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An Examination of Barriers to the Adoption of Smart Living Services: A Case Study of the Al-Madinah Region Development Authority

(Full Paper)

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ABSTRACT

The Middle East region is undergoing significant changes due to the growing number of people migrating to the cities. This has influenced the growth of progressive smart city initiatives and agendas, which seek to improve the quality of people's lives using technology-enhanced services. From health care to transportation, platforms to support smart living services are being developed and promoted as part of these efforts. Thus far, there has been slow adoption of these new technologies. This paper explores why people resist the very technologies that are being created to improve their lives. We use innovation resistance theory to examine functional barriers that hinder the adoption of smart living services in Saudi Arabia, in order to help inform the policy and marketing efforts of governments seeking to establish smart cities.

Keywords: Barriers to innovation, Innovation resistance theory, Middle East, Smart living services.

INTRODUCTION

The growth of and interest in the establishment of smart cities has reached significant levels in the Middle East. According to researchers, at least 11 of the 17 countries in the region have begun planning or implementing agendas for smart city development to support growing populations (Maheswaran & Badidi, 2018; Misbahuddin et al., 2015; Washburn et al., 2009; Zahran, 2013). Over €107 billion are being poured into these efforts (Fint, 2017; Pan, 2018) but there is significant consumer resistance that should be of concern to those promoting smart cities. By examining the types of services being offered to customers, we can better understand why these consumers are not using the health, energy, entertainment, and surveillance technologies necessary for cities to be 'smart'.

This study considers people's views on the smart living services that are available to them, in order to identify reasons for some individuals choosing not to use them. By examining the reasons for the lack of interest in, or awareness of, smart living services (W. Keijzer-Broers, Nikayin, & De Reuver, 2014), this study will contribute to helping Middle Eastern countries build better cities and related amenities.

Research into smart living services adoption is vitally important to national and regional agendas that seek to diversify oil-based economies. Use of technology is seen as an opportunity to do so, since the data that can be gathered can be used to build new devices and platforms for smart living services. Strategic decision makers in Middle Eastern nations want to ensure they can continue to enhance the quality of life for all by providing a high level of services. However, acceptance of emerging information and communications technology (ICT)-based applications by citizens in the Middle East faces a profound challenge (Aldraehim, 2013; Alshehri, Drew, Alhussain, & Alghamdi, 2012; Khan, Woo, Nam, & Chathoth, 2017). One of the biggest challenges to acceptance is the adoption rate of the new technologies (Almuraqab & Jasimuddin, 2017; A. Baabdullah, Dwivedi, & Williams, 2013; A. M. Baabdullah, Alalwan, & Al Qadi, 2018).

The adoption rate of new smart technologies is a topic within smart living research that requires more exploration. This paper examines barriers to the adoption of smart living services and identifies issues that are critical to technology innovation and policy. The goal of this paper is to examine the challenge in increasing the adoption of smart living services, using innovation resistance theory to explore functional and psychological barriers. The results of a five-month case study conducted in Madinah, a major city in Saudi Arabia, suggest that the resistance to certain types of barrier goes beyond the two established in the literature (i.e., functional and

psychological obstacles). These results are unique and impactful and contribute to the knowledge needed for smart cities to function as required.

LITERATURE REVIEW

This section presents research from the smart living literature, highlighting and discussing barriers to usage with a focus on smart living services (W. Keijzer-Broers & de Reuver, 2016). Innovation resistance theory provides a lens through which to examine how smart living products and services are made available, by focusing on where they have not been widely adopted. According to Nikayin and De Reuver (2015), lack of adoption presents a problem for financial decisions made by governments investing in building smart cities.

Smart Living and its Services

The rapid evolution of innovations in ICT and the internet of things (Vanston, Elliott, Bettersworth, & Caswell) (Vanston et al., 2006) for smart cities has created opportunities to enhance many people's quality of life, which is considered to be one of the main goals of the smart city agenda (Skouby, Kivimäki, Haukiputo, Lynggaard, & Windekilde, 2014). This goal is directly linked to the ICT/IoT platforms that enable smart living and is one of the six smart city characteristics (Giffinger & Pichler-Milanović, 2007). This is called smart living (SL), the area of focus in this paper.

Smart living is a trend that encompasses advancements that give people the opportunity to benefit from new ways of living (Riva-Mossman, Kampel, Cohen, & Verloo, 2016). The SL vision is to improve a population's quality of life and facilitate individuals' personal comfort (Nikayin, Skournetou, & De Reuver, 2011). Therefore, smart living services (SLS) are regarded as "mediators between providers and customers in the process of value creation" (W. J. Keijzer-Broers, Florez-Atehortua, & de Reuver, 2015, p. 2). These services are able to achieve the SL vision (Nikayin & De Reuver, 2011) by providing several ICT-enabled services linked with the IoT (Sudha Ram, 1987; Vanston et al., 2006). In leveraging ICT, SLS are capable of enhancing the quality of life for the inhabitants of a smart city (Chen, 2012). However, if the inhabitants of smart cities do not use the SLS, the smart city value chain is broken and the value delivery fails (Dameri, Benevolo, Veglianti, & Li, 2019). Therefore, it is clear how important SLS are to the success of a smart city in improving the quality of life of its population.

The pursuit of research into SLS is a recent trend in the information systems domain because many view this topic as part of the United Nations (UN) stainability goals and associated with social science research. SLS is a term used in research to refer to technology which is "applied to daily life to increase efficiency, affordability, and sustainability" (C.-K. Lee et al., 2011, p. 93). SLS are also seen as being capable of creating an urban environment able to "offer advanced and innovative services to citizens in order to improve the overall quality of their life" (Piro, Cianci, Grieco, Boggia, & Camarda, 2014, p. 1). However, the use of SLS should not be restricted to users and residents within the home; individuals should also be able to take advantage of external information in order to consider a range of novel service concepts (Nikayin & De Reuver, 2011).

Such opportunities can result in increased motivation for service providers from different industry sectors (e.g., energy, security, telecommunications, and health) to become interested in offering SLS (W. J. Keijzer-Broers, de Reuver, & Guldemond, 2013, p. 1). In this way, multiple actors, "sometimes from different industries, pool their resources and capabilities to create and capture value from new services and products" (Solaimani, 2014, p. 12).

SLS are increasingly being exploited by city governments, "changing the ways to interact with citizens and providing novel and interactive services" (J. Lee & Lee, 2014, p. 94). SLS s commonly provided to consumers living in smart areas via sector-specific service platforms. A service platform is used to "host a set of core functions (e.g., data storage, processing power, intelligent decision-making components)" and service suppliers deploy these platforms to create, run, and deliver value-added services to consumers (Nikayin & De Reuver, 2012, p. 19). In short, to achieve that vision, smart living provides several ICT-enabled services, such as those that gather the value drivers of health, energy, security and entertainment (Agahari, 2016).

Many of the current benefits accrued from these types of new technology involving enabled and enhanced services are considered to be 'just' an innovation or fad (Mani & Chouk, 2018), with implications for diversification and development. Evidence suggests that consumers may perceive SLS (smart homes, smart healthcare, smart grids, smart banking, etc.) as something new and different. Consequently, the view of SLS in this paper is as a form of social innovation that brings together tech-enabled environments for daily living. The perspective that is taken in this paper is that SLS are critical to sustaining a smart city, presenting a challenge for

sustainability, new business development, and improved quality of life for the Gulf State region. The next section describes barriers to the use of SLS to understand better why consumers resist the new technologies.

Barriers to Smart Living Services

In order to ensure the maximum benefit from SLS, it is necessary to make sure that smart living is optimally adopted. This study examines the barriers to adopting smart living services. As people become more accustomed to adopting and using SLS, data can be collected and then used to assist with urban planning and in overcoming various technological and regulatory challenges (Wilson, Hargreaves, & Hauxwell-Baldwin, 2015). Despite smart living explicitly promoting users' quality of life, SLS, although technologically feasible and acceptable (W. Keijzer-Broers, Florez-Atehortua, & de Reuver, 2016), are faced with a number of challenges, which include the following:

Lack of awareness among end users, to market commercialisation, to end-user acceptance, as to resistance.
Lack of awareness of what SLS are and what is available as part of these services (W. Keijzer-Broers et al., 2016).
Lack of knowledge of how these types of services can fulfil user needs (W. Keijzer-Broers et al., 2014).
Markets for these services also struggle as a result of a lack of appropriate market structures (Good, Ellis, & Mancarella, 2017), market mechanisms (Cappers, MacDonald, Goldman, & Ma, 2013), and market regulation (Nikayin & De Reuver, 2012).

These challenges hamper the adoption and widespread use of SLS (Balta-Ozkan, Davidson, Bicket, & Whitmarsh, 2013). At a higher level, according to Sundaresan Ram and Sheth (1989), two fundamental barriers emerge that cause resistance to innovation in general. Those barriers are generic to resistance to various types of innovation and are categorised as functional and psychological. Functional barriers include usage, value, and risk barriers, whereas psychological barriers are linked to traditional and image barriers associated with use. Later SLS researchers argued that information, technology, and system barriers were consistent with certain functional barriers and institutional barriers aligned with psychological barriers. However, a review of the literature suggests that research that focuses on barriers that inhibit the use of smart living services is limited, which indicates that this area is in need of further investigation (Balta-Ozkan et al., 2013; Nikayin & De Reuver, 2015). This study seeks to explore further the barriers preventing people using SLS, with a focus on innovation resistance theory as a means of analysing a case study.

A View of Innovation Resistance Theory (IRT)

The reasons for consumers not adopting innovation are not always clear in the existing literature. IRT describes resistance "by consumers to changes imposed by innovations" (Sudha Ram, 1987, p. 208) during new product adoption. Resistance can also arise due to "fears that a product could be dysfunctional or malfunctional" (Joachim, Spieth, & Heidenreich, 2018, p. 97). Sundaresan Ram and Sheth (1989) first explained that consumers face various barriers that limit their desire to accept innovation. Furthermore, these barriers are more likely to appear once consumers perceived considerable change as a consequence of adopting the innovation (Sundaresan Ram & Sheth, 1989). Barriers were then classified into the following two categories: functional barriers and psychological barriers (Figure 1).

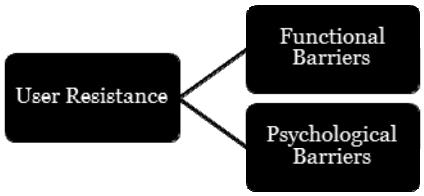

Figure 1: Types of barriers to innovation (Ram & Sheth, 1989)

Functional barriers are more likely to occur when a consumer perceives a significant change during a new product adoption (Ng, Lim, Lim, Ng, & Tan, 2013). According to Sundaresan Ram and Sheth (1989), functional barriers are directly related to three areas of the innovation itself:

usage patterns, which may give rise to usage barriers to a new innovation;
the value of the product or service; and
risks associated when adopting the product or service (see Figure 2).

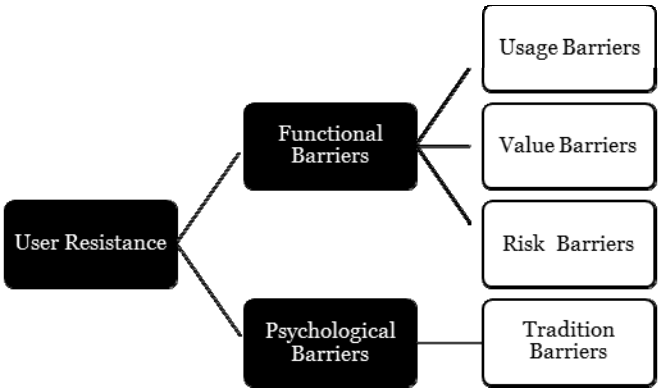

Figure 2: Innovation resistance theory (Ram & Sheth, 1989)

Psychological barriers emerge once an innovation conflicts with a consumer's social norms, practices, or individual usage patterns (Kleijnen, Lee, & Wetzels, 2009). These barriers are related to tradition (daily routines) and image (brand and product category) (Mani & Chouk, 2018). They come from traditional views, perceptions, and image views (Figure 2).

The two types of barrier are common to different types of innovation and are not specific to innovations in smart living services. However, as mentioned earlier, functional barriers can include usage, value, and risk barriers, whereas psychological barriers are associated with tradition and image barriers (Table 1).

Table 1: Types of barrier to innovation

Barriers		Definition	Sources
Functional Barriers	Usage barriers	Resistance towards a new invention due to its incompatibility with present routines, exercises, and plans.	Barati and Mohammadi (2009); Lian and Yen (2014); Lunsford and Burnett (1992); Moorthy et al. (2017); Sundaresan Ram and Sheth (1989); Rotchanakitumnuai and Speece (2003).
	Value barriers	Resistance towards the usage of products or services when they do not fulfil the user's perception of performance-to-price value in contrast with other substitutes.	Fain and Roberts (1997); T. Laukkanen, Sinkkonen, Kivijärvi, and Laukkanen (2007); Lian and Yen (2014); Moorthy et al. (2017); Sundaresan Ram and Sheth (1989); Rammile and Nel (2012)
	Risk barriers	Uncertainty regarding the possible negative consequences of using a product or service.	Lian and Yen (2014); Marett, Pearson, Pearson, and Bergiel (2015); Sundaresan Ram and Sheth (1989)
Psychological Barriers	Tradition barriers	The cultural change created for the customer by the innovation.	Cruz, Barretto Filgueiras Neto, Munoz-Gallego, and Laukkanen (2010); Hoeffler (2003); Joachim et al. (2018); Sundaresan Ram and Sheth (1989).
	Image barriers	The degree to which an innovation is perceived as having an unfavourable image.	Antioco and Kleijnen (2010); Chauhan and Choudhary (2018); Claudy, Garcia, and O'Driscoll (2015); Herbig and Day (1992); Talke and Heidenreich (2014).

Usage barriers have been defined as resistance towards a "new invention due to the incompatibility with present routine, exercise, and plan" (Moorthy et al., 2017, p. 39). These barriers are mostly linked to the usability of the service and the degree of behavioural change it requires from consumers in its use (Bagozzi & Lee, 1999; Kuisma, Laukkanen, & Hiltunen, 2007; T. Laukkanen et al., 2007). Once the innovation has been seen as incompatible with consumers' practices or customs, the consumers deliberately reject it because they perceive it as functionally inadequate and unsuited to existing workflows, practices or habits (Bagozzi & Lee, 1999; Gurtner, 2014; Sundaresan Ram & Sheth, 1989). Indeed, usage barriers seem to be the most common cause of consumer resistance to innovations (T. Laukkanen et al., 2007) because of values and risks perceived by both governments and consumers.

Value barriers are defined as resistance towards the usage of products or services (Rammile & Nel, 2012) when "they do not fulfil users' perception of performance-to-price value" (Moorthy et al., 2017, p. 40) or when the consumers have not achieved the desired experience during their use of the innovation . These barriers refer to a perceived lack of relative advantage or superior performance by the innovation over existing

alternatives (Hoeffler, 2003; Kuisma et al., 2007; T. Laukkanen et al., 2007). Consequently, an innovation must be better than "the idea that it proceeds" (David, 2014, p. 61).

Risk barriers are defined by Featherman and Pavlou (2003) as the "uncertainty regarding possible negative consequences of using a product or service" (p. 453). This type of barrier is used to explain the degree of risk associated with technological innovation (Sundaresan Ram & Sheth, 1989; Rammile & Nel, 2012). In the context of innovation, risk barriers refer to the degree of risk an innovation entails (P. Laukkanen, Sinkkonen, & Laukkanen, 2008; Sundaresan Ram & Sheth, 1989). According to Sundaresan Ram and Sheth (1989), "all innovations, to some extent, represent uncertainty and pose potential side effects that cannot be anticipated" (p. 208). Consequently, uncertainty is ingrained in innovations (P. Laukkanen et al., 2008) and, therefore, always entails at least some degree of real risk (Barati & Mohammadi, 2009).

Tradition barriers mainly refer to the change an innovation may cause in a culture or routine. The change an innovation may cause can "potentially be in conflict with existing traditions and norms of the consumers" (Gurtner, 2014, p. 8), which can, in turn, lead to resistance (Kleijnen et al., 2009). Thus, if norms and routines are "important to a consumer, resistance will be high" (Sudha Ram, 1987, p. 209). Claudy et al. (2015) regard an image barrier as the "degree to which an innovation is perceived as having an unfavourable image" (p. 530). According to Sudha Ram (1987), these barriers are associated with the origin of an innovation, such as the product class, industry, or the name of the firm. They show the consumer's feelings about the product itself, the manufacturer, or even the area in which the innovation was produced (Kuisma et al., 2007; Sundaresan Ram & Sheth, 1989).

In the service context, an image barrier raises the need for consumers to have human contact with their service experience (T. Laukkanen & Kiviniemi, 2010; Mani & Chouk, 2018). Evidence suggests that while some consumers obviously prefer individual contact throughout the period of service, others may seek personal contact only in a specific case, such as making a complaint, getting an answer to a particular question, or solving a problem. For example, some smart applications, such as "Monitor Your Weight", offer opportunities to consumers who suffer from obesity or who have awareness of and concern for their health to manage and reduce their weight, monitor their health status or receive information on how to improve their health.

In contrast, following the instructions of an application may generate changes in food culture or lifestyle. Individuals who see these changes as conflicting with existing routines, norms, and traditions are much more likely to resist those products (Gurtner, 2014). In response to a consumer preference for existing practices and products, an innovation needs to offer better value and performance in order to become accepted (Sudha Ram, 1987). Physical, economic, functional, and social risks influence resistance, in addition to traditions and norms, usage patterns, and perceived value and image (Kleijnen et al., 2009). This study focuses on functional barriers, as these are identified as the major obstacles to accepting innovation (T. Laukkanen, 2016; Mani & Chouk, 2017).

The IRT model has been applied and tested and is supported by past studies that focused on technological innovations in services (Table 2). Examples of these areas of innovation include mobile and internet banking (P. Laukkanen et al., 2008; T. Laukkanen, 2016), online shopping (Mani & Chouk, 2018), and the IoT (Moorthy et al., 2017; Vanston et al., 2006).

Table 2: Research that has utilised IRT

Title	Justification for using IRT	References
Consumer Resistance to Internet Banking: Postponers, Opponents and Rejectors.	To understand the innovation resistance to using internet banking.	P. Laukkanen et al. (2008)
Consumer Resistance to Innovation in Services: Challenges and Barriers in the Internet of Things Era.	To provide better understanding of the barriers that lead to consumers' resistance to smart services as an innovation.	Mani and Chouk (2018)
Consumer Adoption versus Rejection Decisions in Seemingly Similar Service Innovations: The Case of the Internet and Mobile Banking.	To test how five theory-driven adoption barriers and three key consumer demographics influence consumer adoption versus rejection decisions in two seemingly similar service innovations.	T. Laukkanen (2016)
Barriers of Mobile Commerce Adoption Intention: Perceptions of Generation X in Malaysia.	To explore resistance factors to understand the reasons for the low adoption of mobile commerce among Generation X in Malaysia.	(Moorthy et al., 2017)

Applying Innovation Resistance Theory to Understand User Acceptance of Online Shopping: The Moderating Effect of Different Product Types.	To understand online users who know about but never (or rarely) use online shopping.	Mani and Chouk (2018)

The literature selected above provides a clear interpretation of how technology scholars have realised and studied the importance of IRT and the reasons behind the phenomenon of resistance to innovation. For instance, in 2008, when the concern was to understand why a large proportion of bank customers were resistant to using internet banking, the researchers used IRT as an appropriate theory to study the phenomenon. In 2012, when researchers sought a better understanding of the barriers that lead to consumer resistance to smart services, considering that smart services were a form of innovation, they also used IRT. Likewise, when researchers in 2017 and 2018 intended to explore resistance factors to understand the reasons for not accepting innovations such as mobile commerce and online shopping they also employed IRT.

IRT is seen as one of the most suitable theories for consideration "by any future researchers who would conduct research relating to technological innovation" (Moorthy et al., 2017, p. 53). IRT was, therefore, considered appropriate for exploring this topic in Madinah in Saudi Arabia. The next section discusses how IRT was employed in this study to explore the barriers that affect use and adoption in order to better understand consumer resistance to SLS.

RESEARCH METHODOLOGY

This section describes the research approach taken to study SLS barriers in a Middle Eastern cosmopolitan area with a strong smart city agenda. Using a qualitative approach, data were gathered through semi-structured interviews to reveal factors that have an impact on functional barriers.

Research Approach

The research objective of this study is to build a Smart Living Services Barriers model. This approach seeks to improve our understanding of barriers through identification and classification in order to better examine why people resist the use of smart living services. To achieve an objective, research methods are the channels "through which data is being gathered and analysed within a research study" (Kellmereit, 2015, p. 44) and usually involve a quantitative, qualitative or mixed methods approach. According to Marshall and Rossman (1989), the selection of qualitative research methods depends on the purpose of the study. The value of qualitative research lies in "understanding rather than measuring the difference" (Ritchie, Lewis, Nicholls, & Ormston, 2013, p. 52). Using a qualitative method is the best approach to gaining in-depth understanding of a situation or behaviour (Pope & Mays, 1995) and was thus deemed appropriate for this research. The findings will help to understand the causes of existing barriers and it is argued that examining the barriers will lead to the analysis and creation of practical solutions for real-world issues, which will contribute to increasing the adoption of smart living services.

This research adopted a qualitative approach in order to address the research question and fulfil the research objective. Other researchers in the smart services field (Chouk & Mani, 2019; Luo, Lee, Mattila, & Liu, 2012; Sprenger, 2016; Szmigin & Foxall, 1998) have also used a qualitative approach to study issues relate to IRT. There is a general consensus that a qualitative case study methodology is the most appropriate to exploring barriers to the use of SLS, as this approach is considered to be the most effective for examining the reasons for, or explanations of, phenomena or their different impacts and consequences and how they vary between groups (Ritchie et al., 2013). Furthermore, the approach facilitates more comprehensive exploration and analysis for understanding the reasons that influence a population in their use/non-use of smart living services.

Case Study: SLS in the Al-Madinah Region Development Authority (MRDA)

To diversify the economy and develop public service sectors such as health, education, infrastructure, recreation and tourism in the Kingdom of Saudi Arabia, the Saudi government launched the *Saudi Vision 2030*. One of the main goals is to provide "a high-quality lifestyle to the citizens with modern architecture, smart mobility systems, adequate water and energy, public systems accompanied by a lush green space" (Vision, 2016). To achieve this goal, five of the biggest cities in the Kingdom were selected to be transformed into smart cities. One of the five cities is Al-Madinah Al-Munawarah, which was selected because it had hosted c.12 million visitors by 2018. That number is expected to increase to 15 million by 2020, and 30 million by 2030. In addition to the inhabits, the millions of visitors also have expectations of a good level of services in the city, which is a significant site of pilgrimage for Moslems around the world.

Linked to the goals laid out in the Vision 2030, Madinah's local government established the MRDA. In order to provide high-quality services for both inhabits and visitors, the MRDA conducted and supervised many non-technology projects, such as infrastructural improvements, increasing green areas, and undertaking technology projects such as the implementation of a digital transformation plan. However, this study will focus on the city's technology projects. The MRDA's technology projects aimed to provide a smart living area, in which SLS can be utilised to improve the quality of services. The MRDA was then expanded to include internet services via a fibre optic network for the entire city. Furthermore, the free Wi-Fi in the centre of the city ensures that all inhabitants and visitors can benefit from SLS. Smart parking, smart public transport cards, and translations of the Friday prayers and sermon into more than 15 languages via smart phones are examples of the SLS provided by the MRDA.

In sum, this city was chosen as the case study because it has many smart living services currently running that aim to enhance the quality of life for inhabitants and visitors and many are free and easy to use. This presents a case to be examined in order to establish what barriers exist to SLS adoption for the Middle East region. The researchers approached MRDA department heads and a randomly selected group of the Authority's customers to explore resistance to the SLS being deployed.

Data Collection and Analysis

Sixteen semi-structured interviews were conducted at MRDA offices using open-ended questions. The interviews were between 45 and 86 minutes in length and took place with six MRDA head managers (M) and 10 MRDA customers (C). The managers were chosen as they were responsible for SLS and had performed a variety of tasks within the MRDA (Table 3) related to deployments of active SLS. The customers were chosen randomly, based on all having received marketing campaign information from MRDA about the features of their properties.

Table 3 Interview breakdown

No.	**Interviewees**	**Length of interviews**
1	Head of Technology and Systems Department	59 min.
1	Head of IT Management	73 min.
1	Head of Digital Cities Programme	86 min.
1	Head of Survey and Geographic Information Systems (Hielkema & Hongisto) Department	66 min.
1	Head of Projects Department	52 min.
1	Head of the Office of Realisation of Vision 2030	62 min.
10	Customers of MRDA	517 min.
16	Total	15 h and 25 min.

All the interviews were digitally recorded with prior permission from the participants. All the interviews were later transcribed *verbatim* for analysis. The data collected were analysed using three coding techniques: open, axial, and selective coding (Birks, Fernandez, Levina, & Nasirin, 2013; Jones & Alony, 2011), supported by the NVivo software program. Initial codes (331) were then reviewed, analysing the relationships between them, and summarised into a total of 99 concepts (axial coding). The concepts were then categorised into 34 categories (selective coding).

The open coding technique was employed first to analyse the data (Biswas & Sarkar, 2000). The transcript of each interview was examined to capture important concepts related to barriers to the use of smart living services. Barriers could include any physical or non-physical obstacle or reasons that prevented or made it difficult for people to adopt smart living services. The data were coded based on concepts identified in the literature and the results are presented in Table 4.

Table 4: Process of analysing data

Category	Concept	Code/Open Code	Excerpt
Lack of infrastructure	The need to have an appropriate infrastructure	No underground infrastructure	Interviewee 2 M: "*there is a lack of underground infrastructure*."
		Not a fit with infrastructure	Interviewee 11 C: "*I used to have a smart electric meter in my house. It was an excellent device and it had saved me time, money and effort. When I wanted to buy the newer version, which was easier to install, I couldn't activate*

			it because it did not fit with the same building."
	Consumers have to understand what SLS are	Customers need help to understand	Interviewee 13 M: "*I think there has to be awareness and education in this marketplace to help the customer understand, you know, the value there, as a customer understands the benefit of using*."
		Low level of understanding	Interviewee 3 M: "*when that development was done, there was very low level of customer understanding*."
Lack of usability	Level of difficulty in using SLS	Smart technology means it is more difficult	Interviewee 10 C: "*I think technology is difficult already, when you go smart, it's even more difficult*."
		Difficult to use	Interviewee 14 M: "*I stopped using this service when I found that it was difficult to use in some regions of Saudi Arabia; there were some delays*."
	The need to access SLS easily	Accessibility	Interviewee 13 M: "*there are many places in the world that offer free Wi-Fi, but they first require the user to enter either his phone number or his email*."
		Limited access	Interviewee 1 M: "*Some smart services are not available to the public, but it is available for some sectors that need it*."

If a statement made in an interview referred directly to a barrier described in the literature, such as "*there is a lack of underground infrastructure*", the code given was "No infrastructure". Next, this code was merged with similar codes, such as "Need for smart infrastructure" to create one concept: "The need to have appropriate infrastructure". Likewise, this concept was merged with a similar concept, such as "Consumers have to understand what SLS are", to create one category: "Lack of infrastructure". The next step was to merge this with a further similar category, such as "Lack of usability". This process was applied to all the interviews to analyse the data. The final step was to combine the two newly formed categories under the "Usage barriers" classification (Figure 3).

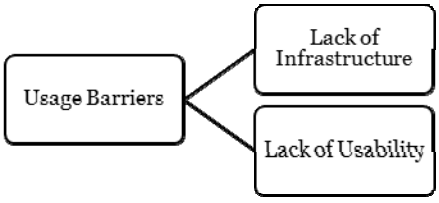

Figure 3: Process of data analysis

If a statement referred to a number of benefits, such as "*when we transferred to smart services, we saved a lot of money, it provided a perfect service in a short time, made the right decisions, and reduced the effort with the high quality of the services*", the code assigned was "Need to convert to SLS". The same process as the one referred to above was also applied at this stage.

Finally, if a statement referred indirectly to a barrier, such as "*I think there's a very different level of customer understanding*", indicating a lack of understanding of SLS among customers, which is clearly seen as a barrier, the except was coded as "Different level of understanding". The same process of analysis was applied here too.

The next section presents a discussion of the findings of the preliminary analysis of the data that centred around functional barriers and extends our view of SLS adoption.

FINDINGS

This section presents the findings from the 16 interviews conducted for the study. The analysis identified three new additional barriers that have not previously been identified in the literature: lack of user feedback, lack of migration incentives in the use of SLS, and lack of language options.

Support for Functional Barriers to SLS Adoption Identified in the Literature

Generally, the data were consistent with the barriers identified in the literature. Rapid development, lack of knowledge, lack of awareness, and poor understanding of user needs are examples of barriers that have been identified in previous literature and were also found in the interview data. Some of the interviewee statements that clearly support previous findings are presented in Table 5.

Table 5 Barriers identified in the literature and the current research data

Literature reference	Code	Data
Nikayin and De Reuver (2015); Shieh, Yeh, and Lai (2013)	Rapid development	Interviewee 16 M: "*Well, technology is developing very rapidly, and every day there's something new. So, sometimes, if I don't use the device in a certain period, I will be too late. You can imagine how many technologies you have witnessed in the past 30 to 40 years. The development pace is very rapid, and if you don't keep up with it, you will be left behind*." Interviewee 13 M: "*It's a bit difficult for us to catch up with the leading countries when it comes to technology. We couldn't catch up with the rapid technological development*."
W. Keijzer-Broers and de Reuver (2016)	Lack of knowledge	Interviewee 5 M: "*The first one is the lack of knowledge about technology itself. The second cause is that some technologies are hard to understand and implement in the beginning for some people. So, you should make everything clear for the user. There are many things that people ignore. There are people who don't believe that some devices can really do the technological tasks described*." Interviewee 11 C: "*I see the main barrier is the lack of knowledge. Also, some smart living services have a level of difficulty in 1) registration and 2) in use as well*."
W. Keijzer-Broers et al. (2016); Saied Al Surf, Trigunarsyah, and Susilawati (2013)	Lack of awareness	Interviewee 1 M: "*That's why I talked about awareness. You should educate people before introducing the service. Do you know why the Malaysian and Indonesian experience was successful? Because they made people aware before they introduced their smart services. They show people renderings of the smart cities with all the details so they can get familiar with them*." Interviewee 2 M: "*There was very, very little awareness at that time here in the regional market of smart services and smart capabilities."* Interviewee 6 C: "*So, I started discovering the useful features that I didn't know before. I think one of the barriers is that sometimes the technology is too advanced for a region. The first thing is cultural awareness*."
Wilson et al. (2015)	Poor understanding of user needs	Interviewee 7 C: "*They take notice of the problem, but the solution isn't always implemented in the way that the user likes*." Interviewee 10 C: "*That there was a mismatch between the smart services brought in the country with the needs of the residents…You can't take a service from another country and implement it here. We have our own needs and problems. And that's what makes a service successful or not, it's whether or not it's customised*."

With the rapid development of SLS, the participants commented that smart services were being developed very rapidly, thus making most of the services obsolete in a short period of time. It was also difficult for developing countries to catch up with developed ones due to the rapid technological development of the latter. With the lack of knowledge of SLS, interviewees stated that one of the main barriers to innovation was a lack of knowledge - people did not have the know-how to use smart services. It was, they felt, difficult to use some of the SLS. Together with the lack of awareness, interviewees reported that there was not enough cultural understanding and realisation of the importance of scientific research in technology. The developers of the systems did not create awareness of the existence and usage of smart services. Finally, in terms of the poor understanding of user needs, participants noted that there was a disconnect between what was available in the market and what users needed.

New SLS Barriers Identified from the Current Case Study

In addition to the interviewees confirming much of the existing research regarding barriers, three new barriers emerged from the data collected for this case study. The newly identified barriers have implications for innovation resistance theory, SLS adoption by Middle East consumers, and smart living policy. The new barriers are described below and detailed in Table 6.

Table 6 New barriers identified from the data

Barrier	Definition	Data
Lack of user feedback	Lack of information opportunities for customers to express their user experience (good or bad), opinions, advice, or comments about the smart living services they are using.	Interviewee 13 M: "*I should ask them for their feedback and the problems that they have experienced. These people can be aware of problems that I don't know about from my position*." Interviewee 13 M: "*So, today, the feedback from the people working on the site rarely reaches the decision makers*." Interviewee 1 M: "*The problem is most of the smart living services have no feedback icon that gives consumers the chance to share their experience or their issues they have faced. So, if the supplier provides feedback in an easy way, I think this will maybe help to overcome some issues*." Interviewee 13 M: "*No smart living services have asked me to leave feedback*." Interviewee 13 M: "*The absence of feedback is a barrier; it does give you an idea about the gaps in your service*." Interviewee 13 M: "*The companies should ask for user feedback*." Interviewee 13 M: "*There are things that only the visitor who is close to the service knows; maybe I don't know about those things since no feedback has been given.*"
Lack of migration incentives in the use of SLS	Lack of motivation for individuals to migrate to smart living services.	Interviewee 14 M: "*In technological applications, there should be incentives that attract people to use the service*." Interviewee 10 C: "*In my opinion, if the technology is first adopted by the government and its institutions, that will motivate people to adopt it faster than if there were only individual people putting their effort to use the service*." Interviewee 14 M: "*Especially here in Saudi Arabia, nobody gives you motivation to use the technology. We lack the encouragement to utilise the advanced technology and we also need to start using it in order to keep up with developed countries*."
Lack of language options	User cannot find an appropriate language to enable him/her to use smart living services.	Interviewee 13 M: "*I can say language is a barrier. Sometimes, the technology is available either in English or two languages only: the local language and one foreign language*." Interviewee 9 M: "*The differences in language are a huge barrier. We provide a very advanced service to the visitors, but the problem is the visitors to the Prophet's Mosque are from all nationalities and speak all kinds of languages, so the differences in language are a problem, we can't provide that services with all languages.*" Interviewee 14 M: "*But it is indeed...a barrier when someone comes from another country and he knows neither Arabic nor English. We need to provide him with support to use our smart services.*" Interviewee 16 C: "*I bought from Amazon, a smart device [virtual reality glasses] from China but I couldn't use it because it was in Chinese*."

The first new barrier discovered was the lack of user feedback and can be defined as a lack of information opportunities for customers to express their user experience (good or bad), opinions, advice, or comments about the smart living services they were using. This barrier represents two different perspectives: a managerial perspective and a user perspective. From a managerial perspective, some of the SLS managers regard feedback from users as a pillar to use to keep improving and to fix issues that may appear for consumers from time to time. The result will then be improved, advanced SLS free of error.

The data show the interaction between the SLS and the user, which is positively reflected when users see that their feedback has been considered by the decision makers. Therefore, users may feel that they have become partners in the success of a service, as their feedback has been used to work towards the development of the product. This may increase users' loyalty in adopting more services in the future. Other feedback from SLS users shows potential and dynamic interest among consumers. Therefore, providing feedback to decision makers will increase the efficiency of SLS, which will lead to increased adoption of those services. In contrast, from the user perspective, some customers regard the absence of a feedback icon as a disadvantage, which may cause them to leave the service and they may not use it again. Thus, the presence of a feedback icon in smart living services could contribute significantly to reduced resistance.

The second barrier evident from the data is the lack of migration incentives in the use of SLS. This barrier can be defined as a lack of motivation in individuals to migrate to using smart living services. One of the interviewees, 14 M, stated that "*there should be incentives that attract people to use the service*". Therefore, as ease of use is not the only reason to use SLS, individuals might start to move towards using SLS instead of a traditional facility if there were an incentive to use the new services. Moreover, one of interviewees, 10 P, remarked that the adoption of SLS by the government could be considered a major motivation to people to want to adopt SLS. However, the lack of migration incentives will cause resistance to SLS, especially in people who see no reason to leave the traditional services with which they are familiar.

The third new barrier observed in the data was the lack of language options. This barrier appears when users cannot find an appropriate language to enable them to use smart living services. This causes a barrier to people starting to use SLS. Limited language options within SLS, with only two languages used currently, presents a barrier for people who speak other languages. One interviewee made this point by stating that "*we provide a very advanced service to visitors, but the problem is the visitors to the Prophet's Mosque are of all nationalities and speak all kinds of languages, so the differences in language are a problem. We can't provide the services with all languages"*. Thus, multilingualism in SLS is essential for both the people using the services and for the SLS providers to ensure that what is being offered is fully useable.

In summary, the three new barriers identified above contribute directly to resistance to the adoption of SLS. The squares shaded grey in Figure 4 illustrate the three newly identified barriers that represent the contribution of this paper to IRT: lack of user feedback, lack of migration incentives in the use of SLS, and lack of language options. The evidence suggests their significance as barriers to adoption, providing insight into why individuals resist the new SLS options. It is recommended that these barriers should be addressed in order to increase the adoption of SLS.

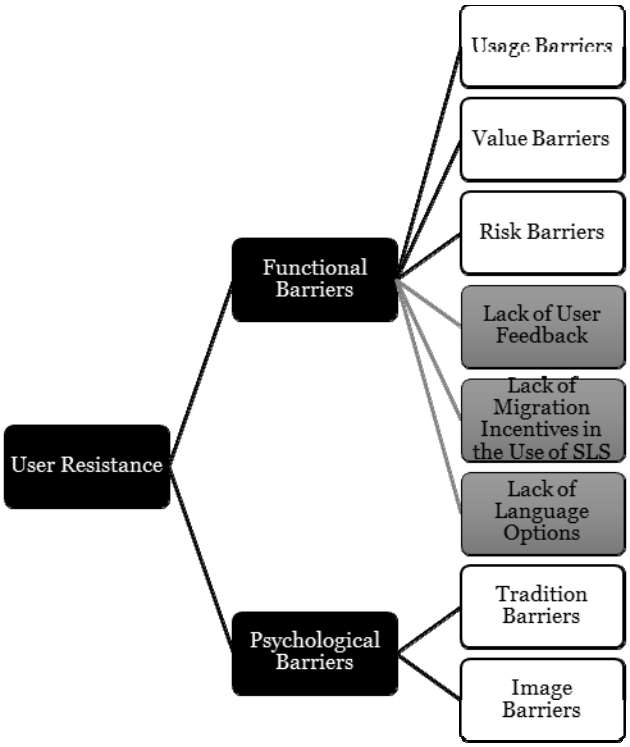

Figure 4: Barriers to adopting smart living services

This study was conducted in a region that has shown an interest in increasing the number of smart cities. It is important as a case study to help understand the reasons for people resisting using and adopting new technologies that are made to improve the quality of their lives. The data suggest that the three new barriers identified in the study are significant because they represent factors that have an impact on the government's ability to operate SLS platforms successfully. This means that governments that are trying to build more smart cities need to consider how these barriers will limit the functions of the technology in their cities. A potential limitation of this study is that the case study was conducted in a region that is well resourced, where the government has been working on the smart city model for a number of years with well-established investment in new infrastructure. Another potential limitation is that the study was conducted in one place; future research should be conducted in multiple places in the region to examine if the evidence presented here is consistent.

DISCUSSION

This section provides conclusions regarding the study findings and outlines their implications for technology adoption and resistance to it. It describes why the findings are important to successful outcomes for the smart city agenda. By changing how governments present SLS technology to their citizens, who are also their consumer base, policies and practices can be changed to benefit everyone. The section concludes with implications for theory, practice, and policy.

Study Impact and Future Research

This study explored a region of the Middle East at the centre of the Smart City Global Initiative. Policies, infrastructure investments, and other financial support have helped to realise the potential in the region's ability to shape future cities. The region's cities are experiencing a boom in unprecedented ways due to a number of challenges caused by war and migration. This means that the systems that are supposed to help people experience a better quality of life have to be easy enough for them to use in order to obtain that improvement in standards. The literature review presented barriers in light of a progressive smart cities agenda and policies that are rapidly developing the technology to demonstrate that, by using data, people can achieve a better quality of life. In order to achieve improvement, there is a need for services in the areas of health, energy, transportation, and even entertainment to support a higher living standard. Smart living services are critical to the success of the smart city agenda and its adoption, offering key insights into how data are collected to power new IoT platforms. The research supports claims that SLS adoption is an indicator of the success of the policy.

This study used innovation resistance theory to investigate the barriers that the existing literature shows can cause resistance to innovation. Although experts agree that there are functional and psychological barriers associated with use, values, risk, traditional, and image, this study suggests there may be more. Prior to this

study, there had been no research carried out to explore and examine barriers to the adoption of smart living services. Thus, examining barriers to the adoption of SLS is a critical issue that challenges the existing research on innovation adoption and resistance. What this study shows is that people resist technology because it is not 'speaking their language' and because there is no way to give feedback. It is possible that the sentiment to use this technology is not there due to the lack of an incentive to encourage its use.

A future direction of research could be to delve deeper into technology adoption to establish if it relates to a short- or long-term change. Research could look more closely at the government departments that help to support SLS platforms, track how many people use the platforms and how long they stay using them. When numbers dip, that would be the time to offer marketing promotions to stimulate interest and remind people that the services are helpful. This could, for example, be a reminder that a tracker could let travellers know when the next train or taxi is due to arrive or it could be that a monitor can tell doctors about changes in blood pressure or blood sugar. There are many ways that IRT could be used as part of an SLS adoption strategy to help the smart city agenda that have yet to be explored.

Implications for Adoption Research, Adoption Practice, and Smart City Policy

The research found a number of implications for research, as IRT theory can be applied and extended to other areas of technology use. Additional implications for practice to better develop the right SLS technology point to policy implications as governments are making aggressive attempts to implement new policies and initiatives quickly.

The IRT model has been expanded in this study to include three additional barriers: lack of user feedback, lack of migration incentives in the use of SLS, and lack of language options. This expanded theory gives future researchers more dimensions to consider in order to explore the reasons for people's resistance to innovation. Departments in governments that are responsible for monitoring SLS platforms should also be able to find ways to determine actual usage. They should provide ways for people to give feedback and voice their concerns if the platforms are not doing what they are supposed to do. These departments have the ability to change features, so that by listening to people, they can employ better ways to support them. There is a lot of funding around smart cities, and this money should be used wisely.

This study examined people's views of the smart living services that are available to them and identified reasons for resistance to them. By examining the reasons for a lack of interest in or awareness of smart living services, the study will contribute to helping Gulf states build better cities and amenities. Another important reason for smart living services adoption is the impact that it could have on the diversification of an economy. For many in the Gulf state region, there is a need to move beyond being an oil-based economy. Technology provides an opportunity to do this, so better understanding of why people resist this innovation offers a means to improve SLS.

REFERENCE

Agahari, W. (2016). Can ICT Contribute to Achieve Independent Living?: Exploring Capabilities of the Health and Wellbeing Platform.

Aldraehim, M. S. A. (2013). *Cultural impact on e-service use in Saudi Arabia.* Queensland University of Technology.

Almuraqab, N. A. S., & Jasimuddin, S. M. (2017). Factors that Influence End-Users' Adoption of Smart Government Services in the UAE: A Conceptual Framework. *Electronic Journal of Information Systems Evaluation, 20*(1), 11.

Alshehri, M., Drew, S., Alhussain, T., & Alghamdi, R. (2012). The impact of trust on e-government services acceptance: A study of users' perceptions by applying UTAUT model. *International Journal of Technology Diffusion (IJTD), 3*(2), 50-61.

Antioco, M., & Kleijnen, M. (2010). Consumer adoption of technological innovations: Effects of psychological and functional barriers in a lack of content versus a presence of content situation. *European Journal of Marketing, 44*(11/12), 1700-1724.

Baabdullah, A., Dwivedi, Y., & Williams, M. D. (2013). *IS/IT adoption research in the Saudi Arabian context: Analysing past and outlining future research directions.* Paper presented at the European, Mediterranean, and Middle Eastern Conference on Information System (EMCIS 2013), Windsor, United Kingdom.

Baabdullah, A. M., Alalwan, A. A., & Al Qadi, N. S. (2018). Evaluating the Current Situation of Mobile Services (M-Services) in the Kingdom of Saudi Arabia *Emerging Markets from a Multidisciplinary Perspective* (pp. 149-160): Springer.

Bagozzi, R. P., & Lee, K.-H. (1999). Consumer resistance to, and acceptance of, innovations. *ACR North American Advances*.

Balta-Ozkan, N., Davidson, R., Bicket, M., & Whitmarsh, L. (2013). Social barriers to the adoption of smart homes. *Energy Policy, 63*, 363-374.

Barati, S., & Mohammadi, S. (2009). *An efficient model to improve customer acceptance of mobile banking.* Paper presented at the World Congress on Engineering and Computer Science.

Birks, D. F., Fernandez, W., Levina, N., & Nasirin, S. (2013). Grounded theory method in information systems research: its nature, diversity and opportunities. *European Journal of Information Systems, 22*(1), 1-8.

Biswas, A., & Sarkar, J. (2000). Availability of a system maintained through several imperfect repairs before a replacement or a perfect repair. *Statistics & Probability Letters, 50*(2), 105-114.

Cappers, P., MacDonald, J., Goldman, C., & Ma, O. (2013). An assessment of market and policy barriers for demand response providing ancillary services in US electricity markets. *Energy Policy, 62*, 1031-1039.

Chauhan, V., & Choudhary, V. (2018). Barriers to adopting internet banking: analysing the influence of information availability and consumer demographics. *International Journal of Financial Services Management, 9*(3), 207-225.

Chen, Y.-T. (2012). Sketch industry promotion framework for smart living services by leveraging living lab harmonization cube. *International Journal of Electronic Business Management, 10*(2), 149.

Chouk, I., & Mani, Z. (2019). Factors for and against resistance to smart services: role of consumer lifestyle and ecosystem related variables. *Journal of Services Marketing*.

Claudy, M. C., Garcia, R., & O'Driscoll, A. (2015). Consumer resistance to innovation—a behavioral reasoning perspective. *Journal of the Academy of Marketing Science, 43*(4), 528-544.

Cruz, P., Barretto Filgueiras Neto, L., Munoz-Gallego, P., & Laukkanen, T. (2010). Mobile banking rollout in emerging markets: evidence from Brazil. *International journal of bank marketing, 28*(5), 342-371.

Dameri, R. P., Benevolo, C., Veglianti, E., & Li, Y. (2019). Understanding smart cities as a glocal strategy: A comparison between Italy and China. *Technological Forecasting and Social Change, 142*, 26-41.

David, R. S. (2014). *To Tweet Or Not to Tweet: An Investigative Analysis of the Government of Canada's Social Media Practices.* Université d'Ottawa/University of Ottawa.

Fain, D., & Roberts, M. L. (1997). Technology vs. consumer behavior: The battle for the financial services customer. *Journal of Direct Marketing, 11*(1), 44-54.

Featherman, M. S., & Pavlou, P. A. (2003). Predicting e-services adoption: a perceived risk facets perspective. *International journal of human-computer studies, 59*(4), 451-474.

Fint, D. (2017). *Urbanization, a financing challenge for a sustainable world.* Paper presented at the Annales des Mines-Responsabilite et environnement.

Giffinger, R., & Pichler-Milanović, N. (2007). *Smart cities: Ranking of European medium-sized cities*: Centre of Regional Science, Vienna University of Technology.

Good, N., Ellis, K. A., & Mancarella, P. (2017). Review and classification of barriers and enablers of demand response in the smart grid. *Renewable and sustainable energy reviews, 72*, 57-72.

Gurtner, S. (2014). Modelling consumer resistance to mobile health applications.

Herbig, P. A., & Day, R. L. (1992). Customer acceptance: the key to successful introductions of innovations. *Marketing Intelligence & Planning, 10*(1), 4-15.

Hielkema, H., & Hongisto, P. (2013). Developing the Helsinki smart city: The role of competitions for open data applications. *Journal of the Knowledge Economy, 4*(2), 190-204.

Hoeffler, S. (2003). Measuring preferences for really new products. *Journal of marketing research, 40*(4), 406-420.

Joachim, V., Spieth, P., & Heidenreich, S. (2018). Active innovation resistance: An empirical study on functional and psychological barriers to innovation adoption in different contexts. *Industrial Marketing Management, 71*, 95-107.

Jones, M., & Alony, I. (2011). Guiding the use of grounded theory in doctoral studies–An example from the Australian film industry.

Keijzer-Broers, W., & de Reuver, M. (2016). Cooperation and knowledge challenges in realizing smart homes: The case of small installer businesses. *Indoor and Built Environment*, 1420326X16670227.

Keijzer-Broers, W., Florez-Atehortua, L., & de Reuver, M. (2016). *Prototyping a Health and Wellbeing Platform: an Action Design Research Approach.* Paper presented at the System Sciences (HICSS), 2016 49th Hawaii International Conference on.

Keijzer-Broers, W., Nikayin, F., & De Reuver, M. (2014). *Main requirements of a Health and Wellbeing Platform: findings from four focus group discussions*.

Keijzer-Broers, W. J., de Reuver, M., & Guldemond, N. A. (2013). *Designing a matchmaking platform for smart living services.* Paper presented at the International Conference on Smart Homes and Health Telematics.

Keijzer-Broers, W. J., Florez-Atehortua, L., & de Reuver, M. (2015). Prototyping a Health and Wellbeing Platform in a Living Lab Setting.

Kellmereit, B. (2015). Focus groups. *International Journal of Sales, Retailing, and Marketing, 4*(9), 42-52.

Khan, M. S., Woo, M., Nam, K., & Chathoth, P. K. (2017). Smart City and Smart Tourism: A Case of Dubai. *Sustainability, 9*(12), 2279.

Kleijnen, M., Lee, N., & Wetzels, M. (2009). An exploration of consumer resistance to innovation and its antecedents. *Journal of economic psychology, 30*(3), 344-357.

Kuisma, T., Laukkanen, T., & Hiltunen, M. (2007). Mapping the reasons for resistance to Internet banking: A means-end approach. *International Journal of Information Management, 27*(2), 75-85.

Laukkanen, P., Sinkkonen, S., & Laukkanen, T. (2008). Consumer resistance to internet banking: postponers, opponents and rejectors. *International journal of bank marketing, 26*(6), 440-455.

Laukkanen, T. (2016). Consumer adoption versus rejection decisions in seemingly similar service innovations: The case of the Internet and mobile banking. *Journal of Business Research, 69*(7), 2432-2439.

Laukkanen, T., & Kiviniemi, V. (2010). The role of information in mobile banking resistance. *International journal of bank marketing, 28*(5), 372-388.

Laukkanen, T., Sinkkonen, S., Kivijärvi, M., & Laukkanen, P. (2007). Innovation resistance among mature consumers. *Journal of consumer marketing, 24*(7), 419-427.

Lee, C.-K., Lee, J., Lo, P.-W., Tang, H.-L., Hsiao, W.-H., Liu, J.-Y., & Lin, T.-L. (2011). Taiwan Perspective: Developing Smart Living Technology. *International Journal of Automation and Smart Technology, 1*(1), 93-106.

Lee, J., & Lee, H. (2014). Developing and validating a citizen-centric typology for smart city services. *Government Information Quarterly, 31*, S93-S105.

Lian, J.-W., & Yen, D. C. (2014). Online shopping drivers and barriers for older adults: Age and gender differences. *Computers in Human Behavior, 37*, 133-143.

Lunsford, D. A., & Burnett, M. S. (1992). Marketing product innovations to the elderly: Understanding the barriers to adoption. *Journal of consumer marketing, 9*(4), 53-62.

Luo, X., Lee, C. P., Mattila, M., & Liu, L. (2012). An exploratory study of mobile banking services resistance. *International Journal of Mobile Communications, 10*(4), 366-385.

Maheswaran, M., & Badidi, E. (2018). *Handbook of Smart Cities*: Springer.

Mani, Z., & Chouk, I. (2017). Drivers of consumers' resistance to smart products. *Journal of Marketing Management, 33*(1-2), 76-97.

Mani, Z., & Chouk, I. (2018). Consumer Resistance to Innovation in Services: Challenges and Barriers in the Internet of Things Era. *Journal of Product Innovation Management, 35*(5), 780-807.

Marett, K., Pearson, A. W., Pearson, R. A., & Bergiel, E. (2015). Using mobile devices in a high risk context: The role of risk and trust in an exploratory study in Afghanistan. *Technology in Society, 41*, 54-64.

Marshall, C., & Rossman, G. B. (1989). Designing Qualitative Research Sage Publications. *Newbury Park, California*.

Misbahuddin, S., Zubairi, J. A., Saggaf, A., Basuni, J., Sulaiman, A., & Al-Sofi, A. (2015). *IoT based dynamic road traffic management for smart cities.* Paper presented at the 2015 12th International Conference on High-capacity Optical Networks and Enabling/Emerging Technologies (HONET).

Moorthy, K., Suet Ling, C., Weng Fatt, Y., Mun Yee, C., Yin, K., Chong, E., . . . Kok Wei, L. (2017). Barriers of mobile commerce adoption intention: perceptions of generation X in Malaysia. *Journal of theoretical and applied electronic commerce research, 12*(2), 37-53.

Ng, W. X., Lim, C. C., Lim, X. C., Ng, S. N., & Tan, Y. J. (2013). *Consumer resistance to mobile banking services: An empirical study among baby boomers in Malaysia urban areas.* UTAR.

Nikayin, F., & De Reuver, M. (2011). *Motivation for collective action in the smart living business ecosystem.* Paper presented at the The First International Conference on Mobile Services, Resources, and Users.

Nikayin, F., & De Reuver, M. (2012). *Governance of smart living service platforms: state-ofthe-art and the need for collective action.* Paper presented at the CESUN 2012: 3rd International Engineering Systems Symposium, Delft University of Technology, The Netherlands, 18-20 June 2012.

Nikayin, F., & De Reuver, M. (2015). What motivates small businesses for collective action in smart living industry? *Journal of Small Business and Enterprise Development, 22*(2), 320-336.

Nikayin, F., Skournetou, D., & De Reuver, M. (2011). *Establishing a Common Service Platform for Smart Living: Challenges and a Research Agenda.* Paper presented at the ICOST.

Pan, Y. (2018). A Global Review on Smart City Development *Strategic Research on Construction and Promotion of China's Intelligent Cities* (pp. 1-27): Springer.

Piro, G., Cianci, I., Grieco, L. A., Boggia, G., & Camarda, P. (2014). Information centric services in smart cities. *Journal of Systems and Software, 88*, 169-188.

Ram, S. (1987). A model of innovation resistance. *ACR North American Advances.*

Ram, S., & Sheth, J. N. (1989). Consumer resistance to innovations: the marketing problem and its solutions. *Journal of consumer marketing, 6*(2), 5-14.

Rammile, N., & Nel, J. (2012). Understanding resistance to cell phone banking adoption through the application of the technology acceptance model (TAM). *African Journal of Business Management, 6*(1), 86-97.

Ritchie, J., Lewis, J., Nicholls, C. M., & Ormston, R. (2013). *Qualitative research practice: A guide for social science students and researchers*: Sage.

Riva-Mossman, S., Kampel, T., Cohen, C., & Verloo, H. (2016). The senior living lab: An example of nursing leadership. *Clinical interventions in aging, 11*, 255.

Rotchanakitumnuai, S., & Speece, M. (2003). Barriers to Internet banking adoption: a qualitative study among corporate customers in Thailand. *International journal of bank marketing, 21*(6/7), 312-323.

Saied Al Surf, M., Trigunarsyah, B., & Susilawati, C. (2013). Saudi Arabia's sustainable housing limitations: the experts' views. *Smart and Sustainable Built Environment, 2*(3), 251-271.

Shieh, L.-F., Yeh, C.-C., & Lai, M.-C. (2013). Evaluating smart living technology strategies using the analytic network process. *Journal of Testing and Evaluation, 41*(6), 1011-1023.

Skouby, K. E., Kivimäki, A., Haukiputo, L., Lynggaard, P., & Windekilde, I. M. (2014). *Smart cities and the ageing population.* Paper presented at the The 32nd Meeting of WWRF.

Solaimani, H. S. (2014). The alignment of business model and business operations within network-enterprise environments.

Sprenger, J. (2016). An examination of the reasons for late adoption of innovative consumer technology.

Szmigin, I., & Foxall, G. (1998). Three forms of innovation resistance: the case of retail payment methods. *Technovation, 18*(6-7), 459-468.

Talke, K., & Heidenreich, S. (2014). How to overcome pro-change bias: incorporating passive and active innovation resistance in innovation decision models. *Journal of Product Innovation Management, 31*(5), 894-907.

Vanston, J. H., Elliott, H., Bettersworth, M. M., & Caswell, W. (2006). Home Technology Integration.

Vision, S. (2016). 2030,(2016), Saudi Vision 2030.

Washburn, D., Sindhu, U., Balaouras, S., Dines, R. A., Hayes, N., & Nelson, L. E. (2009). Helping CIOs understand "smart city" initiatives. *Growth, 17*(2), 1-17.

Wilson, C., Hargreaves, T., & Hauxwell-Baldwin, R. (2015). Smart homes and their users: a systematic analysis and key challenges. *Personal and Ubiquitous Computing, 19*(2), 463-476.

Zahran, M. (2013). Smart grid technology, vision, management and control. *WSEAS transactions on systems, 12*.