E-voting adoption in a developing country

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Abstract

Purpose – The purpose of this paper is to present factors that affect e-voting adoption in the Middle East and, in particular, Jordan. Changing the election voting method for the people in Jordan from traditional voting to interactive voting via the web needs exploration to understand the factors affecting e-voting adoption by citizens. Therefore, this paper reports on a study undertaken to identify the main factors that would influence citizens' intentions to adopt the use of an e-voting system in Jordan, using an established e-government adoption model and a theoretical framework consisting of the diffusion of innovations (DOI) theory and the technology acceptance model (TAM).

Design/methodology/approach – A survey study of 267 Jordanian citizens who were internet users investigated the influence of the aforementioned factors on the adoption and use of e-voting websites. Multiple regression analysis was used to test the hypotheses.

Findings – Contrary to the previous established e-government adoption model, beliefs and website design were not found to be significant predictors of the intention to use e-voting websites. The paper found that trust in government, attitudes, perceived usefulness and complexity were significant factors in Jordanian citizens' intentions to use e-voting websites.

Originality/value – This is one of few studies to have used an established e-government adoption model to test the adoption of e-voting as one of the e-government applications. In addition, this paper is one of the few to examine the factors that influence the adoption and use of e-voting systems by citizens in the Middle East. Although the previous e-government adoption model showed the impact of attitude to be non-significant on e-government adoption, this paper shows the significant influence of attitudes on citizens' intentions to use e-voting websites. On the other hand, this paper supports previous e-government adoption studies in showing the importance of including constructs of the DOI theory (relative advantage and complexity) and those related to TAM (perceived usefulness and perceived ease of use) when considering the topic of e-government adoption in a Middle Eastern country, although previous studies have shown similarities between these constructs.

Keywords Jordan, Developing countries, E-government, Factors, E-voting adoption, Intention to use

Paper type Research paper

Introduction

To enhance the democratic process, governments worldwide have been prompted to use an electronic system known as e-voting. E-voting, as a new technological innovation, assists governments to enhance the democratic process by ensuring more participation by voters in choosing their representatives and leaders. Various definitions of "e-voting" have been formulated from different perspectives. Some definitions tend to focus on how e-voting has evolved through new technological media by utilizing information and communications technology (ICT) applications including the internet as tools to enable people to vote efficiently and effectively (Alomari *et al.*, 2012; Nu'man, 2012). On the

other hand, Kumar and Walia (2011, p. 1,825) indicated that e-voting was simply a machine by stating that e-voting is:

> […] a simple electronic device used to record votes in place of ballot papers and boxes which were used earlier in conventional voting system. It is a simple machine that can be operated easily by both the polling personnel and the voters.

On the basis of the above definitions, "e-voting" is defined for the purpose of this research as follows:

> A mechanism through which voting processes are produced and delivered to citizens utilizing web-based internet applications.

E-voting, as with some other technological innovations, has been implemented and designed by developed and Western countries. It has been implemented to suit the social cohesion of these communities. Therefore, this study has shown the necessity to address the factors that, from social and cultural perspectives, would influence the adoption of an e-voting system when such a system is implemented in developing and Middle Eastern countries such as Jordan. Jordan is one of the developing countries that has recognized the importance of ICT involvement in the political and governance processes in moving toward e-democracy. Jordan has taken the required step to replace the traditional election process (a paper-based system in which voters cast their ballots in specially designed boxes in election centers) with an online system to choose the 120 parliamentary representatives who are elected by the public. Attempts have been made by researchers to study the adoption and implementation of e-voting in Jordan even though the system has not yet been fully implemented (Alomari, 2014b; Nu'man, 2012; Khasawneh et al., 2008). Therefore, this research paper has significantly extended these attempts by exploring the adoption of e-voting in the Middle East and, in particular, Jordan.

Obtaining citizens' trust in e-voting is one of the main barriers related to e-voting in Jordan (Nu'man, 2012). Therefore, this research paper focuses on a citizen-centric approach in researching e-voting adoption in Jordan by identifying factors that would influence adoption of an e-voting system by Jordanian voters.

This study adopted an established e-government adoption model to discuss factors related to e-voting adoption in Jordan (Alomari et al., 2012). The model is composed of 11 constructs, namely: trust in the internet, trust in government, attitudes, beliefs, internet and computer skill confidence, website design, relative advantage, compatibility, complexity, perceived usefulness (PU) and perceived ease of use (PEoU). These factors were addressed based on socially based perspectives as social community acceptance represents one of the major points that need to be emphasized when implementing and adopting any technology including e-government and e-voting (Alomari et al., 2009; Xenakis and Macintosh, 2005).

This paper comprises seven sections, the first being the introduction which is followed in the second section by the presentation of an established model in e-government adoption and the related literature. The next section outlines two theoretical frameworks: the diffusion of innovations (DOI) theory and the technology acceptance model (TAM). Data for this study were collected using a questionnaire, and then analyzed using factor analysis and multiple regression, with these processes described in the paper. Based on the analyzed data, the significant findings are then

presented and discussed. Before concluding the paper, the research implications and the limitations of the study are presented.

E-government adoption model

Alomari *et al.*'s (2012) model of e-government adoption integrated constructs derived from three main sources, namely:

(1) the literature (constructs such as trust in the internet, trust in government, attitudes, beliefs, computer and internet skill confidence and website design);

(2) the DOI theory (relative advantage, compatibility and complexity); and

(3) the TAM (PU and PEoU) (Figure 1).

The model presented the direct association between the aforementioned constructs (independent variables) and the construct of e-government adoption (dependent variable). It has also redefined the previous established model in e-government adoption, which was designed based on a research study conducted in a developed country, the USA (Carter and Be'langer, 2005).

The e-government adoption model developed by Alomari *et al.* (2012) identified the main factors that influence the adoption of e-government. The authors highlighted the applicability of using their model of e-government adoption to test the adoption of other governmental initiatives such as e-voting, e-democracy and e-services, especially in developing and Middle Eastern countries. Alomari *et al.* (2012) undertook their study in Jordan where the current research, reported in this paper, has also been conducted. In general, previous studies have stressed the benefits of using an e-government adoption model in testing the adoption of e-voting (Schaupp and Carter, 2005). The following paragraphs report on findings in the literature about factors of trust (trust in the internet and trust in government), attitudes, beliefs, internet and computer skill confidence and website design.

Trust in the internet and trust in government

In their model of e-government adoption, Alomari *et al.* (2012) stated that two types of the trust need to be outlined to ensure the successful adoption of e-government by citizens, namely, trust in the internet and trust in government. In a previous study conducted in a developed country, the USA, researchers found that trustworthiness (trust in the internet and trust in government) influenced citizens' intentions to use e-government services (Carter and Be'langer, 2005). Moreover, in their study in the USA, Schaupp and Carter (2005) found that these two constructs influence the intention to use one e-government initiative, namely, e-voting. They reached this conclusion by using a model which aims to identify the major factors that influence citizens' adoption of e-voting. The model consists of eight factors including trust in the internet and trust in government. Avgerou (2013) proposed a model that explains trust in e-voting by highlighting the importance of citizens' perceptions of the trustworthiness of both the technology system and the electoral authorities when e-voting systems are being developed and implemented. In addition, Powell *et al.* (2012) conducted a study, by surveying different age groups (young people and senior citizens), to test the influence of different constructs including trust in the internet and trust in e-voting adoption. In the results from the full sample, Powell *et al.* (2012) found that, while trust in the internet has a significant relationship with
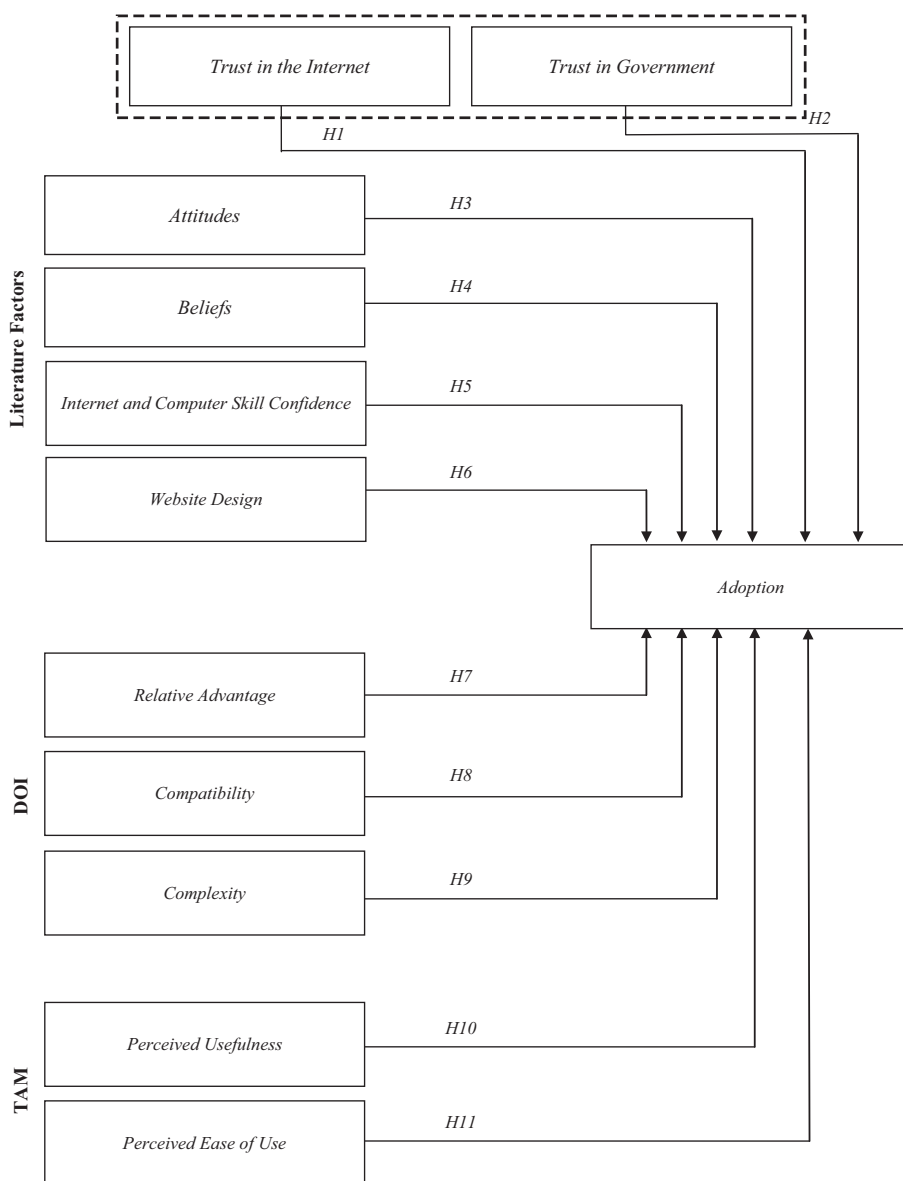
Figure 1.
Research model

e-voting, this was not the case for trust in the government. These studies have been conducted in developed countries and show slight differences in their findings with respect to these two constructs (trust in the internet and trust in government). This has prompted the necessity to explore these same constructs in developing countries to examine the extent to which they would influence voters' intentions to use an e-voting system in these countries.

By investigating the influence of these two constructs in the adoption of e-voting in a developing and Middle Eastern country, Jordan, the current study has extended other research. Previous research has stressed the importance of investigating these factors in relation to technology adoption, including e-government and e-voting, in both developed and developing countries (Abandah *et al.*, 2014; Alomari *et al.*, 2009, 2010; Avgerou, 2013; Chiang, 2009; Moynihan, 2004; Manolopoulos *et al.*, 2013; Nu'man, 2012). Accordingly, the first two hypotheses were proposed:

H1. Higher levels of trust in the internet will be positively related to higher levels of user intention to use e-voting websites in Jordan.

H2. Higher levels of trust in government will be positively related to higher levels of user adoption of e-voting websites in Jordan.

Attitudes and beliefs
Because of the need to understand people's feelings and norms toward e-voting as a change in their lives, this study highlighted the relationship between attitudes and beliefs and e-voting adoption. Previous theories, such as the theory of reasoned action (TRA), have stated that actual behavior is influenced by the person's intention to perform such behavior, and this intention is influenced by one's attitudes and subjective norms (Ajzen and Fishbein, 1972). Different definitions of attitudes have been introduced by previous studies conducted in different research contexts including the technological context. Researchers have formulated a definition of attitudes in relation to e-government (Alomari *et al.*, 2012) based on previous definitions (Taylor and Todd, 1995; Fishbein and Ajzen, 1975). Alomari *et al.* (2012) declared in their definition that attitude is "a positive or negative feeling that individuals might have towards interaction with the government online through its websites" (Alomari *et al.*, 2012). E-voting as an e-government application represents a form of interaction with government. Therefore, this prompts the need to investigate the factors including the attitudes and beliefs that influence this kind of interaction. Although there is a lack of research on examining the influence of attitude on e-voting adoption, a few previous studies have indicated the significant role of attitudes when discussing e-voting as a new change in social communities (Adeshina and Ojo, 2014; Avgerou, 2013; Beroggi, 2014; Liptrott, 2006, Manolopoulos *et al.*, 2013; Svensson and Leenes, 2003). Adeshina and Ojo (2014), based on their multi-level analysis of e-voting, highlighted that voters' attitudes toward technology change is a remarkable construct that should be considered when addressing the topic of e-voting adoption. Avgerou's (2013) model of trust in e-voting showed that a positive attitude toward information technology (IT) is a necessary mechanism to build voters' trust in e-voting systems. In Taiwan, Chiang (2009) conducted a study with over 281 participants to test their perceptions about e-voting systems and found that attitude has a significant influence on the use of e-voting systems. By focusing on a citizen-centric approach, the current study has addressed this construct in depth by examining the direct impact of voters' attitudes on their intentions to use an e-voting system. A hypothesis was proposed to present this relationship:

H3. A higher level of positive attitudes regarding the internet will be positively related to higher levels of user adoption of e-voting websites in Jordan.

Furthermore, "beliefs" can be described as the individual's subjective perception of the probability that performance of a given behavior will result in a given consequence (Taylor and Todd, 1995; Fishbein and Ajzen, 1975). This study has taken into account different beliefs including religious beliefs about the internet. The researchers have provided an example of these beliefs by reporting that:

> […] some people in Jordan will not connect to the internet from home, as they may believe that their family members would have access to the internet and would thus be able to view various immoral themes that appear on websites (Alomari *et al.*, 2012).

A hypothesis was proposed for this factor:

H4. A higher level of positive beliefs regarding the internet will be positively related to higher levels of user adoption of e-voting websites in Jordan.

Previous studies have highlighted the significant role of attitudes and beliefs in their impact on the intention to use information technologies (Alomari, 2014a, 2014b; Alomari *et al.*, 2010, 2012, 2014; Al-Saggaf, 2004; Hill *et al.*, 1998; Manolopoulos *et al.*, 2013; Vassilakis *et al.*, 2005). The current study has extended other research conducted in different technological contexts by presenting the impact of attitudes and beliefs on the use of e-voting technology.

Internet and computer skill confidence

The factor, internet and computer skill confidence, was one of the main factors presented in Alomari *et al.*'s (2012) e-government adoption model. The direct association between this construct and e-government adoption was presented in their model. Previous studies have claimed that having the skills in and knowledge about using the internet and computers is one of the main factors that affect the adoption of e-government and e-voting as technological innovations (Alomari *et al.*, 2012; Alvarez *et al.*, 2011; Be'langer and Carter, 2008; Oostveen and van den Besselaar, 2005; Welch *et al.*, 2005). On the other hand, Be'langer and Carter (2010) claimed that internet use (proposing that frequent internet users possess a level of technical and information literacy) does not have a significant impact on the acceptance of internet voting in a developed country, the USA. Conversely, based on their model which studied factors that influence e-voting adoption by young and elderly voters in the USA, Powell *et al.* (2012) claimed that if voters have a fear of using computers, their intention to vote online decreases. In exploring factors influencing the adoption of an e-voting system by organizations in Nigeria, Salimonu *et al.* (2014), based on their e-voting technology adoption model, stated that no significant association was found between ICT training and skills, and e-voting adoption. Salimonu *et al.* (2014) investigated the influence of this construct on e-voting adoption from organizational perspectives. Because of the lack of research studying this construct in relation to e-voting adoption by citizenry from social perspectives (in the social community), the current study has presented internet and computer skill confidence as one of the main predictors of voters' intentions to use an e-voting system. Jordanian voters need to have the required skills to enable them to interact with the online voting system so they can carefully choose who will represent them in parliament:

H5. Higher levels of ability to use the internet and computers will statistically predict higher levels of user adoption of e-voting websites.

Website design
Website design was another important factor highlighted in studies on the adoption of
e-voting. Asiimwe and Lim (2010, p. 3) claimed that "government websites are
sometimes even touted as drivers to eDemocracy because they help boost democratic
practices such as voting, deliberation or decision-making". As websites have become
one of the main channels of e-government, the use of a website also represents one of the
main types of e-voting that is not supervised by governmental authorities. It has been
stated that "citizens' intention to adopt e-government increases if e-government
websites are available with adequate, attractive and well-organized design and content"
(Alomari *et al.*, 2012). Therefore, e-voting websites need to be available with an adequate
design to encourage voters to use the online voting system. Asiimwe and Lim (2010,
p. 3) stressed the necessity of having a clear, simple and consistent website that was easy
to use to ensure citizens' involvement in the democratic process including e-voting,
stating that "usable government websites promote a bottom-up approach to
democracy". Asiimwe and Lim (2010) studied government website usability by
conducting a website evaluation based on different criteria including website layout
design and website navigation. However, these researchers did not study the direct
relationship and association between website design and e-voting adoption by citizens.
Therefore, the current research has studied this type of relationship to provide an
in-depth investigation of its effect on citizens' intentions to use an e-voting website, thus
ensuring their involvement in the democratic process. Previous research has presented
website design as one of the main predictors of e-government adoption (Alomari *et al.*,
2012). Because of the lack of research testing the direct influence of website design on
e-voting adoption, the current research conceptualized the direct association between
website design and voters' intentions to use an e-voting system:

> *H6.* Higher standards of e-government website design will be positively related to
> higher levels of user adoption of e-voting websites.

Diffusion of innovations theory
As the DOI theory has been widely used by researchers to investigate the adoption of
other technological innovations, Alomari *et al.* (2012) used this theory to study the main
factors that may influence e-government adoption in Jordan. "Innovation" is defined as
an "idea, practice, or object that is perceived as new by an individual or other unit of
adoption" (Rogers, 1983). It has been claimed that "e-voting is a new practice and
therefore satisfies this definition" (Liptrott, 2006).

The current study investigated the adoption of e-voting as a new technological
innovation which would introduce voters in Jordan to a new approach for choosing their
representatives in parliament. The DOI theory has introduced five main characteristics
of innovation, namely: relative advantage, complexity, compatibility, trialability and
observability (Rogers, 1983). Relative advantage, complexity and compatibility have
been found to be consistently significant in technology adoption (Tornatzky and Klein,
1982). These three characteristics have previously been used to test the factors related to
the adoption of e-government in Jordan (Alomari *et al.*, 2012), and thus were used in this
study for the same purpose.

"Relative advantage" is defined as "the degree to which an innovation is perceived as
better than the idea it supersedes" (Rogers, 1983). In the current study, relative
advantage was considered to be the level to which citizens perceived that voting through

an e-voting system was superior to traditional methods of voting (i.e. by visiting the election center in person). Previous empirical technological adoption studies have found relative advantage to be either a significant (Ojha *et al.*, 2009) or a non-significant (Schaupp and Carter, 2005) predictor for the adoption of a tax e-filing system and an e-voting system, respectively. Although relative advantage was found to be similar to one of the TAM's constructs (Venkatesh *et al.*, 2003), namely, PU, the two constructs were included separately in two established models of e-government adoption (Alomari *et al.*, 2012; Carter and Bélanger, 2005). The current study presented relative advantage as a determinant of the adoption of an e-voting system. Therefore, the study proposed the seventh hypothesis:

> *H7.* Higher levels of relative advantage will be positively related to higher levels of user intention to use e-voting websites.

"Compatibility" is defined as "the degree to which an innovation is perceived as being consistent with the existing values, past experience, and needs of potential adopters" (Rogers, 1983). In the current study, compatibility was defined as the way in which citizens perceive that e-voting is consistent with their work and lifestyle. Previous studies have found the significant impact of compatibility on citizens' intentions to use e-government services (Carter and Bélanger, 2005) and an e-voting system (Schaupp and Carter, 2005). The current study proposed the direct impact of compatibility on voters' intentions to use an e-voting system as stated in the eighth hypothesis:

> *H8.* Higher levels of compatibility will be positively related to higher levels of user intention to use e-voting websites.

"Complexity" is defined as "the degree to which an innovation is perceived as difficult to understand and use" (Rogers, 1983). In a previous study in the context of e-government adoption in a developed country, the USA, Carter and Bélanger (2005) claimed that "complexity" in the DOI theory and "perceived ease of use (PEoU)" were similar characteristics; therefore, they did not include complexity in their model. However, Alomari *et al.* (2012) indicated the importance of complexity in addition to PEoU when investigating the adoption of e-government in a developing and Middle Eastern country, Jordan. Complexity was found to be significant in another study on adoption in different technological contexts including e-commerce (Van Slyke *et al.*, 2004). The current study considered complexity as an important factor in exploring the adoption of e-voting in Jordan. Therefore, the ninth hypothesis suggested that:

> *H9.* Lower levels of complexity will be positively related to higher levels of user adoption of e-voting websites.

The next section outlines two constructs of the TAM, namely, PU and PEoU.

Technology acceptance model
The TAM is another theoretical framework that was used by Alomari *et al.*'s (2012) adoption model. The TAM states that there are two determinants for the consumer's attitude toward usage intention: "perceived usefulness (PU)" and "perceived ease of use (PEoU)". PU is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989). PEoU is defined as "the degree to which a person believes that using a particular system would be free of effort"

(Davis, 1989). PU has been identified in the context of e-voting as "[…] citizens' perceptions of e-voting as a means to participate in the election process more efficiently" (Schaupp and Carter, 2005). On the other hand, PEoU was explained by stating that it "[…] refers to government agencies designing sites that are clear, easy to understand, easy to navigate and easy to interact with" (Schaupp and Carter, 2005). The two main constructs of TAM, namely, PEoU and PU, were proposed as having had an influence on e-government adoption in Jordan (Alomari *et al.*, 2012). The current study proposed the same two constructs as having a direct influence on e-voting adoption.

The TAM is used to evaluate user acceptance of a technology. Previous research has demonstrated the convenience of using the two main constructs of the TAM to investigate the intention to use e-government and e-voting (Carter and Bélanger, 2004, 2005; Chang *et al.*, 2005; Choi and Kim, 2012; Hung *et al.*, 2006; Phang *et al.*, 2005). Most research conducted in developing countries have examined an intermediate relationship between PU and PEoU, and intention to use (Chang *et al.*, 2005; Hung *et al.*, 2006; Phang *et al.*, 2005). The use of these two constructs led to the final set of hypotheses:

H10. Higher levels of PU will be positively related to higher levels of user adoption of e-voting websites.

H11. Higher levels of PEoU will be positively related to higher levels of user adoption of e-voting websites.

The following Table I summarizes the hypotheses.

Methods

Sample
In this research, questionnaires were used to collect information on the perceptions of 267 Jordanian citizens, who had regular access to the internet, about e-voting adoption. Most respondents (65.2 per cent) were female. The highest percentage (53.6 per cent) was in the age range of 20-29 years old. University students represented the majority of respondents (60.7 per cent). Most respondents (80.1 per cent) used the internet at home. The amount of internet access time that respondents had each week was spread fairly evenly ranging from one hour to more than eight hours per week. Most respondents (59.9 per cent) held a bachelor's degree level of education.

The survey
This study used a survey to examine the different factors influencing e-voting adoption. The survey items were adapted from previous studies (Davis, 1989; Moore and Benbasat, 1991; Gefen and Straub, 2000; Jarvenpaa *et al.*, 2000; Pavlou, 2003; Van Slyke *et al.*, 2004; Carter and Bélanger, 2005; Vassilakis *et al.*, 2005; Alomari *et al.*, 2012). Responses to the statements in the research questionnaire were measured on a five-point Likert scale (interval scale) ranging from 1 (strongly agree) to 5 (strongly disagree). The questionnaire was translated into Arabic because English is not the first language of Jordan and most Jordanians are not fluent in English. Back-translation was used, with the questionnaire translated from English to Arabic first and then from Arabic to English.

Hypothesis no.	Hypothesis	Construct
H1	Higher levels of trust in the internet will be positively related to higher levels of user intention to use e-voting websites in Jordan	Trust in the internet
H2	Higher levels of trust in government will be positively related to higher levels of user adoption of e-voting websites in Jordan	Trust in government
H3	A higher level of positive attitudes regarding the internet will be positively related to higher levels of user adoption of e-voting websites in Jordan	Attitudes
H4	A higher level of positive beliefs regarding the internet will be positively related to higher levels of user adoption of e-voting websites in Jordan	Beliefs
H5	Higher levels of ability to use the internet and computers will statistically predict higher levels of user adoption of e-voting websites	Computer and internet skill confidence
H6	Higher standards of e-government website design will be positively related to higher levels of user adoption of e-voting websites	Website design
H7	Higher levels of relative advantage will be positively related to higher levels of user intention to use e-voting websites	Relative advantage
H8	Higher levels of compatibility will be positively related to higher levels of user intention to use e-voting websites	Compatibility
H9	Lower levels of complexity will be positively related to higher levels of user adoption of e-voting websites	Complexity
H10	Higher levels of perceived usefulness will be positively related to higher levels of user adoption of e-voting websites	Perceived usefulness
H11	Higher levels of perceived ease of use will be positively related to higher levels of user adoption of e-voting websites	Perceived ease of use

Table I.
Summary of
hypotheses

Results
Factor analysis
To first analyze the results of the survey, exploratory factor analysis was conducted. The 65 items measured by the Likert scale were subjected to axial components analysis using the Statistical Package for the Social Sciences (SPSS) version 20.0. Prior to performing axial component analysis, the suitability of the data for factor analysis was assessed. Inspection of the correlation matrix revealed the presence of many coefficients of 0.3 and above. The Kaiser–Meyer–Olkin value was 0.818, and Bartlett's test of sphericity reached statistical significance, supporting the factorability of the correlation matrix. Axial components analysis with varimax rotation was used. The axial factor analysis revealed the presence of 14 components with eigenvalues exceeding 1, making them suitable for analysis (Hair *et al.*, 1998). An inspection of the screen plot revealed a clear break after the seventh component. It was decided to retain the following seven components that showed a number of strong loadings:

(1) website design;
(2) beliefs;
(3) PU;
(4) complexity;
(5) attitudes;
(6) trust in government; and
(7) trust in the internet.

Furthermore, a strong loading of items was recorded for the dependent variable, e-government adoption. Four factors were dropped from any further analyses:

(1) internet and computer skill confidence;
(2) PEoU;
(3) relative advantage; and
(4) compatibility.

Table II shows the factor analysis, which explains that all the items loaded properly in their expected factors. The headings of columns report the name of the factors that showed strong loading, while the headings of rows indicate the main items that are related to each factor. The current study was in agreement with Alomari *et al.* (2012) in showing that respondents viewed attitudes as different from beliefs. In both studies, attitudes and beliefs did not load together – they loaded as different components. However, the current study recorded a strong loading for attitudes only while Alomari *et al.* (2012) also highlighted a significant loading for beliefs. This would indicate that both factors need to be considered in examining the adoption of technological innovations in general, such as e-government, and its applications, including e-voting.

Table III shows the reliability analysis for trust in the internet, trust in government, beliefs, attitudes, website design, PU, complexity and adoption.

Results of multiple regressions (hypotheses testing)

As the main purpose of this research was to determine the relationship between e-government adoption (dependent variable) and the factors (independent variables), multiple regression was deemed to be the most suitable analytical technique. Table IV illustrates the main variables used for multiple regression.

There were no violations of assumptions for multivariate normal distribution, independence of errors and equality of variance. Multicollinearity was not a concern, with variance inflation factors ranging from 1.18 to 2.97 for the main effect regression model. Outliers and influential observations were identified with leverage, standardized residuals and Cook's D-statistic, with this analysis indicating that no problems were found with respect to influential outliers. The regression resulted in a model with an adjusted R of 25 per cent. This indicated that independent variables accounted for 25 per cent of the variance in citizens' intention to use e-government. Because the overall model was significant ($F = 13.671$, $p = 0.000$), the significance of each variable was tested. As can be seen from Table V, the hypotheses were supported, with the exception of those relating to the following: trust in the internet, beliefs, website design, compatibility and PEoU, which were all dropped from further analysis because they did

Item	TRUST_I	TRUST_G	BELIEF	Factor loading ATTIT	WEB	PU	CX	ADOP
TRUST_I.1	0.684							
TRUST_I.2	0.661							
TRUST_I.3	0.658							
TRUST_I.4	0.688							
TRUST_G.1		0.710						
TRUST_G.2		0.675						
TRUST_G.3		0.573						
TRUST_G.4		0.635						
BELIEF.1			0.678					
BELIEF.2			0.773					
BELIEF.3			0.689					
ATTIT.1				0.646				
ATTIT.2				0.688				
ATTIT.3				0.701				
WEB.1					0.546			
WEB.2					0.760			
WEB.3					0.640			
WEB.4					0.755			
WEB.5					0.732			
WEB.6					0.738			
WEB.7					0.790			
WEB.8					0.666			
PU.1						0.601		
PU.2						0.693		
PU.3						0.726		
PU.4						0.674		
PU.5						0.602		
PU.6						0.562		
PU.7						0.643		
CX.1							0.509	
CX.2							0.534	
CX.3							0.631	
CX.4							0.685	
CX.5							0.651	
ADOP.1								0.607
ADOP.2								0.670
ADOP.3								0.575
ADOP.4								0.517

Notes: Trust_I = trust in the internet; Trust_G = trust in government; BELIEF = beliefs; ATTIT = attitudes; WEB = website design; PU = perceived usefulness; CX = complexity; ADOP = adoption

Table II.
Factor analysis

not load with their proper items. Thus, the hypotheses related to trust in government, attitudes, complexity and PU were found to be significant, and thus were supported. Table V presents the results of the hypotheses testing.

Complexity had the strongest impact on intention to use, followed by website design, PU and beliefs. Beliefs had a negative impact on the dependent variable, intention to use;

thus, a lower level of negative beliefs regarding the internet was found to be related to a higher level of the user's intention to use e-government websites. Figure 2 presents the modified research model of e-government adoption in Jordan, using only the significant path (the supported hypotheses).

The next sections discuss e-voting adoption and the implications of the current research paper's findings, followed by the conclusion of the paper.

Discussion

This section discusses the significant results of the multiple regressions, which relate to trust in government (*H2*), attitudes (*H3*), complexity (*H9*) and PU (*H10*). The results highlight the significance of two different categories of factors: the two factors reviewed in the literature – "trust in government" and "attitude" – and the two factors derived from the theoretical framework of this research – "complexity" from the DOI theory and "perceived usefulness (PU)" from the TAM.

Constructs	No. of items	Alpha coefficient
Trust in the internet	4	0.78
Trust in government	4	0.77
Beliefs	3	0.80
Attitudes	3	0.76
Website design	8	0.78
Perceived usefulness	7	0.77
Complexity	5	0.76
Adoption	4	0.76

Table III.
Reliability analysis

Variable	No. of items	Mean	SD
Website design	8	1.81	0.69
Beliefs	3	2.10	0.69
Perceived usefulness	7	2.10	0.56
Complexity	5	2.29	0.69
Attitudes	3	2.44	0.85
Trust in government	4	2.78	0.88
Trust in the internet	4	2.97	0.90
Adoption	4	2.40	0.72

Table IV.
Final regression variables

Hypotheses	Variable	Alpha coefficient	*t*-value	Significance	Supported
H1	Trust in the internet	0.111	1.730	0.085	No
H2	Trust in government	0.154	2.371	0.018	Yes
H4	Beliefs	−0.027	−0.508	0.612	No
H3	Attitudes	0.220	3.715	0.000	Yes
H6	Website design	0.040	0.656	0.513	No
H10	Perceived usefulness	0.152	2.457	0.015	Yes
H9	Complexity	0.147	2.462	0.014	Yes

Table V.
Hypotheses testing
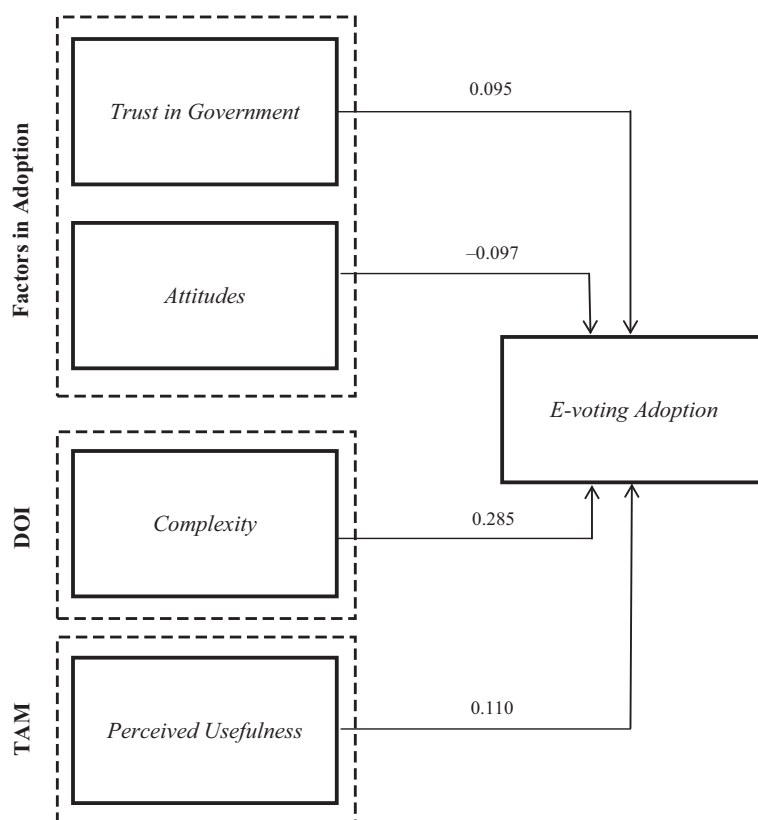
Figure 2.
Modified research
model

The findings support *H2*. Higher levels of trust in government will directly predict higher levels of user adoption of e-voting websites in Jordan. The ability of the Jordanian Government to carry out different voting transactions, process different forms and provide citizens with up-to-date information about elections are the main measurements of trust in government. The finding of this study is consistent with the significant results of the e-voting research conducted by Schaupp and Carter (2005) and other e-government research conducted by Bélanger and Carter (2008) in the USA and Alomari *et al.* (2012) in Jordan. Jordan is a Middle Eastern country still in the early stage of implementing e-government and its applications, including e-voting. The main focus at this stage of Jordan's development is on improving the internal and external IT infrastructure. Jordanian citizens do not see e-government, in general, and e-voting, in particular, as a real test of the government as no transactional processes are offered by the government and most e-government websites are informational websites. Therefore, this presents a reason for Jordanian citizens to question the government's ability to conduct elections online. Furthermore, the Jordanian Government lacks collaboration between its entities in terms of drafting policies, laws and regulations related to ICT usage, standardizing system use and sharing information. By considering these issues, the Jordanian

Government could have a starting point for moving online to conduct elections and to increase voters' intentions to choose their candidates online through an e-voting website. For example, the Jordanian Government should convey to citizens that it is capable of providing them with a trustworthy election process by promoting its actual interaction with the Independent Election Commission to provide voters with a reliable e-voting system by formulating policies, regulations and rules to govern the election process online. It has been stated that "for e-voting to be adopted, citizens must believe that government will take measures to ensure a fair and reliable voting process" (Schaupp and Carter, 2005, p. 596). On the other hand, Avgerou (2013, p. 444) stressed the importance of election fairness and citizens' trust in government by claiming that:

> […] e-voting is likely to be trusted if it is perceived to be associated with efforts for strengthening fair elections, is introduced and enacted amid other initiatives to create a positive IT culture in the country, and is mobilized by an already trusted government agency.

The government in Jordan, in working toward its purpose of creating an information society, therefore needs to ensure fairness of elections conducted through an e-voting website and to introduce e-voting as an IT initiative.

The findings support *H3*: the more positive the attitudes held by citizens, the greater their intention to adopt e-voting. This research found that the factor "attitudes" is a significant predictor of e-voting adoption in Jordan. The finding of this research is in line with the literature which indicates the significant role of attitudes in terms of e-voting adoption (Adeshina and Ojo, 2014; Svensson and Leenes, 2003; Liptrott, 2006). Although this finding is consistent with that of previous studies, those studies were conducted in different contexts. The current research was conducted in an Arabic country in which the culture and social life are different from Western countries. The consistency of results despite such different contexts might refer to the nature of e-voting as a new technological innovation which requires changes, regardless of the context in which it is implemented. Liptrott (2006) stressed the importance of exploring factors, such as individuals' attitudes to the perceived attributes of the innovation, as well as the culture of the social system, when discussing the diffusion of e-voting as a technology. The current research encountered religion as one of the barriers facing e-voting adoption in Jordan. Religion was one of the items used to measure the "attitudes" construct. In their qualitative-based study conducted in Jordan, Alomari *et al.* (2014) found that one of the main factors influencing citizens' intentions to adopt e-government was religion. Religion was encountered as one of the main cultural factors that should be taken into account when implementing different e-government initiatives (Elsheikh and Cullen, 2008). As e-voting is one of these initiatives, the Jordanian Government needs to understand the extent to which attitudes influence citizens in their adoption of e-voting. The current research provides the required answer by empirically examining the impact of attitudes on citizens' intentions to use e-voting.

The findings support *H9*: the more the users perceive e-voting websites as being easy to understand and use, the more they will intend to use these websites. The Jordanian Government is intending to facilitate voters' interaction with an e-voting system as the way in which voters choose their candidates. One strategy for the Jordanian Government to achieve this is to launch its e-voting services and information in an easy

and understandable way by ensuring simplicity when it comes to completing the voting process and navigating the e-voting website. For example, voters should be able to locate information about their candidates and the election process on e-voting websites with less effort. Previous studies stressed the importance of voters having a general knowledge and understanding of the e-voting process (Beroggi, 2014; Schaupp and Carter, 2005). Complexity has often had a significant relationship with user intentions in other contexts, such as e-commerce (Van Slyke *et al.*, 2004) and also in the e-government context (Alomari *et al.*, 2012). In addition, the current research found that complexity is a significant factor that may influence the intention to adopt e-voting – in this case, by Jordanian citizens. In this research paper, complexity is a significant factor because the survey was administered to people who were internet-literate and capable of assessing to what extent the website was easy to use and understand. In summary, this paper found complexity to be a significant factor related to adoption within the e-voting context.

The findings support *H10*: higher levels of PU were associated with the increased intention to adopt e-voting. This finding indicates that citizens will be more willing to adopt e-voting if the e-voting system increases the efficiency and effectiveness of the voting process and the way in which elections are conducted. Commenting on the efficiency and effectiveness of the e-voting process, Schaupp and Carter (2005, p. 595) stated that e-voting is useful, as "it will reduce the amount of time and effort required to actually cast a vote". Increasing the efficiency and effectiveness of the election process is one of the objectives of the Jordanian Government and the Independent Election Commission. Therefore, the Jordanian Government should ensure that the e-voting website is free of technical problems to ensure its usefulness. One reason for this result could be that the survey sample was familiar with the internet; therefore, they would be more capable of assessing the extent to which the e-voting website would help them to choose their candidates in comparison with the traditional approach. This research finding is consistent with findings of previous e-voting adoption research conducted by Schaupp and Carter (2005), and is in line with e-government adoption research conducted by Alomari *et al.* (2012). This would indicate that PU should be considered for both e-government and its applications, including e-voting.

Research implications
This research found that trust in government, attitudes, complexity and PU are the main factors that would influence e-voting adoption by voters in Jordan. The Jordanian Government can sustain the people's trust in different ways – one way is through its websites, by providing them with up-to-date information, such as information about elections and voting procedures, laws and regulations. In addition, the Jordanian Government, in coordination with the Independent Election Commission, should increase its promotion about e-voting being one of the initiatives undertaken by the government to ensure the accuracy of elections and to enhance the democratic process in Jordan. The Jordanian Government must ensure that it develops an e-voting system with a framework that respects the principles of democratic elections especially as previous studies have shown the linkage between e-services and the democratic process (Collins and Butler, 2002; West, 2004).

Attitude has also been encountered as one of the main influential factors on e-voting adoption. The Jordanian Government should increase the popularity of e-voting by

focusing on its promotional campaigns about the internet through which the e-voting system runs. The government needs to promote the importance of utilizing the internet in daily life, introducing the internet as a way toward change and a medium that saves time and cost. Pons (2004) listed three main elements that should be considered in successfully adopting any IT, with the main one being the use of the internet as a medium. The other two elements are awareness and understanding the internet. Therefore, the Jordanian Government should take appropriate actions to increase voters' awareness of the internet as a medium which can simplify the e-voting process for them. These actions should comprise different approaches, including the use of mass media to conduct promotional campaigns about e-voting. These campaigns could be directed toward the main advantages of e-voting; thus, they may resolve many of the voters' concerns about elections. Avgerou (2013) indicated that the media could affect citizens' attitudes toward e-voting with advertisements that familiarize voters with its technology and procedures.

Complexity and PU were the other predictors of e-voting adoption in Jordan. The Jordanian Government, through the Independent Election Commission, should provide people with a voting process that requires little effort to use, by providing clear directions of how to navigate the e-voting website and clearly listing the steps involved in conducting a particular voting transaction. Asiimwe and Lim (2010, p. 5) stated that "[a] good navigation structure and navigation tools help users find information easily and quickly on webpages". In addition, the e-voting website should be free of any technical problems to ensure the usefulness of the election process provided, for instance, by speeding up the counting procedures of ballots.

The current study has highlighted that e-voting is one of the main initiatives that would enable the Jordanian Government to motivate voters to use an online voting system, thereby enhancing the democratic process. This research paper helps the Jordanian Government by providing a preliminary idea about what Jordanian voters think about e-voting as a new method for choosing their representatives in parliament. Articulating these factors will assist the Jordanian Government in considering citizens' centricity in the implementation stage of an e-voting system.

Furthermore, this research paper is significant in bridging the gap between the theoretical design of e-voting and the actual deployment of an e-voting system in the social community. Through the research's interaction with voters, it has explored factors that can help to boost e-voting acceptance by different social groups. By looking at these factors, this research provides an insight into the problems that could influence e-voting's effective functioning in the social community. The research proves the applicability of the established e-government adoption model for identifying factors related to e-voting adoption in one Middle Eastern country (Jordan); hence, it may be used in further studies on e-voting adoption in other Middle Eastern countries. This research paper, by confirming the influence of factors on one technological innovation, could be a useful resource for researchers and practitioners concerned with the development, implementation and adoption of IT projects, in general, and e-democracy and e-voting, in particular.

On other hand, because of socio-cultural issues relevant to Jordan and other Middle Eastern societies, voters' confidence in the voting process depends on many factors. These factors include culture, religion, customs, traditions, politics, family ties and economic issues. Another factor is the experience that voters have with

technology, with this being the traditional research context of e-voting. Therefore, this research attempts to explore the issue of e-voting outside the traditional research context by examining the socio-cultural aspects of electronic voting from the perspectives of ordinary citizens in Jordan. Therefore, the research approach is to utilize common theoretical models to provide new insights into electronic voting in Jordan mainly from socio-cultural perspectives, but also taking into consideration the technological factor.

This research paper fulfills two functions: it acts as a research facilitator in identifying factors and barriers requiring further exploration in relation to e-voting adoption. It also prompts governments in the Middle East and the Jordanian Government, in particular, on the necessity to begin implementation of an e-voting system, especially as the paper introduces a study that has focused on the main users of the online voting system, that is, voters.

Limitations and suggestions for future research

This research did not focus on specific election processes such as parliamentary elections or municipal elections. It will be useful to see if there is any difference in perceptions of e-voting adoption in terms of either of these types of elections. Furthermore, this research has surveyed people who had regular access to the internet. Therefore, it is necessary in another study to include citizens who do not have regular access to the internet as that would increase the generalizability of the results. The current research was carried out by surveying participants who were mostly in the age group of 20-29 years. Therefore, it is necessary in future studies to include citizens who are older and who have had more experience with the election process. Others factors influencing intention to use e-voting may exist. Further expansion of Alomari *et al.*'s (2012) model would capture factors not contemplated in the current paper. Furthermore, it would be useful to conduct future study using a qualitative method to encapsulate more factors related to e-voting adoption. Finally, this research has focused mainly on obtaining respondents' perceptions of websites as one of the e-voting channels; thus, further studies should be conducted to examine e-voting adoption by focusing on other channels.

Conclusion

In conclusion, this research paper has discussed the main factors that would influence the adoption of e-voting by citizens. In articulating these factors, the study used an established and published e-government adoption model (Alomari *et al.*, 2012). These factors are: trust in the internet, trust in government, attitudes, beliefs, internet and computer skill confidence, website design, relative advantage, compatibility, complexity, PU and PEoU. This study has taken the first step in examining the applicability of Alomari *et al.*'s (2012) e-government adoption model to test other technological innovations, including e-voting. A survey of 267 Jordanian citizens facilitated an empirical examination of the main factors influencing e-voting adoption. The study performed multiple regressions on the different factors resulting from the factor analysis. According to the findings, trust in government, attitudes, complexity and PU are significant factors in the adoption

of e-voting. It will be important in further studies to collect qualitative data involving internet-illiterate people to sustain the required generalizability of the study's findings.

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