AN INTEGRATED MODEL OF E-SERVICE QUALITY AND PUBLIC SATISFACTION FOR SMART CITY INITIATIVES IN THE ABU DHABI LOCAL GOVERNMENT

ALRASHDI HAMDAN SAEED
MUSALLAM MOQBIL

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University Tun Hussein Onn Malaysia

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DEDICATION

For my beloved sweet family

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ABSTRACT

The efficient management of resources against the background of urban developments has become critical to the development of sustainable cities. Several governments worldwide, including the UAE, are faced with an increasing challenge of urbanisation in social spaces. Resorting to smart cities to resolve urbanisation, the UAE, and the Abu Dhabi Emirate has made significant strides in this regard. Nonetheless, challenges remain pertinent, adoption is staggered, and overall service quality and the level of public satisfaction remain questionable. In this background, the study aims to investigate the impact of smart city initiatives on the government e-service quality and public satisfaction in Abu Dhabi Local Government. Particular reference is made to the e-service initiatives of TAMM and Jobs Abu Dhabi. Theoretically, the study builds on the Chourabi Model of Smart City Dimensions and the e-SERVQUAL model measurement of e-service quality. A quantitative research method was adopted, considering a sample of 384 users of the two selected smart service initiatives. Empirical findings were presented following the structural equation modelling analytical technique. Findings show that the smart city domain of institutional processes has a significant impact on e-service quality ($B = 0.613$, $p < 0.05$); however, the smart city technology ($B = -0.021$, $p = $ n.s) and human capital ($B = 0.019$, $p = $ n.s) do not improve e-service quality in the Abu Dhabi local government. Also, from the observations, trust did not qualify as a significant moderator of the impact of service quality on public satisfaction (R^2 change $= .0002$, $p = $ ns). Findings, however, supported that service quality differs across the various smart city domains (R^2 change $= .0149$, $p < 0.05$). The study contributes to the existing body of knowledge by establishing that smart city dimensions partly have a significant influence on e-service quality, which in turn influences public satisfaction. The study also makes a novel contribution to knowledge by establishing the moderating effect of policy domains on the relationship between e-service quality and public satisfaction. It shows that the effect of e-service quality on public satisfaction vary based on the policy domain. The study recommended that Abu Dhabi Local Government improve public satisfaction and maximise the success of the Abu Dhabi Smart City Initiative.

ABSTRAK

Kecekapan pengurusan sumber di dalam persekitaran pembangunan bandar merupakan satu aspek kritikal di dalam pembangunan bandar yang mampan. Kerajaan di serata dunia, termasuk di UAE, menghadapi cabaran yang kian meningkat di dalam aspek perbandaran terutamanya berkaitan ruang sosial. Dengan melaksanakan initiatif perbandaran pintar di dalam menyelesaikan isu dan cabaran perbandaran, UAE dan Abu Dhabi Emirate telah mengambil langkah proaktif dan penting di dalam melaksanakan initiatif tersebut. Namun begitu, cabaran masih tetap wujud, perlaksanaan initiatif perbandaran pintar masih di dalam ketidaktentuan, kepuasan umum dan kualiti perkhidmatan masih menjadi persoalan utama. Berdasarkan kepada isu-isu berkaitan, matlamat kajian ini adalah untuk menyiasat kesan initiatif bandar pintar kepada kualiti *e-service* kerajaan dan kepuasan umum di dalam kawasan pentadbiran kerajaan tempatan Abu Dhabi. Kajian ini memberi tumpuan khusus kepada initiatif *e-service* yang dilaksanakan oleh TAMM dan Jobs Abu Dhabi berdasarkan kepada *Chourabi Model of Smart City Dimension* dan e-SERVQUAL model bagi mengukur kualiti *e-service*. Ianya mengaplikasikan kaedah penyelidikan kuantitatif menggunakan borang soal selidik dengan bilangan responden sebanyak 384 orang yang menggunakan khidmat yang disediakan oleh TAMM dan Jobs Abu Dhabi. Berdasarkan kepada teknik analitikal Structural Equation Modelling (SEM), dapatan kajian menunjukkan domain proses institusi memberi kesan yang siknifikan kepada kualiti *e-service* ($B = 0.613$, $p < 0.05$); namun begitu, domain teknologi bandar pintar ($B = -0.021$, $p = n.s$) dan modal insan ($B = 0.019$, $p = n.s$) didapati tidak memberi kesan dalam mempertingkatkan kualiti *e-service* di dalam kerajaan tempatan Abu Dhabi. Hasil dari pemerhatian juga mendapati pembolehubah percaya (*trust*) tidak signifikan sebagai moderator didalam menilai kesan kualiti perkhidmatan kepada kepuasan umum (perubahan $R^2 = 0.0002$, $p = n.s$). Namun begitu, hasil dari analisa mendapati kesan kualiti perkhidmatan berbeza mengikut beberapa domain bandar pintar (perubahan $R^2 = 0.0149$, $p < 0.05$). Kajian ini telah memberi sumbangan yang signifikan didalam bidang akademik kerana ianya merupakan satu kajian ulung berkenaan pengoperasian bandar pintar mengikut kontek kajian empirical. Adalah dicadangkan kajian berikutnya dibina berdasarkan kepada skala dimensi bandar pintar bagi memberi pengesahan selanjutnya. Selain itu, pihak kerajaan tempatan Abud Dhabi perlu mempertingkatkan kepuasan umum bagi memaksimakan kejayaan initiatif Abu Dhabi Smart City.

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ADCED	-	Abu Dhabi Council for Economic Development
ADDA	-	Abu Dhabi Digital Authority
ADM	-	Abu Dhabi Municipality
AED	-	Arab Emirate Dirham
AI	-	Artificial Intelligence
ANCOVA	-	Analysis of Covariance
C.R.	-	Critical Ratio
CAIC	-	Consistent Akaike Information Criterion
CFA	-	Confirmatory Factor Analysis
CFI	-	Comparative Fit Index
Df	-	degree of freedom
EFA	-	Exploratory Factor Analysis
GCC	-	Gulf Corporation Council
GFI	-	Goodness of Fit
H	-	Hypothesis
ICT	-	Information Communication Technology
KMO	-	Kaiser-Meyer-Olkin
MLE	-	Maximum Likelihood Extraction
NFI	-	Normed Fit Index (NFI)
OECD	-	Organisation for Economic Co-operation and Development
P	-	Significance level
PD	-	Policy Domain
PS	-	Public Satisfaction
RMR	-	Root Mean Squared
RMSEA	-	Root Mean-Square Error of Approximation
S.E.	-	Standard Error
SCH	-	Smart City Human Capital
SCP	-	Smart City Institutional Processes

SCT	-	Smart City Technology
SEM	-	Structural Equation Modelling
SQ	-	Service Quality
TAM	-	Technology Acceptance Model
TLI	-	Tucker-Lewis Index
TPB	-	Theory of Planned Behaviour
TRA	-	Theory of Reasoned Action
UAE	-	United Arab Emirates

CHAPTER 1

INTRODUCTION

1.1   Study Background

With the increasing urbanisation coupled with greenhouse gas emission and global warming, smart city is embraced to solve societal, economic and environmental problems in urban settings. Smart cities allow the optimisation of energy, economy and resource flows using information and communication in urban areas (Abbass, 2017; Batagan, 2011; Hefnawy, Bouras, & Cherifi, 2018). The economic potential of the smart cities range from USD 1.5 trillion by 2020 to USD 3.5 trillion by 2026 (Ringel, 2021). To achieve such economic potential, several countries of the world implemented the smart city with varying degree of success. For instance, Germany implemented smart city projects with major objective of providing efficient energy solutions including renewable energies. The country also deploy sophisticated technology for mobility appraisal solutions. The country is among the leading markets (Ringel, 2021). The Germany initiative is based on the European projects that redesigns the existing infrastructure in mostly smaller projects.

In Spain, Barcelona is among the cities with smart city. The city has undertaken significant reforms to transform into a smart city and a leading smart city among European cities. The Barcelona smart city is based on the vision that the city "should be able to actively generate smart ideas in an open environment through fostering clusters or Open Data or developing proper living labs while directly involving citizens in the co-creation process of products or services" (Bakici, Almirall, & Wareham, 2013).

The United States has long embrace smart city as a means of urban reconfiguration and management. The country has a vision for its cities to be lively, workable and sustainable which are the key attributes of smart city (Abbass, 2017). China also embraces the development of smart cities. The existing smart city initiatives in China are predominantly top-down approach from central government to localities. In China, Smart city is considered as a "supply-side policy solution to reshape economic structures, transform economic development modes, upgrade industrial technologies, re-educate and enhance the competiveness of the workforce, stimulate domestic demands and government expenditure" (Yu & Xu, 2018).

Unlike the European redesign approach, the Middle East/ North Africa approach is based on new infrastructure installation. The NEMA countries (e.g. Kuwait, Qatar) develop new infrastructure according to the global best practices. The countries consider the smart city development as an economic diversification option (Ringel, 2021). In Qatar, the first transition to smart city was envisioned in 2014 when the government release a smart city policy document in a form of white paper. The document regarded smart cities as the future and way forward for developing and designing new urban centres in Qatar (Badran & Badran, 2021). The model is similar to that of the other NEMA countries based on new infrastructures. All the Gulf Cooperation Countries (GCC) including Bahrain, Oman, Saudi Arabia, Kuwait, Qatar, and United Arab Emirate (UAE) are keen on improving upon their infrastructure to push their ''smart city'' agenda which would go a long way in furthering the economic diversification objective of their region besides improving the quality of public services (Saxena, Ali, & Mansour, 2018).

Accordingly, the UAE and Abu Dhabi Government rely on smart cities to solve these emerging problems, one rather challenging outcome is maintaining public satisfaction and, even more importantly, service quality as an immediate outcome of service delivery. However, the very underlying blocks of smart city are not well understood and have remained ambiguous; this, therefore, serves as one of the key research gaps that must be closed to pave the way for practitioner contributions to be established.

The UAE and Abu Dhabi, in particular, understand the need to tackle the challenge of urbanisation through the Smart City initiative. The planning regimes and general policy model start with a leadership vision and the installation of key strategic paths, as witnessed in the Zayed Smart City Project introduced from 2018 to 2022

(Abu Dhabi Government, 2018). According to the General Manager of the Abu Dhabi City Municipality (ADM), Badr Al Qubaisi, the Zayed Smart City represents:

> *"a pioneering project for managing the infrastructure by using Information Technology and the Internet of Things. The project aims to envision the future, drive innovation and provide infrastructure at world-class standards."*

The Zayed Smart City is not the only project in the pipeline, as other projects such as Onwani, a physical address system, and Masdar City have gained increased recognition. The Masdar "Smart" City Project, for instance, is the first of such renewable energy policy in 2009. According to Mezher and Park (2012), this initiative aims to "advance renewable energy and sustainable technologies through education, R&D, investment and commercialisation". The government aspires to build on technology and modernity to improve the quality of life and ensure happiness among the populace. There is a need to make digital transformation by building on the collective efforts of the individual Departments and Agencies (Gulf News, 2018).

According to the UAE Government (2019), the Smart Abu Dhabi Initiative, a broader government orientation that encompasses all e-government and smart government initiatives, involves the transformation of all government e-services, including the introduction of the TAMM, a one-stop portal to serve the complete list of government services into a single city application. Beyond a mobile application, the application has the vision to adopt a "journey focused approach" that builds on customer preferences by crafting personal solutions across all Abu Dhabi Mart City scopes. This application is integrated into the single-pass application for the UAE Government or the Smart Pass, another system installed to ensure a single-sign-on system for all UAE residents regardless of government e-channel of concern.

Other applications, including the Jobs Abu Dhabi, City Guard, and free Wi-Fi in Taxis, are programs partly enrolled and at different stages of implementation to ensure an uninterrupted connection to all systems and people within the Emirate. All government payments in the Abu Dhabi Emirate have recently been channelled through the new Abu Dhabi Digital Payment Platform or the ADPay (Fintech, 2018). Towards the end of 2017 alone, the Abu Dhabi Government set for itself a benchmark of 100 Smart Government Initiatives and 1000 smart or e-services by the end of the year to contribute to the main objective of creating a Smart City out of the entire city of Abu Dhabi.

These and many other developments indicate that the Abu Dhabi Emirate and the Government have put in place measures to ensure channel correspondence between general society and the administration official in several unique areas of government service delivery. According to Reiche (2010), on this account, this aims to ensure collaborations not only between service providers and citizens but between the partners of service provision, which is the overall supply chain. The need for collaboration across government institutions and departments has been emphasised across several channels. These initiatives are not only implemented to serve the population but help create a sustainable future. Alternative energy sources and water in the UAE and Abu Dhabi are central to the Abu Dhabi Smart City initiative (Tok et al., 2015; UAE Government, 2019).

The Abu Dhabi Digital Authority (ADDA) was formed to help manage the Abu Dhabi Smart Government programme, and the Government Authority is championing the Abi Dhabi Smart City initiative by consolidating over 1600 Abu Dhabi Government services onto the single platform called TAMM. This Authority is also in charge of the Government Payment Gateway and consolidates all Abu Dhabi Government applications and e-services onto a single platform. According to HE Dr Rauda Al Saadi, Director General of ADDA (Fintech, 2018, p. 1):

> *"We are confident that Abu Dhabi will soon be one of the best smart cities in the world, and we aim to help make this happen by providing state-of-the-art government serves to our citizens and residents… By harnessing the power of technology, we are enhancing the local economic environment and helping improve the quality of life of our people. We will support all efforts to bring happiness, success, prosperity, and protection to the public."*

The ADDA works together with all sectors through various Data Exchange programmes which seek to direct vast amounts of resources to technological enhancement targeted at improving the quality of life of end-users and strengthening the position of Abu Dhabi as an ideal investment and business destination while encouraging a sustainable future for the future generations. As seen from these observations, the government has adopted an e-services model, a smart government methodology, and other underlying commitments to the Smart City agenda (Al-Khouri, 2012). The UAE Vision 2021 and the UAE National Innovation Strategy seeks to put systems, human resource, and infrastructure into optimum use in the

government's effort to optimise public administrative systems through smart governance.

Even though the purpose of the Smart City Initiative of the Abu Dhabi Government includes future sustainability and the need to ensure that the people are happy and satisfied, little is achieved or known in terms of citizens satisfaction with these introduced measures. Adoption, for instance, has remained a central problem in Abu Dhabi (AlNuaimi *et al.*, 2011). Despite having the highest mobile phone subscription as a percentage of the population in the world, the highest mobile phone penetration and over 97% smartphone penetration, popular applications introduced by ADDA such as TAMM and CITY GUARD have less than 1000 downloads on Google Play as at the time of the present study. Most popular applications like the SMART PASS have just about 50,000 installs out of a population of over 9 million people.

In simple terms, the UAE and Abu Dhabi Government, in particular, is keen on the Smart City agenda, but the actual adoption required to propel the Emirate towards the creation of this Smart City is far from reach. According to AlNuaimi *et al.* (2011), the quality of the information systems of e-services, which serves as the root of the Smart City is questionable. Quality has been observed as a significant and very important factor within the Abu Dhabi Smart Government model that inhibits the smooth implementation and adoption of government e-services (AlNuaimi *et al.*, 2011; Albassam & Alshawi, 2010). To add to this, Albassam and Alshawi (2010), also within the context of Abu Dhabi, support the assertion that perceived service quality is a major issue within the context of information systems and technology-related service delivery.

With the Abu Dhabi Government Smart City Initiative challenged by the lack of adoption and other evidence of poor service quality, the present study seeks to empirically support a model from the roots of the Smart City model, where technology, human capital, and institutional processes come into perspective as originally conceptualised by Nam and Theresa (2011). It will also build on the measurement of service quality conceptualised for e-services from the popular SERVQUAL measure of service quality. This study will not only help identify which aspect of the Smart City is unable to support government e-service quality, but it will also help arrive at key insight on how the basic unit of Smart City building that is government e-services, can be enhanced to improve citizen satisfaction amid key moderators

1.2   Problem Statement

The UAE has witnessed unprecedented urbanisations over the years. Accordingly, Smart city initiatives have been implemented to address some of the urbanisation issues. Despite the implementation and high rate of ICT and internet penetration in UAE which is put at about 97%, the rate of adoption of the smart city initiative by the citizen in Abu Dhabi is rather minimal. As at time of this research, there is less than 1000 downloads for the popular ADDA applications of TAMM and CITY GUARD on Google Play. The most popular applications like the SMART PASS have just about 50,000 installs out of a population of over 9 million people. Another issue of concern about the smart city initiative is the conflicting satisfaction outcome. While some residents are satisfied some are not. The satisfaction was mainly an outcome of the citizens' demographics rather than the smart city (Salim, Barachi, Onyia, & Mathew, 2020). Also, citizens' trust on public initiative such as smart city is not always straight-forward. There are concerns of security and privacy. Another issue of concern is the lack of organizational maturity and stability on technology adoption (Al-Khouri & Bal, 2007; Yaseen & Okour, 2012). This issues therefor require holistic investigatation to discern how the the the quality of the initiative and how it influence satisfaction with the smart city. Previous research efforts have attempted to explore the smart city initiative.

Earlier studies on smart cities, including Pérez González and Díaz (2015), have observed smart city in public spaces. Other scholars, including Giffinger *et al*. (2007), Kehoe *et al*. (2011), Harrison and Donnelly (2011) and Pattaro and Tripi (2013), have all argued that the smart city concept is centred on the needed improvement in the lives of citizens in the wake of urbanisation, with a keen focus on the public sector. Whereas this remains an assertion that can least be objected to, these studies barely provide theoretical precedence without much empirical support. It is recommended that empirical work on smart city observes the concept from an acute perspective to pursue measurable indicators in this area. The smart city domains analogy has gained precedence in this argument (Pérez González & Díaz, 2015); these include the analysis of smart city from the perspectives of domains such as smart municipal waste management, smart grids and metering, smart buildings, efficient public lightening among several others.

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