 0-12.

Table 0-12 Study classification to determine the study's purpose

Theme	**Study ID #**	**#**
Sustainability	[SCA3] [SCA4] [SCA14] [SCA38]	4
Adoption	[SCA1],[SCA3], [SCA18], [SCA19], [SCA20], [SCA22], [SCA30], [SCA38], [SCA53], [[SCA55], [[SCA59],	11
acceptance	[SCA2], [SCA4], [SCA17], [SCA37], [SCA48],	5
Challenges	[SCA4], [SCA9], [SCA12], [SCA56]	4
Factor	[SCA2], [SCA17], [SCA19], [SCA20], [SCA30],	5
Understanding	[SCA4], [SCA49], [SCA57],	3
Smart city	[SCA1],[SCA2], [SCA3], [SCA4], [SCA5], [SCA8],[SCA17], [SCA18], [SCA19], [SCA23], [SCA26], [SCA27], [SCA30], [SCA31], [[SCA36], [[SCA38], [SCA40], [SCA41], [SCA42], [SCA44], [[SCA51], [[SCA54], [SCA59],[SCA60]	25
Smart city framework	[SCA4],[SCA16], [SCA26], [SCA27], [SCA28], [SCA32], [SCA42], [SCA43], [SCA44], [[SCA54]	10
	Total	67

The aim of smart city framework adoption and IoT benefit for the smart city can be easily determined based on Table 0-12, the overall picture.

As a result, smart city adoption and adoptions have gotten a lot of attention in studying smart city sustainable living in cities. However, research on the impact of the smart city framework using IoT after implementation is still lacking and gets little attention. As a result, the gaps should be highlighted, and further study is required.

1.3.2 Attempting to answer Review Question No. 2:

RQ2. What evidence is there factors for smart city adoption by city planner and citizen?

Twenty articles were selected as proof elements for smart city framework acceptance by municipal planners and citizens to answer the RQ2. RQ 2 experiments are included in

Table 0-13.

Table 0-13 Relevant Studies for RQ 2

Study ID #	Factors
[SCA2], [SCA3] [SCA4] [SCA12] [SCA14] [SCA17], [SCA37] [SCA38] , [SCA48]	People living and working in cities rely on a variety of Driving Forces to help improve their quality of life by ensuring that they have access to clean drinking water; reliable electricity; efficient urban mobility; and affordable housing. Data and technology are used by these Driving Forces to help improve these quality of life factors in cities.

However, these elements are dissimilar, with just a handful overlapping. As a result, the researcher uses content analysis to filter out duplication or overlapping aspects in the adoption and application of smart city frameworks and IoT in smart cities. Content analysis is a versatile research strategy that has been widely used in information systems (IS) (White & Marsh, 2006). This section might use it to carefully summarize and analyze all of the aspects of making a Smart city for sustainable living and answer RQ2.

To begin, most prior research classified the elements of smart city framework adoption using the Technological, Organizational, and Environmental (TOE) framework. Then, after understanding the significance of the function of the city planner or citizen in the smart city sector, the Technological, Organizational, Environmental, and Individual (TOEI) research was included. Various academics use the Technology Acceptance Model (TAM), Diffusion of Innovation (DOI), and Resources Based-View (RBV) To identify the important component. Some research does not employ particular ideas in addition to frameworks and theories. Some research is more focused on contextual or other aspects. In Table 2.13, these four (4) dimensions and sub-factors are mentioned.

Table 0-14 Dimension of factors affecting smart city framework

1.TOEI Factors • Technology • Environment • Organization • Individual	2. Factors underlying theories • DOI related factors • TAM related factors • RBV related factors
3. General Considerations • Cost savings • Convenience and ease of use • Reliability • Sharing and cooperation • Security and privacy	4.Contextual Factors • Trust • Risk • Entrepreneurship • Knowledge • usage

Prioritize and explore with city planners and citizen groups at all levels the myriad needs and issues at the forefront of Smart Municipal conceptualization. Because cities are built for people, human factors must be considered in the smart city project design process. It should assist in establishing stakeholder groups' user requirements and, ideally, building agreement around those thought most important, allowing for wide discussions, decision-making, and effective project implementations.

When planning a smart city, there are five types of human elements to consider. Social, technical, economic, environmental, and political considerations are among them.

The following are examples of

sociological determinants:

Inequality, Employment, Community, Cohesion, Informal Settlements, Public Health, Education, Individual Safety, Tourism, the world's middle-class growth in the population, Migration to the city, the ageing population, Household patterns, inequity, employment, community cohesion, informal settlements, health, sustainable behaviours Housing, Infectious diseases, and Entrepreneurship are all topics that come up in conversations about digital lives.

Factors of technology:

Automation and the Internet of Things The word "smart infrastructure" conjures up images of data and sensors, intelligent transportation systems, technology leapfrogging, energy efficiency, and integration. An autonomous vehicle is one of many technological factors. Additive manufacturing, microgeneration, and e-mobility are just a few technologies that will shape the future. Scaled-down solutions A slew of new technologies are emerging to address various challenges, including artificial intelligence, digital modelling, the quantified self, small-scale solutions, smart buildings, and a deteriorating cybersecurity infrastructure with regional ties.

Economic Considerations:

All economic elements, particularly financing, must be taken into account. Factors in the circular economy include a scarcity of skilled workers as well as an emphasis on the needs of the end user. The digital economy and city logistics A city's manufacturing capacity is based on the strength of its women's economic power, urban regeneration, small businesses, and neighborhoods revitalization. Supply chain vulnerability and the sharing economy City identity, economic progress, and the informal economy are all linked to self-sufficiency. Decarburization

Environmental Considerations:

Water management, food security, green infrastructure, ecosystem services, waste reduction, inclement weather, air quality, pollution, urban expansion, and biodiversity loss are only some of the environmental issues that need to be addressed. Heat fatigue Sanitation, To go about without using a vehicle, the rise in sea level buildings, and land use patterns have all been altered. Utilization of infrastructure the widespread use of internal combustion engines

Factors of politics:

Public-Private Partnerships, Stakeholder Engagement, Public Opinion, Institutional Capacity, and Competitiveness Politics in the World Public Space, System Interdependence, Terrorism Subsidies, and Environmental Policy are all aspects of leadership, transparency, policing, devolution, and standard-setting.

1.3.3 Attempting to answer Review Question No. 3:

RQ3. What are the value or benefits of smart city framework adoption?

This sub-section synthesises smart city framework adoption advantages to address RQ 3 based on an evaluation of relevant smart city adoption literature. The advantages of smart cities are shown in Table 0-15.

Table 0-15 Smart city Benefits

Study ID #	Smart city Benefits
[SCA1],[SCA2], [SCA3], [SCA4], [SCA5], [SCA8],[SCA17], [SCA18], [SCA19], [SCA23], [SCA26], [SCA27], [SCA30], [SCA31], [[SCA36], [[SCA38], [SCA40], [SCA41], [SCA42], [SCA44], [[SCA51], [[SCA54], [SCA59],[SCA60]	• make better decisions based on data and digital technology • Air quality monitor. Cities that are less dangerous to live in. Examples of smart city technology include Wi-Fi, Internet of Things (IoT), and security cameras. • Monitored with a video camera. • The infrastructure has been improved upon. • Squeezing the metre. To get more from the people.

1.3.3.1 The benefits of the smart city using IoT:

Technology is rapidly transforming the globe. Active connected devices are changing various sectors and our everyday urban environment. The "smart city" notion arose from integrating information technology and IoT capabilities with urban infrastructures.

The term "smart city" is ambiguous. It can be interpreted in many ways. However, we may say in general:

A smart city usages digital technology to advance residents' lives, manage infrastructure, and manage the urban environment. A smart city collects, analyses, and exchanges data to make decisions (by the city government and individual residents at different levels). Sensors and IoT devices collect essential data. There are already several active sensors. The possibility to blend them and create new solutions is the most exciting feature. Here are some smart city examples of IoT technology. Emergencies are detected through sensors placed in the engineering infrastructure. Meters for water, gas, and electricity automatically notify service providers of use. In response to changing illumination conditions, the efficacy of smart street lighting adjusts its output (for example, the rapid darkness onset due to weather changes). The data collected by smart waste bin sensors is used to improve collection routes for the bins being collected. In an intelligent city, self-driving cars are a must. Autonomous buses and vehicles will minimise traffic congestion, carbon dioxide emissions, and human-caused accidents. Intelligent Transportation Systems (ITS) are in charge of everything from traffic signals to road signs to licence plate identification and data flow integration (intelligent transport systems).

Security firms often use facial recognition technologies. They examine data gleaned from cameras positioned throughout the city. Anybody, even kids, who goes missing might be found thanks to these new tools. Intelligent parking systems monitor parking lot exits and warn other vehicles when a parking space becomes available. Energy, water, and other resource efficiency have a direct impact on the city's environmental state. Residents can access common services like government websites and stay up to speed with current events by using the internet. Internet of Things (IoT) and Smart Cities We will learn more about productivity, difficulties, and possibilities as the Internet of Things (IoT) becomes increasingly prevalent in our everyday lives and urban environments. The Internet of Things (IoT) is the most promising new technology for the future of cities. Compared to the past, most cities have developed IoT ecosystems that improve mobility, security, health care, and efficiency for their citizens. The next industrial revolution is looming, and the world is changing rapidly. An increase in the Internet of Things may be achieved by using a 5G mobile connection. "new electricity." in the IoT lingo refers to this technology. Cities of the future will be more sustainable, enjoyable, and safe thanks to technological advancements.

1.3.4 Attempting to answer Review Question No. 4:

RQ4. What were the measurement dimensions of smart cities for sustainable living?

The measuring of smart city performance is the topic of this research question. The smart city adoption metric is shown in Table 0-16. The Balanced Score Card was used in all of the trials (Hudson, Smart, & Bourne, 2001)

Table 0-16 Measure used for smart city performance

Study ID #	Measurement	Dimension
[SCA1],[SCA3], [SCA18], [SCA19], [SCA20], [SCA22], [SCA30], [SCA38], [SCA53], [[SCA55], [[SCA59]	Balance scorecard (BSC)	Smart mobility Smart People Smart Government Smart economy Smart environment Smart living

1.3.4.1 Smart Government:

All stakeholders in a municipality, including inhabitants and companies, are encouraged to participate in "Smart Government" which attempts to enhance communication. Residents and companies may find new ways to get the services they need if a city adopts a smart city strategy. Combining cutting-edge technology with innovative thinking might lead to the creation of a "smart government" (e.g., for digital citizens or commercial services or the administration of public infrastructure). Using a "city as a service" model may assist improve efficiency, effectiveness, openness, and confidence in the public sector.

1.3.4.2 Smart Economy:

The term "smart economy" refers to any and all efforts to improve a municipality's economic well-being. Establish an innovative and sustainable economy in order to boost the competitiveness of a city's business environment and attract new (highly trained) workforce

The use of (digital) technology and innovative methods results in economic development that benefits all stakeholders. Smart economic development is a vital government tool for aggressively seizing opportunities and creating circumstances that support new company growth and employment creation.

1.3.4.3 Smart Environment:

For the benefit of its residents and tourists, communities are taking care of their constructed and natural environments. Using current technology and novel methodologies, we can develop more sustainable norms and behaviours. Reduce waste and pollution, reduce emissions, manage water, increase energy efficiency and speed up local energy transitions are all significant "smart environment" aims.

Another objective is to improve efficiency and reduce environmental impact via new urban design rules.

1.3.4.4 Smart Living:

In order to improve the quality of life for both residents and tourists, "Smart Living" encourages participation from people of all ages and backgrounds. It is necessary to address the issues of environmental management and livability at the same time if local government and its stakeholders are to reap the greatest advantages. Digital inclusion, healthcare for the aged through eHealth and Ambient Assisted Living, secure living conditions and smart buildings are all part of Smart Living's mission. In order to improve accessibility and the citizen experience, new civic and social engagement tactics and new technologies (e.g. IoT based on WiFi or LPWA network technology) are being used.

1.3.4.5 Smart Mobility:

Urban transportation and people's mobility may be enhanced by better mobility management and targeted infrastructure improvements, according to the plan. Cities and communities have a tough time achieving affordable, quicker, and more environmentally friendly transportation. There must be long-term strategic support for multiple kinds of public transit, as well as the acceptance and use of new means of mobility, such self-driving automobiles and bike-sharing programs. We must take a customer-centric strategy in order to offer high-quality mobility services and lower our environmental footprint.

1.3.4.6 Smart People:

First, "Smart People" aspires to transform how people engage with the public and private sectors. Encouraging social and digital inclusion/equality via education is essential for improved information and service delivery. Everyone may benefit from "Smart People" professional advice, job search and education tips. Economic growth increasingly depends on talent development. Smart People solutions improve a city's economy and creativity by making it accessible and inclusive. Inspire cooperation, transparency, and innovation with intelligent solutions. The synthesis findings reveal the Smart City indicators and dimension. Among the topics they studied were Smart Governance, Smart Environment, Smart Mobility, Smart People, Smart Economy, Smart Living, Smart Infrastructure/Technology and Education. Smart buildings, healthcare, safety, and education were considered factors for synthesizing Smart city indicators. Smart Hospitals, for example, provide healthcare and patient e-monitoring. Smart Public Safety reflects Smart Living. The study's primary findings may help towns establish goals and track their progress toward becoming smart cities.

As a result, cities utilise indicators to track their success. Following a thorough literature research, the results and analysis lead to a set of Smart city performance measures. Smart governance, smart environment, smart mobility, smart people, smart economics, smart lifestyle, smart infrastructure/technology, and smart energy are all part of smart cities. This research may address a knowledge vacuum on Smart City indicators and help local authorities evaluate Smart City performance. Choosing a few Key Performance Indicators (KPIs) is crucial given the large quantity of data generated by cities.

1.4 Discussion on SLR’s Findings

This section focuses on SLR's results and debate. The main goal of this examination is to look at the impact of Smart Metropolitan adoption on city performance. The ideas, methods, and previous international research in Pakistan were discussed in the following sub-sections.

1.4.1 A Critical Analysis of Adoption Theories: Organizational level

After performing SLR on smart city adoption in academic literature, it was discovered that numerous hypotheses are pertinent to this study. Individual theories judged inappropriate for this research, such as the Technology Acceptance Model (TAM) and (UTAUT), were eliminated according to the SLR inclusion and exclusion criteria methodology. Diffusion of Innovation (DOI), Technology-Organization-Environment (TOE), and Resources-Based View (RBV) at the organizational level are the most widely employed theories in historical research on smart city uptake and IoTs, according to SLR findings. As a result, the following is a critical critique of three key adoption theories: DOI, TOE, and RBV.

1.4.1.1 Diffusion of Innovation (DOI)

(Rogers,.2003) created the Diffusion of Innovations (DOI) hypothesis, which was inspired by sociology. The DOI describes how innovations propagate throughout a company and Via several people that work for that company. DOI was formerly thought to be a model for innovation adoption in general, but it is currently being effectively used to explain the adoption of information technology in businesses. DOI also highlights communication channels' relevance and opinion leaders' relevance in invention dispersion. (Moore and Benbasat, 1991) extended the theory to include eight distinct constructs: "voluntariness, relative advantage, compatibility, image, ease of use, result demonstrability, visibility, and trialability." The DOI idea is shown in Figure 0-3 below.

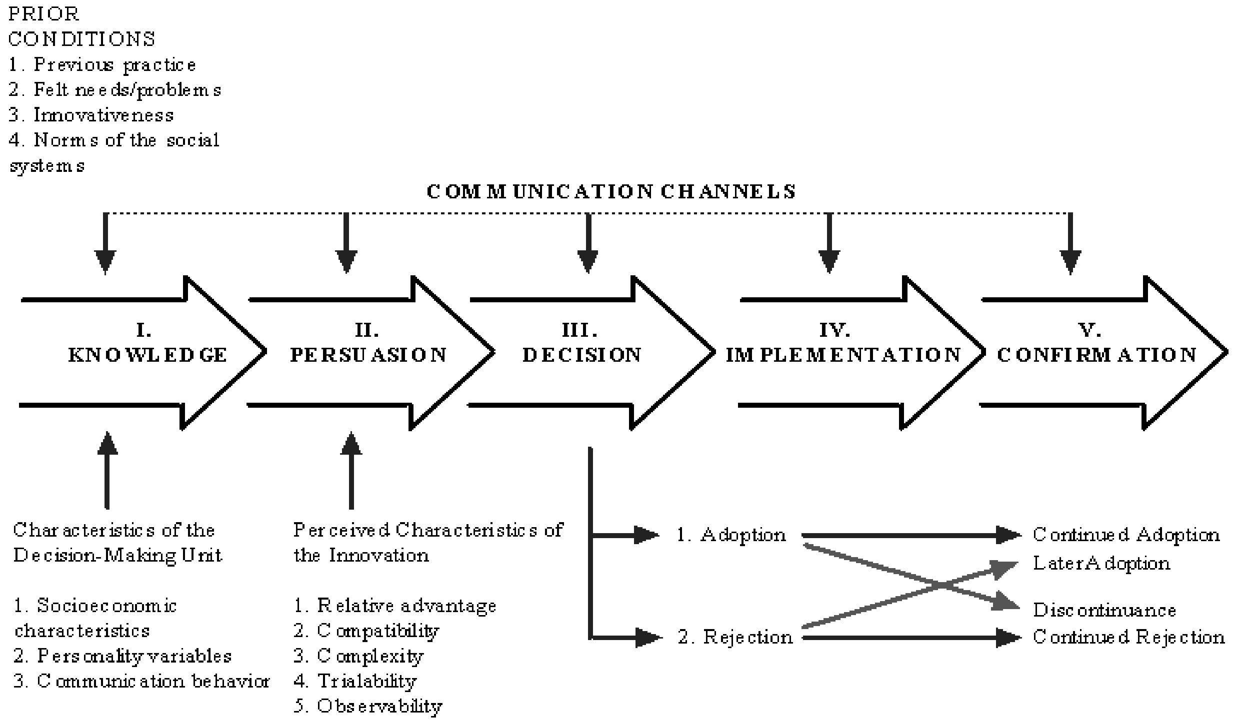


Figure 0-3 DOI Theory

For each step, the DOI model is regarded as a direct model. The model is suited for testing using first-generation multivariate analytic approaches due to the flow of communication channels. The model includes many constructs, with relative advantage, complexity, and compatibility being consistently linked in DOI research (Bradford & Florin, 2003). DOI has been used and used in various ways (Oliveira and Martins, 2011).

Despite the widespread use of DOI in multi-domain acceptance studies in the IS field, DOI is unsuitable for this research due to many fundamental concerns. DOI proposes that innovations propagate within a social system through interpersonal communication channels (a social system includes individuals, informal groups, and organizations). Rogers said that people who sustain interpersonal contact are likely to have comparable opinions, viewpoints, and experiences. As a consequence, interpersonal communication will spread innovations more efficiently. However, when innovation is adopted at an organizational level and provided by a third party, such as a cloud service provider, the effect or outcome will be different. Families, business networks, local community networks, and industries are part of multilayer social systems that include smart cities. Contradictory standards, behaviours, and beliefs exist in multilayer social systems. The DOI theory, in particular, is unable to properly capture and investigate the structures and processes of complex social systems and relationship aspects.

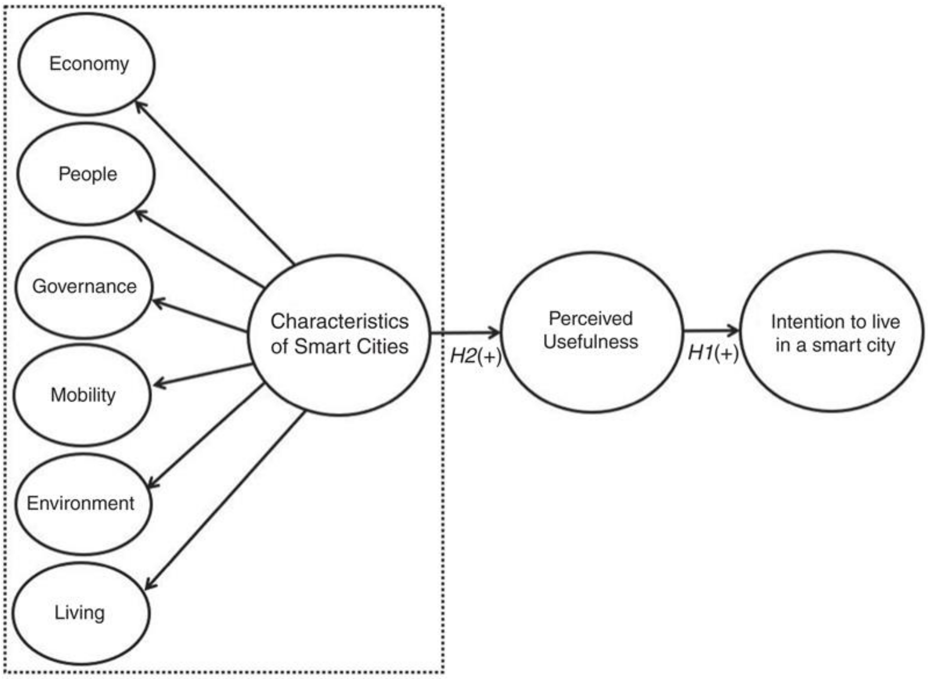
More than merely the involvement of innovation is required to advance technology. Even after being created, there is still more work to be done. It is critical to communicate an invention to make more people aware of it, utilize it, and profit from it. It's referred to as "diffusion of innovation." Diffusion is the way of spreading innovation to members of a social system through time. "novelty" refers to a new notion, activity, or item. The phrase may be novel to some, but not always (Rogers, 1983). Research on new technology has used the diffusion of innovation theory in education (Lee et al., 2011; Ntemana & Olatokun, 2012), gender (Castrillon & Cerradelo, 2014), and business (Castrillon & Cerradelo, 2014). (Ghobakhloo et al., 2012) They studied everything from dispersion features to the influence of the invention itself. Diffusion is a kind of communication that involves new ideas. Diffusion seeks mutual understanding between source and receiver as a communication goal.

In this research, dispersion is directly tied to mutual understanding between the city of Solo's Transportation, Communication, and Informatics Agency and the intended beneficiaries, the people of Solo. Residents of Solo and its environs and visitors from all around Indonesia and the world are the target receivers. This merchant-supported software also targets business owners, retail owners, and hotel or restaurant managers. Furthermore, the public perceives the Solo Destination application as new due to the extensive use of the internet in everyday activities. Finding a place to eat is a regular task, and this app may help. As stated before, diffusion has four components: innovation, communication channels, time, and the social system. In this view, the innovation is the Solo Destination app, and the communication channels are how the authority spreads the word about it.

The third component, time, maybe handled by noting that the application has a deadline, and the fourth component, the social system, indicates that this invention will improve social life. It will improve people's productivity and convenience of doing anything internet-related. The innovation-decision process is a well-known principle in the transmission of innovation

(Rogers, 1983). It develops an individual's comprehension of an invention into an attitude toward it. Some will accept it, and others will not. The steps are comprehension, persuasion, decision, action, and confirmation. A person gains knowledge when they learn about an innovation and its operation. Persuasion occurs when an individual has a good or negative attitude toward an idea, and choice occurs when an individual adopts or rejects the innovation. An innovation is implemented when it is used. It occurs when someone tries to improve an already creative option but changes their mind if something horrible happens in the future. The first stage is to get information that will help the following phases. It includes signals like the target learning about the innovation, comprehending the information, and knowing how to use it. If the objectives have previously satisfied the three criteria, they will benefit.

Technology systems are complex, intricate, and sophisticated in today's world. Consequently, knowledge and comprehension of innovation seem to be optional, and adoption will occur. Galang (2013) stated that people, corporations, and organizations learn about sophisticated technology as they study and employ innovation. This illustrates a paradox: an organization is unlikely to hear about technology until it is adopted. Yet, they are less likely to adopt it if they do not know about it. As a result of the above debate, it can be inferred that the absence of particular elements like organizational and environmental factors, which are regarded as a key drawback of DOI theory, may impact the adoption of technological innovation such as smart city is shown in Figure 0-4.



Source: Own elaboration

Figure 0-4 Theoretical model(DOI) for smart city (Pinochet, L.H.C., Romani, G.F., de Souza, C.A. and Rodríguez-Abitia, G. (2019),

1.4.1.2 TOE framework

The firm's adoption of technical advances is impacted by a) technological, b) organizational, and c) environmental circumstances, according to the TOE framework created by Tornatzky and Fleischer in 1990.

a) The technical viewpoint describes the company's internal and external technology. The technical context encompasses all of the firm's current procedures, equipment, and technology.

b) Organizational viewpoint refers to an organisation's size, scope, and management structure, all of which impact the adoption of information technologies. The situation in which a company operates is referred to as the environmental context.

c) Competitors, business partners, consumers, and regulators make up the environmental setting. The TOE framework provides a strong analytical foundation for evaluating acceptability and adoption.

Diverse IT innovation [T]he TOE paradigm has a solid theoretical base, consistent empirical backing, and the ability to be applied to IS innovation areas (Oliveira and

Martins, 2011). This paradigm is particularly effective for IT adoption at the corporate level. Several writers have utilized it to understand better various IT adoptions such as open systems, e-commerce, and e-business.

Figure 0-5 depicts the Technology-Organization-Environment (TOE) relationship:

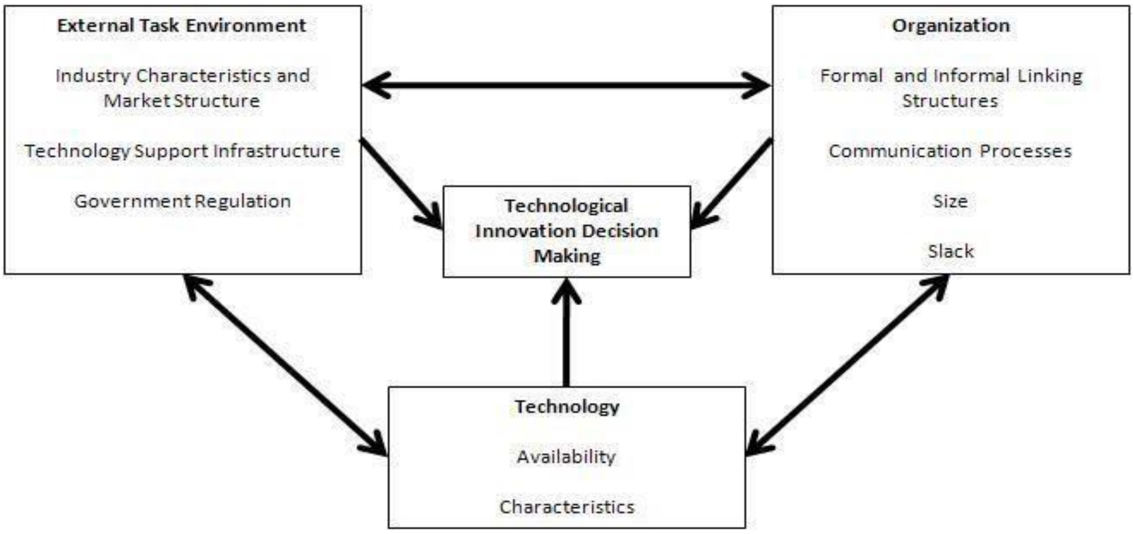


Figure 0-5 Technology-Organization-Environment (TOE)

The TOE perspective looks at new technology adoption from three broad macro levels. Using cloud computing effectively requires matching organizational demands to cloud characteristics. This method emphasizes the key aspects of both opposing perspectives. It examines cloud adoption in terms of how well an organization's objectives and technological capabilities coincide. An environmental lens is used to identify external success factors or pressure points influencing adoption decisions. This is critical because, even if technology and organizational objectives align, external factors may affect the requirement to continue the adoption process. In this study, the TOE framework could not give information on the "cost" of cloud adoption. Despite the significance of organizational and technological components such as top management commitment, the difficulties of cloud costs are frequently underestimated.

1.4.1.3 Resource-Based View (RBV)

RBV is broadly used in the field of information security. Previous ICT research on resources, performance, and competitive advantage has been influenced by RBV (Bhardwaj et al., 2000).

According to RBV, organizations are made up of specialized resources. An organization's management's ability to integrate such resources enables the company to take advantage of market opportunities that increase its performance (Penrose, 1959).

As a result, it is commonly accepted that resources are the primary unit of analysis in the organisation process (Grant 1991). It is possible to see a company as a collection of resources and talents that enable it to continue to exist. An organisation has a set of resources that, based on its characteristics, may enhance its competitive advantage according to the RBV (Barney 1991). In a dominant paradigm, a link between a company's resources and its strategic competitive advantage has been discovered (Piccoli et al. 2002). Unique and distinctive resources that are permanent, uncommon, suitable, non-substitutable, immobile or imperfectly mobile and valued in the firm's environment and marketplace may create and retain competitive advantage in general (Birkinshaw and Goddard 2009; Wade and Hulland 2004; Barney 1991). A "missing" ingredient in RBV, for example, is the cultural component. RVB believes that the examination of three important ideas at the organisational level makes it appropriate to pursue the study's goal of creating a complete model of smart city performance.

The theoretical underpinning, knowledge, and information connected to the smart city framework model are presented by examining the theories and models employed in the research. The researcher, driven by theory, model, framework, and concept (TMFC), adopted the conceptual method by classifying theory or framework (Duncombe & Boateng, 2009). The TMFC comprises

a) theory-based techniques, which use a known theory.

b) Framework-based approaches: they apply an analytical framework based on a corpus of theoretical work.

c) Model-based approaches: these employ models but do not relate to a body of knowledge;

d) Idea-based approaches: these make use of a specified concept.

The notion, however, is not conceptually sound.

The majority of the research has narrowed its scope by focusing on a single theoretical approach, with just a handful combining two ideas. The technology-organization-environment (TOE) paradigm is often compared to other theories, with diffusion of innovation (DOI) theory coming in second. TAM (Technology Acceptance Model) and RBV (Resource-Based View) are other useful tools.

For getting a complete acceptance regarding the theory, the researcher also double-checks and identifies the past empirical studies of smart city adoption. Table 0-17 shows past empirical studies, theories, and the main results.

Table 0-17 Past empirical study and Models used in smart city adoption (Araral, 2020)

	Model	Description
Architecture		
Anthopoulos (2015)	Smart city dimensions	Resource, Transportation, Urban infrastructure, Living, Government, Economy, Coherency
Giffinger et al. (2007)	Smart city components	Smart Economy, Smart Governance, Smart People, Smart Mobility, Smart Living, Smart Environment
Glebova et al. (2014)	Smart city conceptual elements	Intellectual transport system, public security, energy consumption management and control, environmental protection and ICT
Hancke et al. (2013)	Sensor areas in smart city	Smart Infrastructure, Smart Surveillance, Smart Electricity and Water distribution, Smart Buildings, Smart Healthcare, Smart Services and Smart Transportation
Hollands (2008)	Smart City Model	Instrumented (based on data collection) Interconnected (enable data flow) Smart (utilize data to improve urban living)
IBM (Söderström et al., 2014)	Nine Pillar Models Smarter City Equation	Planning and Management Services Infrastructure Services Human Services Instrumentation (*the transformation of urban phenomena into data*) + Interconnection (*of data*) + Intelligence (*brought by software*)
Naphade et al. (2011)	Smart city model	Government services, transportation, energy and water, healthcare, education, public safety and other core ICT systems
Neirotti et al. (2014)	Smart City domains	Natural resources and energy, Transport and mobility, Buildings, Living, Government, Economy and people
Yovanof and Hazapis (2009)	Digital City Architectural Framework for Smart Service Provision	Infrastructure (communications); Mobilized Services (capability to mobilize data, applications and users); Policy (legal framework to foster innovation)
Zygiaris (2012)	Smart City reference model	Multi-tier smart city model with several components and entities

		entities
Governance		
Albino and Dangelico (2015)	Smart City Dimensions	- city's networked infrastructure that enables political efficiency and social and cultural development - emphasis on business-led urban development and creative activities for the promotion of urban growth - social inclusion of various urban residents and social capital in urban development - the natural environment as a strategic component for the future.
Baron (2012)	Three level-model for city intelligence for resilience conceptualization	First level of city smartness: led by example Second level of city smartness: govern the private urban actors Third level of city smartness: integrated approach (hi/medium/no resilience)
ISO (2014b)	A table of city characteristics where smartness is applied	Environmental Context City History and Characteristics Societal Context City Governance City Subsystems (actors, activities, facilities and buildings, hard infrastructure, soft infrastructure, technical systems, city functions, scale)
ITU (2014a)	Attributes and Core themes	Attributes: sustainability; quality of life; urban aspects; intelligence or smartness Core themes: society; economy; environment; governance
Lee et al. (2014)	Framework for smart city analysis	Urban Openness, Service Innovation, Partnerships Formation, Urban Proactiveness, Smart city infrastructure integration, Smart city governance
Leydesdorff and Deakin (2011)	Triple-Helix Model of Smart Cities	Networks of universities, industry and government
Liu et al. (2014)	Smart city value chain (SCVC) model	Primary Activities: smart inbound logistics; smart operations; smart outbound logistics; smart marketing; smart services Supportive Activities: smart government; smart infrastructure; smart procurement; smart technology
Lombardi et al. (2012)	Triple helix model for smart city analysis and performance measurement	A table with rows: University, Government, Civil Society, Industry and columns: smart governance, smart economy, smart people, living, environment
United Nations Habitat (United Nations, 2014)	Dimensions of City Prosperity	Productivity and the Prosperity of Cities, Urban Infrastructure: Bedrock of Prosperity, Quality of Life and Urban Prosperity, Equity and the Prosperity of Cities, Environmental Sustainability and the Prosperity of Cities
Planning and Management		
Anthopoulos and Fitsilis (2013)	Technology Roadmapping for Smart City development	Patterns for smart city technological evolution
Lee et al. (2013)	Technology Roadmapping for Smart City development	Interconnections between services and devices, and between devices and technologies
Data and knowledge		
Batty et al. (2012)	Structure of FuturICTs smart city programme	Data Analysis and Modelling: Mobility and Transport Behavior; Urban Land Use Transport; Urban Market Transactions; Urban Supply Chains Infrastructure: Sensing & Networks, New Social Media; Integrated Databases Management: Decision Support and Participation; City Governance
Bellini et al. (2014)	Knowledge Model for Smart City data (KM4City ontology)	Administration; street-guide; point-of interest; local public transport; sensors; temporal; and metadata
Edvinsson (2006)	City as a knowledge tool model	Knowledge key driver definition and interrelation discovery (ICT and multimedia; University; Society and Entrepreneurship; Knowledge Cafes/Cathedrals; Diversity; Strange Attractors)

Facilities		
Calvillo et al. (2016)	Smart City Energy Interventions and Energy System Design Model	Energy interventions areas: Generation, Storage, Infrastructure, Facilities and Transport Energy System Design Model: (i) System Input (resources, costs, geolocation, energy prices, regulation, demand) (ii) System Output (capacity, total production, costs, environmental benefits, viability)
Services		
Fan et al. (2016)	Smart health organization model	Multi-tier architecture for smart health service production in smart city
People		
Shapiro (2006)	Neoclassical city growth model	Employment growth sources: productivity, quality of life
Thite (2011)	Urban factors for human capital attractiveness	*Magnets* (a healthy and well-educated workforce, clean environment, vibrant business climate, and a solid social and cultural infrastructure) and *glue* (city infrastructure, flexible regulation system)
Environment		
Shwayri (2013)	u-eco-city model	City as a range of ubiquitous services (including u-health, u-education, u-transport and u-government)
Tsolakis and Anthopoulos (2015)	Eco-city System Dynamics Model	A system of 5 interconnected components/subsystems: (i) population, (ii) housing, (iii) business, (iv) energy and (v) environmental pollution

Table 0- Past empirical study and Models used in smart city adoption use in from 2017-2021

Table 0-20 systematic literature review paper on smart city framework Adoption

Author	Model	Main Results
Kumar et al., 2017	Business Model	The smart economy in smart city
Pinna et al., 2017	Mobility	Smart city mobility and sustainable city
Shladover, 2017	Mobility	Smart city mobility and automatic transport system
Bibi & Krogstie, 2017	Literature review	Future cities that are smart and sustainable:
Schipper & Silvius, 2018	A background for strategic smart, sustainable urban development or a smart, sustainable city	Framework studies for smart, sustainable cities
Memos et al., 2018	Algorithm for a Surveillance System Based on Media	In a smart city, there is a framework and an IoT model.
Le-Dang & Le-Ngoc, 2018	Handbook of smart city	Understanding g the smart city in a good manner.
Yu & Xu, 2018	Development of smart city.	How to make and develop a smart city.
Boko et al., 2019	Smart city adoption model.	Comprehend smart city framework.

Abdulrahman H et at.,2019	Smart city acceptance model	Sympathetic the acceptance model of smart city
Anthopoulos, L., et al., 2019	Uniform smart city Model	Thoughtful the uniform model for smart city development
Heaton & Parlikad, 2019	Theoretical framework model	organization assets to citizen requirements within a Smart Cities framework.
Azizalrahman & Hasyimi, 2020	Towards a Generic Framework for Smart Cities	Understanding the Generic Context for Smart Cities
Wahab et al., 2020	Methodical literature Review	Study the Dimensions of Smart Cities
Sharma et al., 2020	Internet of Things (IoT) adoption obstacles of smart cities' waste management Model	Accepting Internet of Things (IoT) adoption barriers of smart cities' waste management
Manfreda et al., 2020	Citizens' Participation as an Important Component for Smart City Development	Understanding the Citizens' Contribution as an Important Element for Smart City Development
Żywiołek & Schiavone, 2021	Perception Model of the Quality of Smart City Solutions	Understanding Perception of the Quality of Smart City Solutions
Pira, 2021	.novel taxonomy of smart sustainable city indicators	Understanding the novel classification of smart sustainable city indicators
Gade & Aithal, 2021	.Smart City Waste Management concluded ICT and IoT driven Solution	Recognize the Smart City Waste Management through ICT and IoT driven Solution
Lom & Pribyl, 2021	.Smart city model based on a systems model	Considerate the Smart city model based on systems theory

To summarize, previous research has shown that most studies have a restricted reach due to using a particular framework or theoretical viewpoint. On the other hand, a few research merged the TOE and DOI frameworks. The RBV theory is also used to analyze smart city adoption at the city level.

1.4.2 Comparative study of research methodologies.

This section examines previous research on the adoption of smart city frameworks in different contexts and countries. The review's methodological methods are categorized using a systematic mapping of publications. As a outcome, it serves as a substance for identifying gaps in techniques, data collecting approach (e.g., case study, Delphi methodology, survey, and interview), research environment, and study nation. The mapping of studies based on research technique, context, and nation is shown in Table 0-18.

Table 0-18 Articles are mapped to classification research methods and their context.

Authors	Method	Context	Country
Kumar et al., 2017	methods for a collection of indicators to guide and monitor municipal service performance and quality of life	Smart city economy	Magnolia and India
Bokolo et al., 2019	Quantitative research approach	Smart City Adoption	Yerevan, Armenia
Neupane, C., et al., 2021	Structured Equation Modeling (SEM) Partial Least Squares (TAM Model) (PLS)	Adoption of Smart City Technologies	Australia
Lim, S. B., et al., 2021	Case of Malaysian Smart City Framework	Understanding and Acceptance of Smart City Policies	Malaysia
Bokolo et al., 2018	Case study Qualitative	A Simple Approach to Creating a Smart City: A Step Towards a More Sustainable Society	Malaysia
Kumar et al., 2017	Case study Quantitative	Smart budget in smart cities	Mongolia, India
Pangbourne et al., 2018	Qualitative	The Case of Mobility as a Service	UK
Mick et al., 2018	Qualitative study	NDN IoT in Smart Cities: Lightweight Authentication and Secured Routing	New Mexico
Paiva et al., 2021	Literature review Qualitative	Empowering Technologies for City Smart Mobility	Switzerland.

Ullah et al., 2021	A TOE framework	Hazard management in sustainable smart cities authority	Australia and Turkey
Zhang et al., 2020	Systematic literature review	Factors Inducing the Acceptance and Usage of Smart City Services	China
Manfreda et al., 2020	quantitative	Citizens' Contribution as an Important Element for Smart City Development. Re-Imagining Dispersion and Adoption of Information Technology and Systems	Ljubljana, Slovenia
Marimuthu, 2020	Systematic literature review	IoT for Smart City Services	Australia
Chohan & Hu, 2020	IoT-PVM Model for country's ICT adoption	Success Factors Inducing Citizens' Adoption of IoT Service Instrumentation for Public Value Creation in Smart Government	Pakistan
Araral, 2020	Quantitative	Why do cities adopt smart technologies? Possibility theory and evidence from the United States	USA and Singapore
Samuel et al., 2020	Quantitative	Drivers and obstacles to e-government adoption in Indian cities.	India
Vidiasova & Cronemberger, 2020	Quantitative	sensitivities of smart city initiatives in Saint Petersburg, Russia	USA

Bibri & Krogstie, 2017	Systematic literature review	Smart supportable cities of the future:	Norway
Sohag & Podder, 2020	IoT based application/ System formation	Smart Garbage Management System for a Supportable Urban Life	Bangladesh
Westraadt & Calitz, 2020	Quantitative by Modeling framework	A visual representation of the joint planning and administration of a smart city	South Africa
Noori et al., 2020	Qualitative	Towards an Integrated Framework to Measure Smart City Readiness as The Case of Iranian Cities	Iran
Heaton & Parlikad, 2019	Systematic literature review	arrangement of infrastructure assets to citizen requirements within a Smart Cities framework	UK
Trindade et al., 2017	Systematic Literature review	Justifiable development of smart cities	Mexico USA
Bremser et al., 2019	Qualitative	Technology Adoption in Smart City Creativities	Germany and Ireland

The findings of research smart cities are dominated by the quantitative, Quantitative and systematic literature review investigation via the literature review, survey interview approach, as shown in Table 0- and Table 0-18. Meanwhile, qualitative research continues to get less attention, and there are fewer studies, but these studies are very important in smart city framework adoption. The next part will go through previous studies on smart city frameworks in Pakistan and other international countries.

1.4.3 A previous study of smart city studies in Pakistan, Malaysia and beyond

The first SLR question, RQ1, discusses Smart city adoption in general, including Pakistan. However, in the case of Pakistan, a thorough SLR is required to focus on smart city adoption. As a result, the researcher created a distinct SLR methodology released from 2017 to date to investigate current relevant study studies on smart city adoption in Pakistan. The investigation was carried out on several engines offered by IIUM databases. As a result, the search string was filtered to only include phrases related to smart city adoption in Pakistan. This section focused on one aspect in particular.

Read up on prior study on Smart Cities in Pakistan and Malaysia. The "the smart city" idea envisions a networked, sustainable, pleasant, beautiful, and safe community of average technological size. It is vigorous to address local issues and landscape demands Unified communications (UC) are used to promote operational efficiency, public information sharing and citizen welfare. Digitalization and rapid technological advancements have made it easy to gather data on nearly any topic, allowing for simpler measurement and integration. Public value development is justified by weaker government-citizen interaction. Consequences include increased propensity to use and reliability. This project will investigate ISST and cognitive trust in IoT service orchestration. An IoT-based Public Value Model (IoT-PVM) was developed to assess system success. PLS-SEM is used to quantify this conceptual model. Researchers discovered that public trust may help individuals accept IoT in e-government services. The study's findings and debate may help lawmakers develop IoT service orchestration and make government smarter, more transparent, and more responsive to people. Bokolo et al. It is expanding because of the issues encountered by cities, especially in developing nations. Technology alone cannot create a sustainable society. A simple strategy highlights key considerations for maximizing smart city potential. A single case study was used to confirm the findings. In addition to interviews with Malaysian specialists, archival research was conducted. Their findings suggest that cities should have government, transportation, living, facilities, services, environmental, social, economic, technological, and information elements. This basic method may help sustainable city managers plan, execute, and evaluate sustainable city objectives for future generations. The number of research on smart city policy evaluations from practitioner acceptance. Their study tries to analyse Malaysia's smart city initiatives. The data were gathered through a survey and analysed using Fuzzy DelphiTM. Purposive sampling was used to pick a 40-person focus group. The Malaysian Smart City Framework's seven smart city domains and programs were assessed in this study. Participants' comprehension and uptake of smart city domains differed. On the smart economy, lifestyle, people, and government, all poll participants agreed. But all smart environment and digital infrastructure domain goals were refused (expert consensus 55–74%). No smart mobility either (professional agreement 56 per cent, threshold d value 0.245). The results demonstrate that while establishing more inclusive smart city policy, all opinions must be included. The Delphi approach was used to gather professional practitioners' comprehension and acceptance of a national smart city policy. The report also advises local governments on citizen participation in smart city strategies and initiatives. C. Neupane Stakeholder trust impacts smart city technology adoption in Australian rural cities, according to (Chohan & Hu, 2020). An extensive examination of the relevant literature As a result of this study, we developed a trust-based research technique for analysing the relevance of adopt Data from ICT professionals in rural Australian cities is used to validate this model. The research concluded that perceived usefulness, external pressure, and data security affect smart city trust. Stakeholder trust is closely connected with adoption of smart city technologies. An Australian ICT specialist explores stakeholder confidence in the adoption of smart city technologies in this unique research. The study results may be used to establish strategies to boost smart city technology adoption in Australia's rapid smart city development. (Bokolo et al., 2019) claim significant populations are moving to cities. By 2030, more than half of the world's population will be living in cities. The human home is huge and complicated. An understanding of smart city operations is essential to stay up with global urbanisation. Stakeholders, decision-makers, and city planners/developers are unaware of smart cities. Urban planners and developers must make strategic choices to achieve smart cities. Accordingly, policymakers must define the smart city's proportions. We developed a smart city adoption model to assess current smart city initiatives. A survey questionnaire was also utilised to get feedback on the planned smart city adoption strategy. So, partial least squares structural equations were used to represent the data (PLS-SEM). In the vote, smart city dimensions selected will help adoption. (Kumar et al., 2017) Globally emerging urbanisation patterns represent a variety of situations demanding a variety of approaches. A worldwide conversation on smart city economic development has sprung up around sustainable, resource-conserving, and resilient cities. Smart city economic development is likely to be a unique challenge for each nation or continent. As the rural economy gives way to the urban economy, the topic of smart city economic development arises. What makes it unique? OR DO WE NEED TO LOOK AT NEWER SMART CITY ECONOM What is a foodshed in a smart city? Smart Cities Industry: What are smart city commerce, transportation, and communications services? A smart city discussion is overdue. Can inclusive smart cities and economies exist? How can smart cities prepare for social inclusion? How should smart cities be governed and supported? What are Smart Cities Standards and how do they work? (Vidiasova) Smart cities continue to captivate practitioners and academics alike. While a study agenda has been established, case studies on residents' impressions of smart city initiatives are rare. This article explores views towards smart cities in Saint Petersburg using surveys and textual analysis of plans and documents. A disconnect exists between citizens and smart city supporters, particularly governments. Despite widespread use of conventional e-government technology, St. Petersburg's smart city objectives are hampered. There may be an expectation-results gap in collaborative e-government in smart city development that needs to be studied. With a critique of how neglecting to monitor gaps like the one in this case study may impact stakeholders' views. Manfreda, et Smart towns. One of the most widely debated current issues. A fascinating future undertaking that will better people's lives piques the curiosity and enthusiasm of academics and professional researchers alike. Smart cities' technical components have been extensively examined, but individual acceptability remains a challenge. Attending events may help promote smart city services. Many elements of smart city involvement have been investigated, but not the influence of participation on overcoming barriers and anxieties. Our research intends to measure and assess the efficacy of engagement in changing people's views and attitudes about smart cities, services, and development. We want to see how much interaction changes perspectives on smart city concerns. They conducted an online poll with over 500 people globally. (Samuel et al., 2020) to examine adoption drivers and obstacles of e-government services in a developing nation. An examination of the literature informs the construction and experimental assessment of a technology adoption model using data from four Indian cities. It was part of a strategy to learn individuals' perspectives on e-government adoption. It discovered both drivers and barriers to adoption in a developing nation. Only four Indian cities are studied. Contextualizing technology adoption requires cultural context. The study's findings are critical for policymakers and practitioners seeking to increase e-government adoption and efficiency. The study conceptualizes e-government adoption using planned behaviour and the technology adoption model. This model incorporates preference as a driving element for e-government adoption, unlike previous models.

What drives smart city adoption in Quetta and Gwadar?

This research looks on the long-term advantages of IoT and smart city technology. The implementation of smart cities in Pakistani regions requires further investigation.

To summarize, research on smart city utilization in Pakistan is currently limited. A previous study in Pakistan focused on the elements that influence smart city adoption. There is a absence of investigation on smart cities' social and economic benefits once implemented. The results of SLR will be examined next.

1.4.4 RESEARCH GAPS

This research used an SLR review of articles published between 2017 and 2021 to overview the literature on smart city adoption. All 60 articles met the criteria and followed the SLR protocol's steps. On the other hand, the SLR overview result highlighted an underdeveloped study topic and called for further empirical investigations on the use of smart city frameworks for sustainable living. SLR was used to detect, identify, and reveal important research gaps in smart city framework adoption sustainable living in province Balochistan Pakistan.

1.4.5 Limited post-adoption smart city framework

While these studies add to the literature, they are mostly conceptual and focused on adopting smart city frameworks. However, work on smart city deployment is already underway in Pakistan's Balochistan region. While there are certain notable cities, the broad adoption of revolutionary, integrated solutions to urban problems has proven difficult. Any smart city technology implementation has peculiarities, but there are three fundamental roadblocks to genuinely collaborative solutions: financing, people, and data.

Despite significant discussion of the pre-adoption and adoption processes, post-adoption research seems to be lacking. This vacuum is exacerbated by the lack of literature on ideas, frameworks, or theories for analyzing post-adoption outcomes. In the context of Pakistan, post-adoption smart city adoption has been comparatively under-explored since 2017.

1.4.6 Limited smart city framework Adoption Fixed in theory

The use of grounded categorization and generic ideas is prevalent in articles, although few pre-existing theories were used to investigate the adoption of smart city frameworks. However, there is an urgent need to implement a few post-adoption theories, such as Resources Based-View. THE MOST PREVIOUS STUDY USED the DOI theory and the TOE framework to explore smart city framework adoption under various circumstances. However, there is still potential to study and analyze viable post-adoption hypotheses in the scientific domain of post-adoption.

1.4.7 Limited Research from IoTs context

IoT has various assistances, yet some of the detriments described above continue to make IoT unstable. If these problems are not addressed, society and individuals will suffer greatly. The government should take initiatives to include citizens in the rapidly evolving technologies.

People need to feel safe while using these technologies; thus, privacy concerns must be addressed.

1.4.8 Conclusion

The researcher covers smart city definitions and the notion of the smart city in general, as well as the dimension of smart city, in the first section. The second section is SLR, in which the researcher goes through the SLR process, which Kitchenham developed in 2007 to capture a comprehensive picture, synthesize results, and provide evidence for the smart city framework context. Finally, SLR results achieved by identifying the goal of living in a smart city as well as its qualities from the audience's perspective. Cities' urban attractions increase university students' social participation. This gives the city's public a powerful and full intelligence. An enabling environment and ICT technologies may enable a new activism. As individuals connect with the city in real-time, we may envision well-known marches or demonstrations becoming outdated. The implementation of smart cities is a positive social development that helps people to become more inclusive. Even so, change is swift. So that the public may participate in city decisions, the information is promptly recognized. Groups large and small can use digital technology to coordinate. This enables IT entrepreneurs and social innovators to design digital solutions to social concerns with public input. This enables open data to give more transparency about public operations and may also help create knowledge for smart cities. To support and grow this type of inclusive shared economy, (Almirall et al. 2017) Smart cities employ disruptive technology, social advances, and data in novel ways. In this light, the study's public is swiftly influenced. People in a digitally developing economy have a natural yearning for smart cities. Thus, youth might create a social group that promotes digital education. This study's findings imply that target audience engagement in public innovation processes is crucial on the success of innovation and collaborative processes in smart cities.

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