The Role of Data Management in the Transition to Digital Government in UAE Smart Cities

International Journal of Service Excellence
ISSN: 1993-8675
Vol. 1, Issue 2, 2021

Author: Noura Mohamed Al Yafei

Master of Science in Innovation and Change Management, Dubai, UAE
Email: noora.n.y@outlook.com

ABSTRACT

Data management is one of the underlying foundations of smart cities. So, in this paper, the purpose is to explore and identify the role of data management in UAE smart cities in relation with the transition of the government to a digital government. Therefore, the paper includes a sample from the smart cities (Abu Dhabi & Dubai) as a statistic to reveal the importance of the role of data in the era of digital government. Also, the paper clarifies the strengths, challenges and smart transformations in the field of data management towards digital government in smart cities.

Keywords: *Data Management, Digital Government, Smart Cities*

Methodology

Based on a constructivist paradigm, a qualitative research approach was followed in this research. Samples from 32 participants are included. All of them were employees of five different government organizations directly involved in the implementation of smart city initiatives in the country. Using a qualitative structured interview as data collection method, insights of participants were gathered relating to the importance of data management in the transformation to a digital government in smart cities, the data management efforts exerted by their organizations in the said transition, and the issues they encountered.

Findings

From the findings, three themes emerged. The first theme reiterated the importance of data management in the efficient collection, analysis, storage, management, access, and sharing of data which subsequently result in improved quality of government services and increased efficiency of government functions. The second theme mentioned a variety of strategies that mainly focus on adoption of governance, legal and regulatory frameworks alongside provision of staff training and education. Lastly, issues on security and privacy were found relating to the integration of data management.

Research Limitations

With findings above, the study also acknowledges certain limitations including the participation of only five government institutions out of 12. This is attributed to the remote work caused by the pandemic. In addition, some government institutions fear university research on the pretext of confidential work information. As a result, only 32 participants were enrolled.

Particle Implications

Data management is an area that create a new transitional curve for organizations, people, and all connected technologies that improve the effectiveness of data use performance under the umbrella of specific laws in the process of decision-making and strategy-making in transition toward digital governments in UAE smart cities (Al Nuaimi et al., 2015). For future research, this study suggests to measure the level of effectiveness of data management in the transformation toward a digital government in UAE smart cities.

Originality/Value

The main value of this study lies in the importance of disseminating data management among government institutions in the United Arab Emirates in smart cities. This study reviews concepts related to data management in smart cities and the trend towards digital governance, which provides a new vision for policy makers, private entities, students, and citizens in the country to create strategies and concepts that promote smart transition.

Paper Type: Case Study

Introduction

The concept of smart cities was developed around the existence of various pressing problems in urban cities around the world, ranging from the rapid increase of urban population to environmental pollution and ineffective waste management. According to Winkowska et al. (2019), the smart city concept is based on the assumption that a city needs to be creative and sustainable, thus promoting enhanced quality of life with high prospects of economic growth. Although there is no universal definition of a smart city, the primary objectives of adopting the said concept are to increase the effectiveness of resource utilization, improve the quality of public services as well as lower public administration costs. In the UAE, an initiative has been undertaken to adopt the concept of smart cities. The federal government has been exerting efforts in building smart cities to pave the way for economic and social development. In the (UAE Government, 2021) website, it was indicated that Abu Dhabi and Dubai are the first emirates to have established their own smart cities, with Masdar City and Zayed Smart City Projects in Abu Dhabi and Dubai having their plans of transforming themselves to being smart and sustainable cities.

The smart city concept is linked to several factors. One of which is data management which, as mentioned by Gharaibeh et al. (2017), is an essential component of a smart city. It is what facilitates the use of Internet of Things (IoTs) which consequently enables these smart cities. Data management involves several processes which include data acquisition, data processing, and data dissemination and is a concept applied to big data applications that provide support to smart city components. It was indicated by Al Nuaimi et al. (2015) that management and utilization of big data enable smart cities to sustain its principles and standards and accomplish all its relevant requirements to build the smart city characteristics including resilience, sustainability, and governance, among others. In relation, data management also promotes data privacy and security which are two of the most important considerations in smart cities as well. Since smart cities are

faced with a variety of security- and privacy-related issues and vulnerabilities, the integration of data management into the smart city systems is a move that helps address this concern, as it aims to secure the large volume of private data gathered (Hashem et al., 2016).

Smart cities, aside from recognizing the importance of data management in enabling their systems and applications, also highlight smart governance which is one of the smart city elements. With smart governance, Mutiara et al. (2018) indicated the use of the ICT platform to establish digital government that is deemed to be a key tool in improving government efficiencies together with increasing transparency and open data for public access. Digital government, otherwise known as electronic government or simply e-government, is defined as "a structure consisting of government practices by using information and communication technologies (ICTs) to enable interactions on government-to-citizen, government-to-government, and government-to-business levels" (Erkut, 2020, p. 4). In other words, digital government is leveraging ICTs to increase the accessibility of government services and at the same time, to automate traditional practices and government functions. According to Al Salmi and Hasnan (2015), adoption of e-government entails several advantages. To mention, it improves efficiency and effectiveness of government services, reduces costs, encourages political participation, and addresses issues in the public sector such as corruption, among others.

These three concepts underscored – smart cities, data management, and digital government – are what binds this research overall. As the study aims to perform an in-depth exploration of the role of data management in the transition to digital government in UAE smart cities, it is thereby important to have a clear understanding of how the concepts are defined and relate with one another. This study seeks to determine the data management efforts made in achieving a digital government in the country's smart cities as well as the data management issues and challenges encountered. Drawn from these research objectives, the following are this study's main research questions:

1. What is the importance of data management in the transformation to a digital government in the UAE smart cities?
2. What data management efforts have been done to achieve digital government in the UAE smart cities?
3. What data management issues are encountered in achieving digital government in the UAE smart cities?

In line with these research aim, objectives, and questions, it is further emphasized that the significance of this study lies on how it enables a clear understanding about smart cities and the role of data management in the said cities, especially when it comes to transitioning to a digital government. Since the UAE has already been implementing smart city initiatives, this research can be a significant contribution as it can be used as a guide for developing data management policies to foster effective digital government. It also adds to the academic body of knowledge regarding the role of technology and big data in transforming smart cities in the UAE.

Literature Review

This section provides a synthesis of existing literatures regarding smart cities, the different smart sustainable and smart development strategies, and the role of the IoT and data in the UAE's smart and sustainable cities and government.

Smart Cities

The term 'smart city' is generally perceived as a concept which makes use of information and communication technologies in order to gain competitive advantages and consequently improve the quality of life of the people. These competitive advantages are seen on the increased efficiency in the operations of the city which consequently yield to several advantages such as improved public services and effective resource utilization. As mentioned in the previous pages of this research, there is no widely accepted definition for smart cities; however, there are also studies which developed their own definition of the concept. As cited by Albino et al., 2015, p. 1726), one of the definitions of smart city was provided by Harrison et al., (2010) which states that it is "a city connecting the physical infrastructure, the IT infrastructure, the social infrastructure, and the business infrastructure to leverage the collective intelligence of the city." Another definition was by Ismagilova et al., (2020), which mainly identified smart city as the utilization of technology-based solutions in order to improve citizens' quality of life as well as government interactions, ultimately paving the way for sustainable development. From these definitions, the smart city is a vision with a huge scope based on data management and analysis within advanced practices through the promotion of ICT. Thus, this will raise the level of living efficiency in urban cities and ensure the sustainability of the smart transition towards digital governance.

In relation, smart city is additionally conceptualized as a combination of a variety of components which are essential for a city to be recognized as smart (Mohanty et al., 2016). In Figure 1, it is depicted that the Internet of Things (IoT) is at the center, thereby signifying that all the seven elements of smart cities are enabled by technology. These seven smart components include smart building, smart infrastructure, smart citizen, smart governance, smart transportation, smart technology, smart healthcare, and smart energy. These dimensions of smart city, according to Dudzevičiūtė et al. (2017), have their individual underlying contexts. For example, smart economy refers to the innovations fostered to achieve high economic competitiveness. Being an indicator of a smart city, smart economy thereby constitutes economic growth through innovation activity and intensive business cooperation. Smart energy, on the other hand, relates with the use of renewable or sustainable energy sources that produces low carbon, with efficient energy distribution, and optimized energy consumption. As what Mohanty et al., (2016) entailed, these three components of smart energy system are held together by the smart energy grid or smart grid which serves as the system's core foundation. The smart grid is an electricity network which can intelligently integrate all user actions in order to improve generator connection and operation to improve the reliability and security of energy supply (Vijayapriya & Kothari, 2011).

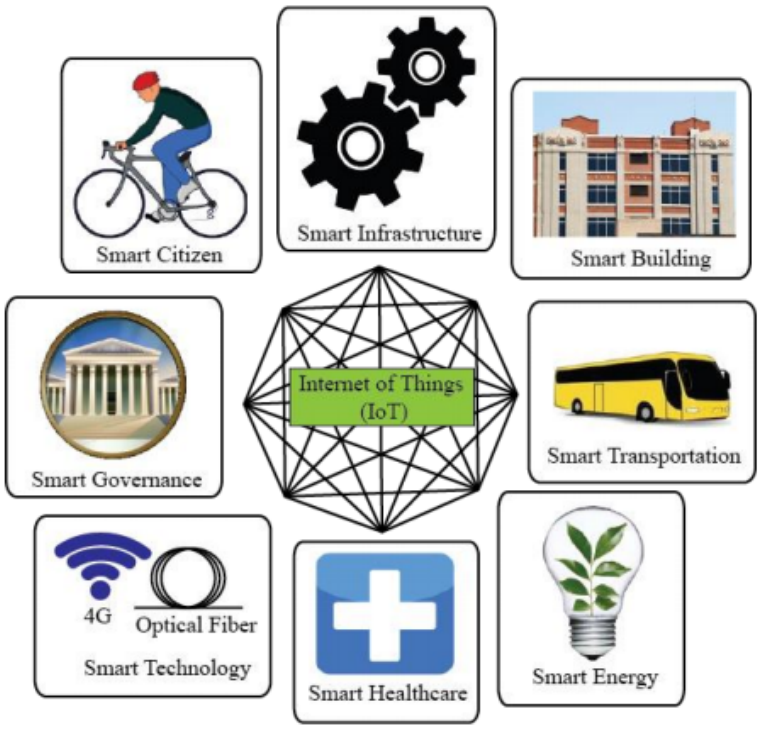

Figure 1: Smart City Components (Mohanty et al., 2016)

Smart governance, according to Joshi et al. (2016), focuses on active political participation of citizens as well as on the development and implementation of a digital government which aims to improve the administration of smart cities. It also promotes partnerships between the public and private sectors. The same author also highlighted the dimension of smart technology which is about the utilization of ICTs to facilitate interconnections of devices and components that is essential in carrying out real-time decision-making processes. Meanwhile, smart citizens are the outcome of increased diversity, creativity, and engagement. Through different programs and services promoted by smart cities, social capital is increased (Dudzevičiūtė et al., 2017). Smart building and smart infrastructure, as Mohanty et al. (2016) pointed out, are the physical, digital, and electrical components of the smart city. Being the backbone of smart cities, they encompass several areas including waste management system, water supply system, law enforcement, apartment buildings, etc. Smart transportation, on the other hand, generally refers to the innovative services provided through a variety of transportation modes and traffic management. It aims to increase safety and efficiency in transportation while also reducing carbon emissions, thus enabling sustainability in the city (Sadiku et al., 2017). Lastly, in smart healthcare, computing technologies are used to transform healthcare and improve the quality and delivery of services provided. Sensors are used to collect and measure healthcare data including temperature, blood pressure, pulse rate, etc. With these advancements, smart healthcare is aligned with the smart city objectives (Cook et al., 2018). Aside from these smart components that define and shape a smart city, there are also characteristics of smart cities that are explored in several studies. According to Dhingra and Chattopadhyay (Trindade et al., 2017, p. 4), there are four main attributes of a smart city. These include sustainability, quality of life, urban aspects, and intelligence. This was further noted by Caragliu et al., (cited in Albino et al., 2015, p. 1733), contending that developments in a smart city are facilitated using networked infrastructure which consequently enhance political and economic efficiency in the city. The authors additionally indicated that urban growth in smart cities is fostered through social inclusion and social and environmental sustainability, among others. Alongside all these characteristics, it was mentioned in the study of Schipper and Silvius (2018), that ICT and improved quality of life have always been the primary factors defining smart cities. With ICT, all the developments in a variety of areas are accomplished, from healthcare to transportation and economy. Meanwhile, improved quality of life is the main objective of smart cities.

Smart Development and Sustainable Strategies

In the development of smart cities, there is a variety of strategic principles and practices taken into regard. In the study of Mora et al., (2019), it was identified that there are four classifications of strategic principles for the development of smart sustainable cities.

The first one is the holistic strategy which connotes to having a holistic vision of smart cities. This first strategic principle denotes that in building smart cities, it is not adequate to only recognize them as a technology-only- focused systems, thus reiterating the importance of having a holistic vision for these cities. This is attributed by the fact that smart cities are socio-technical systems which are linked with several factors – human, economic, social, cultural, and environmental. This can be aligned with what Myeong et al. (2018) mentioned, entailing that the development of smart cities takes more than just the interconnection of ICT devices and infrastructures. As a matter of fact, it is a system involving other complex factors, aside from the technical elements, which include leadership, citizen involvement, and infrastructure.

As for the second strategic principle, according to Mora et al. (2019), is the use of triple-helix model and the gradual shift to a quadruple-helix model of collaboration. The triple-helix collaboration model, according to Leydesdorff and Deakin (2011), entails that the interactions of different dynamics lead to exploitation of knowledge within cities and using ICTs, foster innovation.

Thirdly, a combination of top-down and bottom-up approaches is a strategy deemed to be the most ideal in developing smart sustainable cities. This was indicated by Breuer et al. (2014), noting that building smart cities requires commitment from the government and open collaboration from citizens.

The final and fourth strategic principle in the study of Mora et al. (2019) highlights the implementation of an integrated intervention logic which refers to a strategic approach of solving urban challenges by extending the advantages of using ICT solutions in the city.

Aside from the aforementioned strategic principles, Nasution et al. (2020) emphasized integrated leadership as a key smart development strategy. There have been existing literatures which pointed out the role of leadership in developing smart cities. One of which is the study of Sancino and Hudson (2020) which revealed that in several smart cities such as those in Amsterdam and Bristol, the role of public leaders is critical, especially in promoting collaborations with businesses and communities. At the same time, leaders spearhead smart development and smart sustainable strategies such as forging collaborative partnerships between the public and private sectors for the pursuit of smart city initiatives. In line with integrated leadership, Nasution et al. (2020) also identified having the appropriate and acceptable governance model as a strategy towards smart development and sustainability of cities. In previous studies, there has been an emphasis on the importance of governance in smart cities like Ruhlandt (2018) who noted that smart city governance is a concept that is a foundation of smart cities. Being one of the elements of smart cities, an effective governance model is therefore a necessary aspect, considering that this is linked with human, legal, socioeconomic and regulatory factors. As Tan and Taeihagh (2020) further noted, the right smart city governance framework can lead to positive outcomes such as increased citizen participation and public-private partnerships as well as the realization of the smart city vision.

IoT and Data for Smart and Sustainable Cities and Government

Internet of Things (IoT), by definition, is a concept that denotes the interconnection of devices and user through the use of the Internet. Its objective is to increase the pervasiveness of the Internet and further integrate into the society, thereby improving ease of use and access to different devices (Kumar et al., 2019). In smart cities, the role of IoT is reflected on the collection, management, and analysis of data in a smart city. These large volumes of data are what support the government and the business in making strategic decisions for more developments in a variety of dimensions within the city, may it be in transportation, in healthcare, in infrastructure, etc. As additionally pointed out by Hammi, et al. (2018), the adoption of IoT enables the development of the different smart city initiatives globally as this emerging technology created opportunities integral in smart cities such as analysis of real-time traffic data streams and remote monitoring and management of devices. With the use of IoT comes the importance of data in smart cities. According to Pal et al. (2018), smart cities are founded on data and the different emerging technologies that facilitate management of these large amounts of data such IoT, cloud computing, and analytics. This explains why a big-data framework is an important element in the development of smart cities. Not only are they essential in storing various data forms efficiently, but they are also critical in processing and sharing these data across different applications and/or services. All these aspects are what lead to the success of developing smart sustainable cities.

In government, IoT and data also play a crucial role, especially with the rise of electronic government and/or digital governance. To mention, Velsberg et al. (2020) reiterated that as much as IoT shapes smart cities and their applications, this technology can also be integrated into the public sector, thereby fostering innovation and improvement of public services and process as well as increased human efficiency. The same authors noted that IoT can lead to government effectiveness and efficiency, transparency, and collaboration which result in increased citizen and stakeholder engagement. In the study of Al-Muqrashi and Saqib (2017), it was further noted that with the transition to electronic governments, IoT thereby makes it possible for governments to provide electronic services while also promoting knowledge sharing and communication between them and their citizens.

On the other hand, the importance of data in the government is linked with development of evidence-based policies as well as in building infrastructures to improve public services across industries such as healthcare and public safety (Kim et al., 2020). The same as how IoT is integrated into the public sector, the use and value of data in government are also noted in increased transparency, balancing social communities, and enabling the expanded use of all forms of data, may they be traditional, unstructured or semi-structured. In that regard, sustainable solutions are developed and implemented, thereby improving the quality of governance and the government services provided to the citizens (Kim et al., 2014).

Research Design

This study utilized a constructivist paradigm to identify and explore the role and importance of data management in the transition to digital governments in smart cities in the UAE. According to Ataro (2020), the constructivist perspective highlights the subjectiveness of knowledge. Thus, constructivist researchers interact or engage with participants and use dialogue and reasoning as methods of inquiry. Additionally, constructivism denotes the flexibility and uniqueness of data collected. For this study, structured interviews were performed with 32 participants. Data were scrutinized to find meaning and understand the perceptions of the participants regarding the role of data management in smart cities' transition to digital government. The following research questions guided the approach and methods used in this study:

i. What is the importance of data management in the transformation to a digital government in the UAE smart cities?
ii. What data management efforts have been done to achieve digital government in the UAE smart cities?
iii. What data management issues are encountered in achieving digital government in the UAE smart cities?

In relation to this, a qualitative research approach was undertaken because this allows researchers to understand perspectives and experiences of participants (Shakouri, 2014). In particular, the phenomenological approach was utilized in order to understand the perceptions of the participants with regard to the phenomenon being studied, which is in this research is the effects of data management in the transformation toward digital government in UAE smart cities. Among the qualitative research methods used for this research are purposive sampling, interviewing, and systematic data analysis procedures. Furthermore, data analysis is based on grounded theory.

Participants

The participants of this study are government employees of organizations that work directly in implementing smart city initiatives in the UAE, are either IT or engineering personnel, and have been part of the said organizations for a minimum of three years. Their years of work experience and nature of work are important criteria in this study because they are considered to be knowledgeable informants about data management in smart cities. To help the researchers with sample selection, heads of these organizations were contacted first and consequently, they sent a list of potential participants and their contact information. The researchers then sent an email to the participants with the Consent Form which contained a description of the research, procedures, rights of participants, and the protection of confidentiality. Those employees who signed the consent form were identified as final study participants and were given the details of the procedures for the interview. The 32 final participants interviewed were employees of 5 different government organizations directly working in smart city initiatives across the UAE.

Data Collection Method

Qualitative interviews were used in this study to collect the needed data to accomplish the research objectives. In particular, structured interviews were conducted (see Appendix A for the interview questionnaire). Ryan et al. (2009) indicated that this type of interviewing, which involves the use of predetermined questions, allows comparability of responses, thereby highly useful in finding patterns and themes for analysis. Furthermore, in light of the current COVID-19 crisis, face-to-face interview was not possible, so for the safety of both the researcher and the participants, interviews were conducted via Zoom and telephone conferencing and lasted approximately 45 minutes to 1 hour. Both tools enabled efficient manner of interviewing, considering that they are practical for researcher and employees during this pandemic.

The interviews were started with a description of the research, specifically its purpose and its procedures as well as the rights and confidentiality of the participants. At the same time, researcher took notes to easily keep track of important points in the interview which could be useful when analyzing the data. There are ten main questions in the interview, some with sub-questions to allow the participants further explain their perspectives and experiences related to the topic of the study.

Data Analysis

For the data analysis, there were two procedures employed. First, the researcher, with the use of the grounded theory as basis, highlighted key points from the interviews and went back and forth with the transcripts to identify patterns and consistent themes. These themes were then labeled into sections and organized the transcript data accordingly. Second, the researcher compared and/or triangulated the interview data with data from existing literatures. This helped increase the findings' trustworthiness, specifically the credibility of the research data. Through the data triangulation, which helps enrich research and validates the findings (Noble & Heale, 2019), the study's trustworthiness was established and at the same time, the comprehensiveness, objectiveness, and accuracy of the findings were strengthened.

Results and Analysis

This research aims to understand and identify the role and importance of data management in the transformation toward digital government in smart cities in the UAE. It also aims to explore the efforts exerted in data management and the challenges encountered in doing so by analyzing the results obtained from interviews applied to individuals in those organizations.

Participant Demographics

The results of this research are drawn from the interview responses of 32 employees from five different government organizations/departments working directly in the implementation of smart city initiatives in the UAE. These five organizations were from two emirates: Dubai and Abu Dhabi, where the country's smart cities are located. All participants had more than three years of working experience in their current organization. Eleven of the 31 participants have been working in their department for five years, nine for seven years, seven for four years, and five for nine years. Also, 23 of the total participants are IT personnel and the other 9 participants are engineering

personnel. Given their work experience and departments, it was expected that they have the knowledge and expertise in data management and its application in smart cities and digital government. In line with this, the following government organizations where the participants were from included: (1) Department of Urban Planning & Municipalities Abu Dhabi; (2) Abu Dhabi Digital Authority; (3) Dubai Police; (4) Dubai Customs; (5) Department of Energy Abu Dhabi. All these five organizations have contributed in developing and/or building smart city and sustainable initiatives. To detail, from the Department of Urban Planning & Municipalities Abu Dhabi, there were nine participants while six were from Abu Dhabi Digital Authority. In addition, eight participants were from the Smart Services Department of Dubai Police, five from Dubai Customs, and four from the Department of Energy Abu Dhabi.

As for the interview procedure, 20 participants were interviewed via phone call while the 12 others were interviewed via Zoom, a teleconferencing platform. As mentioned, face-to-face interview was not possible for this study because of the COVID-19 pandemic, making the phone and Zoom interview a practical choice of interviewing platform. Furthermore, the interviews were conducted from March 25 to March 28, 2021.

Research Findings

The results of the study identified three key themes. These included:

1. Data management facilitates **efficient collection, storage, management and access of large volumes of data** necessary for operating electronic governments and for enhancing quality of digital government services.
2. To ensure successful transition to digital government in UAE smart cities, **data management efforts** were exerted which include adoption of a clear governance framework, staff training, implementation of an open government data strategy, among others.
3. Issues in data management are primarily centered in **data protection and security** where there is a high risk of data loss and violation of the privacy of citizens.

Theme 1 answered the first research question: *What is the importance of data management in the transformation to a digital government in the UAE smart cities?* Meanwhile, Theme 2 answered to the second research question: *What data management efforts have been done to achieve digital government in the UAE smart cities?* Finally, Theme 3 responded to the third research question:

What data management issues are encountered in achieving digital government in the UAE smart cities?

On the next page is a more detailed discussion of each of the three themes.

Theme 1: Efficient Data Collection, Storage, Management and Access

All participants have shown good understanding of data management, digital government, and smart cities. With regard to smart cities, most of them mentioned improved quality of life and the use of technologies. Participant 9 stated that smart cities are "reducing the complexity and wealth of information to fact and knowledge inside the city by using different types of electronic methods and sensors to collect data [and] to transfer these data over a network." The same participant additionally noted the use of IoT to "enhance the quality, performance, and optimization of resources." Participant 27 also stated that smart city is a concept of "harnessing technology to build a solid infrastructure that serves the citizens." When asked about their perception of the smart cities in the UAE, all of them agreed that these smart city initiatives are innovative and are essential in the pursuit of a better and more sustainable future, thus pushing the country forward across various areas of growth – economic, social, political, environmental, and cultural. It is said by Participant 26 that in the UAE, these smart cities are envisioned to "become among the best cities in comfort of living and within the highest standards of living."

As for data management, Participant 32 mentioned that it is the process involving management, use and storage of big data that is important to government and citizens. Participant 27 also indicated that data management "is the infrastructure for smart cities." On the other hand, when asked about their understanding of digital government, most of the participants placed emphasis on transference of traditional government transactions to digital. According to Participant 19, "Digital government depend[s] on technologies to make sure they have quality services with high performance standards with less errors." With the participants' understanding of the concepts of smart cities, digital government, and data management, they consequently have established a wider perspective about the importance of data management in the transition to digital government in smart cities. As Participant 1 stated, "Data management is very much important in the transition to a digital government because both are complementary. Without data management, successful implementation of digital government in smart cities cannot be possible."

Furthermore, participants mostly agreed that data management's efficient approach in collecting, organizing, storing, and protecting data is what makes the transition to a digital government in smart cities effective. This then leads to better services within the city, across all dimensions, from transportation to healthcare. Participant 6 said that "With data management, governments which are transitioning to becoming digital are able to handle large volumes of data in their system. At the same time, data management makes this process easier to execute, leading to increased efficiency." Another participant, Participant 12, mentioned that data management "encourages efficient data-sharing across different government departments, specifically in developing and implementing smart city solutions and initiatives. He added that "data management is the core that enables governments to carry out digital transactions and services."

Aligned with efficient data collection, storage and access, most of the participants also emphasized that data management is the key in improving the quality of services in a digital government, which further aid in smart city governance. According to Participant 7, it "makes government services easily accessible". The participant also noted that through data management, transparency in digital government is improved. On the other hand, there were also participants who mentioned that data management facilitates interactions and collaboration between the government, the private sector, and the citizens. Participant 24 stated:

> "When transitioning to digital government in smart cities, it is important to build connection with the city's main stakeholders such as the government, the private entities, and the citizens/residents. Data management is the key to enabling stakeholder collaboration through effective data sharing and analysis. As a result of increased data sharing and stakeholder collaboration, digital government in smart cities is able to improve their operations and services."

Theme 2: Data Management Efforts

Under this second theme, participants have mentioned several data management efforts that their organizations have been implementing in order to support the transition to a digital government in smart cities in the UAE. In Dubai Customs, Participants 6 and 7 mentioned about provision of staff training. As Participant 6 shared, "At Dubai Customs, staff are given training to enhance their digital and data-related skills. They are also educated regarding the use of the digital systems, which improved communication and collaboration within the organization." The same participant also noted that through

training, it was easier for the employees to be familiar with the digital system, making it easier for them to carry out data collection, processing, and management activities. Another employee of Dubai Customs, Participant 11, mentioned that their organization conducts webinars to help staff track and understand the mechanisms of digital government and its services. In addition, Participant 7 revealed that aside from training, "Staff of Dubai Customs are encouraged to participate in all initiatives involving the development of digital governmental programs and services such as the UAE Pass."

Another data management effort indicated by the participants was adopting a clear and well-defined governance framework for digital government. As Participant 2 stated, "This framework is essential in steering the design and in coordinating the implementation of a digital government strategy. Relating with data management, it provides a guideline as to the implementation of a digital system and the manner in which data can be collected, stored, managed, and accessed." As further entailed by Participant 4,

> "The governance framework is aligned with the digital government strategy which the national government has developed and implemented across the country. In our organization, underlying our own governance framework are standards and principles for data management that helps ensure operability of data and efficiency of data management processes."

In relation, Participant 15 mentioned that data management efforts in their organization are more focused on data operability as well, considering that this is the foundation of the quality of exchange and management of data in their organization, which contributes to the transformation to a digital government in smart cities in the UAE. The said participant stated,

> "We have established a framework which we use as reference when managing data. It guarantees that the data we collect, analyze, store, manage, and share within our organization and across other entities have the necessary specifications including discoverability, interoperability, reusability, and reliability. These said attributes enable effective and successful data exchanges."

Other participants have indicated that their organizations have invested heavily in the development of important digital enablers. According to Participant 25, "Digital enablers are what power smart cities and digital governments which is why organization allocated resources to these technologies and implement their usage in our smart city projects and initiatives." Participant 32 also said, "Among these digital enablers such as shared data services have helped in developing solutions for smart systems and also in increasing collaboration with all sections of data, thus facilitating easy data finding and data storage digitally." Aside from this, some of the participants also mentioned having updated their

organizations' legal and regulatory frameworks. As what Participant 26 stated, "In data management for the transition to a digital government, there is a need to have defined and effective legal and regulatory frameworks that will ensure that digital rights of the citizens are protected." Participant 22 concurred, "These regulations for data management cover the potential effects of the increased usage of technologies and data. Consequently, they are incorporated into the current safeguards implemented for smart cities."

The last two initiatives mentioned by the participants related with the adoption of data governance practices and the open data government strategy. According to Participant 9, the data governance practices are essential in the improvement and simplification of data sharing actions within smart cities and digital governments. This was also noted by Participant 13 who said that "Data governance can be facilitated through policies which do not only enhance practices or methods for data sharing [but] also help promote the strategic data and technology usage in the government within smart cities." As for the implementation of an open government data strategy, Participant 16 said that this kind of approach helps in value creation relating with data reuse. At the same time, Participant 24 stated, "An open government data strategy highlights the necessary guidelines for management of the phases of the data value chain."

Theme 3: Data Protection and Security

In data management, there are definitely challenges encountered. Majority of the participants indicated issues on data security and protection as their primary concern. Participant 9 mentioned that any organization, including theirs, is exposed to difficulties in strengthening and maintaining high-level of system and data security because of the growing number of hackers who are taking advantage of the increased use of digital technologies. The same was also noted by Participant 4, who mentioned the high risk of attacks that pose a threat to data security and protection. According to Participant 4, when these attacks occur, there would be possible data leakage or data compromise which "can affect the reputation of the government and also encourage more hacking." With these issues, Participant 28 noted, "Governments which are in transition to becoming digital are faced with the issue on how to protect all data and ensure their safety and security. The vulnerabilities of the system to attacks can trigger the decline of public confidence on the system." Participant 32 furthered, "When data systems are exposed to security risks and attacks, organizations affected will lose large amounts of money, alongside losing pertinent data."

In relation to data protection and security, participants also mentioned privacy of citizens being a challenge. According to Participant 30, "As governments transition to becoming digital in smart cities,

citizens' privacy will; therefore, become nonexistent. Citizens will always worry about their personal information being not within their own control as they are stored in databases which can be misused or leaked in case of system attacks." Alongside the problem on data privacy, Participant 25 mentioned the possibility of data loss. However, issues in data management are not only technical as some of the participants pointed out how lack of training and education or inadequate digital literacy can also cause problems when transitioning to digital government in UAE smart cities. This was emphasized by Participant 12, stating that:

> "Not all people support data management given the complexity it involves, and this consequently affects the transition of governments to digital. Some employees do not fully understand why data management is important and why we need to shift to a digital approach of collecting, analyzing and handling data. This is why some would resist because they are not adequately made aware of the implications of data management."

Participant 26 also had the same perspective, saying that:

> "There are employees who cannot easily learn data management practices and become immediately familiar with these technologies and how to use them. Sometimes, organizations fail to acknowledge this gap. Instead of providing adequate training and education to improve employees' digital and data-related skills, they immerse employees into these new approaches right ahead. This causes resistance and lack of confidence of the staff on the system."

Discussion

This section integrates the findings from the interview and the information obtained from existing literatures, thereby determining whether findings are supported by literature.

Importance of Data Management

In the Literature Review section of this research, it was stressed that smart city is a concept which uses technology in creating solutions that will enhance the quality of life of the citizens (Ismagilova et al., 2020). This consequently relates with the findings of this study as majority of the participants perceived smart cities as cities founded on emerging technologies with the objective of achieving improved citizen life and a sustainable future. With regard to the role of data management in the transition to a digital government in smart cities, existing literatures pointed out that its importance

lies on enabling storage, processing, and transfer of data across a wide range of applications and service (Pal et al., 2018).

At the same time, when a government transforms to becoming digital, data management systems, which are powered by Internet of Things (IoT) and other emerging technologies, facilitate increased efficiency and effectiveness of government functions. Not only are the services delivered digitally, but they also improved in quality, which results in increased citizen satisfaction (Velsberg et al., 2020). In the findings, it was revealed that this improvement in the quality of public services largely aid in smart city governance. The concept of government transparency was also mentioned by the participants which aligns with what Velsberg et al. (2020) indicated about how increased transparency and collaboration between the government and the citizens can lead to increased stakeholder engagement.

Another aspect that was emphasized in both existing literatures and research findings is the importance of data management systems in supporting government decisions through efficient collection and management of large volumes of data. As most of the participants indicated, data management, through the utilization of emerging technologies, makes it easier for the government to handle data. According to Participant 31, "Data management enables efficiency in analyzing and sharing data which then helps government departments make effective solutions that will further promote smart city initiatives in the UAE." This can be associated with what Kumar et al. (2019) noted with regard to how governments make use of data in their decision-making and in collaborating with the private sector and the citizens.

Sustainable Development Strategy and Data Management Efforts

Because of the advantages and opportunities data management creates, specifically in the pursuit of transforming to a digital government in smart cities, efforts have been exerted by government departments in furthering data management processes. In the study of Kim et al. (2014), it was noted that governments have been making efforts in developing and implementing sustainable solutions to improve their data management to consequently enhance their governance quality and government services. For the participants, these efforts range from developing policies and regulatory and governance frameworks to provision of education and training to staff. As Participant 6 noted, "It is important that all members of the organization know and understand the

importance of data management because only then that they can help in creating more programs and services that support the organization and the country's smart city vision and initiatives.

In relation, the literature review highlighted that one of the strategies in development smart sustainable cities is to combine bottom-up and top-down approaches (Mora et al., 2019). The said combination places emphasis on government commitment and collaboration. In the research findings, participants have mentioned training and education to encourage participants to take part in activities related to digital government and its integration in smart cities. As Participant 2 said, "If employees are adequately trained and are able [to] improve their digital skills, it is easy for them to commit to the smart city objective and to the plan of transitioning to a digital government in these smart cities." Participant 18 also stated that collaboration between the government and the citizens would be significantly improved if employees, and even citizens, are made aware of data management, its use in digital government, and its other implications in smart cities.

These data management efforts can be aligned with the general sustainable development strategy implemented in the UAE which was rooted on its vision of smart cities. Not only did the government promote sustainability through the use of advanced technology approaches, but it also promoted the five pillars of a sustainable smart city that both Dubai and Abu Dhabi adopted. According to the UAE's National Committee on Sustainable Development Goals (U.AE, 2021):

i. Governance: UAE vigorous in administering the policies and regulations and team up the diverse components.
ii. Economy: UAE could expand the jobs, finance growth, innovation, productivity, investment
iii. Environmental: Several regulations been put to make the city functioning sustainable for the future example: waste management policies, air quality monitoring, water metering, palm tree weevil identification, water storage tank control, street lighting, health surveillance, logistic control, and asset tracking
iv. Society: the city citizens have equal access to all the facilities, Emirati culture enhanced concerning the different religions and cultures of UAE smart cities (Dubai & Abu Dhabi) citizens and visitors, and those cities customized with big database.
v. Technology and infrastructure development: United Arab Emirates formulized the smart cities to have crucial characteristics for a sustainable city like smart energy, smart security, smart physical safety, smart healthcare, smart education, and smart buildings.

So, based on the aforementioned pillars, the UAE has designed smart cities such as Dubai and Abu Dhabi, with development plans that include the rest of the country's cities, to place on the world map sustainable cities and successful self-service centers.

Conclusion

The smart city concept has already been widely adopted in several developing and developed countries. In the UAE, the national government is working towards the realization of the smart city vision, thus the reason why several government departments have drafted plans and strategies to successfully build more smart city projects. In this study, the main emphasis lies on how data management is integral in the transition to a digital government in smart cities in the UAE. As indicated in the findings of the research, data management is viewed as a tool that guides and aids governments in the said transition, with the notion that data management and digital governments coexist. Through the deployment of a variety of emerging technologies such as Internet of Things (IoT), data management is found to help governments, as they become digital, improve the quality of their services as well as the effectiveness and efficiency of their functions. The findings additionally suggested that governments have been extending their efforts in improving their data management process to ensure a smooth transition to becoming digital. Among their strategies included training the staff, implementing legal and regulatory frameworks, and developing an open government data strategy.

From the findings obtained in this research, this study therefore has a variety of implications. For one, it can be used by policymakers considering that this research mainly focuses on how data management has been deployed among government organizations in the UAE in their shift to a digital government in the country's smart cities. The findings can therefore guide policymakers in creating effective strategies and plans that optimize data management in digital governments and in smart cities. Secondly, private entities can benefit from this research as they, too, can adopt the same set of data management strategies that government organizations had implemented to further their own data management and governance frameworks. Thirdly, students and educators can make use of the findings by exploring further on the role of data management in the smart education dimension of smart cities, alongside smart governance and digital governments. And finally, this research can be useful to the citizens, so they would further understand how important data management is and the implications it has on their privacy and security. Generally, this

research can open more opportunities for discussion relating to data management in smart cities and in digital governments.

Limitations and Scope for Further Research

This study has three limitations. First, the participants were drawn from only five government organizations that are directly involved in the implementation of smart city initiatives in the UAE. Second, the study only interviewed government employees who are handling data management and smart services in their respective organizations. Thus, data management experts from the private sector were not included. Lastly, only 32 participants were involved in the research. For future research, a quantitative research approach can be undertaken in order to explore and measure the effectiveness of data management in the transformation to a digital government in UAE smart cities.

References

Al Nuaimi, E., Al Neyadi, H., Mohamed, N., & Al-Jaroodi, J. (2015). "Applications of big data to smart cities." *Journal of Internet Services and Applications*, vol. 6, no. 25, 1-15. doi: 10.1186/s13174-015-0041-5

Al Salmi, M. A. A. & Hasnan, N. B. (2015). "E-Government Contributions and Advantages: A review of Sultanate of Oman. *"International Journal of Scientific and Research Publications*, vol. 5, no. 12, pp. 214-219. viewed 30 March 2021, http://www.ijsrp.org/research-paper-1215/ijsrp-p4833.pdf

Albino, V., Berardi, U., & Dangelico, R. M. (2015). "Smart Cities: Definitions, Dimensions, Performance, and Initiatives." *Journal of Urban Technology,* vol. 22, no. 1, pp. 3-21. doi: 10.1080/10630732.2014.942092

Al-Muqrashi, N. & Saqib, M. (2017). "Role and Importance of IoT in the smart city and E-Governance.*" Journal of Student Research*. n.p., doi: 10.47611/jsr.vi.544

Ataro, G. (2020). "Methods, methodological challenges and lesson learned from phenomenological study about OSCE experience: Overview of paradigm-driven qualitative approach in medical education." *Annals of Medicine & Surgery*, vol. 49, pp. 19-23. doi: 10.1016/j.amsu.2019.11.013

Breuer, J., Walravens, N., & Ballon, P. (2014). "Beyond Defining the Smart City. Meeting Top-Down and Bottom-Up Approaches in the Middle." *TeMA Journal of Land Use Mobility and Environment*, vol. 7, pp. 153-164. doi: 10.6092/1970-9870/2475

Cook, D. J., Duncan, G., Sprint, G., & Fritz, R. (2018). "Using Smart City Technology to Make Healthcare Smarter." *Proceedings of the Institution of Electrical Engineers*, vol. 106, no. 4, pp. 708-722. doi: 10.1109%2FJPROC.2017.2787688

Dudzevičiūtė, D., Šimelytė, A., & Liučvaitienė, A. (2017). "The application of smart cities concept for citizens of Lithuania and Sweden: Comparative Analysis." *Independent Journal of Management & Production*, vol. 8, no. 4, pp. 1433-1450. doi: 10.14807/ijmp.v8i4.659

dsoa.ae. (2020). *DSOA Description*. https://www.dsoa.ae/explore-dso/who-we-are/our-story

Erkut, B. (2020). 'From Digital Government to Digital Governance: "Are We There Yet?" *Sustainability*, vol. 12, no. 860, pp. 1-13. doi: 10.3390/su12030860

Gharaibeh, A., Salahuddin, M. A., Hussini, S. J., Khreishah, A., Khalil, I., Guizani, M., & Al-Fuqaha, A. (2017). "Smart Cities: A Survey on Data Management, Security, and Enabling

Technologies."*IEEE Communications Surveys & Tutorials,* vol. 19, no. 4, pp. 2456-2501. doi: 10.1109/COMST.2017.2736886

Hammi, B., Khatoun, R., Zeadally, S., Fayad, A., & Khoukhi, L. (2018). "Internet of Things (IoT) Technologies for Smart Cities." *IET Networks*, vol. 7, no. 1, pp. 1-13. doi: 10.1049/iet-net.2017.0163

Harrison C, Eckman B., Hamilton R., Hartswick P., Kalagnanam J., Paraszczak J., & Williams P. (2010). "Foundations for smarter cities."*IBM Journal of Research and Development*, Vol. 4, pp. 54-116. https://www.academia.edu/23496136/Foundations_for_Smarter_Cities

Hashem, I. A. T., Chang, V., Anuar, N. B., Adewole, K., Yaqoob, I., Gani, A., Ahmed, E., & Chiroma, H. (2016). "The role of big data in smart city." *International Journal of Information Management*, vol. 36, no. 5, pp. 748-758. doi: 10.1016/j.ijinfomgt.2016.05.002

Ismagilova, E., Hughes, L., Rana, N. P., & Dwivedi., Y. K. (2020). "Security, Privacy and Risks within Smart Cities: Literature Review and Development of a Smart City Interaction Framework." *Information Systems Frontiers*, n.p., doi: 10.1007/s10796-020-10044-1

Joshi, S., Saxena, S., Godbole, T., & Shreya (2016). "Developing Smart Cities: An Integrated Framework." *Procedia Computer Science*, vol. 93, pp. 902-909. doi: 10.1016/j.procs.2016.07.258

Kim, E. S., Choi, Y., & Byun, J. (2020). "Big Data Analytics in Government: Improving Decision Making for R & D Investment in Korean SMEs." *Sustainability*, vol. 12, no. 202, pp. 1-14. doi: 10.3390/su12010202

Kim, G-H., Trimi, S., & Chung, J-H., (2014). "Big Data Applications in the Government Sector: A Comparative Analysis among Leading Countries." *Communications of the ACM*, vol. 57, no. 3, pp. 78-85. doi: 10.1145/2500873

Kumar, S., Tiwari, P., & Zymbler, M. (2019). "Internet of Things is a revolutionary approach for future technology enhancement: a review." *Journal of Big Data*, vol. 6, no. 111, pp. 1-21. doi: 10.1186/s40537-019-0268-2

Leydesdorff, L., & Deakin, M. (2011). "The Triple-Helix Model of Smart Cities: A Neo-Evolutionary Perspective." *Journal of Urban Technology*, vol. 18, no. 2, pp. 53-63. doi: 10.1080/10630732.2011.601111

Masdar.ae. (2021). *Masdar FAQ*. https://masdar.ae/en/about-us/useful-links/faq

Masdar Free Zone, 2021. *Empowering Business, Pioneering Sustainability, Business Set U*p and Leasing Opportunities at Masdar Free Zone, Abu Dhabi, doi: https://masdarcityfreezone.com

Mohanty, S. P., Choppali, U., & Kougianos, E., (2016). "Smart Cities: Definitions, Dimensions, Performance, and Initiatives." *IEEE Consumer Electronics Magazine*, vol. 5, no. 3, pp. 60-70. doi: 10.1109/MCE.2016.2556879

Mora, L., Deakin, M. & Reid, A. (2019). "Strategic principles for smart city development: A multiple case study analysis of European best practices." *Technological Forecasting & Social Change*, vol. 142, pp. 70-97. doi: 10.1016/j.techfore.2018.07.035

Mutiara, D., Yuniarti, S. & Pratama, B. (2018). "Smart governance for smart city." *Earth and Environmental Science*, vol. 126, pp. 1-10. doi: 10.1088/1755-1315/126/1/012073

Myeong, S., Jung, Y., & Lee, E. (2018). "A Study on Determinant Factors in Smart City Development: An Analytic Hierarchy Process Analysis." *Sustainability*, vol. 10, pp. 1-17. doi: 10.3390/su10082606

Nasution, A. A., Nasution, F. N., & Risanty (2020). "Smart city development strategy and its challenges for city." *Earth and Environmental Science*, vol. 562, pp. 1-5. doi: 10.1088/1755-1315/562/1/012012

Noble, H., & Heale, R. (2019). "Triangulation in research, with examples." *Evidence-Based Nursing*, vol. 22, no. 3, pp. 67-68. doi: 10.1136/ebnurs-2019-103145

Pal, D., Triyason, T. & Padungweang, P. (2018). "Big Data in Smart-Cities: Current Research and Challenges'." *Indonesian Journal of Electrical Engineering and Informatics (IJEEI)*, vol. 6, no. 4, pp. 351-360. doi: 10.11591/ijeei.v6i1.543

Ryan, F., Coughlan, M., & Cronin, P. (2009). "Interviewing in qualitative research: The one-to-one interview." *International of Therapy and Rehabilitation*, vol. 16, no. 6, pp. 309-314. doi: 10.12968/ijtr.2009.16.6.42433

Ruhlandt, R. (2018)."The governance of smart cities: A systematic literature review" *Cities.* https://doi.org/10.1016/j.cities.2018.02.014

Sadiku, M. N. O., Shadare, A. E., & Musa S. M. (2017). "Smart Transportation: A Primer." *International Journal of Advanced Research in Computer Science and Software Engineering*, vol. 7, no. 3, pp. 6-7. doi: 10.23956/ijarcsse/V7I3/01312

Sancino, A., & Hudson, L., (2020). "Leadership in, of, and for smart cities – case studies from Europe, America, and Australia." *Public Management Review*, vol. 22, no. 5, pp. 701-725. doi: 10.1080/14719037.2020.1718189

Schipper, R. P. J., & Silvius, A. J. G. (2018). "Characteristics of Smart Sustainable City Development: Implications for Project Management." *Smart Cities*, vol. 1, pp. 75-97, doi: 10.3390/smartcities1010005

Shakouri, N. (2014). "Qualitative Research: Incredulity toward Metanarrativeness." *Journal of Education and Human Development*, vol. 3, no. 2, pp. 671-680

SmartCitiesWorld news team. (2018). Abu *Dhabi completes smart city project.* Smart Cities World: Sharing Ideas to Solve Urban Challenges. https://www.smartcitiesworld.net/news/news/abu-dhabi-completes-smart-city-project-3465

Smart Dubai Office. (2021). *Smart Dubai 2021, Preparing Dubai to embrace the future, now.* https://2021.smartdubai.ae

Tan, S. Y. & Taeihagh, A. (2020). "Smart City Governance in Developing Countries: A Systematic Literature Review." *Sustainability*, vol. 12, no. 899, pp. 1-29. doi: 10.3390/su12030899

telecomreview.com (2020). *The UAE: An abundance of smart cities.* doi: https://telecomreview.com/index.php/articles/reports-and-coverage/3664-the-uae-an-abundance-of-smart-cities

Trindade, E. P., Hinnig, M. P. F., Moreira da Costa, E., Marques, J. S., Bastos, R. C. & Yigitcanlar, T. (2017). "Sustainable development of smart cities: a systematic review of the literature." *Journal of Open Innovation: Technology, Market, and Complexity*, vol. 3, no. 11, pp. 1-14. doi: 10.1186/s40852-017-0063-2

UAE Government. (2021). *Smart sustainable cities*. https://u.ae/en/about-the-uae/digital-uae/smart-sustainable-cities

U.AE (2021) *The UAE's National Committee on SDGs.* https://u.ae/en/about-the-uae/leaving-no-one-behind/uae-and-the-sdgs/the-uae-national-committee-on-sdgs

Velsberg, O., Westergren, U. H. & Jonsson, K. (2020). "Exploring smartness in public sector innovation - creating smart public services with the Internet of Thing" *European Journal of Information Systems*, vol. 29, no. 4, pp. 350-368. doi: 10.1080/0960085X.2020.1761272

Vijayapriya T. & Kothari, D. P. (2011). "Smart Grid: An Overview." *Smart Grid and Renewable Energy*, vol. 2, pp. 305-311. doi: 10.4236/sgre.2011.24035

Winkowska, J., Szpilko, D., & Pejić, S. (2019). "Smart city concept in the light of the literature review." *Engineering Management in Production and Services*, vol. 11, no. 2, pp. 70-86. doi: 10.2478/emj-2019-0012