

Adapting Cities Name with ICT and Countries Interested in the Smart City

Qasim Hamakhurshid Hamamurad, Normal Mat Jusoh, Uznir Ujang

Abstract—The concept of the city with an infrastructure of Information and Communication Technology (ICT) embraces several definitions depending on the meanings of the word "smart" which include: intelligent city, smart city, knowledge city, ubiquitous city, sustainable city, and digital city. Many definitions of the city exist, but this study explores which one has been universally acknowledged. From the literature analysis, it emerges that the term smart city is the most used in the articles to show the smartness of a city. This paper shares exploration of the research from the seven main website digital databases and journals focusing on the smart city from January 2015 to February 2020 to: (a) Time research, to examine the causes of the smart city phenomenon and other concept literature in the last five years; (b) Review of words, to see how and where the smart city specification and relation of different definitions are implemented; (c) Geographical research to consider where smart cities' greatest concentrations are in the world and determine if Malaysians are interacting with the smart city; and (d) How many papers are published in all of Malaysia from 2015 to 2020 about smart cities. Three steps are followed to accomplish the aim of this study: (1) The analysis which covered a systematic literature review search strategy to gather a representative sub-set of papers on the smart city and other definitions utilizing GoogleScholar, Elsevier, Scopus, ScienceDirect, IEEEExplore, WebofScience, and Springer between January 2015-February 2020; (2) The formation of a bibliometric map based on the bibliometric evaluation using the mapping technique VOSviewer to visualize differences; (3) VOSviewer application program to build initial clusters. The bibliometric analytical findings targeted the word harmony.

Keywords—Bibliometric research, smart city, ICT, VOSviewer, urban modernization.

I. INTRODUCTION

NOW, a city is becoming the center of interest. So, it should be a primary subject of research and focus on functional conceptualizations, and unequivocal definitions [1], [2]. A modern town is seen as a socio-economic structure [3]. This is defined by the difficulty of various elements and their interconnections that incorporate the elements of the city to work and evolve, Metropolitan growth is dominated by the ever-growing flow of people from rural environments to the urbanized region [4]. Urban upgrading is dictated by increasing the migration of people from villages to cities. In 2018, 55% of the world's population lived in urban areas [5], [6]. As shown by the UN Department of Economic and Social Affairs' Population Density Projections [7], this proportion will grow to

68% in 2050. In 2018, the global total population was 4.2 billion. There is a lack of current studies outlining how to expand urbanization and population transfer, as well as a general growth in the worldwide population in this way. In 2050, 2.5 billion people will be added to urban regions, with "roughly 90% of this increase occurring in Asia and Africa" [8]. Researchers proposed the notion of "Digital City," which is taken from "Digital Earth," to address several issues that have arisen in the development of urban modernization [9]. In recent years, some scholars have proposed the "Smart City" notion [9]. Cities will undergo continual changes in the coming years, according to estimates of Winkowska et al. [10]. While the global percentage of urban inhabitants is expected to rise [11], the demand for novel and interesting solutions to deal with the challenges of urban life is growing [12]. Cities are growing as other regions and countries are developing. Every year, the number of smart cities' efforts to promote municipality growth increases [13], but a bibliographical analysis of current studies on this subject discovered that it is shocking in Malaysia [14]. The purpose of this article is to summarize the research disciplines that used bibliometric analysis to analyze publications on smart cities [15]. A specific indication depicts the initial stage of the research process, which aims to identify field research issues and responses [16], as well as theoretically and in terms of smart city government growth [17].

All aspects and analyses concerning the topics discussed are addressed in four parts. The first section is the introduction that provides an overall approach to modern city problems, and we discuss smart city ideas. The second part explains the methods used for the bibliometric review. The third part is dedicated to the findings of the bibliometric research undertaken. The final part of the study analyzes the findings collected and provides the statements.

II. REVIEW

To control the various challenges in the growth of urban modernization [20], researchers proposed the concept of "Digital City" [18], which was developed from "Digital Earth" [19]. In recent years, some scholars have proposed the "Smart City" notion [21], [9]. Settlements use digital technologies to create smart cities, which, in ordinary terms, make life easier for residents [22]. A city must incorporate components [23] such as smart frugality, smart citizens, smart health, smart

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surroundings, smart management, and smart connectivity [2] to be smart. While the definition of smart cities is not straightforward and standard, the author provides a widely accepted connotation for smart cities through this research.

Previous studies showed that many of the technical standards and design issues are daunting, and there were reliable research and development that refer to digital based [25]. Besides, an open flow of data and participatory service design play an essential role in increasing the public involvement of a community [26]. It is supported that cloud computing, artificial learning of big data, and intelligence play essential roles as Internet of Things (IoT) advances its grand vision of "digital services through all connected devices" [27].

Smart cities use ICTs to improve the quality of life [28] for their residents, local economy, infrastructure, traffic management, climate, and engagement with the government. Thanks to the value of smart cities (also used in combination with other terms like Smart City, Data City, Intelligent City, City of Knowledge, Ubiquitous City, Wired City) [29]. A smart city is a city where information is not only available but also findable [30]. There are many terms of the city, as explained before; in this paper, an online database is used to determine which phrase is more useful after attempting to determine which country bears more responsibility than others and which scientific field receives the most responses.

III. RESEARCH METHODS

An analysis of bibliometric data is seen as an investigative tool considering the nature of the paper publication. The data obtained utilizing the bibliometric evaluation are provided as a map that shows interactions among various elements [31]. By the bibliometric study, the mechanisms of interest in the subject of "smart city" were assessed, this is evident in the number of Scopus and Web of Science papers published between January 2015 and February 2020. A bibliometric map was developed throughout the next phase of the study using the mapping tool VOSviewer to visualize the parallels [32]. VOS attempts to position objects in a small-dimensional space while the space between each of the two objects represents as accurately as possible the proximity or connectedness of the items [33].

A. Data Collection

Data collection involved a literature review to create a public database of affected-relevant publications and discoveries [34] in the smart city field. The period discussed in this research was from January 2015 to February 2020.

1. Search Idioms (String)

The search words used when searching fundamental literature review [34] were extracted from prior city-related work on ICT. A systematic literature review [35] addressed a variety of cities terms such as Wired city, Virtual city, Ubiquitous city, Intelligent city, Information city, Digital city, Smart community, Knowledge city, Learning city, Sustainable city, and Green city [35]. Additional search terms were used to reflect the study interest in broadly defined outcomes and effects of the smart city such as "smart city big data," "about smart city," "smart city review," "smart data," "smart city database," "smart city GIS," "smart city information system," "smart city management," "smart municipality," "smart city fog computing," "smart city challenge," "smart city security," "smart city waste management." However, this research focused on the term "smart city" because it is the most used and represents the terminologies in the literature that show the smartness of a city.

2. Databases Searched

From the most trusted resources [31], the study selects database websites and applies filters to some of them as searchable databases, including a large summary and citation database of peer-reviewed literature, as well as search and incoming research from science, technology, and medical branches. The searchable databases are freely available and can be found on:

- Google Scholar (scholar.google.com)
- Scopus (<https://www-scopus-com.ezproxy.utm.my>)
- ScienceDirect (<http://www.sciencedirect.com/>)
- IEEE Xplore Digital Library (<https://ieeexplore.ieee.org/Xplore/home.jsp>)
- Web of Science (<http://apps.webofknowledge.com/>)
- Springer Open (<https://www.springeropen.com>)

TABLE I
 SEARCHABLE DATABASE FOR CITY NEW TERMS

| Title with exact phrase "Idioms" | Google Scholar | Scopus | Science Direct | IEEE Xplore | Web of Science | Springer | Sum/Title |
|----------------------------------|----------------|--------|----------------|-------------|----------------|----------|-----------|
| Smart City | 26200 | 5722 | 1421 | 1003 | 1762 | 249 | 36357 |
| Digital City | 5990 | 1813 | 18 | 510 | 31 | 9 | 8371 |
| Wired City | 551 | 96 | 1 | 0 | 1 | 4 | 653 |
| Virtual City | 4020 | 1055 | 23 | 2 | 27 | 11 | 5138 |
| Ubiquitous City | 1130 | 362 | 6 | 1 | 3 | 8 | 1510 |
| Intelligent City | 3810 | 1029 | 18 | 87 | 23 | 16 | 4983 |
| Information City | 1630 | 117 | 6 | 76 | 1 | 4 | 1834 |
| Knowledge City | 3420 | 1695 | 6 | 17 | 18 | 15 | 5171 |
| Learning City | 1410 | 291 | 2 | 9 | 9 | 5 | 1726 |
| Green City | 10400 | 3276 | 78 | 15 | 57 | 19 | 13845 |
| Connected City | 1700 | 370 | 14 | 29 | 3 | 22 | 2138 |
| Sensor City | 118 | 28 | 0 | 34 | 1 | 1 | 182 |
| Smart Community | 3820 | 2173 | 44 | 21 | 105 | 11 | 6174 |
| Total | 64199 | 18027 | 1637 | 1804 | 2041 | 374 | 88082 |

3. Selection as Criteria

For the inclusion of papers published in the citation database, this searchable database was used to select papers for the current review of papers relating to engagement in smart cities and other terms of the city. Six abstract and reference sources were further researched in order to narrow down the list of selected papers that should be included in the current review, as shown in Table I.

This research examines 88082 articles that are linked to the city's information and communications infrastructure. There were 36,357 articles found in total that were relevant to smart cities, of which, 709 papers were downloaded and read. Next, all material categories were grouped into group clusters as indicated in Table II after narrowing down the 304 papers linked to smart cities.

These articles' (88,082) entries were narrowed down further by focusing on articles that, (a) included empirical evidence relating to engagement in a smart city; (b) discussed engagement in other terms of the city; (c) focused on the positive aspects of geospatial technology in the smart city; (d) were dated from January 2015 to February 2020, because

interest in the smart city flourished during this period; (e) were published in refereed academic journals; and (f) included an abstract. Using these six conditions, 304 papers met the criteria to be included in the current review. Our classification depends upon the maximum number. There are 65 documents (about the city of the future) that explain the smart city, whereas the minimum quantity is three papers (about the smart municipality) as seen in Fig. 1.

TABLE II
 GROUP CLUSTER OF CONTENT IN THE MAIN TITLE OF THE PAPER

| Group cluster | No. of papers | Group cluster | No. of paper |
|-------------------------------|---------------|-----------------------------|--------------|
| About smart city | 65 | Smart city management | 8 |
| Big data | 9 | Smart municipality | 3 |
| Smart city review | 48 | Smart city Fog computing | 15 |
| Smart data | 8 | Smart city challenge | 4 |
| Smart city database | 7 | Smart city GIS | 31 |
| Smart city information system | 4 | Smart city waste management | 4 |
| Smart city security | 6 | Geospatial smart city | 36 |
| Smart city framework | 12 | Smart city bigdata | 44 |
| | | Total number of papers | 304 |

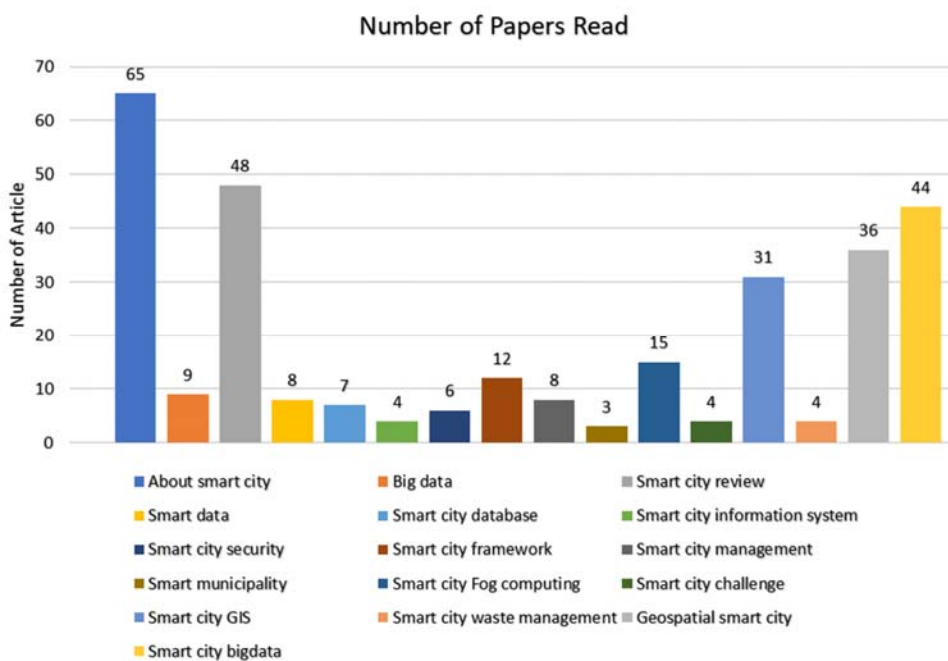


Fig. 1 Classification and number of papers read

A bibliometric map was developed at the end of the bibliometric analysis. It is a visualization from the analysis study concerning the pluralism of terms with the VOSviewer computer application. Outcomes of the investigation are demonstrated in Fig. 2.

IV. RESULTS

A. Main Literature Search

Using search phrases in master searching literature, 88,082 publications relating to smart cities were found. Many of these

papers were speculative or discussion papers, considering the potential impact of a smart city or describing how the digital city was designed (Table I). For the current review, 39,486 articles met the inclusion criteria on engagement in smart cities and we downloaded 709 papers. As a result from analysis as explained before these 304 articles were very diverse in scope and addressed a range of different aspects of engagement in the smart city, utilized a range of theoretical models, and adopted a variety of methodological approaches. A narrative synthesis approach was taken to capture the heterogeneity (see Table II).

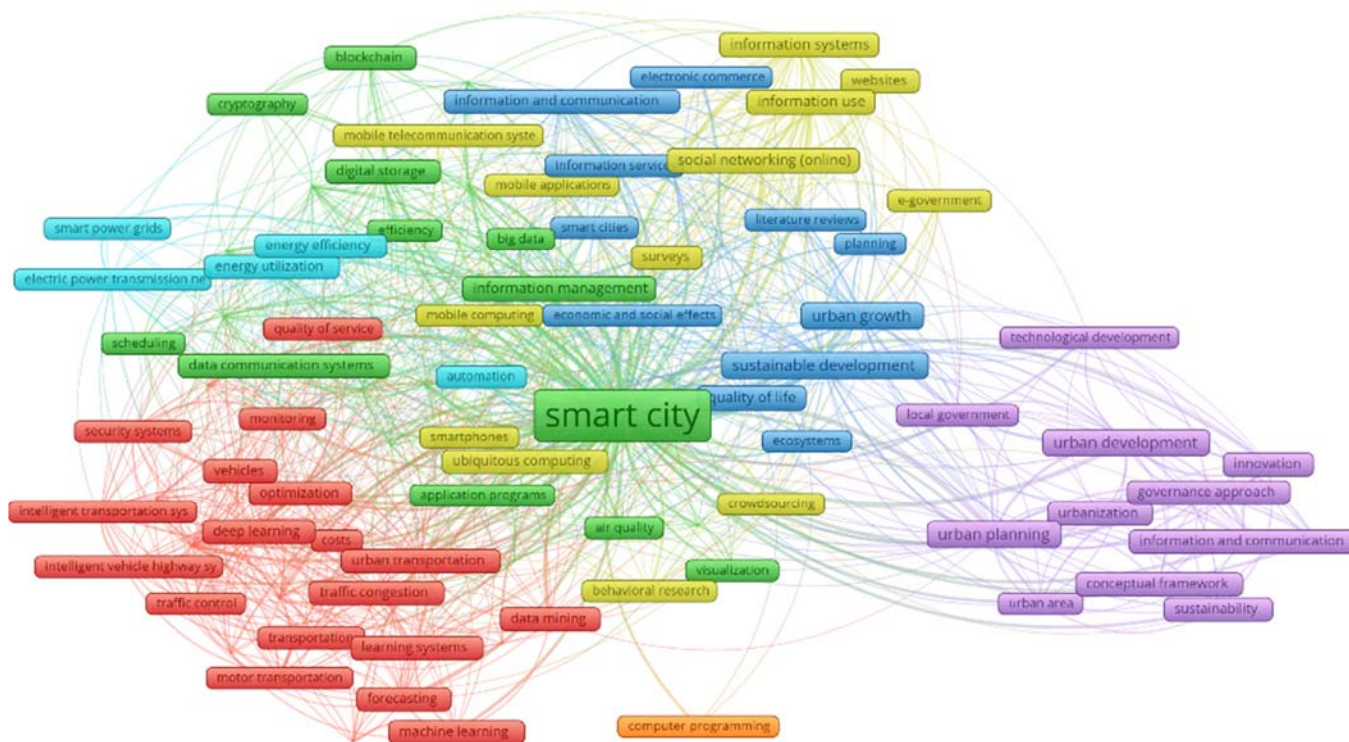


Fig. 2 VOS viewer bibliometric analysis of classified readied papers

Scanning of papers revealed that grouping them depending on the article's emphasis would be beneficial [34]. Table II shows the various categories and the number of articles in each group. The definitions were derived from the assessment of the various phases of the commitment process. For knowledge of the smart urban domain, the structured pattern comprises the following different applications, according to the current literature review, which is based on a city with an architecture of ICTs:

- Big data (utilization and management): deals with data collecting, data analysis, data query, and data management [36].
- Geographic Information System (GIS): is a well-developed system that helps in abstracting physical features on the surface of the globe for the management, analysis, and display of geographic data [37].
- Challenge: there is uncontrolled urban sprawl and environmental pollution [38].
- Framework: a developed framework to be used in modern smart cities with citizen engagement. Eight factors contribute to the smart city being "smarter": management and organization, technology, governance, policy context, citizen and communities, economy, built infrastructure, and natural environment [39], [40].
- Government: mentions public e-service delivery, e-democracy and participation, accountability and transparency, and administration's efficiency within the city [41].

B. Results from Citation Database

Table I shows the different terms related to the city. The major title, however, is "smart city." Google Scholar, Scopus, ScienceDirect, IEEE Xplore Digital Library, Web of Science, and Springer are the six database engines we used in our search. The total number of papers published over the last five years is 39,486.

From the Scopus analysis search, the result shows that there were 5,722 papers found for the phrase "smart city" over the last five years, as seen in Fig. 3.

C. Responses from Countries to Smart City

The majority of smart city-related articles published in the last five years have come from five countries, including the United States, China, Italy, India, and the United Kingdom. The VOS viewer evaluation of the Scopus search engine is shown in Fig. 4. Surprisingly, certain nations, such as Malaysia, have only 76 papers in Scopus from 2015 to 2020. There are just 27 countries that have contributed papers on smart cities.

On the other side, the VOS viewer analyzed the Web of Science citation database. Five countries have prioritized smart city development over five years, including China, the US, Italy, India and UK. Despite being a member of the Association of Southeast Asia Nations (ASEAN) Smart Cities, certain nations, such as Malaysia, have just 22 published papers in Web of Science focused on smart cities over the last five years, as shown in Fig. 3. The Asian Smart City Network (ASCN) has 26 pilot cities [42].

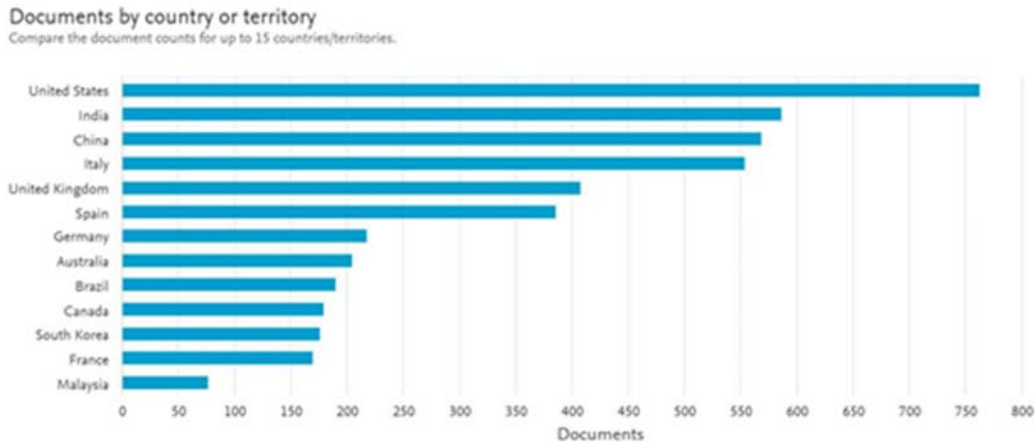


Fig. 3 Scopus analysis as countries

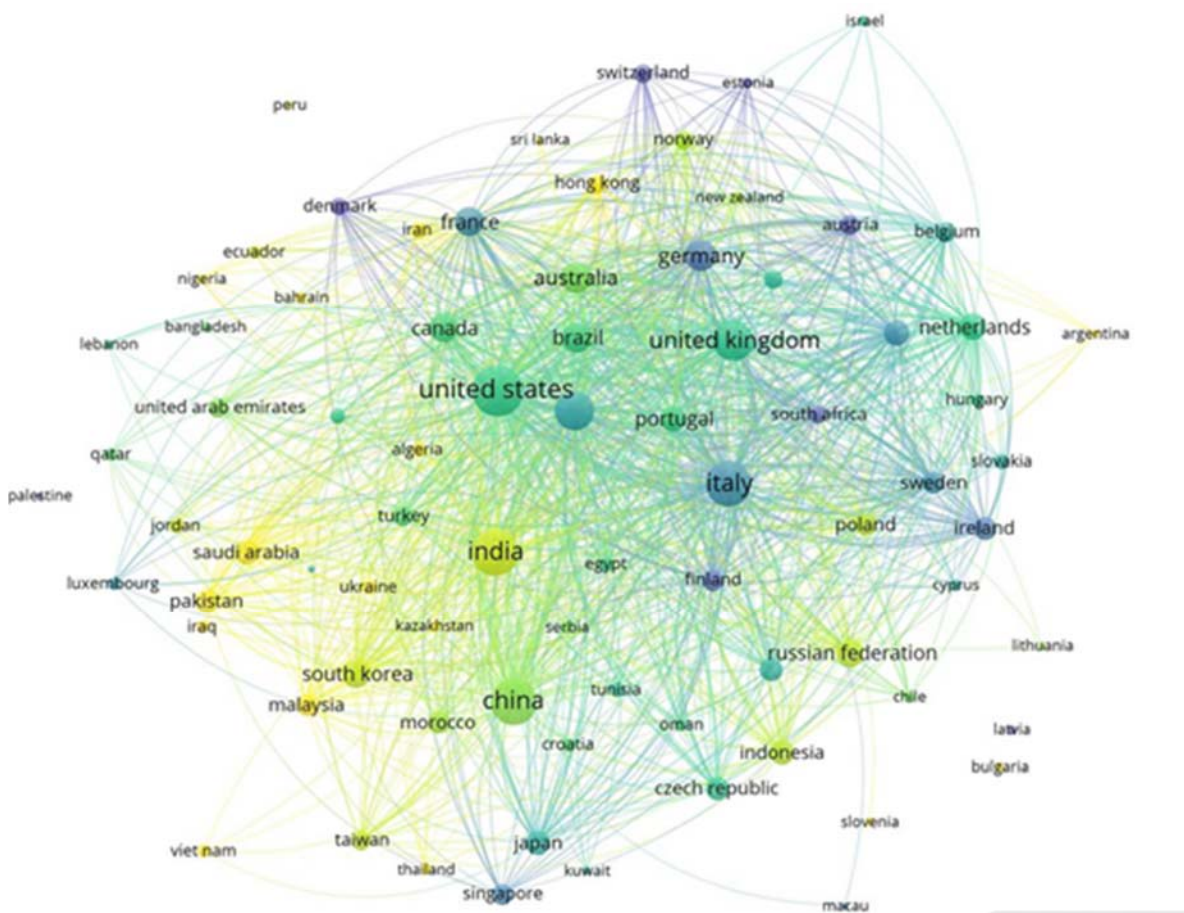


Fig. 4 VOS viewer countries bibliometric analysis data. Source: Scopus

V.CONCLUSION

Based on this study, the number of papers in the studies that provide empirical evidence concerning smart city engagement underscores the spike in interest in this topic over the last five years. From one country to the next, a structured strategy to synthesize the data from this diverse set of articles differed. It also depends on the field of study. According to academics in this subject, bibliometric data suggest that the notion of the city of the future has seen a dramatic surge in interest over the last

five years. As illustrated in Fig. 3, we employ different terms of search for cities with information and communications technologies infrastructure. From January 2015 to February 2020, a systematic literature assessment of empirical research revealed the dynamic, multifaceted core of smart city involvement:

1. As a result of new technologies and the use of ICT as city infrastructure, we can observe that there are many names for cities: Smart city, Digital city, Wired city, Virtual city,

etc. see Table I for more information.

2. Many phrases have a connection to the city and its communication and information technology infrastructure (see Figs. 1 and 2), but smart urban idioms have been accepted.
3. The range of city and smart city frameworks available is continually expanding, and we are just understanding the motivational appeal of different smart fields (see Fig. 3).
4. According to this study, five countries have smart city priorities: the United States, China, Italy, India, and the United Kingdom (see Figs. 3 and 4).
5. Despite that, there are 20 public universities and 47 private universities in Malaysia (34 university colleges and 10 foreign university branch campuses) [43]. The number of research about smart cities is limited and academic articles are few by comparison with other countries (see Fig. 3).

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