applied system innovation

MDPI

Review

Creating Smart Cities: A Review for Holistic Approach

Sophia Diana Rozario [1], Sitalakshmi Venkatraman [2,*], Malliga Marimuthu [1], Seyed Mohammad Sadegh Khaksar [1] and Gopi Subramani [2]

[1] La Trobe Business School, La Trobe University, Melbourne, VIC 3086, Australia; S.Rozario@latrobe.edu.au (S.D.R.); M.Marimuthu@latrobe.edu.au (M.M.); S.Khaksar@latrobe.edu.au (S.M.S.K.)
[2] Department of Information Technology, Melbourne Polytechnic, Melbourne, VIC 3072, Australia; GopiSubramani@melbournepolytechnic.edu.au
* Correspondence: SitaVenkat@melbournepolytechnic.edu.au

Abstract: With the rapid proliferation of Internet of Things (IoT) into urban people's everyday walk of life, the functions of smart cities are fast approaching to be embedded in every step of people's life. Despite the concept of smart cities founded in the late 1990s, there has been limited growth until recent popularity due to the advancements of IoTs. However, there are many challenges, predominantly people-centric, that require attention for the realisation of smart cities and expected real-life success. In this paper, we intend to investigate the state-of-the-art focus of smart cities from three angles: infrastructure engineering, information technology and people-centric management. We adopt a mixed-methods analysis of currently published literature on the topic of smart cities. Our study attempts to draw attention to the need for developing smart cities with a holistic approach involving multiple perspectives rather than a siloed emphasis on technology alone. We highlight that the fields of specialisations such as information technology and infrastructure engineering in contributing to smart cities need a cross-domain holistic approach of managing people-centric service requirements for improving consumer satisfaction and sustainability.

Keywords: smart cities; engineering management; holistic approach; literature review; information technology and infrastructure engineering

Citation: Rozario, S.D.; Venkatraman, S.; Marimuthu, M.; Khaksar, S.M.S.; Subramani, G. Creating Smart Cities: A Review for Holistic Approach. *Appl. Syst. Innov.* **2021**, *4*, 70. https://doi.org/10.3390/asi4040070

Academic Editors: Ondrej Krejcar and Luís Bragança

Received: 2 August 2021
Accepted: 17 September 2021
Published: 22 September 2021

1. Introduction

The concept of smart cities is popularly associated with the creation of an urbanised city that makes use of various technologies and electronic sensors to collect data commonly categorised as the Internet of Things (IoT) [1]. Insights obtained from the information collected are utilised to manage multiple resources, assets and services more efficiently, thereby improving the operations enabling corporate sustainability [2] (considering sustainability's four pillars affecting environmental, social, human and economic spheres) and service quality across the entire city [3]. Some recent reviews carried out in this context [4] covering the technical standards [5], future of smart cities [6], technologies and sustainability [7,8], Big Data architecture [9], self-driving vehicles [10] smart home automation [11], facial recognition [12] and applications of artificial intelligence and machine learning [13] to name a very few of the studies. The objective of this review is to reorient the perception of 'smart city' from the idea of machines and things, and towards people, which should be at the heart of these things.

The motivation behind this study is to rejuvenate the idea of a smart city in a simple, significant and basic manner that is more people-centric. While the description in the paragraph above outlines the meaning and making of smart cities, it is key to note that one of the most important purposes of smart cities is arguably the satisfaction of those who dwell in them—the citizens [14]. Therefore, only a holistic methodology can enable the concept and potential of smart cities to be fully realised for better individual satisfaction

along with the improved quality of life, sustainable environment and improved economic and business performance [15].

A number of existing literature publications carried out has been considered for preliminary analysis to highlight the evolution of publications among various interdisciplinary domains and to understand any disproportionate distribution of the publications related to smart cities between engineering, information technology (IT) and management, which is the key focus of the study. While it is evident that the smartness component in this 'smart city' concept is built upon the knowledge of infrastructure engineering and information technology, there appears to be a lack of importance given to the exploration of the 'city/people/business' or the people-centric component, which is a well-known gap in literature [16]. Evidently, an unoccupied area cannot be called a city, likewise, enabling information technology or providing infrastructure engineering that does not cater to the requirements of people would be considered useless [15]. Irrespective of the rapidly growing technology, the concept of smart cities will remain unfulfilled and not widely accessible if the focus remains only on things more than people. Thus, the focus of this study is to explore and verify if such a disproportion exists. The study aims to provide insights into this research gap and to emphasise potential research in smart cities that could, more importantly, consider the perspectives and aspirations of the people along with other factors of engineering and technology for improving the adoption, quality of life and individual satisfaction.

2. Research Questions, Significance and Outcome

This paper aims to investigate the current distribution of publications in the literature related to research studies on smart cities where the focus was on three domains namely engineering, information technology and management. This study explores if these areas were studied in a silo or there are overlaps, and in particular investigates if there is a lack of research publications from the management perspective with a people-centric focus. Our study attempts to draw attention to this problem and presents the importance of addressing this limitation. We envisage that our study would encourage more research undertakings with a holistic approach in understanding and implementing smart cities from a people-process-technology perspective.

This study pursues answers to the following two research questions and discussions, as illustrated in Figure 1 below depicting the 'what, for the research analysis followed by the 'how' and 'who' to obtain the context to the study. An underlying assumption that existing scholarly publications are disproportionately distributed between the three popular fields of IT, engineering and management is made based on a preliminary analysis that was carried out for this research. This resulted in the following two 'What' questions supported by the following 'How' and 'Who' questions as solutions as illustrated below:

1. What is the proportion of distribution in the academic/scholarly publications related to smart cities among infrastructure engineering, IT and management?
2. What concerns can arise due to possible disproportionate distribution in publications, in the understanding of the concept of smart cities?

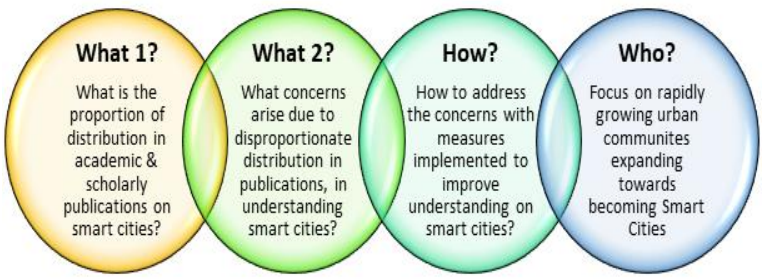

Figure 1. Research questions—What—How—Who.

There is a misconception that designing a city that is intended to incorporate fancy technology and innovation to be called a 'smart city' would rebrand the city as a modernised or digitalised city [17]. However, if the city has only the highly smart technologies but has not been designed to make it safe and liveable for a normal resident, it would only result in effort and money wasted [15]. A city that has smart technologies but not connecting the citizens for their well-being could not produce intelligence for real problem solutions or life quality upliftment [18]. Many cities transformed into smart cities to cater to the benefits of large businesses; for example, those technologies that advance transportation, logistic and business-to-business networking [18,19], but not so much attention given to the workers who are employed by these businesses [16], but inherently experiencing problems such as commuting to work timely, safely and comfortably. These employees are the common citizens who would need to get to work and back home and have a desired standard of living. If the smart city development focuses on the macro aspect but ignores the micro aspect in which the people live, then the concept scope of a smart city should be revised to first accommodate the key stakeholders' requirement for a conducive environment [20]. Failing to understand that people-process-technology are interrelated would result in the implementation of the concept of 'smart city' to falter thereby not catering to the necessities of people who are at the heart and core of a successful and functional city [21]. Therefore, it is essential to give due importance to the management of people (e.g., employees, students, volunteers, customers, public) or businesses (e.g., micro-enterprises, social enterprises, home-based businesses) to capture the regular local citizens' expectations while developing 'smart cities' that have a technology-human connection [22]. This all-around course of action integrating people-process-technology would result in a more holistic approach to embrace engineering and information technology with equal importance of managing people's requirements.

3. Literature Review

This section aims to position this study in the context of prior research and scholarly discussions which are seeking attention for the need to integrate people-process-technology to understand the concept of smart cities from a holistic and all-encompassing perspective that would benefit the society. By associating the research questions directly with such articles, further rationalisation and supporting evidence for this research gap is identified.

This paper focuses on a comparative literature review that revolves around the number of journal articles, key topics and themes published from the popular fields of IT, engineering and management. The literature review analysis in this paper is presented in two parts: first, we provide the quantitative review of existing academic contributions in the area of smart cities, analysing particularly from the three dimensions of IT (technology), engineering (process) and management (people/business). Second, with the supporting evidence on the distribution of the publications obtained from the previous part, we present a qualitative introspection on the need for a more equal emphasis on people-centric focus on smart cities in the scholarly publications from all three fields. This would, in turn, play as the platform for proposing future research and seeking additional fieldwork, evidence and contribution to substantiate the literary recommendations made.

3.1. Review Approach

As outlined above, the first part of this review focuses on the publications on smart cities that present theme/classification analysis on IT, engineering and management first as illustrated in Figure 2. The outcome from this review will feed the necessary information for the second half which analyses the primary keywords underlying the study of smart cities.

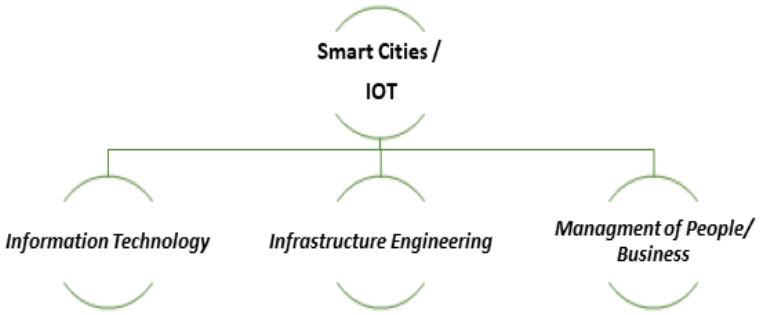

Figure 2. Review approach—topics explored.

3.1.1. Information Technology

From an information technology-based perspective, Ejaz, Naeem [23] argue that the planning and designing of new urban cities, as well as redesigning existing cities is currently being carried out at a time when countries are giving major attention to environmental sustainability [24,25]. This, in turn, contributes as a key factor to increasing the appeal of a city. As a result of this, IBM's take on a smart city, for example, is studied under three broad dimensions of information technology, namely, instrumentation, information and intelligence [26]. The combination of these three characteristics contributes to addressing the concept of 'smart city'. Harrison, Eckman [26] elaborate that 'instrumentation' refers to sensors, cameras, appliances and other devices that assist with the 'information' collection and reporting from real-time live feeds. In addition, 'intelligence' refers to the examination of the information gathered to obtain meaningful insights that assist in the decision-making processes. All these together converge to enable a city to advance as a 'smart city' [27]. Recently, micro-service oriented big data architectures were studied and their applications for intelligent transportation systems for a smart city [9]. While many such IT-focused studies have an aim to support real-time deployments, efficiency, safety and such metrics [19,22], there is a gap in the literature in intertwining the much-needed people-centric dimension.

3.1.2. Infrastructure Engineering

In the domain area of infrastructure engineering, Taylor Buck and While [28] present the idea that the pursuit of the 'smart city' concept echoes with urbanisation through infrastructural renewal projects. They substantiate the rationale for this argument to be based on the city's attempt to overcome the scarcity of resources and climate change [29]. Furthermore, it is noteworthy that currently any infrastructural resilience would certainly have deep-rooted technologies related to smart cities within the project [30]. However, the characteristics of urban infrastructure are posed with substantial challenges in converting those infrastructural projects from aspiration to implementation [31]. With the heavy reliance on the supply side of smart city innovation being on information technology, some probable tensions can be recognised in the process of urban planning and designing [32]. Viitanen and Kingston [33] state that this argument places ICT in an unrivalled position against infrastructure engineering which has a strong influence on urban experimentation experiments.

3.1.3. Management—People/Business

Vasconcelos-Barrote [15] contends that when information as part of IoT is well-managed, and the infrastructure in a city is virtually interconnected to enhance the quality of life—ensuring complete personal satisfaction, the result of this may indirectly contribute to productive employees for a business [34]. This is when it can be arguably established that the concept of 'smart city' has been successfully implemented. Ballas [16] notes that

one of the key issues acknowledged in multiple articles was the potential for interdisciplinary study that focused on obtaining thorough knowledge on the factors that contributed to making the city people 'happy'. One of the recommendations involved expanding on quality of life indicators by combining and complementing those measures to understand the wellbeing and satisfaction measures of the individuals [16]. Hence, it is essential to carry out this study from a multidisciplinary perspective for a holistic understanding rather than concentrating on single domain namely information technology, engineering or management perspectives.

The concept of smart cities is defined to address the quality of life, individual satisfaction, health and happiness of the citizens. Some studies have explored cross-domain areas such as between technologies and management of people requirements [35,36]. However, most studies published on smart cities remain to be 'thing-based' rather than people-based, where the emphasis of the study predominantly revolves more around infrastructure, engineering, Internet, data, technology, etc., than about the people who live in it [11,12] as claimed in the recent studies.

3.2. Theoretical Framework

To serve as a guide in managing the academic and literary process of analysis, a theoretical framework is relied upon. The gaps highlighted in this study will be validated with the support of the People-Process-Technology (PPT) framework that was introduced in the 1960s by Harold Leavitt. The framework explains how the three elements interact with each other in the value chain to create a balance. This framework is also known as the 'Golden Triangle' where recent studies highlighted the relevancy of this PPT framework for digital transformation [37,38]. People in the framework is argued to be an important piece to drive innovation in smart cities [39,40]. The innovations are intended for the people and mostly require people to be involved in the adoption and usage of the technologies. The second element, process, in the framework refers to the steps or actions that facilitate the use of the technology by the people (employee and public) to achieve the purpose. While the third element in the model, the technology, is the tool. Nevertheless, technology often gets more attention [39]; sustainable success in introducing the innovation rely on the effective integration of PPT elements and perfect balancing with the Golden Triangle [37,38].

The fundamentals of this framework are based on the idea that the right combination of having the right processes outfitted with the right technology to support it and ensuring the right people involved in managing these aspects are put in place with equal distribution for the perfect harmony of ensuring desired outcomes are met [41]. With the support of this theoretical framework, this study sets out to analyse if there is a good balance concerning the publications in the smart cities from the perspective of information technology, infrastructure engineering and management of people. These components when brought together in good balance along with maintaining a good relationship among them can assist in obtaining efficiency in smart cities. This study supports the call of recent research in smart cities that emphasised the importance of improving and aligning the level of integration between the application, technology and people domains [42]

4. Research Methodology

This study adopts a mixed method related to a narrative inquiry with thematic analysis. There are multiple ways and techniques in the mixed-method where the data are combined from complex to simple and concurrent to sequential forms of data collection and data analysis. This analysis would be quantitative in reporting factual information on publications by presenting trends and comparative analysis. It would also be qualitatively describing the themes that emerge from the three popular fields outlined earlier. The procedure for data collection and analysis is conducted rigorously for both forms of the data obtained [43].

4.1. Database and Keywords for Search

In this study, we focus on the publications related to the three fields available in the Scopus database and perform analysis with the practical sample size. Scopus is a popular database that houses recognised and renowned journal articles from multiple fields. Scopus was chosen for its broad multidisciplinary coverage, suitable for an interdisciplinary phenomenon such as smart cities, a fuzzy concept. In the scientific field, Scopus is renowned to be the most widespread database that is popularly used in literature searches [44]. This database is known for covering a wide range of articles, particularly publications since 1990 [45,46] a phase when the phenomenon of smart cities was emerging and progressed steadily as a research topic. A simple and generic keyword for the search term used was 'smart city', with its known variations 'smart cities' and 'Internet of Things' were also used.

4.2. Search and Sampling Process

To have a purposeful sampling, journal articles from across the board without any restriction to field and year are included for this study. The focus of this study is the aggregate number of journals published per field along with the key themes covered in each field, particularly in the last 10 years. A sample search syntax used is given below, which does not filter out the publications by year and includes all subject areas. The same search criteria are repeated with a filter for publications between 2010 and 2020. This is illustrated in Figure 3 as articles published since 1997 compared to publications since 2011.

title-abs-key ('smart cities') and (limit-to (srctype, 'j')) and (limit-to (pubstage, 'final')) and (limit-to (language, 'english'))

4.3. Data Collection Strategies and Analysis Techniques

The focus of this research is to follow the second-order narratives which are constructed on the secondary data that are publicly available for analysis from the Scopus database. The standard three-step analysis strategy will be adhered to whereupon collecting necessary data, which is the first step, and involves organising the data for analysis. The second step involves preparing and condensing the data into themes and the final step is to present the themes as synthesised information in the form of illustrations and tabulations for discussion. NVivo application is used as a tool in analysing the necessary data with keywords from the articles to project findings along with emerging themes and patterns.

4.4. Preparing and Processing Data

The following steps are carried out to prepare the data for this study to assist in transforming the data collected into meaningful information.

Data Entry, Coding, Editing and Missing Data

As part of the first step in the data entry, information on the total number of journal articles published across all years in the Scopus database in English with the keyword 'smart city' in the title, content or abstract is identified and tabulated. As the next step for coding and editing the data, the focus is given on analysing data from last 10 years, i.e., from 2011–2020. As the final step, missing data are removed, and any duplicate information is also removed from further analysis. Statistical analysis is conducted with the support of graphical illustrations such as trend analysis and qualitative analysis is carried out using NVivo to identify themes across the journal articles. For easy understanding and analysis, multiple subject areas were broadly categorised under three sections such as information technology, engineering and management.

Following the conceptualisation of content analysis in a qualitative study outlined by Vaismoradi, Jones [47], the coding process required for the thematic analysis in this literature review was accomplished by simplifying huge amounts of journal articles using classifications to create categories. For this purpose, a more direct approach and open coding were used by extracting the author's keywords for all journal articles to form the basis

for the various categories. This assisted with the secondary examination to arrive at the various themes. Processing this list of keywords through NVivo resulted in the count and distribution for the recurrence of those keywords amongst all the journal articles reviewed. Consistent with the format of this study focusing on the three domain areas outlined in this paper (IT, Engg. and Mgmt.), the keywords were processed separately for each domain. Information technology included articles related to computer science and decision science based on technology. Infrastructure engineering covered articles related to engineering, environmental science, energy and earth and planetary sciences. Finally, the last domain, management, covered business, management and accounting, social sciences, psychology, arts and humanities.

4.5. Limitations in the Analysis

One of the possible biggest challenges is the time available to review multiple databases for a cross-reference purpose. Therefore, to overcome this challenge, only one database 'Scopus' is used for this research. Another challenge is that publications related to smart cities that fall outside the three categories are also selected for this study e.g., 'multidisciplinary'. Depending on the number of such publications, a conscious effort is taken to ensure that most of the relevant articles are included in the analysis. However, it is noted that there is a possibility for some overlapping with multidisciplinary subject areas.

4.6. Research Neutrality, Reliability and Validity

As the study uses only secondary data that are publicly available information provided under the Creative Commons license, there is no additional research ethics approval required for this study. To substantiate the authenticity of this study, some of the common ethical issues that can arise have been addressed below: the issue of neutrality refers to any possible conflict of interest where it needs to be outlined at the start of the analysis [48]. For this study, there is no such conflict of interest to be reported. Associated closely with the consistency of research, reliability is related to the repeatability of the tasks in collecting data and obtaining the same results in an error-free and unbiased manner. This ensures credibility to the research conducted [49]. For this study, reliability can be assured as the secondary data used for analysis will not change for this given time frame. In reference to the accuracy of the study conducted, and the correctness of the findings reported for the research problem, validity indicates the results presented have good value [50]. For this study, validity is obtained by ensuring a preliminary analysis was conducted as supporting evidence to dig deeper for more insightful information to be obtained.

5. Analysis and Findings

The following analysis attempts to answer the first research question related to the 'proportion of distribution in the academic and scholarly publications'. Analysis across the years and subjects are carried out to identify if there is any evident disproportion to be reported. To provide the context and an illustrative backdrop to this topic, the graph in Figure 3 depicts the number of publications across all the subject areas in the database within the three domains since its first article in 1997 along with the comparison of the number of publications in the last 10 years.

The minimal gap between the two trends in the above graph establishes that the bulk of the research on this concept has been during the past 10 years. For further analysis, all publications in a relevant subject area as presented in Table 1 are grouped into three broad divisions (engineering, IT and management) and graphically illustrated in Figures 4 and 5. Table 1 below lists the various subject areas categorised into each of the three broad domains. This serves as the background information for the quantitative analysis that identifies the number of publications in each area first and thereby the collective number in each of the domains to further investigate using a comparative analysis and trend analysis.

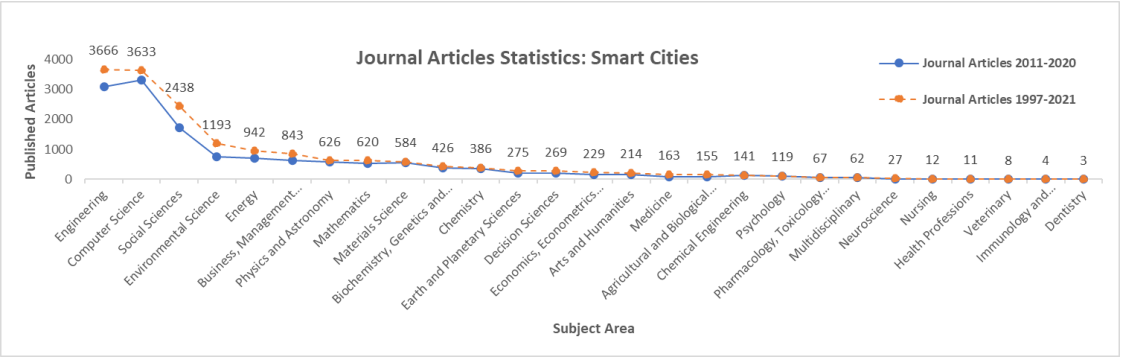

Figure 3. Articles published since 1997 compared with publications since 2011.

Table 1. Categorisation of subject area.

Subject Area	Journal Articles 1997-2021	Journal Articles 2011-2020
Engineering	3666	3081
Environmental Science	1193	753
Energy	942	700
Earth and Planetary Sciences	275	209
Infrastructure Engineering	**6076**	**4743**
Computer Science	3633	3323
Decision Sciences	269	210
Information Technology	3902	3533
Social Sciences	2438	1714
Business, Management and Accounting	843	634
Arts and Humanities	214	149
Psychology	119	95
Management of People/Business	**3614**	**2592**

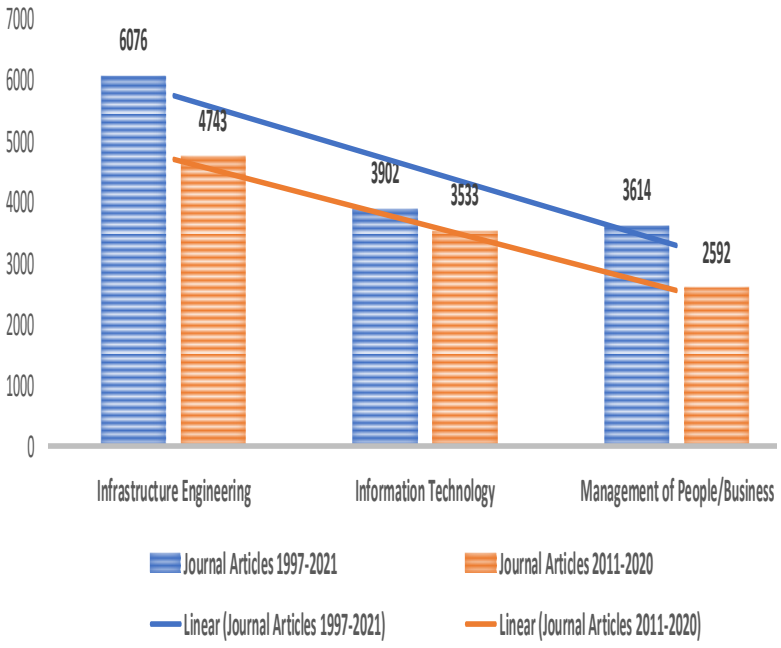

Figure 4. Articles published on Smart Cities: since 1997 vs. since 2011.

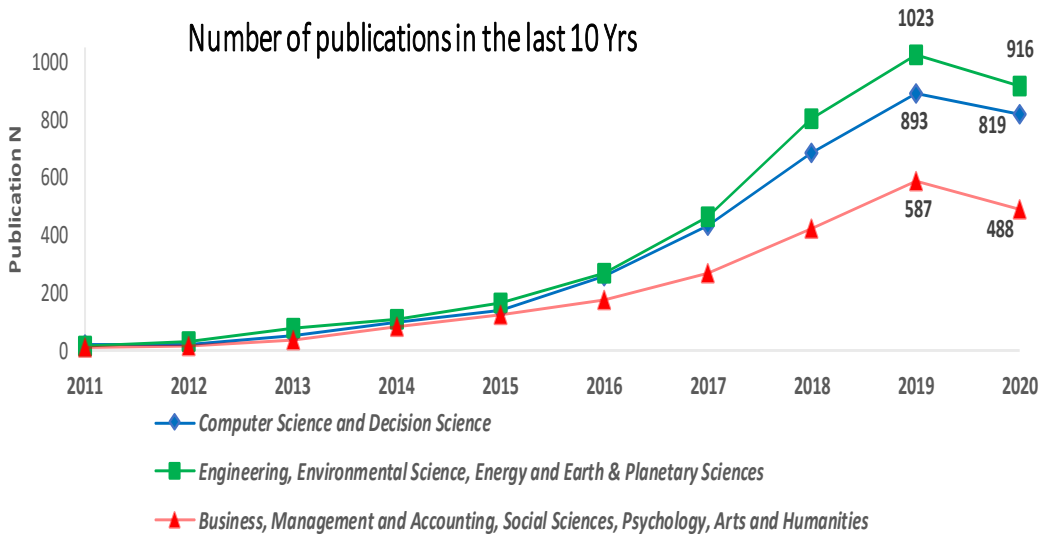

Figure 5. Journal articles on smart cities: IT, engineering and management themes.

Figures 4 and 5 illustrate the comparison in the publications on smart cities, over the last 20 years including the recent 10 years (2011–2020) based on the journal articles with the keyword 'smart city' used for the literature review analysis as explained in the methodology part above. The findings demonstrate that more research outcomes are published in the domain of engineering, followed by research in IT. Figure 4 denotes that the number of research conducted in management is lower compared to the other two domains since 1997. Comparing the number of articles published by the three disciplines over the last 10 years (between 2011 and 2020), it was found that lesser number of studies were published in management (2592 articles) compared to IT (3533 articles) and 4743 in engineering. Figure 5 illustrates the publication in the three disciplines by years for the last 10 years (2011–2020). Publication on the topic of smart cities in management discipline has been consistently lower compared to engineering and IT. Additionally, Figure 5 depicts the drop between 2019 and 2020 was higher for management studies (17%) compared to the drop in engineering and IT which are 8% and 10% respectively. In summary, among the studies of smart cities, management is continuously getting lesser attention compared to engineering and IT and it dropped rapidly in recent year

Using the same data and three domains represented in the graph as shown in Figure 5, a thematic analysis using NVivo on the author keywords is conducted and an extract is tabulated in Tables 2 and 3. The full list for IT domain is provided in the appendix for reference. These tables attempt to answer the second research question related to 'What concerns can arise due to possible disproportionate distribution in publications?' Table 2 presents a list of themes associated with the IT and engineering domains followed by Table 3 which outlines the keywords from the management journals. However, some of the themes in management (see Table 3) reflect IT and engineering domains related keywords and they are marked with an asterisk (*) symbol. This may be caused by the overlap in topics from the multidisciplinary subject area.

While the need for smart cities to be more people-centric was identified much earlier [16], our analysis of keywords usage from literature identifies further gaps in this direction. With the fast evolution in technological advancements, there is a stronger need for people-centric emphasis in future scholarly research studies on smart cities. It is to be acknowledged that while Figure 5 could indicate this well-known gap due to the number of publications across the three domains, the difference in publication rates among these domains could be attributed to the fact that diverse fields or domains have very different publication practices. Hence, the publication trend in Figure 5 should not be misinterpreted with the domain interest in the topic. However, Figure 5 does provide a clear indication of the

evolution of publications across the various domains over a period of time. The differences in the total number of publications could just indicate the relative representation in Scopus or differences in practice adopted in that domain. Interdisciplinary studies are becoming more common as the non-technical concerns of smart cities that are management oriented are more recently being considered in other diverse domains such as Architecture, Urban Planning, Transportation and Geography. Hence, we conducted a further analysis using keywords and themes to gain more data insights as shown in Tables 2 and 3. We provide more coverage of the themes and keywords-based search results in the Appendix A to serve as an illustration of our data analysis for publications under the IT domain.

Table 2. IT and engineering themes.

Words/Themes	Count N	Weighted % > 1%	Group
smart, smartness	2177	6.45	IT
internet	776	2.30	IT
thing, things	708	2.10	IT
network, networked, networking, networks	665	1.97	IT
cities	651	1.93	IT
system, systems	563	1.67	IT
computation, computational, computationally, computer, computers, computing	505	1.50	IT
smart, smartness	2639	6.85	Eng.
cities, cities'	837	2.17	Eng.
network, networked, networking, networks	636	1.65	Eng.
system, systemic, systems	636	1.65	Eng.
energies, energy	594	1.54	Eng.
internet, 'internet	581	1.51	Eng.
urban, urbanism, urbanization	564	1.46	Eng.
thing, things, things'	533	1.38	Eng.
sustainabilities, sustainability, sustainable	423	1.1	Eng.
sensor, sensorized, sensors	420	1.09	Eng.

Table 3. Management themes.

Words/Themes	Count N	Weighted %	Group
smart, smartness	1993	9.05	Mgmt.
cities, cities'	750	3.41	Mgmt.
* urban, urbanism, urbanization	697	3.16	Mgmt.
* sustainabilities, sustainability, sustainable	442	2.01	Mgmt.
governance, government, governments'	301	1.37	Mgmt.
* technological, technologically,	249	1.13	Mgmt.

* system, systemic, systems	235	1.07	Mgmt.
* developers, developing, development	197	0.89	Mgmt.
* planned, planning, plans	196	0.89	Mgmt.
* internet, 'internet	183	0.83	Mgmt.
management, manager, managing	183	0.83	Mgmt.
* network, networked, networking, networks	176	0.80	Mgmt.
* innovation, innovations, innovativeness	163	0.74	Mgmt.
public, publication, publicness, publics	156	0.71	Mgmt.
informal, informality, information,	148	0.67	Mgmt.
* digital, digitalization, digitization	137	0.62	Mgmt.
* mobile, mobilities, mobility, mobilization	135	0.61	Mgmt.
* communication, communications, communicative, communities, community	129	0.59	Mgmt.
social, sociality	128	0.58	Mgmt.
policies, policy	119	0.54	Mgmt.
service, services, services'	118	0.54	Mgmt.
learning	116	0.53	Mgmt.
citizen, citizens, citizens', citizens’	108	0.49	Mgmt.
intelligence, intelligences, intelligent	102	0.46	Mgmt.
* computation, computational, computer,	87	0.40	Mgmt.
participation	72	0.33	Mgmt.
economies, economy	55	0.25	Mgmt.
knowledge	54	0.25	Mgmt.
collaboration, collaborative	44	0.20	Mgmt.
quality	44	0.20	Mgmt.
tourism	44	0.20	Mgmt.
environmental, environmentality,	43	0.20	Mgmt.
green, greening	43	0.20	Mgmt.
share, shared, sharing	42	0.19	Mgmt.
strategies, strategy	41	0.19	Mgmt.
value, values	41	0.19	Mgmt.
efficiency, efficient	40	0.18	Mgmt.
performance, performativity	40	0.18	Mgmt.

future, futures, futuring	39	0.18	Mgmt.
process, processes, processing	39	0.18	Mgmt.
change, changes	39	0.18	Mgmt.
integrated, integrating, integration, integrative, integrity	38	0.17	Mgmt.
local, localization	38	0.17	Mgmt.
media	38	0.17	Mgmt.
business, businesses	37	0.17	Mgmt.
engagement	37	0.17	Mgmt.
human, 'human', humanism, humanities, humanizing, humans	37	0.17	Mgmt.

The number of multi-disciplinary themes and their significance in Table 3 implies IT and engineering domains dominate the studies on smart cities. This is also evident from only 0.17% weight for keywords related to studies focusing on people (human, humans etc.,) that is at the bottom of the list. This also raises the concern that the focus of the studies within the management domain is skewed and the researchers' interest in creating value for people is uncertain. This leads to the following questions: To what extent the studies in management have prioritised the measurements of improving the wellbeing of the people over promoting the technologies to the people? To what extent the policy is revised or designed to assure people's life quality enhancement beyond economic benefits to include social benefits? Are sufficient opportunities provided in a smart city for people to be connected to co-design, co-produce or co-create the service that suits well to their needs and ensure their liveability? Overall, are smart cities helping people live in a conducive environment or is it being thrust upon them? The lack of this information and the disproportionate emphasis on IT and engineering even within the management category are some of the concerns.

6. Discussion

Based on the graphical illustrations presented in the previous section, some very interesting observations can be reported. First, smart cities as a concept have been gaining momentum in the last 10 years. Next, the field of engineering has been consistently dominating the number of publications related to this concept. Following closely are the number of publications from the domain of information technology. The perspective of management even after taking into consideration additional related areas such as humanities, psychology, social science and business management collectively appears to have an under-representation in the number of publications related to this concept. Interestingly, the thematic analysis represented in Table 3 above further illustrates that even in the management domain, the themes related to citizens, society, human participation etc., collectively known as 'people' appear to have a very low representation. Taking into consideration all the three domains collectively to analyse the keywords, Figure 6 below prominently illustrates the lack of words related to management and thereby establishes a direct need to look into the importance of involving the perspectives related to people in this concept. In many ways, this shows that one of the three important pillars outlined in the Golden Triangle framework is not well balanced as it should be to obtain successful desired outcomes.

Figure 6. Thematic patterns across all three subject areas.

From the above figure, it is evident that there is a heavy skew towards publications in information technology and infrastructure, and the management of those technologies compared to people. Information technology and infrastructure are concepts based on things that can enable a city to be rich in technology and engineering. However, as it is not seen as a concept based on people, its citizens may not have all their needs fulfilled [39]. Thus, this study has established the immediate need to balance the research and publications related to people, process and technology for the smart city concept.

7. Conclusions

In conclusion, this study has established that a holistic approach is required in the research field and publications related to understanding the underlying elements that drive successful digital innovation and transformation in a smart city. Our systematic review and analysis have provided empirical evidence from literature published over the past 10 years highlighting the gap that studies involving human elements are not robust enough in smart cities research. This study argued that the gaps in understanding the people dimension in the PPT framework should not be ignored. This review serves as a platform for any upcoming research requiring literary and contextual information on smart cities to present a holistic and balanced investigation. As discussed above, future studies on the topic of smart cities from IT, engineering and management should undertake a multidisciplinary approach by equally reorienting the three pillars (people, process and technology) that are required for the successful implementation of the smart city concept. The analysis and results published in this review deliver vital insights to many stakeholders from across various roles and fields of IT, engineering and management. Having an overall integrated understanding of the PPT is important to equip the digital advancement in the smart cities with proper knowledge creation, tools, training and continuous support for optimal results from the innovation. Eventually, the success of smart cities depends on the interplay between smart technology, smart people and smart process that can be illustrated as Smart Golden Triangle.

Author Contributions: Conceptualisation, S.D.R., S.V., M.M., S.M.S.K. and G.S.; methodology, S.D.R., S.V. and M.M.; software, S.D.R. and G.S; validation, S.D.R., S.V., M.M., S.M.S.K. and G.S.; formal analysis, S.D.R.; investigation, S.D.R.; writing—original draft preparation, S.D.R.; writing—review and editing, S.D.R., S.V. and G.S.; visualisation, S.D.R.; supervision, S.V. and G.S. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. Keywords (Full List for IT)

Word	Count	Weighted (%)	Similar Words/Themes
smartness	2177	6.45	smart, smartness
internet	776	2.30	internet
things	708	2.10	thing, things
networks	665	1.97	network, networked, networking, networks
cities	651	1.93	cities
systems	563	1.67	system, systems
computing	505	1.50	computation, computational, computationally, computer, computers, computing
learning	305	0.90	learning
sensors	303	0.90	sensor, sensors
mobility	278	0.82	mobile, mobilities, mobility
security	268	0.79	secure, security
energy	258	0.76	energy
intelligent	253	0.75	intelligence, intelligent
urbanisation	252	0.75	urban, urbanism, urbanisation
management	252	0.75	management
model	251	0.74	model, modeling, modelling, models
service	244	0.72	service, services
cloud	227	0.67	cloud, clouds
vehicle	194	0.57	vehicle, vehicles
communication	188	0.56	communication, communications, communities, community
information	187	0.55	informal, informality, information, informational, informed
wireless	173	0.51	wireless
transportation	169	0.50	transport, transportation
machine	163	0.48	machine, machines
technology	162	0.48	technological, technologically, technologies, technology
analysis	154	0.46	analysi, analysis
traffic	152	0.45	traffic
governance	145	0.43	governance, government
social	129	0.38	social, socially
optimised	128	0.38	optimal, optimality, optimisation, optimised, optimiser
applications	126	0.37	application, applications
multi	126	0.37	multi
distributed	124	0.37	distributed, distribution, distributional
based	124	0.37	based
algorithm	123	0.36	algorithm, algorithmic, algorithmisation, algorithms
privacy	122	0.36	privacy
control	120	0.36	control, controlled, controller, controllers, controlling, controls
detection	118	0.35	detection
processing	118	0.35	process, processes, processing
sensing	117	0.35	sense, sensed, sensing
public	106	0.31	public, publication
digitisation	98	0.29	digital, digitalisation, digitally, digitisation
analytics	98	0.29	analytic, analytical, analytics
sustainability	95	0.28	sustainability, sustainable
architectures	91	0.27	architectural, architecture, architectures

monitoring	91	0.27	monitor, monitoring
quality	91	0.27	quality
neural	88	0.26	neural
plans	88	0.26	planned, planning, plans
efficiency	87	0.26	efficiency, efficient
routing	87	0.26	route, routing
clustering	86	0.25	cluster, clustering, clusters
blockchain	84	0.25	blockchain, blockchains
mining	82	0.24	mining
software	79	0.23	software, softwarisation
predictive	77	0.23	predictable, predicted, predicting, prediction, predictive
vehicular	76	0.23	vehicular
design	74	0.22	design
environment	72	0.21	environment, environments
innovation	71	0.21	innovation, innovations, innovative, innovativeness
power	69	0.20	power, powered
resource	69	0.20	resource, resources
decision	68	0.20	decision, decisions
parking	65	0.19	parked, parking, parks
artificial	64	0.19	artificial
cyber	63	0.19	cyber
health	62	0.18	health
human	61	0.18	human, humane, humanizing
citizen	59	0.17	citizen, citizens, citizens', citizens'
electric	59	0.17	electric, electrical, electricity
aware	59	0.17	aware, awareness
building	58	0.17	building, buildings
dynamics	58	0.17	dynamic, dynamical, dynamicity, dynamics
physical	58	0.17	physical, physically, physics
platform	57	0.17	platform, platforms
access	57	0.17	access, accessibility
crowdsourcing	57	0.17	crowdsourced, crowdsourcing
protocol	57	0.17	protocol, protocols
authentication	56	0.17	authentication
imaging	55	0.16	image, images, imaging
simulation	55	0.16	simulated, simulation, simulations, simulator
device	53	0.16	device, devices
semantic	53	0.16	semantic, semantics
infrastructure	52	0.15	infrastructure, infrastructures
performance	52	0.15	performance, performances, performativity
video	52	0.15	video, videos
surveillance	51	0.15	surveillance
theory	51	0.15	theory
context	50	0.15	context
agent	49	0.15	agent, agents
development	49	0.15	developed, developing, development
sharing	49	0.15	share, shared, sharing
virtual	49	0.15	virtual, virtualisation, virtualised
integrity	49	0.15	integral, integrals, integrated, integrating, integration, integrity
visualisation	48	0.14	visual, visualisation, visually
classification	47	0.14	classification
fuzzy	47	0.14	fuzzy
healthcare	47	0.14	healthcare
localisation	47	0.14	local, localism, localisation, locally
collection	47	0.14	collection, collective

industrial	46	0.14	industrial, industry
location	46	0.14	location, locational, locations, locative
pattern	46	0.14	pattern, patterns
encryption	44	0.13	encrypted, encryption
policy	44	0.13	policies, policy
crowd	43	0.13	crowd, crowded
evaluation	43	0.13	evaluation
recognition	43	0.13	recognition
lights	42	0.12	light, lighting, lights
stream	42	0.12	stream, streaming, streams
autonomous	42	0.12	autonomic, autonomous
cognitive	42	0.12	cognition, cognitive
defined	41	0.12	define, defined
collaborative	41	0.12	collaboration, collaborative
object	41	0.12	object, objective, objectives, objectivity, objects
spatial	40	0.12	spatial
waste	40	0.12	waste
trust	40	0.12	trust, trusted, trusts
making	39	0.12	making
adaptive	39	0.12	adaptability, adaptation, adaptive
scheduling	39	0.12	scheduler, schedulers, scheduling
vanet	39	0.12	vanet, vanets
framework	38	0.11	framework, frameworks
radios	38	0.11	radio, radios
emerging	37	0.11	emergence, emergency, emergent, emerging
fusion	36	0.11	fusion
knowledge	36	0.11	knowledge
media	36	0.11	media
positioning	35	0.10	position, positioning, positive
value	35	0.10	value, valued, values
business	35	0.10	business, businesses
connected	35	0.10	connected, connection, connections, connectivity
green	35	0.10	green
identification	35	0.10	identification
safety	35	0.10	safety
support	35	0.10	support, supported, supportive
water	35	0.10	water
convolutional	34	0.10	convolution, convolutional
environmental	34	0.10	environmental
ontology	34	0.10	ontological, ontologies, ontology
participation	33	0.10	participant, participation
space	33	0.10	space, spaces
allocation	32	0.09	allocation
function	32	0.09	function, functional, functions
interaction	32	0.09	interaction, interactions, interactive, interactivity
tracking	32	0.09	tracking
operations	32	0.09	operating, operation, operational, operations, operator
chain	31	0.09	chain, chains
middleware	31	0.09	middleware, middlewares
signal	31	0.09	signal, signaling, signalling, signals
attack	30	0.09	attack, attacker, attacks
crowdsensing	30	0.09	crowdsensing
structural	30	0.09	structural, structuration, structure, structured, structures
consumption	29	0.09	consumption
intrusion	29	0.09	intrusion, intrusive

pricing	29	0.09	price, pricing
temporal	29	0.09	temporal
charging	28	0.08	charging
complex	28	0.08	complex, complexity
embedding	28	0.08	embedded, embedding
engineering	28	0.08	engine, engineering, engines
event	28	0.08	event, events
pervasive	28	0.08	pervasive
preserving	28	0.08	preservation, preserving
smartphone	28	0.08	smartphone, smartphones
supply	28	0.08	supply
transformation	28	0.08	transform, transformation, transformations, transformative
behavior	27	0.08	behavior, behavioral, behaviors
congestion	27	0.08	congested, congestion
interoperability	27	0.08	interoperability, interoperation
pollution	27	0.08	pollution, pollutions
programming	27	0.08	program, programming
selection	27	0.08	selection, selections, selective
series	27	0.08	series
ubiquitous	27	0.08	ubiquitous
center	26	0.08	center, centered, centers
delay	26	0.08	delay
indoor	26	0.08	indoor
multimedia	26	0.08	multimedia
point	26	0.08	point, points
ecosystem	25	0.07	ecosystem, ecosystems
genetic	25	0.07	genetic
global	25	0.07	global
index	25	0.07	index, indexing
layer	25	0.07	layer, layered, layering, layers
problem	25	0.07	problem, problems
aerial	24	0.07	aerial
economy	24	0.07	economies, economy
estimation	24	0.07	estimated, estimation
experience	24	0.07	experience, experiment
generator	24	0.07	generated, generation, generations, generative, generator
geographic	24	0.07	geographic, geographical, geographics
graphs	24	0.07	graph, graphs
methods	24	0.07	method, methods
oriented	24	0.07	orientation, oriented, orienteering
measurements	24	0.07	measure, measurement, measurements, measures
centric	23	0.07	centric, centricity
demand	23	0.07	demand
filter	23	0.07	filter, filtering, filters
future	23	0.07	future, futures
hybrid	23	0.07	hybrid, hybridism, hybridity, hybridised
living	23	0.07	living
logic	23	0.07	logic
participatory	23	0.07	participatory
scale	23	0.07	scale, scaling
street	23	0.07	street
approach	22	0.07	approach, approaches
arduino	22	0.07	arduino, arduinos
automation	22	0.07	automated, automation
channel	22	0.07	channel, channels

feature	22	0.07	feature, features
heterogeneous	22	0.07	heterogeneity, heterogeneous
indicators	22	0.07	indicator, indicators, indices
parallel	22	0.07	parallel, parallelism, parallelised
study	22	0.07	studies, study
travel	22	0.07	travel, traveler, travelers, traveling
unmanned	22	0.07	unmanned
mechanisms	22	0.07	mechanical, mechanics, mechanism, mechanisms
assessment	21	0.06	assessment
cooperative	21	0.06	cooperation, cooperative
online	21	0.06	online
personalised	21	0.06	person, personal, personalised, persons
attribute	21	0.06	attribute, attributes
cryptography	20	0.06	cryptography
raspberry	20	0.06	raspberry
reinforcement	20	0.06	reinforcement
source	20	0.06	source, sources, sourcing
storage	20	0.06	storage
utilisation	20	0.06	utilities, utility, utilisation
discovery	19	0.06	discovery
large	19	0.06	large
matching	19	0.06	matching
production	19	0.06	product, production, productivity, products
random	19	0.06	random, randomised
reality	19	0.06	realities, reality
research	19	0.06	research
standards	19	0.06	standard, standardisation, standardised, standards
stations	19	0.06	station, stations
strategy	19	0.06	strategies, strategy
tolerant	19	0.06	tolerance, tolerant
trajectory	19	0.06	trajectories, trajectory
ambient	19	0.06	ambient, ambients
anomaly	19	0.06	anomalies, anomaly
augmented	19	0.06	augmentation, augmented
content	19	0.06	content, contention
metering	19	0.06	meter, metering, meters
contract	18	0.05	contract, contracts
database	18	0.05	database, databases
forecasting	18	0.05	forecast, forecasting
reliability	18	0.05	reliability, reliable
robot	18	0.05	robot, robotic, robotics, robots
camera	18	0.05	camera, cameras
interface	18	0.05	interface, interfaces
linear	18	0.05	linear, linearisation
renewable	18	0.05	renewable, renewal
response	18	0.05	response, responsive
science	18	0.05	science, sciences
stochastic	18	0.05	stochastic
vision	18	0.05	vision
activity	17	0.05	activation, active, activities, activity
anonymity	17	0.05	anonymity, anonymous
hierarchical	17	0.05	hierarchal, hierarchical
level	17	0.05	level, levels
representation	17	0.05	representation, representational
search	17	0.05	search, searching

agreement	17	0.05	agreement
decentralised	17	0.05	decentralisation, decentralised
driven	17	0.05	driven
engagement	17	0.05	engagement
harvesting	17	0.05	harvest, harvester, harvesting
markov	17	0.05	markov
multiplication	17	0.05	multiple, multiplication
noise	17	0.05	noise
offloading	17	0.05	offloading
query	17	0.05	queries, query
sparse	17	0.05	sparse
states	17	0.05	state, stateful, states
compressive	16	0.05	compressed, compression, compressive
forwarding	16	0.05	forward, forwarding
identity	16	0.05	identity
metric	16	0.05	metric, metrics
navigation	16	0.05	navigation
opportunistic	16	0.05	opportunistic
deployment	16	0.05	deploy, deployment
logistics	16	0.05	logistic, logistics
review	16	0.05	review, reviews
swarm	16	0.05	swarm, swarms
bluetooth	15	0.04	bluetooth
challenges	15	0.04	challenges
coverage	15	0.04	coverage
cultural	15	0.04	cultural, culture
direct	15	0.04	direct, directed, directing, direction, directional, directionally, directions, directivity
dissemination	15	0.04	dissemination, disseminations
enhanced	15	0.04	enhanced, enhancement, enhancements, enhancing
gamification	15	0.04	gamification
language	15	0.04	language, languages
placement	15	0.04	placement
protection	15	0.04	protection
zigbee	15	0.04	zigbee
benchmarking	14	0.04	benchmark, benchmarking
recommendation	14	0.04	recommendation, recommendations, recommender
aggregation	14	0.04	aggregate, aggregates, aggregation, aggregator
assisted	14	0.04	assistance, assistants, assisted, assistive
density	14	0.04	density
disaster	14	0.04	disaster
electronic	14	0.04	electronic, electronically, electronics
factors	14	0.04	factor, factors
field	14	0.04	field, fields
group	14	0.04	group, groups
lightweight	14	0.04	lightweight
linked	14	0.04	linked, linking
people	14	0.04	people
regression	14	0.04	regression
remote	14	0.04	remote
scheme	14	0.04	scheme, schemes
short	14	0.04	short
transmission	14	0.04	transmission, transmissions
relations	13	0.04	related, relation, relational, relations
cellular	13	0.04	cellular

drone	13	0.04	drone, drones
education	13	0.04	education, educational
grids	13	0.04	grids
literature	13	0.04	literature
medical	13	0.04	medical
motion	13	0.04	motion
requirements	13	0.04	requirement, requirements
spatiotemporal	13	0.04	spatiotemporal
spectrum	13	0.04	spectrum
statistical	13	0.04	statistical, statistics
survey	13	0.04	survey
transfer	13	0.04	transfer, transferred
transit	13	0.04	transit, transition, transitions
vector	13	0.04	vector
world	13	0.04	world, worlds
balancing	12	0.04	balance, balancing
bayesian	12	0.04	bayesian
colony	12	0.04	colony
constrained	12	0.04	constrained
critical	12	0.04	critic, critical, criticality
differential	12	0.04	differential, differentiation
driving	12	0.04	driving
extraction	12	0.04	extracted, extraction
fault	12	0.04	fault, faults
interest	12	0.04	interest, interests
market	12	0.04	market, marketing, markets
retrieval	12	0.04	retrieval
scalability	12	0.04	scalability, scalable
signature	12	0.04	signature, signatures
similarity	12	0.04	similarities, similarity
society	12	0.04	societies, society
spark	12	0.04	spark
strength	12	0.04	strength
target	12	0.04	target, targets
regulations	12	0.04	regulating, regulation, regulations
agriculture	11	0.03	agricultural, agriculture
android	11	0.03	android
change	11	0.03	change, changing
coding	11	0.03	codes, coding
cybersecurity	11	0.03	cybersecurity
delivery	11	0.03	delivery
evolutionary	11	0.03	evolutionary
forensics	11	0.03	forensic, forensics
geospatial	11	0.03	geospatial
impact	11	0.03	impact, impacts
incentive	11	0.03	incentive, incentives
inclusion	11	0.03	inclusion, inclusive
inference	11	0.03	inference
latency	11	0.03	latency
lifetime	11	0.03	lifetime
lpwan	11	0.03	lpwan
mapping	11	0.03	mapping
memory	11	0.03	memory
moving	11	0.03	moving
range	11	0.03	range

reduction	11	0.03	reduction
reference	11	0.03	reference, references
relay	11	0.03	relay, relays
resilience	11	0.03	resilience, resiliency, resilient
server	11	0.03	server
situations	11	0.03	situated, situation, situational, situations
spatio	11	0.03	spatio
systematic	11	0.03	systematic
techniques	11	0.03	technique, techniques
university	11	0.03	universal, universities, university
advanced	11	0.03	advance, advanced, advancement
cross	11	0.03	cross, crossing
domain	11	0.03	domain, domains
forest	11	0.03	forest, forests
message	11	0.03	message, messages
module	11	0.03	module, modules
antenna	10	0.03	antenna, antennas
conditional	10	0.03	condition, conditional, conditions
consensus	10	0.03	consensus
constraint	10	0.03	constraint, constraints
creation	10	0.03	creation
decomposition	10	0.03	decomposition
driver	10	0.03	driver
everything	10	0.03	everything
frequency	10	0.03	frequency
hadoop	10	0.03	hadoop
library	10	0.03	libraries, library
means	10	0.03	means
methodology	10	0.03	methodologies, methodology
orchestration	10	0.03	orchestration
organisation	10	0.03	organicity, organisation, organizing
particle	10	0.03	particle
passenger	10	0.03	passenger
perceived	10	0.03	perceived
queuing	10	0.03	queuing
regional	10	0.03	region, regional, regions
reputation	10	0.03	reputation
segmentation	10	0.03	segmentation
tourism	10	0.03	tourism
transparency	10	0.03	transparency, transparent
administration	10	0.03	administration, administrative
distance	10	0.03	distance, distancing
enterprise	10	0.03	enterprise, enterprises
accident	9	0.03	accident, accidents
behaviour	9	0.03	behaviour, behavioural
broadcast	9	0.03	broadcast, broadcasting
cycle	9	0.03	cycle, cycles, cycling
dependent	9	0.03	dependability, dependence, dependencies, dependency, dependent
emission	9	0.03	emission, emissions
ensemble	9	0.03	ensemble, ensembles
fingerprinting	9	0.03	fingerprint, fingerprinting, fingerprints
gateway	9	0.03	gateway, gateways
homomorphic	9	0.03	homomorphic, homomorphism
practices	9	0.03	practical, practicality, practice, practices
provisioning	9	0.03	provision, provisioning

wearable	9	0.03	wearable, wearables
battery	9	0.03	battery
block	9	0.03	block, blocks
correlation	9	0.03	correlation
hardware	9	0.03	hardware
heritage	9	0.03	heritage
heuristic	9	0.03	heuristic, heuristics
lorawan	9	0.03	lorawan
micro	9	0.03	micro
occupancy	9	0.03	occupancy, occupants, occupational
perception	9	0.03	perception
project	9	0.03	project, projected, projection, projects
received	9	0.03	received, receiver
recurrent	9	0.03	recurrent
small	9	0.03	small
solar	9	0.03	solar
solid	9	0.03	solid
uncertainty	9	0.03	uncertainty
areas	8	0.02	areas
assignment	8	0.02	assignment
biometrics	8	0.02	biometric, biometrics
coordination	8	0.02	coordinate, coordinated, coordination
enabled	8	0.02	enabled, enablement, enabling
experimentation	8	0.02	experimental, experimentation
fiware	8	0.02	fiware
games	8	0.02	games, gaming
kalman	8	0.02	kalman
manet	8	0.02	manet
microservice	8	0.02	microservice, microservices
migration	8	0.02	migration
mutual	8	0.02	mutual
natural	8	0.02	natural
private	8	0.02	private
probabilistic	8	0.02	probabilistic
probability	8	0.02	probability
publish	8	0.02	publish, publishing
retailing	8	0.02	retail, retailers, retailing
saving	8	0.02	saving, savings
synthetic	8	0.02	synthetic
testbed	8	0.02	testbed, testbeds
testing	8	0.02	testing
thinking	8	0.02	thinking
tools	8	0.02	tools
topological	8	0.02	topological, topology
ultrasonic	8	0.02	ultrasonic
weight	8	0.02	weight, weighted, weighting
automatic	8	0.02	automatic, automatically, automaticity
concept	8	0.02	concept, concepts
crime	8	0.02	crime, crimes
effect	8	0.02	effect, effective, effectiveness, effects
intersection	8	0.02	intersection, intersections
sensitivity	8	0.02	sensitive, sensitivity, sensitisation
threat	8	0.02	threat, threats
actuators	7	0.02	actuation, actuator, actuators
caching	7	0.02	cache, caching

cloudlet	7	0.02	cloudlet, cloudlets
facility	7	0.02	facilities, facility
federation	7	0.02	federal, federated, federation
profile	7	0.02	profile, profiles, profiling
store	7	0.02	store, stores
synchronisation	7	0.02	synchronisation, synchronous
trading	7	0.02	trade, trading
lowpan	7	0.02	lowpan
acquisition	7	0.02	acquisition
apache	7	0.02	apache
availability	7	0.02	availability, available
avispa	7	0.02	avispa, avispas
background	7	0.02	background
capacity	7	0.02	capacity
carbon	7	0.02	carbon
competitive	7	0.02	competition, competitive, competitiveness

References

1. Hashem, I.A.T.; Chang, V.; Anuar, N.B.; Adewole, K.; Yaqoob, I.; Gani, A.; Ahmed, E.; Chiroma, H. The role of big data in smart city. *Int. J. Inf. Manag.* **2016**, *36*, 748–758.
2. Rozario, S.D.; Venkatraman, S.; Chu, M.-T.; Abbas, A. Enabling corporate sustainability from a talent acquisition perspective. *J. Sustain. Res.* **2020**, *2*, e200014.
3. Zubizarreta, I.; Seravalli, A.; Arrizabalaga, S. Smart city concept: What it is and what it should be. *J. Urban Plan. Dev.* **2016**, *142*, 04015005.
4. Hoffman, M.C. Smart cities: A review of the most recent literature. *Informatiz. Policy* **2020**, *27*, 3–35.
5. Lai, C.S.; Jia, Y.; Dong, Z.; Wang, D.; Tao, Y.; Lai, Q.H.; Wong, R.T.; Zobaa, A.F.; Wu, R.; Lai, L.L. A review of technical standards for smart cities. *Clean Technol.* **2020**, *2*, 290–310.
6. Batty, M.; Axhausen, K.W.; Giannotti, F.; Pozdnoukhov, A.; Bazzani, A.; Wachowicz, M.; Ouzounis, G.; Portugali, Y. Smart cities of the future. *Eur. Phys. J. Spec. Top.* **2012**, *214*, 481–518.
7. Ahad, M.A.; Paiva, S.; Tripathi, G.; Feroz, N. Enabling technologies and sustainable smart cities. *Sustain. Cities Soc.* **2020**, *61*, 102301.
8. Trindade, E.P.; Hinnig, M.P.F.; Moreira da Costa, E.; Marques, J.S.; Bastos, R.C.; Yigitcanlar, T. Sustainable development of smart cities: A systematic review of the literature. *J. Open Innov. : Technol. Mark. Complex.* **2017**, *3*, 11.
9. Asaithambi, S.P.R.; Venkatraman, R.; Venkatraman, S. MOBDA: Microservice-oriented big data architecture for smart city transport systems. *Big Data Cogn. Comput.* **2020**, *4*, 17.
10. Campisi, T.; Severino, A.; Al-Rashid, M.A.; Pau, G. The development of the smart cities in the connected and autonomous vehicles (CAVs) era: From mobility patterns to scaling in cities. *Infrastructures* **2021**, *6*, 100.
11. Asaithambi, S.P.R.; Venkatraman, S.; Venkatraman, R. Big Data and personalisation for non-intrusive smart home automation. *Big Data Cogn. Comput.* **2021**, *5*, 6.
12. Asaithambi, S.P.R.; Venkatraman, S.; Venkatraman, R. Proposed big data architecture for facial recognition using machine learning. *AIMS Electron. Electr. Eng.* **2021**, *5*, 68–92.
13. Ullah, Z.; Al-Turjman, F.; Mostarda, L.; Gagliardi, R. Applications of artificial intelligence and machine learning in smart cities. *Comput. Commun.* **2020**, *154*, 313–323.
14. Albino, V.; Berardi, U.; Dangelico, R.M. Smart cities: Definitions, dimensions, performance, and initiatives. *Journal of urban technology* **2015**, *22*, 3–21.
15. Vasconcelos-Barrote, E. SMART CITIES: A HOLISTIC APPROACH TO A PEOPLE-BASED CONCEPT. *Стратегии развития социальных общностей, институтов и территорий* **2020** *2020*, 98–101.
16. Ballas, D. What makes a 'happy city'? *Cities* **2013**, *32*, S39–S50.
17. Kummitha, R.K.R. Entrepreneurial urbanism and technological panacea: Why Smart City planning needs to go beyond corporate visioning? *Technol. Forecast. Soc. Chang.* **2018**, *137*, 330–339.
18. Marimuthu, M. Expanding Beyond Technology-Driven Factors: IoT for Smart City Services. In Proceedings of International Working Conference on Transfer and Diffusion of IT, Tiruchirappalli, India, 18–19 December 2020; pp. 252–258.
19. Kummitha, R.K.R.; Crutzen, N. How do we understand smart cities? An evolutionary perspective. *Cities* **2017**, *67*, 43–52.
20. Kummitha, R.K.R.; Crutzen, N. Smart cities and the citizen-driven internet of things: A qualitative inquiry into an emerging smart city. *Technol. Forecast. Soc. Chang.* **2019**, *140*, 44–53.
21. Akande, A.; Cabral, P.; Gomes, P.; Casteleyn, S. The Lisbon ranking for smart sustainable cities in Europe. *Sustainable Cities and Society* **2019**, *44*, 475–487.

22. Kummitha, R.K.R. Why distance matters: The relatedness between technology development and its appropriation in smart cities. *Technol. Forecast. Soc. Chang.* **2020**, *157*, 120087.
23. Ejaz, W.; Naeem, M.; Shahid, A.; Anpalagan, A.; Jo, M. Efficient energy management for the internet of things in smart cities. *IEEE Commun. Mag.* **2017**, *55*, 84–91.
24. Bibri, S.E. On the sustainability of smart and smarter cities in the era of big data: An interdisciplinary and transdisciplinary literature review. *J. Big Data* **2019**, *6*, 1–64.
25. Toli, A.M.; Murtagh, N. The concept of sustainability in smart city definitions. *Front. Built Environ.* **2020**, *6*, 77.
26. Harrison, C.; Eckman, B.; Hamilton, R.; Hartswick, P.; Kalagnanam, J.; Paraszczak, J.; Williams, P. Foundations for smarter cities. *IBM J. Res. Dev.* **2010**, *54*, 1–16.
27. Lim, C.; Kim, K.-J.; Maglio, P.P. Smart cities with big data: Reference models, challenges, and considerations. *Cities* **2018**, *82*, 86–99.
28. Taylor Buck, N.; While, A. Competitive urbanism and the limits to smart city innovation: The UK Future Cities initiative. *Urban Stud.* **2017**, *54*, 501–519.
29. Hodson, M. *World Cities and Climate Change: Producing Urban Ecological Security*; McGraw-Hill Education: London, UK, 2010.
30. Hollands, R. Will the real smart city please stand up? City: Analysis of Urban Trend, Culture, Theory. *Policy Action* **2008**, *12*, 303–320.
31. Castelnovo, W.; Misuraca, G.; Savoldelli, A. Smart cities governance: The need for a holistic approach to assessing urban participatory policy making. *Soc. Sci. Comput. Rev.* **2016**, *34*, 724–739.
32. Cugurullo, F. Exposing smart cities and eco-cities: Frankenstein urbanism and the sustainability challenges of the experimental city. *Environ. Plan. A: Econ. Space* **2018**, *50*, 73–92.
33. Viitanen, J.; Kingston, R. Smart cities and green growth: Outsourcing democratic and environmental resilience to the global technology sector. *Environ. Plan. A* **2014**, *46*, 803–819.
34. Rozario, S.D.; Venkatraman, S.; Chu, M.-T.; Abbas, A. Dominant factors for an effective recruitment system: An australian education sector perspective. *Systems* **2019**, *7*, 50, doi:10.1016/j.labeco.2018.10.007.
35. P Kasznar, A.P.; WA Hammad, A.; Najjar, M.; Linhares Qualharini, E.; Figueiredo, K.; Soares, C.A.P.; N Haddad, A. Multiple dimensions of smart cities' infrastructure: A review. *Buildings* **2021**, *11*, 73.
36. Camero, A.; Alba, E. Smart city and information technology: A review. *cities* **2019**, *93*, 84–94.
37. Verina, N.; Titko, J. Digital transformation: Conceptual framework. In Proceedings of the International Scientific Conference "Contemporary Issues in Business, Management and Economics Engineering'2019", Vilnius, Lithuania, 9–10 May 2019; pp. 9–10.
38. Daptardar, S. A review-the golden triangle of rpa, ai and digital transformation. *Int. Res. J. Mod. Eng. Technol. Sci.* **2021**, *3*, 887–891.
39. Alonso, R.G.; Lippez-De Castro, S. Technology helps, people make: A smart city governance framework grounded in deliberative democracy. In *Smarter as the New Urban Agenda*, Springer: Cham, Switzerland, 2016; pp. 333–347.
40. Mancebo, F. Smart city strategies: Time to involve people. Comparing Amsterdam, Barcelona and Paris. *J. Urban. : Int. Res. Placemaking Urban Sustain.* **2020**, *13*, 133–152.
41. Andress, A. *Surviving Security: How to Integrate People, Process, and Technology*; CRC Press: Boca Raton, FL, USA, 2003.
42. Barletta, V.S.; Caivano, D.; Dimauro, G.; Nannavecchia, A.; Scalera, M. Managing a smart city integrated model through smart program management. *Appl. Sci.* **2020**, *10*, 714.
43. Saunders, M. *Research Methods for Business Students*, 6th ed.; Pearson Education: Harlow, UK, 2012.
44. Guz, A.N.; Rushchitsky, J. Scopus: A system for the evaluation of scientific journals. *Int. Appl. Mech.* **2009**, *45*, 351.
45. Aghaei Chadegani, A.; Salehi, H.; Yunus, M.; Farhadi, H.; Fooladi, M.; Farhadi, M.; Ale Ebrahim, N. A comparison between two main academic literature collections: Web of Science and Scopus databases. *Asian Soc. Sci.* **2013**, *9*, 18–26.
46. Vieira, E.; Gomes, J. A comparison of Scopus and Web of Science for a typical university. *Scientometrics* **2009**, *81*, 587–600.
47. Vaismoradi, M.; Jones, J.; Turunen, H.; Snelgrove, S. Theme development in qualitative content analysis and thematic analysis. *J. Nurs. Educ. Pract.* **2016**, *6*, 100–110.
48. Quinlan, C.; Babin, B.; Carr, J.; Griffin, M. *Business Research Methods*; South Western Cengage: Mason, OH, USA, 2019.
49. Cavana, R.Y.; Delahaye, B.L.; Sekaran, U. *Applied Business Research: Qualitative and Quantitative Methods*; John Wiley & Sons Inc.:Hoboken, NJ, USA, 2001.
50. Baxter, P.; Jack, S.J. Qualitative case study methodology: Study design and implementation for novice researchers. *Qual. Rep.* **2008**, *13*, 544–559.