Knowledge Sharing on the Acceptance of Smart Waste Management System: Moderating Effects of Local Cultures

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ABSTRACT

Smart cities utilize information and communication technologies (ICTs) to increase operational efficiency and effectiveness and share information with the public with the aim of improving government services, citizen welfare, and overall quality of urban life. Based on previous studies, the results of the implementation of ICTs are different from one city to another. It was found that in some cities, the implementation was successful, while in others, it was not as successful. This phenomenon often raises the question as to what the main cause of success or failure is, of the implementation and acceptance of technology in society. Various factors can influence success in the adoption of technology. The issue of waste management is one the biggest challenges to local authorities of both small and large cities. It is an important question that needs to be investigated in academic research, regarding the potential of smart cities in remediating environmental problems in general and waste management. In this paper, we focus on governance in using the Smart Waste Management System (SWMS) for waste management. The successes of Smart Waste Management System (SWMS) may be attributed to many factors. We are concerned with cultural roles, mainly on what we term as "local culture" (LC) elements of SWMS acceptance. The main focus of this paper is based on Hofstede's Onion Model and adopted in the proposed model: Knowledge Culture, Basic Assumption Culture, and Beliefs Culture.

Keywords: Local cultures, smart city technologies, moderating, technology acceptance.

I INTRODUCTION

The European Commission defines smart cities as places where traditional networks and services are made more efficient with the use of digital and telecommunication technologies for the benefit of its inhabitants and businesses. It clearly indicates that the smart cities use information and communication technologies (ICTs) to increase operational efficiency and effectiveness, and to disseminate information to the public with the aim of improving government services, citizen welfare and overall quality of urban life. In this paper, we refer to the ICTs artifacts used by smart cities as Smart Cities Technologies (SCTs for short). With the advent of the 4th Industrial Revolution (4IR), harnessing the potential technologies of 4IR will require governments of the cities to integrate new innovation and technology-related concepts, to allow more effective, improved, higher-quality public services, and greater infrastructure robustness. Many studies have focused on the technology infrastructure and the importance of new SCTs in relation to modern infrastructure in cities (Kummitha, 2018). They have focused on how smart communities could be smarter, and cities could be designed to implement SCTs. Waste generation is a concern for modern societies due to both, the service cost of waste collection, and the environmental issues of landfills. The IoT seems a promising solution for handling waste collection and recovery operations in smart cities (Zanella et al., 2014).

However, with respect to these SCTs, issues related to their failure or success at the technology acceptance level are still crucial, and these issues are commonly discussed topics in research, discussions on which are ongoing in current literature. SCTs solutions must be holistic enough so that they can engage people and are sustainable economically, environmentally, socially, culturally, and ethically. For example, there are internal and external determinants related to smart cities studied in (Myeong et al., 2018). The government perception that efforts to accept SCTs must be able to address all stakeholders, has had a direct or indirect impact towards SCTs. Hence, the level of SCTs acceptance at the organizational level is always influenced by the perception of all stakeholders. For instance, stakeholders' local perception towards SCTs has to be carefully tackled with a holistic approach which is not only limited to giving a full emphasis on SCTs from a technological aspect. In fact, local urban identity, culture, and knowledge ecosystems continue to shape innovative capacity and technological acceptance despite global exchange in talent, trade, and technology. There are many studies such as (Sun et al., 2018; Baptista &

Oliveira, 2015; Goularte & Zilber, 2018; Ozbilen 2017) which elaborate on the role of cultures in technology acceptance. Most studies are regarding the dimension of the national culture model (Hofstede, 2011) such as power distance, individualism versus collectivism, masculinity versus femininity, uncertainty avoidance, and long- term orientation. Hofstede's cultural dimension is a general aspect of culture which is used to understand the differences in culture across countries and is not specific to locality culture. There are a few studies (Ucar, 2018; Cui et al., 2017; Pannilage, 2016; Gabriel, 2015) focused on the constructs that are related to what is referred to as local culture. Although there is no standard definition of local culture, the term "local" can be understood as configurations of people as well as their practices and experiences that exist under the nation-state (Gabriel, 2015). By "culture" it refers to a collective minded programming where there are distinguishing factors in patterns of thought, feelings, and actions between experts in a society or a human group and another community or other human groups (Hofstede 2011). Hence, "local culture" would be understood as the way people live where all aspects of human thought or beliefs and behavior are inherited from one generation to another through the process of learning in that particular locality or area.

Therefore, this study attempts to explore whether local cultural factors would cause urban failure in the context of the intention to use SWMS from an organizational perspective. It would be able to address two important points regarding SCTs which this paper attempts to investigate further. First, although smart cities are on the rise, it is crucial to understand why the same initiatives succeed in some places but not in others. Is this failure due to a specific aspect of a cultural issue like local cultural factors? Second, taking a local culture perspective would be a promising theoretical lens that could yield new insights into the local success of SWMS. The composition of this paper is as follows. We start looking at the background of this paper. Next we describe a theoretical foundation and also establish our proposed research model. Subsequently we briefly give a research direction to be taken from this paper and discuss the main contribution of this paper in relation to our proposed model. Finally, we conclude the research in progress work and provide an explanation on what is next for future work.

II BACKGROUND

A. Smart City and The Fourth Industrial Revolution (4IR)

A rapid urban development process and the provision of various services to the community should be placed on the main agenda of transformation in steps towards moving on to a smart city. There is still no standard for defining a smart city (Anthopoulos & Fitsilis, 2013). But it can still be seen and measured from the efficiency of management and the improvement of the quality of township and the livelihoods of a city. It is evident that most researchers have emphasized the term smart city since 1998 (Bastelaer, 1998), where more recent studies focus on the relationship between smart city components (Giovannella, 2013; Giffinger, 2007). The 4IR posed many challenges to public administration in developing countries, where human and material resources were inadequate to bring about significant technological advancements, despite the increasing benefits, as a result of efficiency and effectiveness in service delivery. The 4IR technologies will effectively enable the SCTs and play a part in making their acceptance and subsequently, adoption level, a complex endeavor.

B. The Role of Local Government, Cultures and Technology Acceptance Issues in Smart Cities

The development and management of a city center is a complicated and challenging task for a local authority which aims to ensure quality of life to the population by providing the best services. Therefore, a local authority should also be prepared to transform the city management operations to become more efficient and effective, in line with the smart city goals. The government must be able take decisions in favor of accepting the SCTs (in this paper the focus is on SWMS). However, this is a very challenging task, since the SWMS level of acceptance is always influenced by multiple factors and perspectives. Culture plays an important role not only in terms of cultural influence, but also in bringing economic and technological developments, and furthering the ideology of the developed countries on a global level. Studies of cultural factors on technology adoption have also been widely applied in previous studies.

Referring to Table 1, the two main components of the previous study were, the basic theory used, and the cultural factors that were focused on the study. In terms of the theory used, previous studies have used TAM and UTAUT in studying technological adoption, most of which have used the TAM theory as the basic theory. On the other hand, the second component is a cultural factor which in the previous studies focused more on Hofstede's cultural

dimension model. Studies have revealed different user experiences related to the success of modern technologies that use different cultural values, and levels of technology acceptance, as determinants of consumer recognition and response to new technologies (Yoo et al., 2011). Issues on technology acceptance in smart cities are crucial and unique. Technology acceptance models can be classified into different categories as argued by Hsiao and Yang (2011). These categories are: 1) Psychological approach which focuses on ease of use; 2) A social or commercial approach; and 3) A task-related, information systems approach. For entities as complex as smart cities, the integration of all three approaches is a necessity (Yigitcanlar et al., 2018).

Table 1. Studies on the role of culture on technology acceptance.

Sun et al. (2018) - Impact of cultural values on technology acceptance and technology readiness	**Cultural Factors:** Collectivism, Long-term Orientation, Masculinity **Theory Use:** Hofstede's national culture, TAM **Acceptance Factors:** Discomfort, Perceived Ease of Use, Perceived Usefulness **Domain Context:** Hotel Management
Baptista and Oliveira (2015) - Understanding mobile banking: The unified theory of acceptance and use of technology combined with cultural moderators	**Cultural Factors:** Collectivism, Femininity, Individualism, Long-term Orientation, Masculinity, Power Distance, Short-term Orientation, Uncertainty Avoidance **Theory Use:** Hofstede's cultural dimension, UTAUT 2 **Acceptance Factors:** Effort Expectancy, Facilitating Condition, Habit, Hedonic Motivation, Performance Expectancy, Price Value, Social Influence **Domain Context:** Mobile Banking
Al-Jumeily and Hussain (2014) -The impact of cultural factors on technology acceptance: A technology acceptance model across Eastern and Western cultures	**Cultural Factors:** Collectivism, Individualism, Power Distance, Uncertainty Avoidance **Theory Use:** Hofstede's cultural dimension, TAM **Acceptance Factors:** Facilitating Conditions, Perceived Ease of Use, Perceived Usefulness, Political Factors, Social Factors **Domain Context:** Education
Lin (2014) - An investigation of the effects of cultural differences on physicians' perceptions of information technology acceptance as they relate to knowledge management systems	**Cultural Factors:** Collectivism, Femininity, High Context, Individualism, Low Context, Masculinity, Power Distance, Uncertainty Avoidance **Theory use:** Hofstede's cultural dimension, TAM, TAM 2 **Acceptance Factors:** Perceived Ease of Use, Perceived Information, Security, Perceived Usefulness, Subjective Norms **Domain Context:** Knowledge management
Robin et al. (2014) - Technology Acceptance Model: Worried about the Cultural Influence?	**Cultural Factors:** Collectivism, Femininity, Individualism, Masculinity, Power Distance, Uncertainty Avoidance **Theory use:** Hofstede's cultural dimension, TAM **Acceptance Factors:** Perceived Ease of Use, Perceived Usefulness **Domain Context:** Communication
Caporarello et al. (2014) - Does Culture Make The Difference? Technology Acceptance And Diffusion In India	**Cultural Factors:** Collectivism, Performance Orientation, Power Distance, Uncertainty Avoidance **Theory Use:** Hofstede's cultural dimension, TAM **Acceptance Factors:** Perceived Ease of Use, Perceived Usefulness **Domain Context:** Communication

TAM - Technology Acceptance Model; **UTAUT** - Unified Theory of Acceptance and Use of Technology

C. Smart Waste Management System (SWMS)

Smart waste management system (SWMS) is a solution to manage and improve cities governance in terms of waste collection systems using ICT technology. Local authorities have an opportunity on access networks to support all types of city management and maintenance services which require data connection (Gutierrez et al., 2015). SWMS is currently the best and most trending solution (Mahajan et al., 2017) which helps Local Authorities monitor real time waste management data such as waste collection data. Therefore, SWMS provide accurate reports, increase the efficiency of the system and make good governance.

III THEORETICAL FOUNDATION AND RESEARCH MODEL

A. Theoretical Foundation of Technology Acceptance

There are several commonly used theories for predicting and describing behavior related to the usage and acceptance of technology. Therefore, some basic theories have been used such as TRA (Azjen & Fishbein, 1980), IDT (Rogers, 1983), TPB (Azjen, 1991), TAM (Davis, 1989), TOE (Tornatzky &

Fleischer, 1990), UTAUT (Venkatesh et al., 2003), and TAM 3 (Venkatesh & Bala, 2008). The application of these basic theories can also be seen from two aspects of the research paradigm as described by Porter and Donthu (2006). The first paradigm defines a specific system and focuses on how the characteristics of technology influence one's perception of technology. The TAM has become one of the most widely used models (Porter & Donthu, 2006). There are two main constructs in TAM that influenced the use of technology, namely, perceived usefulness and perceived ease of use. However, El-Gohary (2012), argues that the above model is appropriate to investigate the use of technology at the individual level. TAM's main focus is on technology-related neglect of social and psychological parameters (Venkatesh & Bala, 2008), that limits its explanatory and predictive utility, and thus demands integration with other frameworks (Awa et al., 2015). The second paradigm focuses more on the hidden personality dimensions in explaining the acceptance and adoption of new technologies. However, in this study, authors prefer to focus on the acceptance of technology at the organizational level, taking into account not only technology, but also other holistic aspects such as culture, in particular. In terms of paradigm, this study is more likely to be the second paradigm.

B. The Technology-Organization-Environment (TOE) Framework

The Technology-Organization-Environment (TOE) framework by (Tornatzky & Fleischer, 1990) further explains the acceptance of technology from the perspective used by organizations (*Table 2*). These are, 1) the technological context, 2) the organizational context, and 3) the environmental context. The technological context describes the technology acceptance that depends on the pool of technologies inside and outside the organization. The organizational context refers to the characteristics and resources of an organization including the firm's business scope, firm size, top management support, organizational structure, human resource, number of slack resources, and linkages among employees. The environmental context relates to the structure and size of the industry, the firm's competitor, the regulatory environment, and the macroeconomic context.

The TOE framework is more holistic, large-scale, and industry-friendly (Wen & Chen, 2010); it has a strong empirical support in the field of information systems where it is superior to other used frameworks, as argued in (Yoon & George, 2013), and meets contemporary scientific demands as explained in (Jacobsson & Linderoth, 2010) for more social interactive systems that address deterministic system problems. Therefore, TOE is the preferred choice taken in this study for several important reasons: a) this theory has a solid foundation; b) consistent empirical support; and c) has the potential to be used in technology acceptance and adoption at an organizational level.

Table 2. TOE Definition Factors.

Technology	Statement
1. Perceived Usefulness	Perceptions of the system's ability to improve subsequent work performance.
2. Security Concern	Perceptions of information security in using the system to improve subsequent work performance.
Organization	**Statement**
1. Top Management Support	Support and involvement of top management on the use of the Smart Waste Management System.
2. Organizational Readiness (Size)-(Human, technical and financial resources)	Focus on the strength of the organization in using the resources accordingly.
Environment	**Statement**
1. Costumer Readiness	Customer readiness for using the technology will affect adoption of the Smart Waste Management System, which depends on the relationship between organization and customer.
2. Government Regulatory	Government strategies or initiatives that encourage consumers to accept the Smart Waste Management System

C. Culture

There are many cultural differences that exist between different countries, which influence the ability of multinational organizations to embrace and use technology (Straub, Keil & Brenner, 1997). Akhtar (2018) argues that cultural factors need to be included in the acceptance model. It refers to the use of information systems influenced by culture (Im et al., 2011). The cultural dimensions of countries have been widely used to distinguish between them (Hofstede, 2011). A study by Blut et al. (2016) confirms that cultural dimensions change the effectiveness of acceptance factors in the use of technology in different countries. Therefore, cultural factors act as important moderators in technology adoption (Baptista & Oliveira, 2015; Srite & Karahanna, 2006). There are several studies that have modeled Hofstede's cultural dimension as a moderator

(e.g. Goularte, 2018; Khan et al., 2017). Although Hofstede's model is generally accepted as the most comprehensive national cultural framework, its validity and limitations have been criticized by some researchers (Baptista & Oliveira, 2015).

D. Research Model and Hypotheses

Despite the popularity of the Hofstede's cultural dimension model and its high praise, it has been criticized for focusing only on values that clearly ignore other important cultural layers such as practices, traditions, cultural artifacts, and more (Taras, 2017). Whereby his conceptual Onion Model of Culture is different from the cultural dimension model, which has rarely been challenged (Richter, 2016).

Relatively, local culture research on technology acceptance and adoption has received little attention in previous studies. In this paper, the proposed model incorporates with three antecedents of acceptance as manifested in (i) local knowledge culture, (ii) local basic assumption culture, and (iii) local beliefs culture, owing to the varied influences exerted by this local culture on the intention to use the SWMS (see Figure 1).

These antecedents of acceptance will have to be treated as moderating variables affecting the relationship between TOE factors on SCTs acceptance. There is a need to balance between the need to adapt to local practices and customs, and the need to standardize best practices across national boundaries (Friedman, 2007), in order to use the technology.

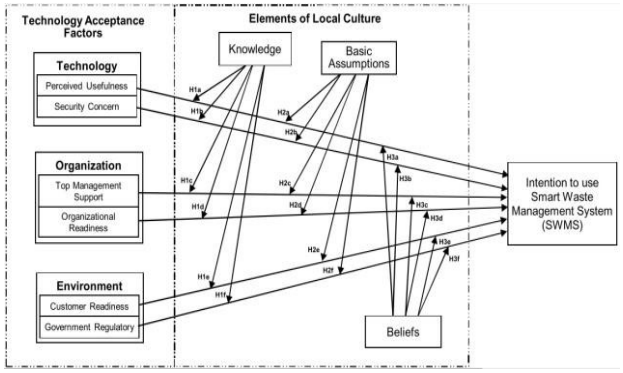

Figure 1. Research Model

Local Knowledge Culture

The definition of culture by Edward B. Tylor (1871) mentions that knowledge is one of the elements which is acquired by an individual as a member of the society. There are several researches which have defined knowledge culture in terms of the organizational culture itself (Oliver & Kandadi, 2006; Wu et al.. 2011). However, the discussion so far has laid a foundation for defining knowledge culture (Travica, 2013), and it can be inferred that currently there is no standard definition for local knowledge culture.

Local Knowledge Culture is depicted to influence TOE Frameworks among members of the local society, whether that technology is useful or not to them. And the knowledge about that technology in terms of its usage, its benefits and usability, will be shareable to the facets of the local society. When the technology is introduced and brought into an area where most of the people are less exposed to current technology, it will lead to the rejection and possibly the failure of the technology. This is due to the lack of knowledge related to SWMS. Therefore, the hypotheses of this study of local knowledge culture are:

H1a: There is a significant impact of local knowledge culture as a moderator between perceived usefulness and the intention to use SWMS.

H1b: There is a significant impact of local knowledge culture as a moderator between security concern and the intention to use SWMS.

H1c: There is a significant impact of local knowledge culture as a moderator between top management support and the intention to use SWMS.

H1d: There is a significant impact of local knowledge culture as a moderator between organizational readiness and the intention to use SWMS.

H1e: There is a significant impact of local knowledge culture as a moderator between customer readiness and the intention to use SWMS.

H1f: There is a significant impact of local knowledge culture as a moderator between government regulatory and the intention to use SWMS.

Local Basic Assumptions Culture

Basic Assumptions which are been ignored within a society and create patterns of cognition, perceptions and feelings displayed by the members of the group (Schein, 2010). Basic Assumptions of a particular culture tends to prescribe the ways its members perceive, believe, think, and evaluate the world, self, and others (Asma, 2000). These basic assumptions need to be understood because they provide the basis to the differences in thinking and acting. Failure to look at these basic assumptions can cause people from one culture to evaluate people from another

culture by using their own cultural assumptions. In this research study, basic assumptions among the society in the local area can be an indicator of whether the society is ready to accept SWMS or not. Therefore this study leads to see whether:

H2a: There is a significant impact of local basic assumptions culture as a moderator between perceived usefulness and the intention to use SWMS.

H2b: There is a significant impact of local basic assumptions culture as a moderator between security concern and the intention to use SWMS.

H2c: There is a significant impact of local basic assumptions culture as a moderator between top management support and the intention to use SWMS.

H2d: There is a significant impact of local basic assumptions culture as a moderator between organizational readiness and the intention to use SWMS.

H2e: There is a significant impact of local basic assumptions culture as a moderator between customer readiness and the intention to use SWMS.

H2f: There is a significant impact of local basic assumptions culture as a moderator between government regulatory and the intention to use SWMS.

Local Beliefs Culture

Inspired from Hofstede's Onion Model, local beliefs culture was proposed based on values and rituals which can be explain in two perspectives; 1) social beliefs; and 2) religious beliefs. Social beliefs are the tenets or convictions that people hold to be true where individuals in a society have specific beliefs, but they also share collective values. Religious beliefs are the collection of cultural systems, belief systems, and worldviews that relate humanity to spirituality and sometimes to moral values. Beliefs are also the main driver for the construction of any person's general view of the world and the whole core community has in common (Richter, 2016). Due to reflections, which directly are influenced through several factors, beliefs might differ in detail, on the level of both sub-societies and individuals. The local societies which have strong beliefs are expected to have an influence on the technology in terms of social and religious beliefs, and hence conflicts on the usage of SWMS. This study suggests finding whether:

H2a: There is a significant impact of local beliefs culture as a moderator between perceived usefulness and the intention to use SWMS.

H2b: There is a significant impact of local beliefs culture as a moderator between security concern and the intention to use SWMS.

H2c: There is a significant impact of local beliefs culture as a moderator between top management support and the intention to use SWMS.

H2d: There is a significant impact of local beliefs culture as a moderator between organizational readiness and the intention to use SWMS.

H2e: There is a significant impact of local beliefs culture as a moderator between customer readiness and the intention to use SWMS.

H2f: There is a significant impact of local beliefs culture as a moderator between government regulatory and the intention to use SWMS.

IV RESEARCH DIRECTION AND CONTRIBUTION

We have chosen our samples from 7 local authorities in Terengganu State, Malaysia, which involve as many as 700 stakeholders as respondents (e.g., vendors, contractors, communities, and staff). The target for the samples is to have at least 100 respondents from each local authority who will be using or have been using SCTs such as **SmartBins**, smart parking and more. Our data collection instruments will focus on local cultural elements (knowledge, basic assumption and beliefs) on the intention to use SWMS through a questionnaire. We will formulate close-ended, multiple-choice questions to reflect our research questions, so that the answers will satisfy our research objectives. The measuring items or indicators will measure each hypothesis using a Likert scale ranging from 1 to 5. The findings from this study are expected to contribute to empirical research on local cultural factors that influence the technology, organization and environment of technological decisions by local communities. These contributions would be explored from the government's perspective, given the importance of local cultural factors in bringing new technologies to the people and ensuring that they use them. This study is designed to enable the government to formulate policies, plans and target appropriate factors to support the adoption of new technologies in society.

V CONCLUSION

This paper presents a research in progress work on proposing a research model describing the phenomenon of moderating effects of local cultures on SWMS acceptance. The model describes how the

role of local cultural factors would moderate the relationships between technology and the intention to use the technology among the local society and its stakeholders, which would lead to its acceptance. The model brings the heterogeneous nature of local culture elements (knowledge, basic assumptions and beliefs) into the research matters on moderating SWMS acceptance.

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