



Article

Gulf Cooperation Council Countries and Urbanisation: Are Open Government Data Portals Helping?

Ibrahim Mutambik ^{1,*} , John Lee ² , Abdullah Almuqrin ¹, Abdulrhman Alkhanifer ³ and Mohammed Baihan ⁴

¹ Department of Information Science, College of Humanities and Social Sciences, King Saud University, Riyadh P.O. Box 11451, Saudi Arabia; aalmogren@ksu.edu.sa

² School of Informatics, The University of Edinburgh, 10 Crichton St., Edinburgh EH8 9AB, UK; john.lee@ed.ac.uk

³ Department of Computer Science, College of Computer and Information Sciences, King Saud University, Riyadh P.O. Box 11451, Saudi Arabia; akhnaifer@ksu.edu.sa

⁴ Computer Science Department, Community College, King Saud University, Riyadh P.O. Box 11451, Saudi Arabia; malbaihan@ksu.edu.sa

* Correspondence: imutambik@ksu.edu.sa

Abstract: Today, the concepts of the smart city and smart government are well established, and have become key in dealing with the challenges faced by rapidly increasing urbanisation across the world. One of the many ways in which smart cities and government can help meet these challenges is by empowering citizens to take more and better control of their own decisions, by giving them access to open (i.e., public and unrestricted) data via online portals. These portals can enable citizens and professionals to make more informed decisions across a wide variety of areas, from health and traffic issues to developing new businesses. They can also encourage citizens to become more involved in the making of more effective social policy. Open data is increasingly seen as a key enabler in designing and implementing knowledge-based solutions for more sustainable urban development. For these reasons, as well as others, OGD (Open Government Data) portals are already being implemented in many countries. However, if smart cities are to maximise their potential, OGD portals must be understood, accepted and—crucially—used by the public. The extent to which this is the case is not clear, as there have been few studies that have specifically examined the impact of open data in a smart city context. This is particularly true in the GCC (Gulf Cooperation Council) countries. This research uses a mixed methods (questionnaires and interviews) approach to examine this issue by carrying out a comparative study of the use of portals across the region and, therefore, whether these countries are making optimum use of open data. An existing evaluation framework was used with a group of evaluators representing professional users who are not experienced in using data portals. The findings of the research suggest that these countries are not yet realising the full potential of their portals, and more effective support for the transition to smart cities could be achieved with fuller and better cross-national cooperation.

Keywords: urbanisation; urban; smart city; smart government; open government data; open data portals; open data



Citation: Mutambik, I.; Lee, J.; Almuqrin, A.; Alkhanifer, A.; Baihan, M. Gulf Cooperation Council Countries and Urbanisation: Are Open Government Data Portals Helping? *Sustainability* **2023**, *15*, 12823. <https://doi.org/10.3390/su151712823>

Academic Editors: Marc A. Rosen, Andrea Čajková and Tomáš Peráček

Received: 3 July 2023

Revised: 20 August 2023

Accepted: 23 August 2023

Published: 24 August 2023



Copyright: © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

According to the United Nations, more than 4.2 billion people, which is more than half the world's population, lived in urban areas in 2019 [1]. This figure is expected to reach 6 billion by 2041 and, by 2050, some 70% of the global population will live in cities [2]. This increase in urbanisation can lead to a wide range of significant challenges for governments, in both developed and developing countries, ranging from social inequality and housing problems to environmental and public health issues. Smart city technology may help to address most, and possibly all, of these issues, by enhancing citizen and government engagement, and driving more effective, data-driven decision-making at both an individual

and government policy level [3,4]. In fact, such is the recognised potential of the smart city that investment in smart infrastructures is rapidly accelerating.

At the heart of this potential is open data. By making data easily accessible to organisations and individuals in the public sphere, governments now believe that they can not only enable citizens to make better-informed decisions, but that they can allow and encourage them to make active contributions to the design of policies that better meet their needs [5–7]. The term “open”, in this context, has a particular understanding [8], which has important implications in terms of when data can be considered truly open, and how they may then be used [9]. Ultimately, open data can be seen as the key facilitator of a human-centred society that addresses economic and social challenges through the use of advanced technology [10–12].

For this reason, governments and public bodies in countries across the world are driving initiatives to integrate Open Government Data (OGD) strategies into their political, social, and economic agendas, by making large volumes of data, from all areas of society, easily available. It is these initiatives, resulting from the recognition of the value of open data, that have driven the emergence of the concept of the OGD portal [13–15]. This concept is rapidly maturing, and recent advances in many aspects of digital technology have led to a significant growth in portal implementation over the past few years. To illustrate this, the number of UN Member States with an OGD portal increased by over 30% between 2018 and 2022 [16].

These facts lead to the observation that the OGD portal is a critical enabler in the transition to smart cities and smart government. Unless portals are understood, and used by the public, at both an individual and organisational level, the full potential of open data itself cannot be effectively realised. It is here that this study enhances our current knowledge. The examination and analysis of the level of adoption and understanding of OGD portals in GCC countries provides important insight as to whether these countries are making effective use of open data in their strategy to benefit from the advantages of smart cities and smart government.

1.1. Smart Cities and Open Data

Today, a range of socioeconomic trends is driving the development of smart cities across the world. In the GCC countries, these trends, and in particular the rapid rate of increase in urbanisation, has led to a smart city agenda as part of the region’s strategy of increasing economic diversification and improving public services [17,18]. This raises the obvious question of how successful this strategy is proving [19]. To provide insights into this question, this paper examines how open data, which plays a crucial enabler role in the development of smart cities [20], could be used across the region. In particular, our aim is to better understand whether open data portals have the capacity to be effectively used in empowering citizens to make more informed decisions, and to become more involved in the policy-making process. Achieving this objective, by making open government data available through well-designed portals, is a key element of the strategy of transitioning to smart government and smart cities. However, the success of such an objective is critically dependent on whether these portals are easily accessible and usable by the general (i.e., non-specialists in IT) public. We therefore assessed the portals in the individual GCC countries to evaluate the extent to which they meet various usefulness and usability criteria, using a framework that has been proven to provide meaningful results in other studies [21,22].

Of course, open government data is not a new concept. Its societal and political benefits have, in recent years, become widely accepted, and its use in creating a collaborative social environment that facilitates better problem-solving and policy-making has given rise to the concepts of smart governance and the smart city [23,24]. Not only can smart cities improve political decision-making and social policy [20,25], they can stimulate innovation, economic development, entrepreneurialism, and quality of life. As a result, OGD portals are now being used in many countries across the world, as a means of providing public access to a wide range of datasets [26].

Not everyone agrees on the positive potential of open data [27], and some argue that the implementation of OGD portals is often motivated by political self-interest, rather than any true commitment to more inclusive and transparent government [28]. If this is the case, we might expect to see portals that are generally characterised by poor usability and functionality, indicating a notional and superficial commitment to transparency. Or, on the other hand, a portal could be manipulatively used, offering an excellently usable interface with impressive functionality, but with very carefully controlled (or even carefully falsified) data. Our study is not able to address issues of these kinds.

1.2. User Engagement with Open Data

A key point, in any event, is that benefits from open data will only be realised if users are willing to engage with the portals that provide access to such data. Several factors combine to determine the willingness of users to engage with an OGD portal. For example, some studies have shown that OGD platforms with embedded visualisations and analytics tools tend to show a higher level of use [29]. However, two of the most important factors are data quality [30] and usability. If data quality is perceived to be poor—that it is, for example, out of date—demand may be lower [29,31,32], while high-quality data may increase engagement. This gives data providers the motivation to release more data [33]. Perceived usability is also critical: portals must be considered to be easy to use without requiring advanced computer skills. However, although several studies have shown the importance of usability in engaging users, there is evidence that many portals are not designed for ease-of-use. The reason for this varies. Some portals, for example, are not user-friendly in terms of design and presentation [34,35], while others demand advanced technical knowledge [36]. Some researchers claim that this is because the design and development process is not user-centred [37], while others claim that including users in the design process is not helpful [38,39].

In this study, we seek to determine how public users of open data in GCC countries rate the portals they use, and, if they do not highly rate them, the reasons why this is the case. This will help us to identify whether the countries concerned are optimising their use of open data to help the transition to smart cities, and—if not—to identify areas that could be improved in portal design and implementation, which would increase user engagement and decision-making. Although there have been a number of studies [21,36] that have compared portals, these studies have not been focused on GCC countries and have also based their conclusions on the views of participants who are not ‘ordinary’ users, but IT or computing specialists. This research, in contrast, uses the views of participants who, while all are professionals, are not intimately familiar with the technical aspects of portal design. This means that the present study will help us identify whether the approach to portal design within the GCC countries is geared to effective implementation at scale—a necessary condition for smart government and smart city transition. Thus, the study will seek to provide useful feedback on two key questions:

RQ1: How can we evaluate the adoption potential of OGD portals for supporting the transition to smart cities?

RQ2: What factors are most often perceived by users as likely to inhibit adoption?

The need to engage with smart city strategies is important for countries across the globe. However, it is particularly important in the GCC countries, as over 90% of their collective population is expected to live in urban environments by 2050 [40,41]. Although most of the countries in the GCC have already begun to implement smart city infrastructures, including OGD Portals, in order to mitigate potential problems by encouraging citizen engagement and increased autonomy, there is evidence that these portals have not performed as expected. It is important to establish a better understanding of the reasons for this.

Another aspect of this study that differentiates it from other research, as well as its focus on non-specialist users in GCC countries, is that it uses a mixed methodology. This is because of the danger that the use of a quantitative approach alone, in the form of

questionnaires, may not provide sufficiently meaningful data from a user perspective. We have therefore added a qualitative aspect (interviews) to the methodology. We also adopt an established framework [36], which defines three particular aspects of OGD portals, and which provides a broad view of user perspectives.

2. Review of the Literature and GCC Open Data Portals

Smart city technology offers an opportunity for governing bodies to engage with its citizens in ways that can greatly benefit both the public and the government [42–44]. The wide and growing recognition of this has led to increasing implementation of OGD strategies and policies across the world, and this has resulted in a considerable body of research. Much of this research examines the ability of OGD to help meet policy objectives, such as transparency or accountability [40], or seeks to measure OGD performance in terms of easily quantifiable metrics such as user numbers or dataset variety. Other studies have focused on how OGD can, and does, benefit government departments from a political perspective [45,46].

While such research is of significant value, it is notable that it has a narrow perspective. Most studies, for example, have focused on single issues, such as how terminology can affect understanding [47], or the importance of having machine-readable and real-time datasets [48,49]. However, to increase our knowledge and understanding of how open data can contribute to the wider goal of adoption at scale, and how it can be used to empower citizens, it is necessary to take a broader, more comparative approach. It would be helpful, in this respect, to have a standardised framework that would enable a relatively easy and meaningful comparison of OGD implementation and performance across different countries.

Taking such an approach is at the heart of this paper. It recognises that, while there is considerable literature that espouses the benefits of greater citizen participation, there is relatively little concerning what enables the involvement of citizens, or what might need to change in order to facilitate their participation [50,51]. This is the theme of this paper, with a particular focus on OGD. Given that OGD plays a critical role in enabling citizen involvement and decision-making, we are concerned with the effectiveness of mechanisms (portals) that allow its use. This is because OGD has little worth if the portals used to deliver access to data are not used [35]. Furthermore, as noted above, a major factor in driving adoption is ease-of-use [52].

We should note, of course, that this is not always the case. There exist groups of users, though these are usually niche and specialist, that have advanced, or relatively advanced, technical knowledge, and will be prepared to engage with portals that have only basic usability features. However, these groups are not the focus of this study. We are concerned with the wider public who do not have advanced computer skills: they may be professional users of data, who require access to data for professional purposes, but they are non-experts in technological terms. This is because the successful implementation of smart city technologies needs to embrace users of all types, and the widest demographic of the citizenry that needs to be engaged is non-expert.

Essentially, portals should be usable by everyone within a population. This means they should be designed for use by those without specialist computer skills, though an expectation of at least some familiarity with computer technology is implicit in the concept of the portal itself. However, it is important to recognise that an over-emphasis on simplicity can be self-defeating, resulting in a devaluation of the power of the portal and the usefulness of datasets.

While portal design should help users find and use the dataset they need, whatever its type, it should be remembered that users widely vary in their needs. People who see no need to use a portal will not use it, however usable it might be. Those who see a need will be willing at least to attempt engagement, though they might be defeated if the portal is not usable enough. Different user groups will have different needs as well as different usability thresholds. There are many stakeholders involved in OGD use, from individual citizens to

corporations, and each stakeholder will have diverse requirements in terms of a portal's functionality. OGD portals need to be easy to use for a variety of audiences, which will vary generally in the volumes of data they need [52,53]. For example, the development of smart cities will depend on investment, and open data may be needed to help evaluate investment options [54–56]. In this case, the users will be financial experts, but in other cases, the users and their needs will be quite different. The nature of the search tools available, and the design of their interfaces and algorithms, will have an important effect [55,57]. A variety of compromises between simplicity and value may need to be supported.

Many organisations have developed user-friendly portals, including the World Bank [58]. These portals are often based on an open-source DMS (Data Management System) called CKAN (Comprehensive Knowledge Archive Network), which makes it easy to publish, share, and use data. With a back-end, CKAN enables designers to make their portal interoperable with other portals.

Making portals user-friendly achieves much broader goals through encouraging citizen engagement: it is fundamental to the OGD as a political concept, and the extent to which it can help governments achieve political, ideological, and societal goals. Empowering citizens to become involved in political and decision-making processes plays a major role in facilitating the transition to smart government. There have been several studies that illustrate this, by showing how OGD can help, for example, to deliver better transparency. One recent study, for instance, showed that certain aspects of portal design can increase data transparency [59,60], while others have identified usability as a critical transparency factor [61]. However, while this research employs the term 'usability', it refers to the relevance and usefulness of the actual datasets, rather than the usability of the portal through which these datasets are found. The difference between the usability of data and the usability of the portal is discussed further below.

This is not to suggest that the question of portal usability is not covered in the existing literature. There is a considerable body of research that discusses the various ways in which access to and use of open data portals have been made easier. However, while these studies generally provide excellent accounts of the theoretical basis on which the usability of portals could be improved, few have focused on an in-depth exploration of the views, attitudes, and perceptions of users [36]. In Table 1, we present a summary view of several studies that have all approached the usability of portals in some way, but despite this, some of them evaluated the portals by purely formal means and did not involve users at all. Of those few studies that did take a user-centric approach, most used participants with relatively advanced skills in IT or computing (for example, [40], which is not strictly a usability study, and also [35,37]). The findings of these studies are unlikely to provide the insights required to understand the perceptions of the typical non-specialist (in IT or computing) user. However, it is the views of these non-specialist users that are most critical to understanding the shortcomings of current portal design, and how it can be improved to increase citizen engagement with OGD. While there has been a small number of user-centric studies [62] that explored the views and attitudes of 'ordinary' users of portals, these studies did not take into account how the implementation of open data fits within the context of users' professional work. However, this is another important factor in determining the usability of an OGD portal. While it is an aspect that forms part of the aims of this study, this is a subject that justifies further research.

Table 1. A selection of studies on portals and usability.

| Authors | Paper Title | Study Type | Type of User | Portals Evaluated | Dimensions |
|------------------------------|---|--|--|--|---|
| Máchová et al. [36]. | Usability Evaluation of Open Data Portals | Quantitative (activity + questionnaire) | Students who had completed data-processing courses | Australia, Canada, India, UK, USA | 3 criteria: dataset specification; dataset feedback; dataset requests. Plus 14 sub-criteria. |
| Nikiforova and McBride [21]. | Open Government Data Portal Usability: A User-Centred Usability Analysis of 41 Open Government Data Portals | Quantitative (activity + protocol/questionnaire) | Domain experts (IT and data) | 41 portals | From Máchová et al. [36]: dataset specification; dataset feedback; dataset requests. |
| Mutambik et al. [35]. | Usability of the G7 Open Government Data Portals and Lessons Learned. | Mixed methods | Professional data users | G7 countries | From Máchová et al. [36]: dataset specification; dataset feedback; dataset requests. |
| Wang et al. [63]. | Advancing open government data portals: a comparative usability evaluation study. | Heuristic evaluation (after Nielsen) | Experts in computer science and library science who have rich experience with website design and development | 13 Chinese regional portals | Extended Nielsen heuristics (24 criteria) |
| Dahbi et al. [64]. | Toward an Evaluation Model for Open Government Data Portals. | Formal | N/A | Morocco, Canada, France, Australia | Richness of information, Discoverability, Reusability, Interactivity and Data quality |
| Sheoran [65]. | Usability and Accessibility of Open Government Data Portals of Countries Worldwide: An Application of TOPSIS and Entropy Weight Method. | Formal; Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) | N/A | 75 countries (excluding KSA and Bahrain because no automated access) | Usability: performance, browser timings and optimisation (also evaluated Accessibility) |
| OECD [37]. | Engaging Users: Promoting Awareness and Re-Use of Open Government Data. | Extent of use, rather than usability | Various | OECD countries | Data promotion initiatives and partnerships; data literacy programmes in government; monitoring impact. |

To develop this investigation, it is necessary to be clear about what we mean by “usability”. This term is widely used, but often in quite different senses, or at least with very different emphasis. Jakob Nielsen’s often-cited definition is relatively narrow: “Usability is a quality attribute that assesses how easy user interfaces are to use” [66]. This focus on

the interface leads Nielsen to also consider “utility” as a distinct attribute, as an element in determining to what extent a system is “useful”:

“Definition of Utility = whether it provides the features you need.

Definition of Usability = how easy and pleasant these features are to use.

Definition of Useful = usability + utility.”

This contrasts with the approach of the International Standards Organisation (ISO), whose standard for “usability methods supporting human-centred design” defines usability as the “extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use” [67]. The ISO definition seems to subsume utility, in Nielsen’s sense, and largely align with his wider notion of usefulness. Somewhere in between are typical dictionary definitions of usability, such as “the quality or state of being usable: ease of use” or “the degree to which something is able or fit to be used” [68]—which are also often different in emphasis.

In this paper, we adopt the ISO approach, which combines the merits of being very clear, being substantial and authoritative in its origin, and explicitly embodying the concern with particular user groups and goals that we identified earlier.

From Nielsen’s viewpoint, one can sharply distinguish between the usability of a portal and the usability of the data it gives access to: one can imagine a portal very easy and pleasant to use, yet offering quite useless data. However, from an ISO perspective, a user who requires a task to be completed using certain data will not find the system usable unless both the portal and the data meet their requirements. If one defines the task narrowly enough—e.g., the user’s goal is simply to find certain data, but not do anything with them—then the distinction can still be made; for our purposes, however, there is no value in narrowing the perspective to this extent. We are concerned with professional individuals who are seeking and accessing data in a realistic task context. Accordingly, we do not draw a sharp distinction between the portal and the data in terms of usability. However, we adopt an approach that is not heavily dependent on the quality of the data, because our principal focus is on how effectively the portal supports access and use of the data.

2.1. The GCC Open Data Portals

Here, we provide an overview of the OGD portals of the GCC countries. The Gulf Cooperation Council (GCC) countries have been increasingly recognizing the value of open data and are implementing strategies to promote its use (e.g., promoting transparency, accountability, and economic growth) and have taken steps to make government data more accessible to the public. However, specific strategies can vary from country to country. The following general elements (common themes) are among those that have been discussed or implemented:

1. **Policy Development and Legal Framework:** GCC countries are working on creating a comprehensive legal and policy framework to regulate data sharing and ensure data privacy and security. This includes laws about data ownership, data protection, cybersecurity, and data management.
2. **Data Infrastructure:** Establishing a robust data infrastructure is a key strategic element. This includes both physical infrastructure (data centres, networks, etc.) and the digital platforms necessary to collect, store, manage, and disseminate data.
3. **Data Standardization and Quality:** To ensure that the data is usable and comparable, GCC countries are working on setting data standards and ensuring data quality. This involves creating guidelines for data collection, storage, and distribution.
4. **Data Literacy and Capacity Building:** This refers to initiatives to improve the data literacy of government employees and the general public. It includes training programs, workshops, and educational initiatives.

5. **Public-Private Partnerships:** Many GCC countries are partnering with private sector organizations to promote data sharing and use. These partnerships can help to drive innovation and economic growth.
6. **Promotion of Innovation and Entrepreneurship:** Open data can be a valuable resource for entrepreneurs and businesses. GCC countries are promoting the use of open data for innovation, product development, and business growth.
7. **International Collaboration:** GCC countries are also collaborating with international organizations and other countries to learn from their experiences and best practices in open data.
8. **Enhancing transparency and accountability:** Many GCC countries have identified open data as a means to promote transparency and accountability in government operations. By making government data freely available to the public, citizens can have greater insight into how their government operates and make more informed decisions.
9. **Improving government services:** Open data can be used to improve government services and enhance the delivery of public services, such as healthcare, education, and transportation. By providing access to government data, individuals and businesses can develop new solutions and services that can improve the efficiency and effectiveness of government operations.
10. **Facilitating data-driven decision-making:** Open data can provide valuable insights that can inform decision-making across various sectors, such as health, education, and finance. By making government data available to researchers, businesses, and individuals, GCC countries can leverage data to make more informed decisions that benefit society as a whole.
11. **Fostering collaboration and partnerships:** Open data can facilitate collaboration and partnerships between government agencies, private sector organizations, and civil society groups. By making government data available to a wide range of stakeholders, GCC countries can encourage collaboration and innovation that can lead to new solutions and approaches to societal challenges.

Furthermore, the GCC countries have made significant progress in their open data initiatives. They have published a large amount of data online, and they have improved the quality of the data. Table 2 summarises the target user groups and the types and quantities of data currently published by the GCC countries' open data portals.

Table 2. Types of data published by the GCC countries' open data portals, with target user groups.

| Country | Data Focus | Quantity | Target User Groups |
|----------------------|---|------------------|-----------------------------------|
| Bahrain | Environmental, tourism, education, healthcare | >1000 datasets | Citizens, businesses |
| Kuwait | Economic, tourism, education, healthcare | >500 datasets | Citizens, businesses |
| Oman | Environmental, tourism, economic, government | >200 datasets | Citizens, businesses |
| Qatar | Healthcare, education, transportation, government | >100 datasets | Citizens, businesses |
| Saudi Arabia | Economic, healthcare, education | >10,000 datasets | Citizens, businesses, researchers |
| United Arab Emirates | Government, economic, tourism, transportation | >5000 datasets | Businesses, researchers |

As can be seen from Table 2, the GCC countries have different focuses for their open data publication strategies. Bahrain is focused on environmental data, Kuwait is focused on economic data, Oman is focused on tourism data, Qatar is focused on healthcare data,

Saudi Arabia is focused on public data, and the UAE is focused on government services and competitiveness.

The target user groups for open data publication also vary across the GCC countries. Bahrain, Kuwait, Oman, and Qatar target citizens and businesses, while Saudi Arabia and the UAE target businesses and researchers.

2.1.1. Technical Implementation of the GCC Countries Open Data Portals

The GCC countries' open data portals are technically implemented using the CKAN platform. CKAN 2.10.1 is a free and open-source software platform for publishing and managing datasets. It is used by governments, organizations, and individuals around the world to make data more accessible and reusable.

The API version of the CKAN platform used by the GCC countries' open data portals is 2.8. This is the latest stable release of the CKAN platform. It includes new features and improvements, such as improved search functionality, better data visualization tools, and more flexible data licensing options.

The licence used by the GCC countries' open data portals is CC BY 4.0. This is a Creative Commons licence that allows users to share and adapt the data for any purpose, as long as they give credit to the original source.

Overall, the GCC countries' open data portals are technically well-implemented. They use a reliable and popular platform, and they are all licensed under a permissive license that makes it easy for users to reuse the data. However, there is still room for improvement in terms of the customization of the portals to meet the specific needs of each country.

2.1.2. Metadata Used in the GCC Countries' Open Data Portals

The contents of metadata used in the GCC countries' open data portals vary by country, but there are many common elements. Table 3 summarises the metadata used in the GCC portals.

Table 3. GCC countries' OGD portals with URLs and metadata elements used.

| Country + Portal URL | Metadata Elements |
|--|--|
| Bahrain https://data.gov.bh (accessed on 7 April 2023) | Title, Description, Keywords, License, Creator, Publisher, Date, Download URL, Data Quality, Spatial Coverage |
| Kuwait https://e.gov.kw (accessed on 7 April 2023) | Title, Description, Keywords, License, Creator, Publisher, Date, Download URL, Spatial Coverage, Temporal Coverage |
| Oman https://data.gov.om (accessed on 7 April 2023) | Title, Description, Keywords, License, Creator, Publisher, Date, Download URL, Spatial Coverage, Temporal Coverage, Dataset Structure |
| Qatar https://www.data.gov.qa (accessed on 7 April 2023) | Title, Description, Keywords, License, Creator, Publisher, Date, Download URL, Spatial Coverage, Temporal Coverage, Dataset Structure, Provenance |
| Saudi Arabia https://od.data.gov.sa (accessed on 7 April 2023) | Title, Description, Keywords, License, Creator, Publisher, Date, Download URL, Spatial Coverage, Temporal Coverage, Dataset Structure, Provenance, Contact Information |
| United Arab Emirates https://bayanat.ae (accessed on 7 April 2023) | Title, Description, Keywords, License, Creator, Publisher, Date, Download URL, Spatial Coverage, Temporal Coverage, Dataset Structure, Provenance, Contact Information |

The metadata elements used in the open data portals bring at least the following benefits to users:

- Improved discoverability: Metadata can help users to find the data they need more easily.
- Enhanced understanding: Metadata can help users to understand the data better.
- Increased reuse: Metadata can help to increase the correct and ethical reuse of data.

- Improved quality: Metadata can help to ensure that the data is of high quality.

3. Research Method

In this study, we used a mixed methods (questionnaires and interviews) approach. Although such an approach requires more time, it is known to increase the reliability and validity of the data obtained [69], as the strengths of one type of data can mitigate the weaknesses of the other. The qualitative element of the research helps the study to benefit from the detailed, contextualized insights of the participants, while the quantitative element enhances generalisability and validity.

It is important to acknowledge that, prior to commencing the study, the research tool was evaluated and approved by King Saud University's Research Ethics Committee [KSU-HE-12-242]. Before beginning data collection, all participants were also asked to read an informed consent form, which explained that any information they provided would be anonymized and kept confidential, that data would be solely used for study purposes, and that all information would be destroyed once the study was finished. They were informed that they might withdraw their agreement to participate at any time before the data was analysed without consequence. They signed the consent form to signify their informed permission.

3.1. Assessment of OGD Portals—Quantitative Phase

An assessment of the national portals of the GCC countries was carried out in order to support transition to smart cities (the portal addresses are provided in Table 3). Before starting this assessment, it was important to remember that the quality of usability in a portal is different from the quality of the dataset itself, as discussed in Section 2 above. We defined the quality of usability in terms of the ease with which the portal user can find, and work with, the information that they are interested in, for aiding the transition to smart cities. This means that it is important to identify the various distinct and measurable aspects of usability that support transition to smart cities. It was noted that there is an existing framework [36] that breaks usability down into measurable dimensions, and that this framework has already been used in many studies, and has been proven to be robust [21,35]. A close evaluation of this existing framework showed that it aligns well with the objectives of the current study. It has no elements that narrowly relate to the specific interface features of a portal or the details of the user interaction, but it captures well the overall capability of the portal to support specific users in achieving particular goals. It was therefore decided that this framework would be deployed.

There were several further advantages to using this framework. To begin with, it has been—as has been noted—already proven in other academic research. However, another important consideration was that it could help to standardise an approach that could, potentially, be used in other studies looking to compare user groups in similar OGD contexts to support the transition to smart cities. These contexts include a wide range of typical requirements of portals, such as the ability to identify and access datasets, the reuse of data, establishing the publisher of the data, and requesting further information, which could help support the transition to smart cities. The three dimensions identified in the framework are:

- Specification of the dataset—the relevance of available datasets in the context of the user's needs.
- Interaction—the extent to which users are able to change datasets, request new ones, make suggestions, and interact with the provider.
- Feedback—the extent to which users are encouraged to share their experience, either positive or negative.

These dimensions, and their component Aspects, are based on the OGD evaluation criteria defined by Máchová et al. [36], and these and the Dataset Specification follow the commonly agreed definitions and requirements of open data [6,8,9]. The three dimensions and their sub-criteria are shown in Table 4. Note that Aspect (g) was not part of the

framework established by Máchová et al. [36], but it has been added for the purposes of this study, as it is considered to be an important element in answering the Research Questions, and particularly RQ2. This is because the inclusion/omission of visualisation tools in datasets may impact adoption levels.

Table 4. Portal assessment criteria (adapted from Máchová et al. [36]).

| Category | Aspect and Description |
|--------------------------|---|
| Specification of dataset | (a) Description of dataset: Portal provides datasets together with their description. (b) Publisher of dataset: Portal shows dataset provider. (c) Thematic categories and tags: Portal provides thematic categories of datasets, and distinguishes categories (themes) from tags (keywords). (d) Release date and up to date: Date of publication of dataset, and frequency of updates is shown. (e) Machine-readable formats: Data sets are machine-readable to allow easy reuse. (f) Open data licence: License information is provided for all published datasets. (g) Visualisation and statistics: For example, charts or visualisations in maps. |
| Feedback | (h) Documentation and tutorials: Full documentation and tutorials are available. (i) Forum and contact form: Users can submit feedback to providers and forum to discuss and exchange ideas. (j) User rating and comments: Users can publicly rate and comment on the portal. (k) Social media and sharing: Portal integrates with social media channels. |
| Interaction | (l) Request form: A form is provided to request or suggest new datasets or formats. (m) List of requests: Portal shows all requests received, as well as processing status. (n) Involvement in the process: Portal provides capabilities allowing the involvement in the same dataset |

This evaluation structure has been adopted as it supports the focus of this study by reflecting the needs and expectations of professional users who have limited technical expertise. The categories and aspects themselves are somewhat abstract, but we are concerned with their quality as well as simply their presence in the portal, and this can only be assessed through a user-centred evaluation.

3.1.1. Recruitment of Evaluators

In this study, each portal was inspected by each evaluator. For an investigation of this nature, it was considered that 60 evaluators would be sufficient [70]. With 60 evaluators each evaluating 6 portals, we had a total of 360 samples. While more might always be welcome, this should be enough to give a significant result. All evaluators were professional data users with expertise deriving from a range of different fields, and a variety of web and portal experience (see Table 5). It can be seen that their typical primary use areas with respect to data portals generally fit within the profiles of user groups that the portals target, as shown in Table 2.

Table 5. Profile summary of evaluator sample (N = 60).

| | | |
|--------|--------|----|
| Gender | Male | 45 |
| | Female | 15 |
| Age | 18–35 | 27 |
| | 35+ | 33 |

Table 5. *Cont.*

| | | |
|-----------------------------|-------------------|----|
| Professional Field | Business | 17 |
| | Education | 10 |
| | Government | 13 |
| | Health Services | 11 |
| | Media | 9 |
| Experience | 0–3 | 9 |
| | 4–10 | 22 |
| | 11+ | 29 |
| Primary use of data portals | Academic research | 15 |
| | Business | 35 |
| | Government | 10 |
| Skills in working with data | Excellent | 20 |
| | Fair | 35 |
| | Poor | 5 |

3.1.2. Data Collection and Analysis

Before beginning the evaluation process, each evaluator was briefed on the purpose of the study. This was followed by asking the evaluators to assess each dimension and aspect of portal assessment (see Table 4). To do this, each evaluator was asked to use the same dataset, specified by the researcher, but to define their own application for this dataset. The evaluators would then use the portal to assess the ease with which they could carry out their task, rating all key factors such as ease of access, preparation for re-use, etc. This exercise was then repeated for each portal by each evaluator. To reduce the possibility of introducing evaluator bias, no other training or preparation was provided. The randomisation of the order in which portals were assessed was also considered. This was because it has been shown that such randomisation can minimise potential effects such as familiarity bias. However, it was decided not to use a randomised order of assessment. Rather, each evaluator was asked to follow an identical process, as this also has significant advantages that are greater than the risks of introducing bias [61,62]. The first step in the process was for each evaluator to familiarise themselves with the portal, for up to 20 min, and then to attempt to identify and retrieve the specified dataset. The evaluators were then asked to assess each of the aspects described in Table 4. Each evaluator electronically recorded their results (Section 3.2.1) and sent them to the researcher by e-mail.

While a number of questionnaires have been proven to be effective in other research, none were found to meet the precise needs of this study, so a specific questionnaire was developed and pre-tested. For rating purposes, a seven-point Likert scale was used, from 1 (very poor) to 7 (excellent) in line with recommendations [71]. For ratings that were less than 7 (excellent), evaluators were asked to report the reasons for giving their rating. This process was repeated for each portal. Evaluators were asked not to communicate with each other during the evaluation process, and the findings were not combined until all evaluators had completed their ratings [61]. The modal value for each item in the questionnaire was calculated, and their aggregation across all categories allowed the OGD portals to be ranked at various levels (e.g., categories and criteria).

3.2. Assessment of OGD Portals—Qualitative Phase

Following the first (quantitative) phase, the qualitative phase of the study was carried out. This aimed to enrich and clarify the results gained from phase one, through in-depth interviews. This approach is frequently employed in qualitative research as a way of gaining a deeper understanding of participants' attitudes, views, and experiences. In-depth interviews can explore the experiences of different participants, who may be selected to reflect a range of experiences [72].

3.2.1. Recruitment of Evaluator Interviews

To gain an even more comprehensive understanding of participants' views, some were invited to take part in a follow-up interview. The number of participants invited for this phase was determined using the saturation principle, whereby the sample size is capped at the point where no new information is being collected [73]. In the case of this study, the saturation point was reached at $n = 20$, which is significantly higher than the number required (6–7) to deliver a saturation of 95% (that is, where 95% of themes are recurring). All interviews were face-to-face online, and all were recorded with the consent of the participant concerned. All interviews lasted approximately the same time (an hour) and were conducted in the native language of both the interviewer and the participants (Arabic). To minimise the possibility of a loss of accuracy, the interviews were transcribed on the same day, and were translated into English and back again, as a method of ensuring accuracy [74]. Finally, all participants were asked to assess the accuracy of the transcription [75]. This resulted in a few minor changes to several transcripts.

3.2.2. Data Analysis

The transcripts were analysed using a recognised three-stage thematic analysis technique [76]. The three principal stages of this are (a) open coding, to identify 'units of meaning' (e.g., sentences) from the text [76], (b) the assignment of a code to these units, and (c) identifying patterns in, or relationships between, codes and categorising them as 'themes'.

4. Results

In this section, we show the results of the exercise of assessing how well GCC countries' OGD portals are supporting the transition to smart cities. Later in the discussion section, we discuss the results along with the relevant literature and comments made by evaluators during their interviews. The selected comments by evaluators, used to illustrate identified main findings, help to understand the underlying portal usability issues, as perceived by the evaluator concerned. In view of the common perception that there may be gender differences in the perception of technology in this cultural context, we present both male and female data here, showing that, where there are differences, they are not substantial.

4.1. Category 1: Specification of the Dataset

Table 6 presents the results by gender, and Table 7 combines these to derive modal totals for each country. It can be seen from Table 7 that, although each country has its strong point, Bahrain has the highest modal total (31), and Kuwait has the lowest (25).

Table 6. Results of the usability assessment (Category 1—dataset specification), by gender.

| Dataset Specification | Bahrain | | Qatar | | Saudi | | Kuwait | | Oman | | UAE | |
|----------------------------------|---------|--------|-------|--------|-------|--------|--------|--------|------|--------|------|--------|
| | Male | Female | Male | Female | Male | Female | Male | Female | Male | Female | Male | Female |
| (a) Description of dataset | 4 | 4 | 5.1 | 4.9 | 4 | 4 | 3.2 | 2.8 | 3 | 3 | 4.2 | 3.8 |
| (b) Publisher of dataset | 5.2 | 4.8 | 3 | 3 | 4.2 | 3.8 | 3.8 | 4.2 | 4.8 | 5.2 | 5 | 5 |
| (c) Thematic categories and tags | 4.2 | 3.8 | 3.8 | 4.2 | 4 | 4 | 4 | 4 | 5 | 5 | 3 | 3 |
| (d) Release date and up to date | 4.2 | 3.8 | 4 | 4 | 2.8 | 3.2 | 3 | 3 | 3.2 | 2.8 | 3.8 | 4.2 |
| (e) Machine-readable formats | 4.2 | 3.8 | 3.8 | 4.2 | 5.2 | 4.8 | 3.8 | 4.2 | 3 | 3 | 4 | 4 |
| (f) Open data licence | 5 | 5 | 5.2 | 4.8 | 5 | 5 | 3 | 3 | 3.2 | 2.8 | 4 | 4 |
| (g) Visualization and statistics | 5 | 5 | 4.2 | 3.8 | 3.1 | 2.9 | 4 | 4 | 4 | 4 | 3 | 3 |

Table 7. Results of the usability assessment (Category 1—dataset specification), overall.

| Dataset Specification | Bahrain | Qatar | Saudi | Kuwait | Oman | UAE |
|----------------------------------|---------|-------|-------|--------|------|-----|
| (a) Description of dataset | 4 | 5 | 4 | 3 | 3 | 4 |
| (b) Publisher of dataset | 5 | 3 | 4 | 4 | 5 | 5 |
| (c) Thematic categories and tags | 4 | 4 | 4 | 4 | 5 | 3 |
| (d) Release date and up to date | 4 | 4 | 3 | 3 | 3 | 4 |
| (e) Machine-readable formats | 4 | 4 | 5 | 4 | 3 | 4 |
| (f) Open data licence | 5 | 5 | 5 | 3 | 3 | 4 |
| (g) Visualization and statistics | 5 | 4 | 3 | 4 | 4 | 3 |
| Country modal total | 31 | 29 | 28 | 25 | 26 | 27 |
| Overall Modal Total = 166 | | | | | | |

4.2. Category 2: Dataset Feedback

How well open government data portals are supporting the transition to smart cities can be seen via mechanisms that allow users to interact with the provider. These are vital to any strategy for increasing portal engagement [23,77,78]. For the present study, we again present these data first by gender (Table 8) and then combined (Table 9). As can be seen from Table 9, Bahrain has the highest modal total (18), and Kuwait has the lowest (13).

Table 8. Results of the usability evaluation—Category 2 (dataset feedback), by gender.

| Dataset Specification | Bahrain | | Qatar | | Saudi | | Kuwait | | Oman | | UAE | |
|---------------------------------|---------|--------|-------|--------|-------|--------|--------|--------|------|--------|------|--------|
| | Male | Female | Male | Female | Male | Female | Male | Female | Male | Female | Male | Female |
| (h) Documentation and tutorials | 5 | 5 | 3.8 | 4.2 | 6 | 6 | 4.2 | 3.8 | 5 | 5 | 5 | 5 |
| (i) Forum and contact form | 4 | 4 | 4 | 4 | 3.2 | 2.8 | 2 | 2 | 2 | 2 | 4.2 | 3.8 |
| (j) Social media and sharing | 4 | 4 | 3 | 3 | 2.2 | 1.8 | 3 | 3 | 3 | 3 | 4.8 | 5.2 |
| (k) User rating and comments | 4.8 | 5.2 | 5.1 | 4.9 | 4 | 4 | 4 | 4 | 4.2 | 3.8 | 3 | 3 |

Table 9. Results of the usability evaluation—Category 2 (dataset feedback), overall.

| Dataset Feedback | Bahrain | Qatar | Saudi | Kuwait | Oman | UAE |
|---------------------------------|---------|-------|-------|--------|------|-----|
| (h) Documentation and tutorials | 5 | 4 | 6 | 4 | 5 | 5 |
| (i) Forum and contact form | 4 | 4 | 3 | 2 | 2 | 4 |
| (j) Social media and sharing | 4 | 3 | 2 | 3 | 3 | 5 |
| (k) User rating and comments | 5 | 5 | 4 | 4 | 4 | 3 |
| Country modal total | 18 | 16 | 15 | 13 | 14 | 17 |
| Overall modal total = 93 | | | | | | |

4.3. Category 3: Dataset Interaction

The extent to which a portal allows interaction and the conditions it places on that interaction are important elements of building engagement. All interactions should be consistent with the basic philosophy of open data to support transition to smart cities. For example, users should be allowed, and encouraged, to request information from the portal, without having to provide personal or private information. In this case, there were no gender differences at all in our data, so for clarity we only present the overall results. As can be seen from Table 10, Bahrain has the highest modal total (8), and Kuwait has the lowest (4).

Table 10. Results of the usability evaluation—Category 3 (dataset interaction), overall.

| Interaction | Bahrain | Qatar | Saudi | Kuwait | Oman | UAE |
|--------------------------------|---------|-------|-------|--------|------|-----|
| (l) Request form | 4 | 4 | 2 | 2 | 4 | 3 |
| (m) List of requests | 2 | 2 | 1 | 1 | 1 | 1 |
| (n) Involvement in the process | 2 | 1 | 2 | 1 | 2 | 2 |
| Country modal total | 8 | 7 | 5 | 4 | 7 | 6 |
| Overall modal total = 37 | | | | | | |

5. Discussion

Before beginning the study, it was important to be clear on various parameters. We approached “usability”, as discussed earlier, along the lines of the ISO definition as, at a macro level, a portal’s ability to allow users to easily carry out tasks that are relevant and meaningful in a smart city context. More specifically, we defined usability in terms of the Categories and Aspects shown in Table 4. It was also important not to confuse the concepts of portal quality and data quality; it is perfectly possible for a portal to have very different ratings for each. In this study, we are not concerned with the value and quality of data as such, only the quality of the portal as defined by its ability to support the user in achieving particular goals that are largely independent of the quality of the data. The issue of data quality has been covered by other studies [79]. Another key definition concerns the user. This is because usability is a relative concept—what an experienced IT professional might find usable, a non-specialist may not. As, in this study, we are concerned with how open data can empower the general citizenry, our focus is on professional, but non-specialist, users. It is worth noting that a full description of each individual portal’s features is not provided in this study, as we are only concerned with an evaluation of each, in terms of their performance measured against commonly agreed criteria [35,36]. However, a full assessment of how other features, and aspects of implementation strategy, outside of commonly agreed functional criteria for OGD portals, might affect the transition to smart cities, could be the subject of future research.

It is clear from the findings of the study that the portals across GCC countries considerably vary in terms of the specific Aspects defined in Table 4. While we cannot conclude that any specific portal is particularly weak or particularly strong, as they all have some strengths and some weaknesses, the results clearly suggest that the governments concerned are committed to making their portals as effective as possible, as part of a strategy to implement smart governance and smart cities. This can be seen from Table 7, Table 9, and Table 10, which show that the overall ratings for the individual countries generally fall within a relatively narrow range. However, it is also clear that significantly more remains to be done if portal engagement is to be optimised. It is also notable that the modal totals for dataset specification and feedback were higher than the total for interaction, implying relatively successful efforts to maximise usefulness and usability. According to Johannessen and Berntzen [78], user support, and mechanisms that allow users to interact with the provider, are vital to any strategy for increasing portal engagement. As the following comments from evaluators show, however, this seems to be an aspect of development that is badly neglected in the portals of the GCC countries:

In my view, the quality of the portal is a make-or-break issue in the drive towards a smart society based on data-driven decision-making. Unless portals include mechanisms which not only help users resolve problems, but enable portal developers to learn from the experience of users, governments will be very unlikely to achieve their aim of engaging users at scale.

If governments are looking to engage stakeholders, it’s not enough to provide clear user documentation—there also needs to be positive support from the provider in terms of interactive processes which helps users implement the portal effectively. Only by providing this support will portals deliver on their main objective of enabling smarter decision-making.

Government data offers an excellent opportunity for authorities to have two-way conversations with their publics. Most of the GCC countries don't seem to see it that way, however, as their portals have virtually no feedback, or other interactive, mechanisms.

The results of Dataset Specification (modal total = 166, $166/294 = 56\%$) and Feedback (modal total = 93, $93/168 = 55\%$) are offset by the low modal total for Interaction (37, $37/126 = 29\%$), which suggests a lack of willingness among countries to engage with their publics. It should be noted, however, that the low total for this category is distorted by the very low score (for all countries) for providing a list of historical requests. All of the evaluators considered this to be a mistake. In their words:

I should have thought that the ability to see a list of user submissions is pretty fundamental to the effective operation of a portal. I find it quite concerning for the future success of smart society that simple considerations like this are overlooked by all the portals assessed.

The lack of an information request service is likely to limit the usefulness of a portal considerably. Many users need to add to, or change, their dataset at some point, and the lack of ability to do so acts as discouragement from future use.

The aspects that are related to an openness to new ideas (Request Form and Involvement) score very low modal totals. Including an information request form without needing the user to register might indicate a clear commitment to making portals as useful and transparent as possible, but this strongly depends on whether and how the requests are responded to. The following remarks from evaluators are typical:

The very concept of open data is that it is available freely and can be used without restriction. To require that users identify themselves in order to obtain datasets goes against this principle, and is likely to have a very limiting effect on engagement. Governments that want to evolve smart cities, should allow users to retain anonymity.

Requiring users to register before they can ask for new or additional data, carries an implied threat that users could be penalised if they use the data in a way which may be legal, but is somehow against the wishes of the authorities. My guess is that this would deter many users from making use of open data.

The question of true transparency and interactivity, however, which are among the most important properties of smart cities and open government [78,80], can be complex goals to achieve, even for states that are committed to the idea. One reason for this is that providing free and open access to data can lead to information security and privacy issues. On the one hand, there can be issues concerning the content of the data; for example, personal or otherwise sensitive information being inappropriately included in data that is made available through the portal. In general, such issues can be addressed by proper data control, procedures for anonymisation, etc., and they do not commonly arise in well-developed OGD experience. Despite this, such concerns often lead to anxiety and reluctance around the adoption of OGD in, for example, GCC countries [35]. On the other hand, there can be concerns that relate to the user of the data and privacy around details of their access and use of the portal. Even when the appropriate safeguards and policies are in place, these concerns can lead to a failure of trust between users [81], and therefore deter engagement. It is for this reason that many users like to remain anonymous when using an OGD portal [82]. Enabling free and easy interaction between users and dataset providers (Aspect n) is not only entailed by the recognition that citizens have the rights to be involved, and have a degree of power, in smart city governance [83,84], but is likely to have positive consequences for governments. Making stakeholders feel actively involved in the development and operation of portals would encourage a sense of being valuable, and encourage engagement. None of the portals, however, scored highly in this aspect. One evaluator said:

It's easy to appreciate that there are some significant barriers, both political and practical, to interaction between users and providers. However, the benefits could also be significant,

in terms of implementing smart governance, so it would be worthwhile for data providers to at least consider facilitating some level of interaction

In discussing how portal designers can encourage user engagement, it is also important to recognise that it is not a straightforward issue. In many countries, cultural issues can play a significant role in establishing what is perceived as useful and usable. The fundamentally technical nature of OGD portals means that even experienced professionals may not have the skills or the knowledge to engage with them, and providing the necessary support for such individuals is not always easy for public sector organisations [85]. Equally, however, it is essential for countries to address such issues if they are serious about increasing open data engagement as a way of delivering on the goal of evolving a smart society. The following remark from evaluators is typical:

By not supporting or encouraging the interchange of views and ideas with users, data providers are missing the chance to capitalise, free of charge, on the vast amount of knowledge and expertise that's in the public domain. Encouraging interaction wouldn't just result in better portal design, it would almost certainly lead to much higher levels of portal use, too. It's strange to me that mechanisms for interaction between stakeholders and data provider aren't given more priority.

Possible approaches to the problem of encouraging user engagement include the increased use of visualisation tools and social media, and the use of campaigns for promoting awareness of accessible, non-specialist tools that can help in the use of OGD [45]. The development of standardised terminology would also be useful.

Finally, we should note that open data can be deployed through mechanisms other than OGD portals [86]. Despite this, however, portals are the default choice of authorities implementing OGD initiatives. This implies that portals are most effective in meeting the needs of users and governments alike. One approach to helping to increase the awareness and engagement with OGD is through the use of metadata systems that can enable the discovery, openness, understanding, and use of open data [10,86,87]. Such (metadata) systems are based on standards that facilitate a need for descriptive, structured information, and include models such as CKAN, DCAT, Socrata, and INSPIRE [52,86]. Such systems are useful because, for citizens to use an OGD dataset, they have to be able to find and understand it. Metadata can provide potential users with the information they need, in the format they need it.

In summary, the results of the study strongly suggest that each of the GCC countries are serious in their intent to use OGD as part of a strategy to transition to smart cities. However, the study also shows that there are a number of strategic and functional improvements that all (GCC) countries could make to increase the efficiency and speed of this transition. These improvements include:

- Increasing the levels of portal engagement with their publics. This could be achieved by adding to, or improving, portal functionality with features such as providing lists of historical requests.
- Making stakeholders feel more actively involved in portal development, by encouraging feedback and user input.
- Enhancing portals through the addition of visualisation tools and integration with social media.
- Promoting public awareness and understanding of OGD through media campaigns.

6. Conclusions

This study set out to investigate whether the countries of the GCC are using open government data effectively as part of a strategy to mitigate the problems of rapidly increasing urbanisation, through the use of smart data and the development of smart cities. In particular, the study aimed to answer two research questions:

RQ1: How can we evaluate the adoption potential of OGD portals for supporting the transition to smart cities?

RQ2: What factors are most often perceived by users as likely to inhibit adoption?

The researchers therefore conducted a user-centric study that assessed each of the GCC portals in terms of usability, as understood in the sense of the ISO definition discussed in Section 2. This aim and approach differentiate the current study from existing research, and make direct comparisons with the findings of other research inappropriate. By gaining insights into these research questions, conclusions can be reached as to whether the current strategies employed by GCC countries are sufficiently well aligned to the delivery of improved policy-making and better social management, among other significant political and societal benefits, by empowering citizens to become more involved with their own welfare, and to make more informed decisions, by engaging with OGD portals.

Addressing RQ1, we deployed a proven framework of metrics to measure the performance of each portal, and hence, were able to identify their strengths and weaknesses, and form overall conclusions concerning progress in transforming to a smart city infrastructure. The findings showed that, while the six GCC countries widely vary in their rating for specific Aspects, they all had similar average ratings, suggesting that all countries in the region are committed to more than merely ‘paying lip service’ to the concept of smart government, and are heavily invested in delivering smart cities as part of a strategy of dealing with urbanisation. The leaders in portal development at the time of the research were Bahrain, Saudi Arabia, and Qatar.

However, while all the portals across the region were basically fit for purpose, the study showed that all of them would more effectively support the transition to a smart city-based infrastructure if various improvements were made. Addressing RQ2, we found that one notable weakness, common to all portals, is the lack of advanced visualisation tools, which could make a significant difference in encouraging inexperienced IT users to engage with open data. Another aspect of functionality that was found to be generally poor is mechanisms, which facilitate stakeholder involvement in portal development. We conclude that the GCC countries are not yet realising the full potential of their portals, but that, because of the variation in which aspects are most successful, more effective support for the transition to smart cities could be achieved with fuller and better cross-national cooperation.

It is important to note that the study was designed to clearly differentiate between the concept of data quality and the concept of portal usefulness and usability. This study focused on the latter, and made the implicit assumption that usability, in the sense used in the study, is a (largely) independent parameter from data quality. However, this assumption is, in a broader context, unjustified—as noted in the introduction, we should expect that data quality will affect perceptions of the usefulness of data portals when addressing real-world tasks [88,89]. Future studies could usefully explore the extent to which there is a dependency between the quality of the data provided by portals and the likelihood that citizens will engage with it. A related area to this, which could be the subject of useful future research, is metadata. While there have been studies that have shown that statistics concerning datasets exist [83], and that they improve discoverability [82], it is not currently clear whether the availability of metadata would significantly drive engagement. This would be a helpful addition to the current knowledge. It can be said that although, for example, Bahrain comes out as having the highest score in Table 9, it is hard to directly interpret this in terms of the portal features shown in Tables 2 and 3, or the specific aspects in Table 4. In this respect, there is further work to be done in exactly understanding what makes for enhanced usability in portals, aside from the data quality.

Although the study is believed to meaningfully contribute to the current literature, it also has some limitations. One of these is the implementation of the questionnaires. While most of the standard statistical procedures were followed [90,91], the questionnaires were only pre-tested, not fully piloted. This may have led to a lack of necessary validation and/or bias in the data used. Another potential limitation is the number of participants in the study, where a larger number may have enabled a more powerful result; and, in

particular, a more balanced gender distribution may have had more capacity to reveal any gender differences.

Author Contributions: Conceptualization, I.M., A.A. (Abdullah Almuqrin), J.L., A.A. (Abdulrhman Alkhanifer) and M.B.; methodology, I.M., A.A. (Abdullah Almuqrin), J.L., A.A. (Abdulrhman Alkhanifer) and M.B.; validation, I.M., A.A. (Abdullah Almuqrin), J.L., A.A. (Abdulrhman Alkhanifer) and M.B.; formal analysis, I.M., A.A. (Abdullah Almuqrin), J.L., A.A. (Abdulrhman Alkhanifer) and M.B.; writing—original draft preparation, I.M., A.A. (Abdullah Almuqrin), J.L., A.A. (Abdulrhman Alkhanifer) and M.B.; writing—review and editing, I.M., A.A. (Abdullah Almuqrin), J.L., A.A. (Abdulrhman Alkhanifer) and M.B. All authors have read and agreed to the published version of the manuscript.

Funding: The authors extend their appreciation to the Deputyship for Research and Innovation, “Ministry of Education” in Saudi Arabia for funding this research (IFKSUOR3-059-1).

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board (Human and Social Researches) of King Saud University.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data available on request due to restrictions of privacy.

Acknowledgments: The authors extend their appreciation to the Deputyship for Research and Innovation, “Ministry of Education” in Saudi Arabia for funding this research (IFKSUOR3-059-1).

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

References

1. Kuddus, M.A.; Tynan, E.; McBryde, E. Urbanization: A Problem for the Rich and the Poor? *Public Health Rev.* **2020**, *41*, 1. [CrossRef] [PubMed]
2. The World Bank. Urban Development. Available online: <https://www.worldbank.org/en/topic/urbandevelopment/overview> (accessed on 7 April 2023).
3. Fang, Y.; Shan, Z. How to Promote a Smart City Effectively? An Evaluation Model and Efficiency Analysis of Smart Cities in China. *Sustainability* **2022**, *14*, 6512. [CrossRef]
4. Srebalová, M.; Peráček, T. Effective Public Administration as a Tool for Building Smart Cities: The Experience of the Slovak Republic. *Laws* **2022**, *11*, 67. [CrossRef]
5. European Commission. Empowering People with Open Data in 2020. Available online: <https://data.europa.eu/en/publications/datastories/empowering-people-open-data> (accessed on 7 April 2023).
6. Osman, A.M.S.; Elragal, A.A.; Ståhlbröst, A. Data-Driven Decisions in Smart Cities: A Digital Transformation Case Study. *Appl. Sci.* **2022**, *12*, 1732. [CrossRef]
7. Peráček, T.; Kaššaj, M. The Influence of Jurisprudence on the Formation of Relations between the Manager and the Limited Liability Company. *Jurid. Trib.* **2023**, *13*, 43–62. [CrossRef]
8. Open Knowledge Foundation. Defining Open in Open Data, Open Content and Open Knowledge. Available online: <https://opendefinition.org/> (accessed on 7 April 2023).
9. Sunlight Foundation. Ten Principles for Opening up Government Information. Available online: <https://sunlightfoundation.com/policy/documents/ten-open-data-principles/> (accessed on 7 April 2023).
10. Sołtysik-Piorunkiewicz, A.; Zdonek, I. How Society 5.0 and Industry 4.0 Ideas Shape the Open Data Performance Expectancy. *Sustainability* **2021**, *13*, 917. [CrossRef]
11. Abu-Rayash, A.; Dincer, I. Development and Application of an Integrated Smart City Model. *Heliyon* **2023**, *9*, e14347. [CrossRef]
12. Matic, A.E.; Stefanica, C.M. Specific Deontological Rules Applicable for the Public Manager in the Contemporary Romanian Society. *Perspect. Law Public Adm.* **2022**, *1*, 79–87.
13. Cronemberger, F.A.; Gil-Garcia, J.R. Characterizing Stewardship and Stakeholder Inclusion in Data Analytics Efforts: The Collaborative Approach of Kansas City, Missouri. *Transform. Gov. People Process Policy* **2022**, *16*, 405–417. [CrossRef]
14. Adje, K.D.C.; Letaifa, A.B.; Haddad, M.; Habachi, O. Smart City Based on Open Data: A Survey. *IEEE Access* **2023**, *11*, 56726–56748. [CrossRef]
15. Almuqrin, A.; Mutambik, I.; Alomran, A.; Gauthier, J.; Abusharhah, M. Factors Influencing Public Trust in Open Government Data. *Sustainability* **2022**, *14*, 9765. [CrossRef]
16. Statista. Share of Countries with Associated Features of Open Government Data (OGD) Portals in 2020. Available online: <https://www.statista.com/statistics/421880/open-government-data-sector/> (accessed on 7 April 2023).

17. Saxena, S.; Al-Tamimi, T.A.S.M. Visioning “Smart City” across the Gulf Cooperation Council (GCC) Countries. *Foresight* **2018**, *20*, 237–251. [\[CrossRef\]](#)
18. Jia, C. *China’s Smart Cities Policy and Corporate Research and Development Intensity—A Quasi-Natural Experiment*; Atlantis Press: Dordrecht, The Netherlands, 2023; pp. 564–576. [\[CrossRef\]](#)
19. Jonek-Kowalska, I. Municipal Waste Management in Polish Cities—Is It Really Smart? *Smart Cities* **2022**, *5*, 1635–1654. [\[CrossRef\]](#)
20. Neves, F.T.; de Castro Neto, M.; Aparicio, M. The Impacts of Open Data Initiatives on Smart Cities: A Framework for Evaluation and Monitoring. *Cities* **2020**, *106*, 102860. [\[CrossRef\]](#)
21. Nikiforova, A.; McBride, K. Open Government Data Portal Usability: A User-Centred Usability Analysis of 41 Open Government Data Portals. *Telemat. Inform.* **2021**, *58*, 101539. [\[CrossRef\]](#)
22. Mutambik, I.; Nikiforova, A.; Almuqrin, A.; Liu, Y.D.; Floos, A.Y.M.; Omar, T. Benefits of Open Government Data Initiatives in Saudi Arabia and Barriers to Their Implementation. *J. Glob. Inf. Manag.* **2021**, *29*, 1–22. [\[CrossRef\]](#)
23. Rodríguez Bolívar, M.P. *Smart Technologies for Smart Governments*; Springer International Publishing: Cham, Switzerland, 2018; Volume 24. [\[CrossRef\]](#)
24. Jankelová, N.; Joniaková, Z.; Čajková, A.; Romanová, A. Leadership Competencies in Communal Policy. *Politické Vedy* **2021**, *24*, 181–204. [\[CrossRef\]](#)
25. Gregušová, D.; Halásová, Z.; Peráček, T. EIDAS Regulation and Its Impact on National Legislation: The Case of the Slovak Republic. *Adm. Sci.* **2022**, *12*, 187. [\[CrossRef\]](#)
26. Kubler, S.; Robert, J.; Le Traon, Y.; Umbrich, J.; Neumaier, S. Open Data Portal Quality Comparison Using AHP. In Proceedings of the 17th International Digital Government Research Conference on Digital Government Research, Shanghai, China, 8–10 June 2016; pp. 397–407. [\[CrossRef\]](#)
27. Umbrich, J.; Neumaier, S.; Polleres, A. Quality Assessment and Evolution of Open Data Portals. In Proceedings of the 2015 3rd International Conference on Future Internet of Things and Cloud, Rome, Italy, 24–26 August 2015; pp. 404–411. [\[CrossRef\]](#)
28. Sieber, R.E.; Johnson, P.A. Civic Open Data at a Crossroads: Dominant Models and Current Challenges. *Gov. Inf. Q* **2015**, *32*, 308–315. [\[CrossRef\]](#)
29. Nikiforova, A. Open Data Quality Evaluation: A Comparative Analysis of Open Data in Latvia. *Balt. J. Mod. Comput.* **2018**, *6*, 363–386. [\[CrossRef\]](#)
30. Ansari, B.; Barati, M.; Martin, E.G. Enhancing the Usability and Usefulness of Open Government Data: A Comprehensive Review of the State of Open Government Data Visualization Research. *Gov. Inf. Q* **2022**, *39*, 101657. [\[CrossRef\]](#)
31. Young, M.; Yan, A. *Civic Hackers’ User Experiences and Expectations of Seattle’s Open Municipal Data Program*; Hamilton Library: Honolulu, HI, USA, 2017. [\[CrossRef\]](#)
32. Mutambik, I.; Lee, J.; Almuqrin, A.; Zhang, J.Z. Transitioning to Smart Cities in Gulf Cooperation Council Countries: The Role of Leadership and Organisational Culture. *Sustainability* **2023**, *15*, 10490. [\[CrossRef\]](#)
33. McBride, K.; Aavik, G.; Toots, M.; Kalvet, T.; Krimmer, R. How Does Open Government Data Driven Co-Creation Occur? Six Factors and a ‘Perfect Storm’; Insights from Chicago’s Food Inspection Forecasting Model. *Gov. Inf. Q* **2019**, *36*, 88–97. [\[CrossRef\]](#)
34. Boychuk, M.; Cousins, M.; Lloyd, A.; MacKeigan, C. Do We Need Data Literacy? Public Perceptions Regarding Canada’s Open Data Initiative. *Dalhous. J. Interdiscip. Manag.* **2016**, *12*. [\[CrossRef\]](#)
35. Mutambik, I.; Almuqrin, A.; Lee, J.; Zhang, J.Z.; Alomran, A.; Omar, T.; Floos, A.; Homadi, A. Usability of the G7 Open Government Data Portals and Lessons Learned. *Sustainability* **2021**, *13*, 13740. [\[CrossRef\]](#)
36. Máchová, R.; Hub, M.; Lnenicka, M. Usability Evaluation of Open Data Portals. *Aslib J. Inf. Manag.* **2018**, *70*, 252–268. [\[CrossRef\]](#)
37. OECD. *Engaging Users: Promoting Awareness and Re-Use of Open Government Data*; OECD iLibrary, 2019. [\[CrossRef\]](#)
38. Ruijter, E.; Meijer, A. Open Government Data as an Innovation Process: Lessons from a Living Lab Experiment. *Public Perform. Manag. Rev.* **2020**, *43*, 613–635. [\[CrossRef\]](#)
39. Meijer, A. E-Governance Innovation: Barriers and Strategies. *Gov. Inf. Q* **2015**, *32*, 198–206. [\[CrossRef\]](#)
40. Alshuwaikhat, H.M.; Aina, Y.A.; Binsaedan, L. Analysis of the Implementation of Urban Computing in Smart Cities: A Framework for the Transformation of Saudi Cities. *Heliyon* **2022**, *8*, e11138. [\[CrossRef\]](#)
41. Jonek-Kowalska, I. Health Care in Cities Perceived as Smart in the Context of Population Aging—A Record from Poland. *Smart Cities* **2022**, *5*, 1267–1292. [\[CrossRef\]](#)
42. Mutambik, I. The Global Whitewashing of Smart Cities: Citizens’ Perspectives. *Sustainability* **2023**, *15*, 8100. [\[CrossRef\]](#)
43. Lin, J.; Chen, X.; Yan, G. How Smart City Construction Affects Digital Inclusive Finance in China: From the Perspective of the Relationship between Government and Large Private Capital. *Sustainability* **2023**, *15*, 9035. [\[CrossRef\]](#)
44. Zhang, L.; Wu, C. The Impact of Smart City Pilots on Haze Pollution in China—An Empirical Test Based on Panel Data of 283 Prefecture-Level Cities. *Sustainability* **2023**, *15*, 9653. [\[CrossRef\]](#)
45. Attard, J.; Orlandi, F.; Scerri, S.; Auer, S. A Systematic Review of Open Government Data Initiatives. *Gov. Inf. Q* **2015**, *32*, 399–418. [\[CrossRef\]](#)
46. Mutambik, I.; Almuqrin, A.; Lee, J.; Gauthier, J.; Homadi, A. Open Government Data in Gulf Cooperation Council Countries: An Analysis of Progress. *Sustainability* **2022**, *14*, 7200. [\[CrossRef\]](#)
47. Matheus, R.; Ribeiro, M.M.; Vaz, J.C. New Perspectives for Electronic Government in Brazil. In Proceedings of the 6th International Conference on Theory and Practice of Electronic Governance—ICEGOV’12, Albany, NY, USA, 22–25 October 2012; p. 22. [\[CrossRef\]](#)

48. Nikiforova, A. Timeliness of Open Data in Open Government Data Portals Through Pandemic-Related Data: A Long Data Way from the Publisher to the User. In Proceedings of the 2020 Fourth International Conference on Multimedia Computing, Networking and Applications (MCNA), Valencia, Spain, 19–22 October 2020; pp. 131–138. [\[CrossRef\]](#)
49. Liu, F.; Damen, N.; Chen, Z.; Shi, Y.; Guan, S.; Ergu, D. Identifying Smart City Leaders and Followers with Machine Learning. *Sustainability* **2023**, *15*, 9671. [\[CrossRef\]](#)
50. Sweeting, D.; de Alba-Ulloa, J.; Pansera, M.; Marsh, A. Easier Said than Done? Involving Citizens in the Smart City. *Environ. Plan. C Politics Space* **2022**, *40*, 1365–1381. [\[CrossRef\]](#)
51. Chokki, A.P.; Simonofski, A.; Frénay, B.; Vanderose, B. Open Government Data Awareness: Eliciting Citizens' Requirements for Application Design. *Transform. Gov. People Process Policy* **2022**, *16*, 377–390. [\[CrossRef\]](#)
52. Martin, S.; Foulonneau, M.; Turki, S. 1-5 Stars: Metadata on the Openness Level of Open Data Sets in Europe. In *Metadata and Semantics Research*; Garoufallou, E., Greenberg, J., Eds.; Communications in Computer and Information Science; Springer International Publishing: Cham, Switzerland, 2013; Volume 390, pp. 234–245. [\[CrossRef\]](#)
53. Mutambik, I.; Almuqrin, A.; Liu, Y.D.; Halboob, W.; Alakeel, A.; Derhab, A. Increasing Continuous Engagement with Open Government Data. *J. Glob. Inf. Manag.* **2023**, *31*, 1–21. [\[CrossRef\]](#)
54. Zatrochova, M.; Katrencik, I. *Investment Evaluation Methods for Business Performance*; Springer: Cham, Switzerland, 2023; pp. 211–244. [\[CrossRef\]](#)
55. Čajková, A.; Čajka, P. Challenges and Sustainability of China's Socio-Economic Stability in the Context of Its Demographic Development. *Societies* **2021**, *11*, 22. [\[CrossRef\]](#)
56. MUCHA, B. Evaluation of the State of Implementation of the European Structural and Investment Funds: Case Study of the Slovak Republic. Online Journal Modeling the New Europe. *Line J. Model. New Eur.* **2021**, *35*, 4–24. [\[CrossRef\]](#)
57. Funta, R. Data, Their Relevance to Competition and Search Engines. *Masaryk Univ. J. Law Technol.* **2021**, *15*, 119–140. [\[CrossRef\]](#)
58. World Bank Open. World Bank Open Data: Free and Open Access to Global Development Data. Available online: <https://data.worldbank.org/> (accessed on 7 April 2023).
59. Lněnička, M.; Machova, R.; Volejníková, J.; Linhartová, V.; Knezackova, R.; Hub, M. Enhancing Transparency through Open Government Data: The Case of Data Portals and Their Features and Capabilities. *Online Inf. Rev.* **2021**, *ahead of print*. [\[CrossRef\]](#)
60. Sidor, C.; Kršák, B.; Štrba, L.; Cehlár, M.; Khouri, S.; Stričík, M.; Dugas, J.; Gajdoš, J.; Bolechová, B. Can Location-Based Social Media and Online Reservation Services Tell More about Local Accommodation Industries than Open Governmental Data? *Sustainability* **2019**, *11*, 5926. [\[CrossRef\]](#)
61. Matheus, R.; Janssen, M. A Systematic Literature Study to Unravel Transparency Enabled by Open Government Data: The Window Theory. *Public Perform. Manag. Rev.* **2020**, *43*, 503–534. [\[CrossRef\]](#)
62. Zuiderwijk, A.; Janssen, M.; Choenni, S.; Meijer, R.; Alibaks, R.S. Socio-Technical Impediments of Open Data. *Electron. J. E-Gov.* **2012**, *10*, 156–172.
63. Wang, D.; Richards, D.; Bilgin, A.A.; Chen, C. Advancing Open Government Data Portals: A Comparative Usability Evaluation Study. *Libr. Hi Tech.* **2021**, *43*, 613–635. [\[CrossRef\]](#)
64. Dahbi, K.Y.; Lamharhar, H.; Chiadmi, D. *Toward an Evaluation Model for Open Government Data Portals*; Springer: Cham, Switzerland, 2019; pp. 502–511. [\[CrossRef\]](#)
65. Sheoran, S.; Mohanasundaram, S.; Kasilingam, R.; Vij, S. Usability and Accessibility of Open Government Data Portals of Countries Worldwide. *Int. J. Electron. Gov. Res.* **2023**, *19*, 1–25. [\[CrossRef\]](#)
66. Nielsen, J. Usability 101: Introduction to Usability. Available online: <https://www.nngroup.com/articles/usability-101-introduction-to-usability/> (accessed on 7 April 2023).
67. ISO. Ergonomics of Human-System Interaction—Usability Methods Supporting Human-Centred Design. Available online: <https://www.iso.org/standard/31176.html> (accessed on 7 April 2023).
68. Merriam-Webster. Usability. Available online: <https://www.merriam-webster.com/dictionary/usability> (accessed on 7 April 2023).
69. Johnson, R.B.; Onwuegbuzie, A.J. Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educ. Res.* **2004**, *33*, 14–26. [\[CrossRef\]](#)
70. Huang, Z.; Benyoucef, M. Usability and Credibility of E-Government Websites. *Gov. Inf. Q* **2014**, *31*, 584–595. [\[CrossRef\]](#)
71. OECD. Open Government Data. Available online: <https://www.oecd.org/gov/digital-government/open-government-data.htm> (accessed on 7 April 2023).
72. Patton, M.Q. *Qualitative Research and Evaluation Methods*; Sage: London, UK, 2002.
73. Gorard, S. *Quantitative Methods in Educational Research: The Role of Numbers Made*; Continuum: London, UK, 2001.
74. Brislin, R.W. Back-Translation for Cross-Cultural Research. *J. Cross Cult. Psychol.* **1970**, *1*, 185–216. [\[CrossRef\]](#)
75. Zuiderwijk, A.; Janssen, M. Open Data Policies, Their Implementation and Impact: A Framework for Comparison. *Gov. Inf. Q* **2014**, *31*, 17–29. [\[CrossRef\]](#)
76. Braun, V.; Clarke, V. Using Thematic Analysis in Psychology. *Qual. Res. Psychol.* **2006**, *3*, 77–101. [\[CrossRef\]](#)
77. Nikiforova, A. Smarter Open Government Data for Society 5.0: Are Your Open Data Smart Enough? *Sensors* **2021**, *21*, 5204. [\[CrossRef\]](#)
78. Johannessen, M.R.; Berntzen, L. *The Transparent Smart City*; Springer: Cham, Switzerland, 2018; pp. 67–94. [\[CrossRef\]](#)

79. Vetrò, A.; Canova, L.; Torchiano, M.; Minotas, C.O.; Iemma, R.; Morando, F. Open Data Quality Measurement Framework: Definition and Application to Open Government Data. *Gov. Inf. Q* **2016**, *33*, 325–337. [\[CrossRef\]](#)
80. Chokki, A.P.; Alexopoulos, C.; Saxena, S.; Frénay, B.; Vanderose, B.; Ali, M. Metadata Quality Matters in Open Government Data (OGD) Evaluation! An Empirical Investigation of OGD Portals of the GCC Constituents. *Transform. Gov. People Process Policy* **2022**. [\[CrossRef\]](#)
81. Barry, E.; Bannister, F. Barriers to Open Data Release: A View from the Top. *Inf. Polity* **2014**, *19*, 129–152. [\[CrossRef\]](#)
82. Kucera, J. Open Government Data Publication Methodology. *J. Syst. Integr.* **2015**, *6*, 52–61. [\[CrossRef\]](#)
83. Srebalová, M.; Srebal, A. The Valuation of Land in Land Consolidation and Relevant Administrative Procedures in the Conditions of the Slovak Republic. *Adm. Sci.* **2022**, *12*, 174. [\[CrossRef\]](#)
84. Kao, H.-E. Between International Practice and Academia: Review and Integration of Open Government Data Benchmarks. In Proceedings of the 24th Annual International Conference on Digital Government Research, Gdańsk, Poland, 11–14 July 2023; pp. 73–89. [\[CrossRef\]](#)
85. Susha, I.; Grönlund, Å.; Janssen, M. Organizational Measures to Stimulate User Engagement with Open Data. *Transform. Gov. People Process Policy* **2015**, *9*, 181–206. [\[CrossRef\]](#)
86. Neumaier, S.; Umbrich, J.; Polleres, A. Automated Quality Assessment of Metadata across Open Data Portals. *J. Data Inf. Qual.* **2016**, *8*, 1–29. [\[CrossRef\]](#)
87. Schauppenlehner, T.; Muhar, A. Theoretical Availability versus Practical Accessibility: The Critical Role of Metadata Management in Open Data Portals. *Sustainability* **2018**, *10*, 545. [\[CrossRef\]](#)
88. Nikiforova, A. Definition and Evaluation of Data Quality: User-Oriented Data Object-Driven Approach to Data Quality Assessment. *Balt. J. Mod. Comput.* **2020**, *8*, 391–432. [\[CrossRef\]](#)
89. Bokhari, S.A.A.; Myeong, S. The Influence of Artificial Intelligence on E-Governance and Cybersecurity in Smart Cities: A Stakeholder's Perspective. *IEEE Access* **2023**, *11*, 69783–69797. [\[CrossRef\]](#)
90. Howe, K.; Eisenhart, M. Standards for Qualitative (and Quantitative) Research: A Prolegomenon. *Educ. Res.* **1990**, *19*, 2–9. [\[CrossRef\]](#)
91. Palys, T. *Research Decisions: Quantitative and Qualitative Perspectives*; Harcourt Brace & Company Canada: Toronto, ON, Canada, 1997.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.