Customers' Intention to Adopt Residential Solar Power Systems in Jordan: An Empirical Study Utilizing UTAUT2

Zainah Qasem [1]

ABSTRACT

This study intends to identify and understand the main aspects that could influence on the Jordanian customers' intention to adopt residential solar power systems (SPSs). The current study recognizes the necessity of building a conceptual model covering the most critical aspects related to the adoption of SPSs.

Based on a careful review of main models and theories addressing new systems and the adoption of innovations, the extended Unified Theory of Acceptance and Use of Technology (UTAUT2) was selected to propose the current study model. Also, a focus group comprising of ten Jordanian customers and experts of SPSs was established and led to the identification of trust, awareness and perceived risk as external factors considered along with the factors of UTAUT2.

A survey questionnaire was conducted to collect the required data from household customers within different regions of Jordan. According to the Structural Equation Modeling (SEM) analysis, Jordanian customers' intention is largely predicted by the role of facilitating conditions, social influence, price value, trust, awareness and perceived risk.

It is anticipated that the current study's results add value to the SPS context and enrich literature in the related area.

Keywords: Solar power systems, Technology adoption, UTAUT2, Customers' intention.

1 Assistant Professor, The School of Business, Department of Marketing, The University of Jordan, Amman, Jordan. z.qasem@ju.edu.jo

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نية المستهلكين لتبني أنظمة الطاقة الشمسية السكنية في الأردن: دراسة تطبيقية تستخدم النظرية الموحدة لقبول واستخدام التكنولوجيا (2)

زينة قاسم[1]

ملخص

تهدف هذه الدراسة إلى تحديد وفهم الجوانب الرئيسية التي يمكن أن تؤثر في نية العملاء الأردنيين لاعتماد أنظمة الطاقة الشمسية السكنية (SPSs). تقر الدراسة الحالية بضرورة بناء نموذج مفاهيمي يغطي أهم الجوانب المتعلقة باعتماد أنظمة الطاقة الشمسية السكنية، وذلك استناداً إلى المراجعة الدقيقة للنماذج والنظريات الرئيسية التي تتناول الأنظمة الجديدة واعتماد الابتكارات. تم اختيار النظرية الموحدة الموسعة لقبول التكنولوجيا واستخدامها (UTAUT2) لاقتراح نموذج الدراسة الحالي. بالإضافة إلى ذلك، تم إنشاء مجموعة تركيز تضم عشرة عملاء وخبراء أردنيين في مجال أنظمة الطاقة الشمسية السكنية، وأدت إلى تحديد الثقة والوعي والمخاطر المتصورة باعتبارها عوامل خارجية تجب مراعاتها إلى جانب عوامل UTAUT2. تم إجراء استبيان استقصائي لجمع البيانات المطلوبة من العملاء من الأسر في مناطق مختلفة من الأردن. ووفقاً لتحليلات نمذجة المعادلات الهيكلية (SEM)، فإن نية العملاء الأردنيين يتم التنبؤ بها إلى حد كبير من خلال دور تسهيل الظروف (facilitating of conditions) والتأثير الاجتماعي وقيمة السعر والثقة والوعي والمخاطر المتوقعة. ومن المتوقع أن تضيف نتائج الدراسة الحالية قيمة إلى سياق أنظمة الطاقة الشمسية السكنية وأن تثري الأدبيات في المجال ذي الصلة.

الكلمات الدالة: أنظمة الطاقة الشمسية، تبني استخدام التكنولوجيا، نية المستهلكين.

1 أستاذ مساعد، كلية الأعمال، قسم التسويق الجامعة الأردنية، عمان، الأردن. z.qasem@ju.edu.jo

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1. INTRODUCTION

It is a fact that modern society is almost entirely reliant on fossil fuels for nearly every aspect of its existence. While fossil fuels have been essential in the development of modern society, the negative economic and environmental impact resulting from fossil fuel usage is becoming a worldwide focus (Antonio and Marwa, 2019; Shih and Chou, 2011). As a result, more attention is given to green energy as a substitute for fossil fuel and green innovations, such as solar power systems (SPSs) are becoming more and more widely used (Claudy et al., 2010).

However, introducing green energy technologies in developing countries needs much financial support, policy interventions and more research on how to encourage customers to take action and adopt SPS technology (Elmustapha et al., 2018). For instance, the volume of solar photovoltaic energy has internationally grown from 5 GW in 2005 to reach its highest level of 306.5 GW at the end of 2016 (Statista, 2018a). This number is most likely to increase by 166.6 GW, as additional solar PV capacity is needed from the present day to 2022 (Statista, 2018b). A substantial quantity of financial investment will accompany the increase in solar photovoltaic usage. For instance, approximately 4.7 billion dollars have been spent in the USA alone in terms of residential solar PV energy (Statista, 2018a).

Jordan is a developing non-oil producing country that depends mainly on crude oil and natural gas that it imports from oil-producing countries, such as Saudi Arabia and Egypt (Alghad, 2015; Hassouneh et al., 2010; MEMR Annual Report, 2017).

The increase in Jordan's annual energy bill, the negative environmental impact of fossil fuels and the increased call by different groups amid the Jordanian society to focus on green energy and social responsibility (Al-Khawaldah and Al Shoura, 2018; Fokaha and Saify, 2018; Shih and Chou, 2011) have drawn attention towards renewable energy as an alternative for fossil fuel (Abdallat et al., 2011). Amid renewable energy sources, solar power represents auspicious energy sources that are expected to play a vital role in the domain of green electricity generation.

In this regard, it is worth indicating that the renewable energy contribution amounts to approximately 7% of the total energy production in Jordan (Alawneh, 2013). Since solar power is infinite and contributes positively to preserving natural resources (Wolske et al., 2017), it has become a potential renewable energy source for production in domestic and industrial contexts.

Jordan's geographic location, which places it within the world's solar belt, provides the Kingdom with a high potential to utilize solar energy as the primary form of renewable energy. The Kingdom is exposed to average solar radiation ranging between 5 and 7kWh/m^2, which implies a potential of at least 1,000GWh per year (Zafar, 2018).

In its latest annual report, the Jordanian Ministry of Energy and Mineral Resources (MEMR) stated that renewable energy contributes to less than 6% of the total energy mix (MEMR Annual Report, 2017). Residential solar power systems (SPSs) have been available in Jordan for more than three decades, but these systems were mainly used to heat water and warm-up spaces.

It is only recently that Jordanian households have started to consider using SPSs to generate electricity. However, in Jordan, the deployment of such systems is proceeding at a slow rate (Zafar, 2018). Given the different benefits of using solar energy to produce electricity in Jordan, it is crucial to study factors that influence the Jordanians' decision to install and use SPSs to produce electricity.

The literature suggests two directions that provide an explanation of human decision-making concerning adopting consumer energy use. The first direction is based on social psychology with the main argument being the choice to adopt and use residential SPSs; it is directed by environmental values (Shwom and Lorenzen, 2012).

The second direction is based on the early adoption and diffusion of innovations. The second direction seeks to explain (how, why and at what rate) the residential SPS, as a technology, is initially adopted and how the adoption is spread (Schelly, 2014). In spite of the existence of several studies attempting to analyze what drives the adoption of residential SPS (e.g. Graziano and Gillingham, 2014; Rai and Sigrin, 2013; Schelly, 2014), there is still a need for more detailed studies and tailor-made models to examine and explain what drives the evolution of SPS adoption, both within a particular market and across diverse markets (Reeves et al., 2017). It is only recently that more attention was given towards studying the features of consumers who install residential SPSs and the factors that influence their decision-making (Wolske et al., 2017).

Therefore, in this study, the authors take a step toward introducing a model that explains SPS adoption among customers in immature markets (in this case, the Jordanian market).

2. Background and Literature Review

Zarnikau (2003: 1661) defined green energy - solar energy - as ‘electricity generated using renewable energy sources and including technologies, such as photovoltaic solar panels, biomass projects, geothermal projects and wind farms.

Due to green energy various benefits to environment and economy, countries around the world are focusing on finding suitable technologies to generate green energy such as SPS energy (Shrimali and Kniefel, 2011) and encouraging their citizens to adopt such technologies. Although proper legislation may have an essential role in encouraging the public to adopt SPSs, it is still important to investigate factors that are directly related to consumers and can influence their decision to adopt SPSs (Elmustapha et al., 2018; Sangroya and Nayak, 2017).

Thus, this research will focus on understanding what factors affect consumers’ decision to adopt SPSs in the Jordanian market as an example of a developing Middle Eastern country. A closer look at the relevant literature leads the authors to notice several studies testing the main factors shaping customers’ perception, attitudes and adoption toward many types of renewable systems, such as that of a Malaysian study conducted by Kardooni et al. (2016).

Kardooni et al. (2016) validated and supported the role of financial cost, perceived ease of use and perceived usefulness in shaping the customers’ attitudes toward such energy systems. Other aspects related to income and pollutant emission were reported by Salim and Rafiq (2012) as key factors that determine renewable energy adoption in many emerging countries (i.e., Indonesia, China, India and Brazil). On the other hand, Viardot (2013) discussed the main barriers of renewable energy adoption.

Viardot (2013) noticed that the lack of experience, the lack of the social system support, the lack and level of perceived ease of use, cost and the lack and level of usefulness - all hindered the level of adoption of renewable energy. A more recent study was conducted in Qatar by Mohandes et al. (2019) to identify the main factors predicting the adoption of SPSs by household customers.

This study largely supported the impact of the installation cost of SPSs, the status of property possession, decreasing government subsidies for electricity and imposing a tax on carbon. In Canada,

customers' awareness of the aspects related to SPS technology and their social engagement in the issues related to SPS adoption predicted their decision to adopt such clean energy systems (Parkins et al., 2018). In the rural areas of Ethiopia, Guta (2018) entirely focused on the demographic characteristics of the potential adopters.

Findings of Parkins et al. (2018) indicated that people with high income and educational level seem to be more interested in the adoption of SPSs as another source of energy rather than those with a low level of income and education. Interestingly, Guta (2018) noticed that the willingness to adopt SPS applications reaches its highest level among families under the chairmanship of females rather than those under the chairmanship of men. Based on the theory of planned behavior (TPB), Yazdanpanah et al. (2015) proposed a conceptual model to predict the adoption of renewable energy applications among the Iranian public community. Yazdanpanah et al. (2015) noticed that an individual's intention to use renewable energy applications is largely predicted by the role of perceived behavioral control, attitudes and moral norms.

2.1 Consumer Decision-making on the Adoption of Clean Energy Technology

The adoption stage of new technologies has been the focal point of Roger's Innovation Diffusion Theory (IDT) and Davis's Technology Acceptance Model (TAM). However, both theories have different perspectives. While IDT explained adoption from a general perspective (i.e., how others accept a new technology), TAM focused on the individual user's perspective (i.e., what factors influence an individual's decision to adopt new technology) (Vasseur and Kemp, 2015). Venkatesh et al. (2003) proposed the Unified Theory of Acceptance and Use of Technology (UTAUT) as a unified theoretical base to facilitate research on adoption and diffusion (Vasseur and Kemp, 2015). To deliver the unified theoretical base, Venkatesh et al. (2003) combined eight models of technology acceptance.

Three key variables were found to affect intention directly to adopt new technology; namely, performance expectancy, effort expectancy and social influence. Venkatesh et al. in 2012 introduced UTAUT2 as an extension to UTAUT, which was developed to determine technology adoption in the involuntary working context. It predicted a customer's intention to adopt new technology in the consumer context. To extend the theory, Venkatesh et al. (2012) incorporated price and habit into UTAUT2. The literature on technology adoption suggests that UTAUT2 provides a useful tool to predict consumers' technology acceptance in different fields, such as telebanking (Alalwan et al., 2016b), mobile payment (Morosan and DeFranco, 2016) and mobile Internet (Baabdullah et al., 2015).

The literature on green energy adoption suggests that very few studies have addressed SPS adoption from the consumer behavior perspective (Vasseur and Kemp, 2015). Therefore, this study will focus on exploring factors that influence SPS adoption from the customers' point of view and the authors will use UTAUT2 as the base for the framework by introducing it as a starting point in the analysis.

3. Conceptual Model

As discussed in the previous section, this study aims to propose a conceptual model that can cover the overall aspects and factors shaping Jordanian customers' perceptions and intentions towards SPSs. The reviewed literature on SPS adoption suggests that few studies have addressed the issues of customers' perceptions and adoption of such emerging systems.

Many studies have investigated technology acceptance and utilized diverse theories and models to explain consumer adoption in different fields (e.g.

Saleh et al., 2013; Alalwan et al., 2015, 2016a, 2017; Davis, 1989; Dwivedi et al., 2017a, 2017b; Rana and Dwivedi, 2015, 2016; Rana et al., 2013, 2016, 2017; Venkatesh et al., 2003). However, in this study, the authors will use UTAUT2 as the theoretical foundation. UTAUT was introduced by Venkatesh et al. in 2003 as a full-bodied theory that incorporated variables from eight different models and theories. UTAUT was described as a robust model with 'the ability to describe users' intention to use a new technology up to 70% more than the eight models that were combined to create the model' (Venkatesh et al., 2003:453). In 2012, Venkatesh et al. introduced and examined UTAUT2 to predict customers' intentions and adoption of different systems and technologies. Therefore, the authors chose to use UTAUT2 in the current study as the theoretical foundation of the proposed conceptual model. Using SPSs to generate electricity is considered a new technology in Jordan.

Therefore, there was a need to understand Jordanian customers' view of this technology and factors that influence their willingness to adopt it. A focus group of ten Jordanian SPS customers and experts was established in February 2017. Most participants indicated that SPSs could be more useful and beneficial in their daily life compared to traditional power systems.

Also, they mentioned that their decision to adopt such systems largely depended on the extent of facilities and assistance provided by SPS companies before and after the installation of such systems. Most participants also reported financial implications related to the SPS implementation, especially in light of the high initial cost of these systems.

Social factors were also indicated by some participants as a factor to be considered. Furthermore, some participants who already use other kinds of simple solar systems (i.e., solar water heaters) expressed more interest in the adoption of SPSs in the future.

Participants' interest in adopting SPSs in the future explains the importance of these systems' degree of compatibility with existing systems used by customers. It is worth mentioning that most of the factors reported by participants are covered by Venkatesh et al. (2012) in the UTAUT2 regarding performance expectancy, facilitating conditions, social influences and price value.

Reporting these items, in turn, supports the selection of UTAUT2 as the theoretical basis of the current study model. However, other aspects and factors uncovered by UTAUT2 are indicated by the focus group participants. Most participants in the focus group expressed fear and apprehension regarding the outcomes of using these systems.

Indeed, they mentioned that adopting these systems would be too costly and accordingly, further financial risk could be perceived through the purchase of SPSs. The possible financial risk, as well as their concerns regarding the performance and ability of SPSs to consistently provide them with a significant source of energy (electricity) have also been mentioned as risk factors.

As these systems are still in their early stage of introduction over the Jordanian markets, most participants stated that they are not fully aware of all issues related to SPSs, and this, in turn, makes them reluctant to adopt such systems. Also, according to the participants, trust in the firm providing these systems is a key factor influencing their decision about using SPSs.

The extent of the reliability of these systems was a common point made by most participants. After analyzing the focus group participants' comments and responses, the three factors of perceived risk, awareness and trust were included as extensions of the UTAUT2 factors in the same conceptual model. Likewise, these factors have been approved by

previous literature regarding customers' adoption of new systems (i.e., Al-Hawari et al., 2009; Riffai et al., 2012; Martins et al., 2014; Alalwan et al., 2017).

3.1 Performance Expectancy

As conversed by Venkatesh et al. (2012), customers are likely to pay more attention to instrumental and cognitive benefits and utilities which are comprised of using new systems. Consequently, customers will be motivated to adopt a new technology if they believe that it will positively affect their daily activities' productivity and effectiveness. An SPS, as a new system, is expected to benefit different domains (customers, the environment, governments and the community) (Tsoutsos et al., 2005; Faiers and Cook, 2007; Wang and Qiu, 2009; Solangi et al., 2011; Schelly, 2014).

Thus, the degree to which customers perceive SPSs as useful and cost-effective in comparison to traditional sources of electricity is expected to impact the customers' intention to adopt SPSs. Such assumptions are supported by findings such as those of Faiers and Neame (2006) which empirically proved that UK customers are less likely to be motivated to adopt SPSs if they do not fully recognize these systems as more advantageous and useful than traditional systems.

Similarly, the authors propose that Jordanian customers will be motivated to adopt SPSs if they positively value the system regarding performance expectancy. The following hypothesis proposes that:

H1: Performance expectancy will positively influence Jordanian customers' intention to adopt SPSs.

3.2 Facilitating Conditions

Facilitating conditions are defined as the level to which an individual believes that the organization provides technical and organizational support for him or her to use the system (Venkatesh et al., 2003).

Facilitating conditions were proposed as a predictor of actual usage behavior and customers' intention to adopt new technology (Venkatesh et al., 2003, 2012). This proposition was attributed to the importance of technical support availability when using a new system (Timilsina et al., 2012; Venkatesh et al., 2012). Facilitating conditions are predicted to have a crucial role in shaping Jordanian customers' decisions to adopt SPSs.

Members of the focus group have also mentioned the importance of payment and technical facilitating conditions as motivators and deterrents of adopting SPS technology. This could be attributed to the fact that SPSs are sophisticated and sensitive systems which require particular kinds of technical facilities and support to guarantee their sustainability and efficiency.

Facilitating conditions were reported by Rai and Beck (2015) to be the most important factor in predicting customers' willingness to request a solar quote. Thus, the authors can propose that facilitating conditions positively motivates Jordanian customers' intention to adopt SPSs.

H2: Facilitating conditions will positively influence Jordanian customers' intention to adopt SPSs.

3.3 Social Influences

Social influences are articulated by Venkatesh et al. (2003) as the degree to which an individual values the opinions of important others regarding using a new system. Over the prior literature of technology and new system adoption, social influences or other related factors, (i.e. subjective norms, images and social factors), have been identified as key factors predicting consumers' willingness to adopt a new system, especially when customers have insufficient knowledge and experience with that system

(Venkatesh et al., 2003; Welsch and Kühling, 2009). SPS seems to be a more innovative and modern system that customers could cope with and accordingly, Jordanian customers still do not formulate an adequate understanding and experience toward it.

Therefore, Jordanian customers are more likely to depend on the information and recommendations coming from their reference groups (friends, colleagues, neighbors and relatives) in this regard. In line with this assumption, Welsch and Kühling (2009) empirically confirmed that the likelihood of customers' SPS adoption will reach a high level among individuals whose reference groups (friends, colleagues, neighbors and relatives) have adopted such a system.

Likewise, in Germany, SPS non-owners were noticed by Woersdorfer et al. (2011) to be motivated to adopt solar thermal systems if their peers had used the same systems. Similar results have recently been reached by Mishra et al. (2014), who supported the significant influence of subjective norms on individuals' intention to adopt green information technology.

According to the above discussion, Jordanian customers could be more interested in using an SPS if their social system supports and positively perceives such a system and thus, the following hypothesis proposes that:

H3: Social influences will positively influence Jordanian customers' intention to adopt SPS.

3.4 Price Value

Over the consumer context, customers are more likely to bear the associated financial cost of using a new system.

Therefore, as argued by Venkatesh et al. (2012), customers could become engaged in the trade-off process between the benefits and monetary cost of using a new system. This, in turn, motivated Venkatesh et al. (2012) to add price value as a new construct for the UTAUT2. In fact, it has mainly been indicated that the initial high cost of implementing an SPS is one of the most critical barriers of diffusion of such technology, despite the vast benefits that could be attained in the long term (Bazen and Brown, 2009; Harish et al., 2013; Jacobsson and Johnson, 2000; Mills and Schleich, 2009; Rickerson et al., 2007; Schelly, 2014; Timilsina et al., 2012). Thus, it could be concluded that customers are less likely to be enthused to adopt an SPS if they do not fully understand the higher price value of using this system rather than the cost paid (Harish et al., 2013; Solangi et al., 2011).

According to the main comments provided by participants in the focus group, financial issues and monetary value that could be captured *via* the installation of an SPS are important considerations. In this regard, Al-Salaymeh et al. (2010) have examined the extent of how feasible it is to utilize a kind of SPS (photovoltaic systems) in the Jordanian context.

Their results indicated that due to the high cost associated with the setting up of the SPS compared to traditional sources of electricity, SPS usage could not be feasible in the short term in the Jordanian context (Al-Salaymeh et al., 2010). However, the case could be different for those customers who extensively consume electricity as reported by Borenstein (2015) in his study testing SPS adoption among customers from the USA.

Borenstein (2015) noticed that the highest level of SPS adoption was among customers who extensively consumed electrical power, owing to the high price value related to SPS usage for such customers. A recent study carried out by Chen (2014) also provided empirical evidence to support the significant impact of environmental value on customers' intention to install SPSs. The role of the price value is examined and supported by Alalwan et al. (2016b) in their study of Jordanian customers' intention and adoption of telebanking.

The consideration of all aspects reflects the importance of including price value over the current conceptual model as a key predictor of Jordanian customers' intention to adopt SPSs and accordingly, the following hypothesis proposes that:

H4: Price value will positively influence the Jordanian customers' intention to adopt SPSs.

3.5 Trust

According to the definition by Mayer et al. (1995), trust is 'the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other party will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party' (Mayer et al., 1995: 712). As a source of electrical energy, solar system power could be a highly sensitive issue from the customers' perspective as human life, with all its aspects, largely depends on this source of energy.

Indeed, the sustainability, consistency, reliability and efficiency of the main source of electricity represent critical issues of concern for customers who would like to adopt a non-traditional source of energy (i.e., solar system, wind power, geothermal power) (Harish et al., 2013). Therefore, customers require trust to be motivated to adopt such a non-traditional source of energy.

Theoretically, it has been largely argued that the important role of trust is a key predictor of human behavior towards newly introduced innovations and systems (Flavián et al., 2006; Gefen et al., 2003; Mayer et al., 1995). Thus, in the current study, it was proposed that there is a direct relationship between trust and Jordanian customers' adoption of solar systems and accordingly, the following hypothesis proposes that:

H5: Trust will positively influence the Jordanian customers' intention to adopt SPSs.

3.6 Awareness

Alsheikh and Bojei (2014: 212) defined awareness as 'knowledge about technology, its benefits and risks that are key factors in the voluntary use of systems'.

People engage in a learning process to extend their levels of awareness regarding innovations and products before accepting or rejecting them (Rogers, 2003). As argued by Rogers (2003), people should first have this extent of awareness, so that they can then build behavioral, emotional and cognitive reactions towards new systems. Awareness has been identified as an influencer on adoption intention of new technology (Dinev and Hu, 2007; Merritt, 2011; Shatskikh, 2013).

Choudrie and Dwivedi (2005) stated that awareness leads customers to create subjective thoughts about intention towards a specific behavior. Similarly, awareness was reported as a positive influencer on customer intention to use m-commerce (Safeena et al., 2011). Another recent study carried out by Kardooni et al. (2016) showed that the level of customers' knowledge (awareness) largely shapes the customers' perception toward the aspects related to renewable energy benefits and usefulness. Therefore, the authors are predicting that similar to other forms of new technology, adoption awareness will have a significant effect on shaping Jordanian consumers' intention to adopt SPSs.

By the same token, in Nicaragua, according to Rebane and Barham (2011), the level of customer knowledge and awareness is identified as a fundamental requirement of the adoption of solar systems by household customers. In line with this, Labay et al. (1981) discussed the importance of customers' knowledge as a key difference between adopters and non-adopters of solar systems.

Awareness is not only related to customers'

perception of the solar power systems' existence, but also to all the benefits and aspects associated with such emerging systems (Kapoor et al., 2013). Therefore, according to Rogers' (2003) model, customers are less likely to form an intention or attitude towards an SPS without a level of awareness.

According to prior literature addressing innovation diffusion issues, many examples have supported the role of awareness in customers' intention and adoption of new systems and technologies (Ajili et al., 2012; Alsheikh and Bojei, 2014; Vishwanath and Goldhaber, 2003). The following hypothesis proposes that:

H6: Awareness will positively influence Jordanian customers' intention to adopt SPSs.

3.7 Perceived Risk

Based on the main outcomes of the focus group study, it is clear that Jordanian customers are not sure about the consequences of using SPSs, as most of the participants of the study's focus group reported their concerns regarding the performance and financial risk that they may have to deal with if implementing these systems. This is especially so regarding the role of trust-critical and sensitive nature of SPSs and electricity in customers' lives as previously discussed.

Such risks could also be attributed to the fact that SPSs have been recently introduced in developing countries and the initial cost for implementing these systems is very high compared to their payback period. Customers will have to wait for a long time to evaluate the feasibility of these systems. This, in turn, maximizes the level of risks perceived in such systems (Alalwan et al., 2018; Goldman et al., 2005; Timilsina et al., 2012).

In this regard, according to Labay et al. (1981), SPS adopters and non-adopters were found to be significantly different regarding social and financial risks. Therefore, Jordanian customers could be less likely motivated to adopt an SPS if they perceive a significant level of risk in using this system. Consequently, the following hypothesis proposes that:

H7: Perceived risk will negatively influence Jordanian customers' intention to adopt SPSs.

4. Methodology

This study followed a quantitative dominant mixed-method approach (Wu, 2011). To probe factors that affect Jordanians' adoption of SPSs as a new technology, a focus group of ten SPS Jordanian customers and experts was established in February 2017. The moderator directed an open-ended question session.

Participants were encouraged to answer questions, elaborate and comment using their own words (Bhattacherjee, 2012; Gubrium and Holstein, 2002; McCracken, 1988). Factors that came up as important factors were used to design the conceptual model. To obtain the empirical data needed to validate the conceptual model and examine the research hypotheses, 400 self-administered questionnaire forms were allocated to derive responses from Jordanian potential SPS adopters in Jordan. The response rate was 62.5% and a total of 250 questionnaire forms were used for further analysis.

The measurement items for latent constructs within the proposed model were developed from prior studies to ensure the validity of all measures. To measure the main constructs of UTAUT2 (PE, SI, FC, PV and BI), scales from Venkatesh et al. (2012) were adapted to fit the current study. The scale of Gefen et al. (2003) was adopted to measure trust, while the perceived risk was evaluated based on items adopted from Featherman and Pavlou (2003). Awareness was measured using items from Rogers (2003). Finally, six close-ended questions were dedicated to

demographic variables: age, gender, income, educational level, try-on technology experience and marital status.

The back-translation method was conducted to translate the English version of the questionnaire into an Arabic version, as Arabic is the main language in Jordan (Brislin, 1976).

5. Results

5.1 Respondents' Profile and Characteristics

Two hundred and fifty usable responses have been received. of those participants, 59% were males and 41% were females.

A large number of participants (40%) were within the age group of 20 to 30 years, while 21% of the participants were aged 31 to 40 years. A large number (35.2%) of the current sample had an income level of less than 600 Jordanian Dinar (JOD), while 15% of the participants had an income level between 601 and 1000 JOD. More than 86.8% of participants had a Bachelor's degree or higher.

Around 19% of participants mentioned that their monthly electricity bill was between 10 and 30 JOD and 26% of participants had electricity bills between 31 and 60 JOD, while the most significant percentage of participants (36%) reported that their electrical bill was higher than 61 JOD.

5.2 Structural Equation Modeling (SEM) Analysis

Confirmatory Factor Analysis (CFA) was first used to ensure the model's fitness and the adequacy of both construct reliability and validity. The first run on the measurement model yielded the following fit indices outcomes: CMIN/DF = 2.891; GFI = 0.881; AGFI = 0.782, RMSEA = 0.082; NFI = 0.901; CFI = 0.923. Yet, GFI, AGFI and RMSEA are not within their cut-off values; therefore, the model was to be refined by identifying the most problematic items. A closer look at the standardized regression weight table led the researchers to notice that some items had a factor loading less than 0.50, such as SI1 from social influence, PE1 from performance expectancy, FC4 from facilitating conditions and AW4 and AW5 from awareness.

These items were therefore dropped and the revised measurement model was tested again. In doing so, the measurement model fitness was noticeably improved as all fit indices this time were found within their recommended level: CMIN/DF = 2.745; GFI = 0.908; AGFI = 0.832, RMSEA = 0.041; NFI = 0.932; CFI = 0.954 (Anderson and Gerbing, 1988; Bagozzi and Yi, 1988; Byrne, 2010).

5.3 Construct Reliability

As presented in Table 1, composite reliability (CR) and average variance extracted (AVE) (see formula1 and formula 2) were tested to assure the level of the scales' reliability. All CR values were found to be higher than 0.70, as suggested by Hair et al. (2010). Behavioral intention and awareness had the largest CR values: 0.905 and 0.90, respectively, while the facilitating conditions' construct had the lowest but acceptable CR value of 0.773 (Hair et al., 2010).

Likewise, AVE values were found to be higher than 0.50, as recommended by and erson and Gerbing (1988). Remarkably, social influence had the largest AVE value (0.770), followed by awareness (0.750). The lowest AVE value was found for facilitating conditions (0.532).

Table 1. Construct reliability and validity

	CR	AVE
PR	0.854	0.596
PE	0.814	0.595
SI	0.869	0.770
FC	0.773	0.532
PV	0.848	0.650
BI	0.905	0.704
AW	0.900	0.750
TR	0.892	0.544

Formula 1: CR = [SUM (*A*)] 2 / [(SUM (*A*)] 2 + SUM (*B*)].

*Note: **A** symbolizes the standardized regression weights (factor loading), while **B** pertains to the error of variance for each latent construct (Hair et al., 2010; Fornell and Larcker, 1981).*

Formula 2: AVE = [(SUM (*A2*)] / [(SUM (*A2*) + SUM (*B*)].

*Note: **A2** symbolizes the squared standardized regression weights (factor loading), while **B** pertains to the error of variance for each latent construct (Hair et al., 2010; Fornell and Larcker, 1981).*

5.4 Convergent and Discriminant Validity

All unremoved items had factor-loading values higher than 0.50, as suggested by Hair et al. (2010) (See Table 2). Also, as presented in Table 3, all constructs reached an acceptable level in terms of discriminant validity. Firstly, the highest correlation value (0.623) was between awareness and price value, which was less than 0.85, as suggested by Kline (2005).

Moreover, all constructs were found to have squared root of AVE values higher than the inter-correlation estimates with other corresponding constructs (see Table 3) (Fornell and Larcker, 1981).

Table 2. Standardised regression weights

Item	Construct	Factor loading value
PE2	PE	0.713
PE3	PE	0.79
PE4	PE	0.807
S12	SI	0.778
S13	SI	0.967
FC1	FC	0.695
FC2	FC	0.794
FC3	FC	0.695
PV1	PV	0.764

PV2	PV	0.848
PV3	PV	0.805
B11	BI	0.816
B12	BI	0.839
B13	BI	0.862
B14	BI	0.838
AW1	AW	0.886
AW2	AW	0.874
AW3	AW	0.837
TR1	TR	0.621
TR2	TR	0.641
TR3	TR	0.774
TR4	TR	0.808
TR5	TR	0.811
TR6	TR	0.72
TR7	TR	0.766
PR1	PR	0.637
PR2	PR	0.856
PR3	PR	0.738
PR4	PR	0.838

Table 3. Discriminant validity

	PR	**PE**	**SI**	**FC**	**PV**	**BI**	**AW**	**TR**
PR	**0.772**							
PE	0.198	**0.771**						
SI	0.214	0.457	**0.878**					
FC	0.430	0.417	0.590	**0.729**				
PV	0.230	0.399	0.447	0.487	**0.806**			
BI	0.054	0.375	0.520	0.503	0.622	**0.839**		
AW	0.176	0.581	0.520	0.543	0.623	0.575	**0.866**	
TR	0.403	0.437	0.450	0.456	0.623	0.496	0.610	**0.738**

5.5 Structural Model Analysis

The structural model analysis stage targeted the conceptual model and research hypotheses. First, the main model fit indices supported the adequacy of model goodness of fit, as all fit indices were within their acceptable levels at CMIN/DF = 2.954; GFI = 0.90; AGFI = 0.801, RMSEA = 0.079; NFI = 0.914; CFI = 0.95. The model could also predict about 45% of the

variance in behavioral intention. Analysis of oath coefficient indicated that PV (γ=0.38, p<0.000); PR (γ=-0.23, p<0.002); SI (γ=0.24, p<0.008); FC (γ=0.20, p<0.003); AW (γ=0.155, p<0.016); and TR (γ=0.149, p<0.043) have a significant impact on the Jordanian customers' intention to SPS adoption. However, customer intention was not predicted by the role of PE at all: PE (γ=0.009, p<0.920).

Table 4. Conceptual model testing

Hypothesized Path			Estimate	SE	CR	P
BI	<---	PE	0.009	0.094	0.100	0.920
BI	<---	FC	0.20	0.072	2.174	0.003
BI	<---	SI	0.240	0.068	2.642	0.008
BI	<---	PV	0.381	0.073	4.399	***
BI	<---	TR	0.149	0.073	2.028	0.043
BI	<---	AW	0.155	0.064	2.415	0.016
BI	<---	PR	-0.231	0.075	-3.027	0.002

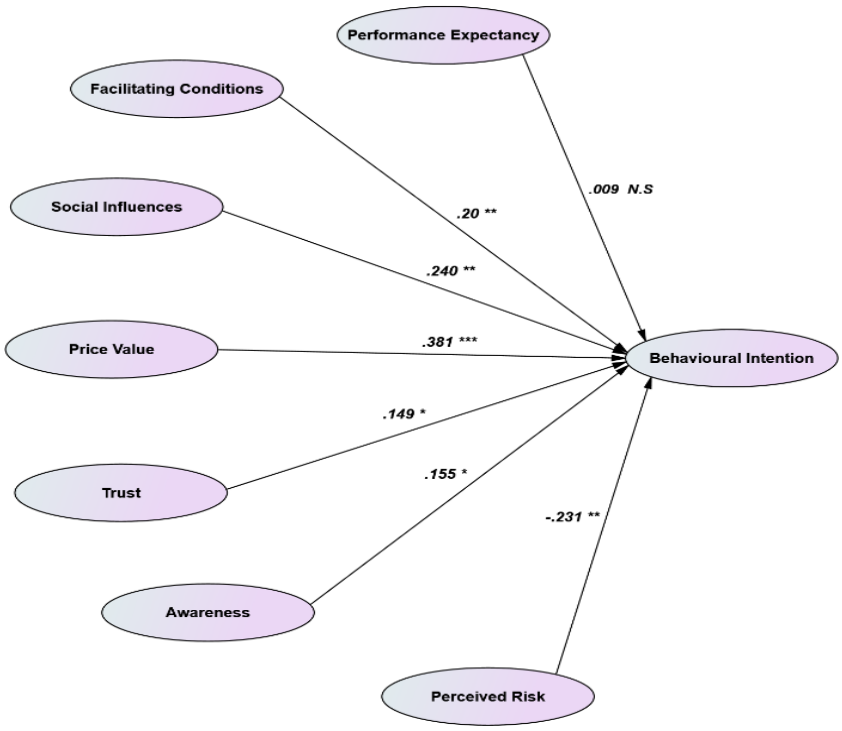

Figure (1): Conceptual model adapted from UTAUT2 (Venkatesh et al., 2012)

6. Discussion

One of the main obstacles that could hinder the SPS applicability is how people are accepting and entirely motivated to adopt such systems instead of other classical approaches for this vital source of energy (electricity).

This could not be reached without a solid scientific and practical foundation that could help researchers and practitioners find applicable solutions to enhance the adoption rate of such systems. Therefore, this study was keen to discover and empirically examine the main factors that could shape Jordanian customers' willingness to adopt SPS applications.

In light of the yielded results, the current study was successful in providing an accurate picture of the key predictors of customers' intention to SPS adoption. First of all, the current study model supported the conceptual model proposed to exlain 53% of the variance that was accounted for in the BI. In addition, excluding PE, the rest of the factors - PV, PR, SI, FC, AW and TR - were said to have a considerable impact on behavioural intentions to adopt SPS applications. As noticed above, price value was the most significant factor in predicting Jordanian customers' willingness to adopt SPS applications.

This means that Jordanian customers are concerned about the monetary utilities that could be derived by relying on SPS electric power. In other words, Jordanian customers are more likely to be engaged in the trade-off process between the cost that should be paid and the benefits of using an SPS system. Accordingly, Jordanian customers will be more interested in using SPS systems if they perceive a high level of monetary value.

Such results could be attributed to a number of reasons: first, the financial cost of traditional sources of electricity, such as those relying on fossil fuels. Second, the nature of SPSs as environment-friendly energy sources, which maximizes the associated benefits and accordingly optimizes the price value perceived in using SPSs.

Finally, as the majority of targeted customers have lower and middle incomes, they will be sensitive to price issues, which means that Jordanian customers are affected mainly by price value. These results are in line with other studies that have tested the role of price value, such as Alalwan et al. (2017), Harish et al. (2013) and Solangi et al. (2011)).

The social system was approved to have a significant positive impact on Jordanian customers' intention to SPS adoption. Such results explain that Jordanian customers are more likely to depend on information and suggestions coming from people surrounding them, i.e., friends, colleagues, neighbors and relatives, once they are in the process to use and adopt SPS applications.

This could be attributed to the nature of Jordanian culture, which is more of a collectivist culture, in which the opinions of people surrounding individuals are critical. Furthermore, SPS applications are in their early stages of introduction in Jordan and accordingly, customers do not have rich knowledge and experience that enable them to be self-dependent to form their decisions regarding accepting or rejecting such new applications (Venkatesh et al., 2003).

It is also important to mention that there is an increase in positive awareness among Jordanian people regarding the positive side of renewable energy systems overall, such as their economic, environmental and social contributions. Such results are parallel with other studies, i.e., Mishra et al. (2014), Welsch and Kühling (2009) and Woersdorfer et al. (2011) who have supported the role of social influence.

Another result from UTAUT2 is that facilitating conditions were proven to have a significant impact on Jordanian customers' intentions to adopt SPS

applications. Clearly, it seems that Jordanian customers are more concerned with the importance of support, facilities, services and information required for the successful use and implementation of SPSs as an alternative source of energy.

Indeed, using SPSs will not be possible without technical and informational support for all stages: prior implementation, over implementation and after implementation to maintain the sustainability of this vital source of energy. Different studies have discussed the concepts that have focused on the critical role of facilitating conditions (Faiers and Neame, 2006; Knudsen, 2002; Rai and Beck, 2015). According to the current study results, awareness has been supported as a critical determinant of Jordanian customers' intention to adopt SPSs.

The level of customers' knowledge is very important for aspects that could shape their decisions regarding such complicated and critical technology. Customers are more likely to ignore any new systems if they do not perceive the existence of this technology or its related outcomes. Furthermore, due to the reasons discussed above regarding the impact of price value and the role of social influence, there is an increasing awareness among Jordanian people about SPS technology.

This could also be due to the promotional and communicational efforts conducted by the Jordanian government and private organizations that are working in the renewable energy sector in Jordan. Current study results regarding the role of awareness are in line with other studies that have addressed such factors (Ajili et al., 2012; Alsheikh and Bojei, 2014; Kapoor et al., 2013; Vishwanath and Goldhaber, 2003). Trust has been among the important factors considered by Jordanian customers.

Specifically, according to the current results, Jordanian customers are more likely to adopt SPSs if they perceive such energy systems to be dependable and trustworthy. SPSs are related to highly sensitive sources of energy, touching all aspects of people's lives. Therefore, without an extent level of trust in such systems, customers will not be sufficiently motivated to adopt them.

Trust in SPS energy could be addressed from different perspectives. First, customers need to trust the ability and performance of the system itself. It is necessary to have electricity 24 hours per day and customers cannot live without such a sustainable source of energy. Second, safety is a critical dimension that customers consider in SP adoption and accordingly, customers will trust more in such systems if they feel that they are using a safe source of energy.

Finally, customers should also trust in the organizations that promote and sell such solutions, especially in light of the fact that using such systems requires continuous maintenance and support from SPS organizations. Consequently, trust issues have received considerable attention from Jordanian customers, as also stated by different studies that have assured the role of trust, such as Flavián et al. (2006), Gefen et al. (2003), Harish et al. (2013) and Mayer et al. (1995).

While trust could motivate customers to SPS adoption, different perceived risks hinder the Jordanian people's intention to adopt SPSs. As stated by the current study results, Jordanian customers will be less interested in adopting SPS solutions if they perceive a high degree of risk in implementing such systems. Indeed, there are different kinds of risk that customers could cope with once they started using SPSs.

For instance, customers often raise a question regarding the feasibility of SPS usage, especially when considering the high initial cost pertaining to SPS implementation. Other risks could be related to customers' concerns associated with the performance and sustainability of such alternative sources of

energy, as supported by other studies; i.e., Goldman et al. (2005), Labay et al. (1981) and Timilsina et al. (2012).

Risk is always among the factors hindering the customers' willingness to adopt and use SPSs.

6.1 Theoretical Contribution

The findings of this study offer a significant theoretical contribution to the related literature. This study was influenced by Venkatesh et al.'s (2012) call to expand the applicability of the UTAUT2 to new kinds of systems.

The UTAUT models are frequently applied for studying user acceptance of technologies' applications (Hoque and Sorwar, 2017); e.g., mobile banking, telebanking, mobile government, online shopping and social media. However, few studies investigated technology acceptance and SPS adoption to generate electricity in general and to the best of the authors' knowledge, this is the first study to consider factors that influence the Middle Eastern customer to adopt SPS technology using UTAUT as its main theory.

Hence, this study comprises a contribution to the theory by approving the usability and validity of UTAUT2 to understand SPS customers' adoption behavior in the developing countries' context. Also, most of the prior studies primarily adopted the basic UTAUT2 model constructs and implemented them in a specific context. Nevertheless, the authors extended the model by introducing perceived trust, perceived risk and awareness as factors that affect Jordanian consumers to adopt SPSs.

6.2 Practical Implications

The findings of this study offer practical implications for the benefits of improving SPS adoption in the context of a developing nation. Results provide guidelines regarding the main aspects that SPS providers need to consider and promote the adoption of such systems. For instance, results suggest that Jordanian customers are price sensitive; thus, SPS providers should spend more time forming their pricing strategy to enhance the level of monetary value related to the adoption of these systems.

SPS providers are also advised to give special attention to facilitating conditions, including technical aspects and payment methods. Finally, this study provides guidelines regarding SPS communication. Results suggest a crucial need to investigate the best means of communication in order to effectively reach the right target market and the beneficial target audience.

Results also highlight the importance of creating a trustworthy image for SPS providers.

7. Conclusions

This study was conducted to identify and empirically examine the main factors that could shape the Jordanian customers' intention to adopt SPSs. As mentioned in the introduction section, the researchers have discussed the current situation of SPSs in Jordan and how the adoption of such systems is not as it is hoped. Furthermore, there is a dearth of studies that have examined SPSs from the Jordanian customers' perspective.

Therefore, an exploratory study using a focus group was established to discover the most important aspects that could facilitate or hinder SPS adoption in Jordan. After analyzing the focus group participants' comments and responses, the three factors of perceived risk, awareness and trust were included as an extension of the UTAUT2 factors in the same conceptual model.

400 self-administered questionnaire forms were allocated to derive responses from Jordanian potential SPS adopters in Jordan. The yielded results based on SEM supported the impact of all factors proposed excluding the role of performance expectancy. The main outcomes of this study have been then discussed

and the researchers have presented the practical and theoretical implications that should be considered by both practitioners and academics.

7.1 Limitations and Future Research

This study presents a valuable attempt to provide a further understanding of customers' reactions toward an important system (SPS). However, as in any other study, there are a number of restrictions that will have to be addressed. Firstly, the main focus of the current study is related to customer intentions and SPS adoption.

However, the current study model does not cover the related SPS issues following the implementation stage and the main outcomes that could be captured by both kinds of customers: household and business. Thus, future studies should pay more attention to the reflection of the implementation of these systems on financial and non-financial performance from the customers' perspective.

In addition, the proposed model explains the SPS issues only from the customers' perspective; it does not consider the role of other sections (suppliers of these systems, governments). Therefore, it could be more useful to consider all of these areas to provide a comprehensive picture to explain how SPS adoption could be fostered in Jordan.

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