The African Journal of Information Systems

Volume 10 | Issue 3 Article 5

May 2018

Framework Towards Enhancing Adoption of Electronic Payment in a Developing Economy: A Case of Uganda

Samuel Eelu
Makerere University Business School, eelusamuel@gmail.com

Agnes Nakakawa
Makerere University, agnesnakakawa@gmail.com

The African Journal of Information Systems

Framework Towards Enhancing Adoption of Electronic Payment in A Developing Economy: A Case of Uganda

Research Paper

Volume 10, Issue 3, July 2018, ISSN 1936-0282

Samuel Eelu
Makerere University Business School
seelu@mubs.ac.ug

Agnes Nakakawa
Makerere University
anakakawa@cis.mak.ac.ug

(*Received January 2018, accepted April 2018*)

ABSTRACT

Usage of electronic payment (e-payment) in developing economies is still limited, yet literature reveals several models and research efforts that explain adoption of innovations associated with information and communication technologies. Thus, this paper investigates issues hindering increased adoption of e-payment systems in a developing economy (specifically Uganda), and suggests possible strategic capabilities or interventions that key stakeholders can actualize to address the issues and enhance e-payment adoption. To achieve this, participatory action research was adopted and instantiated by: conducting an exploratory survey to gain relevant insights from target users of e-payment, devising a framework basing on survey findings and on a literature-based taxonomy of aspects that influence technology adoption, and evaluating the artifact using structured walkthroughs with domain experts. Accordingly, the framework presented herein not only explains dynamics in e-payment adoption, but also informs and directs stakeholders on required interventions towards enhancing adoption of e-payment in a developing economy.

Keywords

Adoption of Electronic Payment Systems, Information Technology Adoption, Strategic Interventions for Electronic Payment Systems

INTRODUCTION

Global adoption of e-commerce created financial needs that could not be adequately fulfilled by traditional payment systems, and this triggered investigation into electronic payment (e-payment) systems – electronic mechanisms for enabling conventional payment systems or mechanisms that use digital currency technology (Sumanjeet, 2009). Examples of e-payment systems are shown in table 1. Although several forms of e-payment exist, developing economies widely embrace mobile-based mechanisms because they are a foundation for: (1) innovative and cheaper solutions for financial, health, and agricultural services; and (2) mobile money services that enable one to directly store electronic value on a cell phone, and then use this value to purchase a wide range of products and services

(NetHope and MEDA, 2012). Thus, mobile payments as a mode of e-payment economically addresses financial needs of many poor people in distant rural areas (Ndiwalana and Popov, 2008).

Table 1: Examples of e-payment systems (Based on: Sumanjeet, 2009; Porteus, 2006; Schneider, 2010; Turban et al., 2008; HN computing, 2016)

#	Form/category of e-payment	Brief Description
1	Online Credit Card Payment System	A cardholder uses this card (i.e. VISA and Master card) to pay for services or products based on the holder's potential to pay.
2	Online Electronic Cash System	Also known as electronic data interchange (EDI), enables online dealings
3	Electronic Cheque System	Someone makes payment by sending a scanned copy of a cheque to the payee, and authenticates payment by providing a digital signature
4	Smart Cards based Electronic Payment System	An Integrated Circuit Card (providing identification, authentication, storage and application) helping clients to make payments to their respective suppliers through Automated Teller Machines, swiping machines among others.
5	Mobile payments (m-payments)	Using mobile devices to undertake financial transactions (e.g. internet service payments, utility bill payments, mobile banking)

Irrespective of innovations in mobile payment and other modes of e-payment, some researchers indicate that the usage rate of e-payment solutions is relatively lower than expected in developing economies such as Uganda. For example, Foster et al (2012) report that e-payment adoption rates are low in urban Africa, to the extent that one service provider records a 10% usage rate of its e-payment systems. Moreover, from a study among 62 selected countries world wide by Hurst (2012), Uganda emerged as number 61 with an overall country ranking of 26.8% usage of e-payment while South Africa emerged as number 35 with an overall country ranking of 57.4%. Although literature (e.g. Oliveira et al, 2016) reports a rapid increase in adoption of mobile payments worldwide, the adoption of e-payment systems in general is not satisfactory especially in developing contexts. Besides, considering that there are several modes of e-payment, gauging adoption level of e-payment solutions by basing on only the extent of adoption of mobile payment is not appropriate. Therefore, this study aimed at exploring e-payment adoption challenges in general such that possible strategic interventions can be devised for regulators and developers of e-payment solutions to consider when building and implementing e-payment solutions.

Major reasons for the low usage rates of e-payment solutions include: insecurity (Barkhordari, 2017; Sidek, 2015; Gathumbi, 2015; Okifo and Igbunu, 2015; Akudo et al., 2012), low customer trust (Nguyen and Huynh, 2018; Barkhordari et al, 2017; Akudo et al., 2012), level of convenience (Akudo et al., 2012), lack of physical receipts, lack of awareness, high transaction costs set by mobile network operators (Sidek, 2015; Foster et al, 2012), inadequate infrastructure, social and economic factors such as low literacy and income levels, and deficient legal provisions or government policies (Hurst, 2012; Gathumbi, 2015; Okifo and Igbunu, 2015).

In developed economies, e-payment challenges have been overcome to some extent through gaining insight from technology adoption theories, and adopting their propositions to inform and guide implementation of electronic innovations (as elaborated in subsequent sections of this paper). Also, other studies (e.g. Zhou, 2011; McKechnie et al, 2006; Teoh et al, 2013) report success factors associated with adoption of technology innovations (see section 2). The prevalence of low adoption rates of e-payment systems in developing economies despite existing developments in specific economies,

indicates the need to adapt existing models to a developing context and holistically analyze challenges and success factors.

Therefore, this paper aims at answering the research question: *what are the factors hindering increased adoption of e-payment systems in Uganda and related economies, and how can such factors be addressed?* To answer this, participatory action research method was adopted, and the next section discusses why and how this was done. Thereafter, the paper discusses: existing models and success factors that inform initiatives on technology adoption; and the design of the framework for informing efforts towards enhancing the adoption of e-payment systems in a developing economy.

ADOPTION OF PARTICIPATORY ACTION RESEARCH

Participatory action research blends participation design and action research (Khanlou and Peter, 2005). Participatory design is motivated by the need to foster democracy in the workplace (Bonacin et al., 2006) by engaging researchers, practitioners and end users in all initiatives associated with developing and implementing information system frameworks (Miller, 2006). Action research focuses on analyzing a problem situation and possible changes to the situation in a social context that involves a researcher and the subjects of the research (Baskerville, 1999). Participatory action research involves 5 steps, i.e.: (a) diagnosing stage – identifying a gap that requires an intervention; (b) action planning – identifying possible ways of undertaking the required intervention; (c) action taking – selecting and specifying the appropriate action to address the problem; (d) evaluation – investigating possible consequences of the selected action; and (d) specify learning – communicating lessons from the selected course of action (Baum et al., 2006). Table 2 shows how these steps were instantiated.

Table 2. Instantiation of Participatory Action Research in this Research

Phases in Participatory Action Research	Approaches used
a). Diagnosing: What is hindering increased adoption of e-payment systems in developing economies such as Uganda?	• Review of literature on: challenges hindering technology adoption and existing models for addressing such challenges **(Section three – next section)**
b). Action Planning: What are the requirements (or possible interventions) for addressing the challenges above?	• Conduct exploratory survey to investigate challenges hindering e-payment adoption and possible solutions **(Section four in subsection one)** • Use factor analysis, correlation analysis, regression analysis, and thematic analysis to identify factors influencing adoption of e-payment **(Section four in sub sections two and three)**
c). Action Taking: How can existing technology adoption models and success factors be adapted to address requirements for increasing adoption of e-payment systems in a developing country?	• Extend an appropriate technology adoption model and devise a holistic mechanism that provides an understanding of requirements for increasing adoption of e-payment in a developing economy such as Uganda **(Section five in subsection one)**
d). Evaluating and Specifying Learning: What are the pros and cons of the research artifact from (c) above?	• Evaluate research artifact using expert reviews/walkthroughs **(Section five in subsection two)**

MODELS AND SUCCESS FACTORS ON TECHNOLOGY ADOPTION

This section presents a literature-based perspective on the diagnosis and action planning stages of this research. The motivation and relevance of this section in answering the overall research question, is depicted in the left boxes of figure 1. Accordingly, this section first discusses key aspects on existing

models that inform adoption of innovations, then discusses success factors from studies that applied the core theories to explore and inform adoption of innovations on information technology, and concludes by highlighting the research gap or required intervention to address the e-payment adoption gap in developing economies.

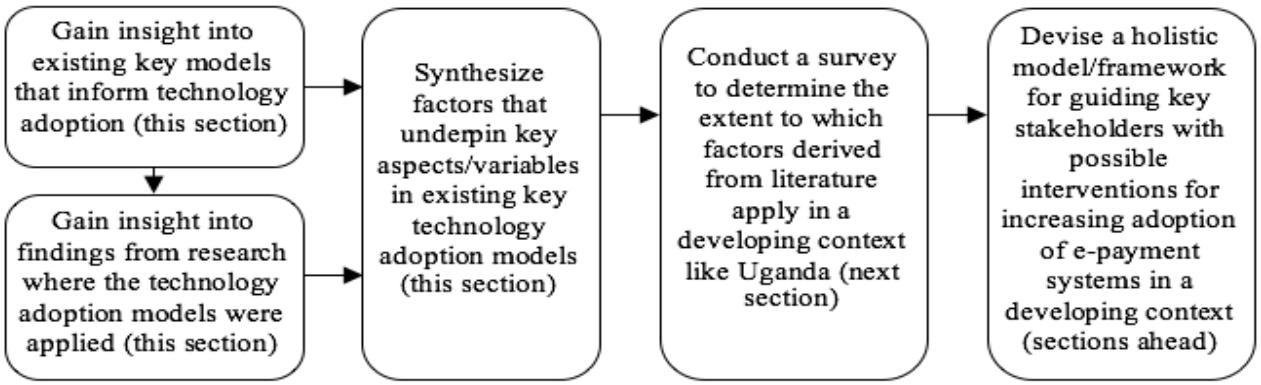

Figure 1. Roadmap of the Research Intervention and Paper Layout

Existing Models on Technology Adoption

From literature, models on technology adoption can be broadly categorized into: (A) foundational models/theories that articulate core and crosscutting aspects in adoption of innovations; and (B) models that extend the core models in category A to accommodate peculiarities of specific contexts. Thus, to gain foundational insight into aspects of e-payment adoption (as an instance of innovations), models in category A are first discussed in this sub section and models in category B are discussed in the next sub section. Below are four examples of models in category A that are very relevant to this research.

Theory of Reasoned Action (TRA). Adoption of an innovation is influenced by behavioral intention, attitude about the behavior, subject norms, beliefs about behavior, evaluation of behavior, opinions of peers or others, motivation to comply and other constraints such as environmental or organizational limits and unconscious habits (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980).

Theory of Planned Behavior (TPB). Adoption of an innovation is influenced by behavioral intention to use, attitude towards behavior, subjective norms, beliefs and evaluations (motivated by social pressures and sense of control), and normative beliefs and motivation to copy (Fishbein and Ajzen, 1975).

Technology Acceptance Model (TAM). TAM articulates that adoption of a technology innovation is influenced by: *perceived usefulness* (the extent to which someone believes that using a technology innovation enhances his or her job performance); *perceived ease of use* (the extent to which someone believes that using a technology innovation is free from effort); *attitude* (an expression of favor or disfavor of a technology innovation); *behavioral intention* (readiness to perform a task using a technology innovation); and various *external factors* (Davis, 1989; Venkatesh and Davis, 2000). TAM further indicates that an individual's behavioral intention to use an innovation is based on perceived usefulness and perceived ease of use, where the latter influences the former provided other factors are uniform. TAM has been widely used to explain contexts of slow adoption of technology innovations, predict user acceptance of technology innovations, and to inform interventions towards increasing adoption of technology innovations (Venkatesh and Davis, 2000). Despite the wide use of TAM, its use

in developing countries is limited (Chuttur 2009), because it overlooks issues such as cost and structural essentials that motivate users into adopting technology (Lunceford, 2009).

Unified Theory of Acceptance and Usage of Technology (UTAUT). This articulates four dimensions, i.e.: *performance expectancy* – anticipated improvement in performance of an activity due to using a technology; *effort expectancy* – anticipated effort in using a technology; *social influence* – extent to which consumers perceive views of family and friends in using a technology; and *facilitating conditions* – perception of consumers on the resources and support available while using a technology (Brown and Venkatesh, 2005; Venkatesh et al., 2003).

From the four examples above, TAM fundamentally subscribes to TRA and TPB (Venkatesh and Davis, 2000), while UTAUT is an extension of TAM (Venkatesh and Davis, 2000). Accordingly, TAM is adapted herein because it instantiates TRA and TPB in the domain of information technology, and therefore its dimensions accommodate core notions of TRA, TPB and UTAUT. Details of how TAM is extended herein to address specific concerns of e-payment adoption in resource constrained settings are discussed in subsequent sections.

Synthesis of Related Work on Success Factors for Technology Adoption

This subsection categorizes key success factors reported in literature that extends models discussed in the preceding section, to accommodate aspects of adopting specific types of technology-based innovations e.g. mobile banking, online banking, cloud computing, m-payment, e-payment, among others. This helps to: (a) gain insight into factors that underpin the dimensions of the chosen model in the preceding subsection (i.e. TAM); and (b) enable holistic reasoning on ways of addressing the key factors in a bid to enhance adoption of e-payment in developing countries. Accordingly, a synthesis of key factors is presented in figure 2, and explained thereafter. The synthesis has been formulated by categorizing success factors with respect components of TAM.

Perceived usefulness (on left side of figure 2). It is depicted that: (a) perceived usefulness of an innovation (such as mobile banking and online banking) is influenced by information quality, system quality, and initial trust; (b) structural assurance and information quality affect initial trust; and (c) initial trust, perceived usefulness, and government support predict intention to use (Zhou, 2011; Chong et al., 2010). Perceived usefulness is also influenced by perceived playfulness, security (Bonera, 2011; Cho and Fiorito, 2009), and perceived enjoyment which also influences the user's attitude towards an innovation (Liao et al, 2007). The adoption of innovations (such as online shopping and web based systems) is influenced by perceived usefulness or value and corresponding degradation barriers, enjoyment, social pressure and social value (Maghrabi and Dennis, 2011; Hsiao, 2011), and perceived ease of use (Cho and Fiorito, 2009). In organizations, perceived usefulness of innovations is influenced by leadership support for transformation of an agency (Schepers et al., 2005).

Perceived ease of use (in the center of figure 2). Intentions of customers to use an innovation (e.g. mobile credit cards, web information systems) is influenced by: perceived usefulness, perceived ease of use, perceived credibility of service provider (Amin, 2007; Featherman et al., 2010), surfing or Internet experience, amount of information available about the innovation (Amin, 2007), and ability to reduce privacy risk and its effects (Featherman et al., 2010). For example, Timmor and Rymon (2007) report that students' behavioral intentions to use an innovation (such as technology-based learning), is influenced by perceived image of the academic institution (as an external factor), perceived outcome/value and ease of use (as internal factors), technology orientation and consistency of the new with the old delivery process (as consistency factors). However, perceived credibility of an innovation

(such as Internet banking) is determined by the extent to which it addresses security and privacy concerns of users (Wang et al., 2003). Perceived security influences perceived trust, which influences e-payment adoption (Barkhordari 2017). Besides, ease of use or proficiency of users of an innovation (such as an e-learning system) is influenced by quality of the innovation, readiness of users to adopt the innovation (Ho et al., 2010), consumers' Internet experience, access to computer resources, and emotions towards the Internet (McKechnie et al., 2006).

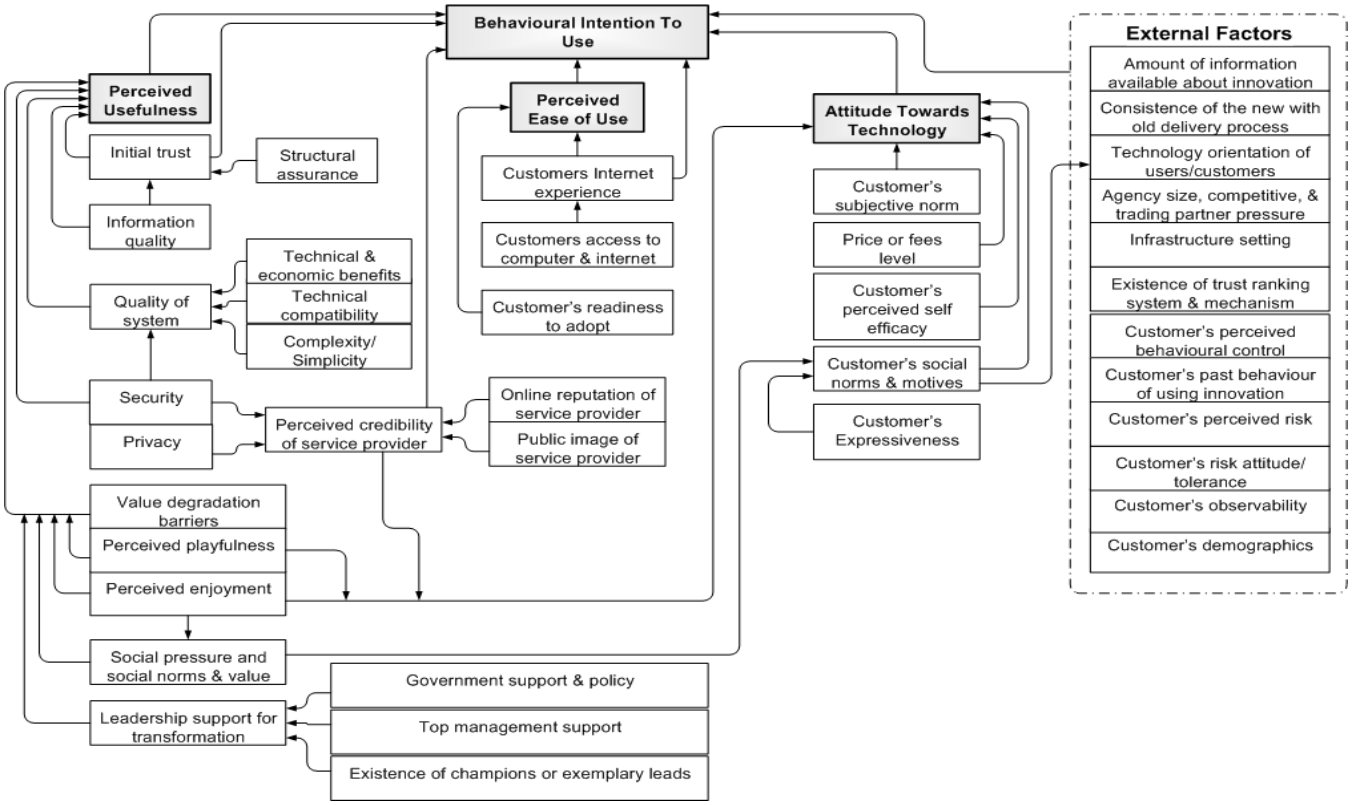

Figure 2. Literature-Based Synthesis of Factors Influencing Adoption of Technology-based Innovations

Attitude towards using the technology (in the center of figure 2). Customers' attitude influences intentions to search for information about an innovation and to adopt or comply (Seock and Norton, 2007). In addition, attitude towards adoption of foreign-developed technology in developing countries is influenced by perceived ease of use, technological compatibility, ease of adoption, anticipated technical and economic benefits of adoption (Benedetto et al., 2003). Attitude towards an innovation (such as m-internet) predicts behavioral intention to use the innovation, while perceived playfulness and price level influence attitude (Cheong and Park, 2005). Thus, agencies need to consider setting affordable charges/rates for conducting online transactions (Bolt et al, 2014). Aboelmaged (2010) also argues that a user's subjective norm and attitude towards an innovation (such as e-procurement) determines a user's intention and behavioral intention to use the innovation. Besides, a consumer's perceived behavioral control to use an innovation (such as an e-coupon) and past behavior of using the innovation influence the consumer's usage intentions (Chen and Lu, 2011). Customers' attitude towards using innovations (such as m-banking) is influenced by perceived ease of use, perceived usefulness, perceived self efficacy and perceived credibility (Lule§et al., 2012).

External/Other factors (on right side of figure 2). Adoption of innovations (such as electronic banking, mobile chat services) is influenced by: relative advantage, complexity/simplicity,

compatibility, observability, risk tolerance, income, education, gender, marital status, and age (Kolodinsky et al., 2004); people groupings based on individuals, management, and technology orientation (Peansupap and Walker, 2005); social norms and intrinsic motives like enjoyment among female users and extrinsic motives like expressiveness among male users (Nysveen et al., 2005); and internal influences of contacts in the social system of potential adopters (Florkowski and Olivas-Luja´n, 2006). These justify why human resistance is a major hindrance to the adoption of e-service delivery innovations (Seth et al., 2005). Thus, service providers need to identify champions or leads to be exemplary to others who may still be skeptical or resistant to using a given technology (Porter, 2013).

In addition, adoption of innovations (such as cloud computing) is influenced by relative advantage, top management support, firm size, competitive pressure, and trading partner pressure (Low et al., 2011). Adoption of innovations (like e-commerce) is influenced by firm size, good government policy (Li and Xie, 2012), enabling infrastructure, and existence of trust ranking systems that allow users to access information about measures of trust that can inform strategic decisions such as whether to conduct e-business within a given country or with a given entity (Aljifri et al., 2003). For example, good government policy for adoption of e-payment would demand that regulatory authorities coordinate and manage a network of financial institutions that implement e-payment systems in order to enhance users' trust in e-payment (Anyanwu et al, 2012). Besides, a consumer's use of an innovation is influenced by perceived risk, which is also influenced by user's risk attitude, online reputation of seller, and product price (Xu et al, 2010).

Summary of the Research Gap

Since studies (e.g. Nguyen and Huynh, 2018; Barkhordari et al, 2017) exist that comprehensively investigate specific issues in e-payment adoption, the research herein explores e-payment issues holistically/broadly because e-payment is one of the intertwined factors that hinder adoption of electronic service delivery. Thus, the preceding section presents a literature-based synthesis of success factors on technology adoption in general in order to holistically understand how TAM and other success factors on technology adoption can inform efforts or interventions towards increasing adoption of e-payment (as summarized in figure 2). However, the synthesis in figure 2 is implicit on actors responsible for specific aspects in order to properly inform efforts towards adoption and implementation of success factors for e-payment efforts. To resolve this, there is need to use figure 2 to further derive an *action-oriented taxonomy* that gives insight into specific categories of actors that are responsible for ensuring that a specific success factor in figure 2 (that is relevant for e-payment) is adopted and implemented. Thus, factors in figure 2 have been further categorized into four themes that serve as pointers to categories of actors or stakeholders responsible for implementing measures that are implied by success factors in figure 2 in order to enhance e-payment adoption. The four themes are shown in row 1 of table 3, and critical factors under each theme (obtained from figure 2) are presented accordingly. Insights in table 3 are used in subsequent sections to inform the design of the survey instrument (where applicable) that yields findings in table 6 and to underpin arguments or justify requirements in table 8.

Table 3: Factors from Literature that can Inform Efforts on Enhancing e-Payment Adoption

1. Attributes of e-payment systems	2. Attributes of the service provider of e-payment	3. Individual and social attributes of a customer	4. Governance mechanisms for e-payment systems
• Quality of information generated by the e-payment system • Technical and economic benefits	• Public and online image of service provider • Price or fees for using e-	• These include a customer's: o Subjective norms o Social pressure, social	• Government support and policy framework • Infrastructure setting

of the e-payment system • Consistence of the e-payment system with the normal payment system • Information available about an innovation • System quality attributes (e.g. convenience, accessibility, compatibility, security, reliability, simplicity, flexibility)	payment system • Existence of famous exemplary leads in using an e-payment system • Institutional top management support	norms & value ○ Computer and Internet experience ○ Initial trust or past experience of using e-payment ○ Perceived risk and risk attitude ○ Demographic details	• Existence of trust ranking systems & mechanism • Customer's accessibility to computer and internet

EXPLORATORY SURVEY ON CHALLENGES HINDERING E-PAYMENT ADOPTION

This section contributes to the diagnosis and action planning stages of this research by providing insights from an exploratory survey (as indicated in table 2). Thus, this section first presents the design of the exploratory survey that aimed at investigating the possible causes of slow adoption of e-payment systems in Uganda (as an instance of a developing economy), and then presents quantitative and qualitative findings from the survey.

Design of the Exploratory Survey

Table 4 presents decisions that were taken in design of the survey and justifications are presented thereafter.

Table 4: Summary on Design of the Exploratory Survey

#	Key dimensions of survey design	Respective considerations or decision taken for each dimension of survey design
1	Target group or respondents or subjects	• (Potential) users of e-payment at household level to settle utility bills and other related expenses
2	Sampling frame	• Users at business level in the central region of Uganda, specifically: ○ Kampala (Nakawa and Central divisions) ○ Mukono (Goma and Mukono municipality) ○ Wakiso districts (Kira town council and Nansana) • Regulators of innovations in information and communication technologies
3	Sampling technique	• Purposive sampling of districts • Cluster sampling of divisions within districts & purposive sampling of respondents in divisions
4	Sample size	• The approximate population size of selected region in row 1 is 3,783,800 • Thus, using Krejcie and Morgan (1970) table for determining the sample size, the appropriate sample size for this study was 384
5	Data collection instruments	• Questionnaire was used to collect data from respondents or users of e-payment • Interview guide was used to collect data from regulators of technology-related innovations in Uganda. Purposive sampling was used to identify interview respondents.

Although e-payment mechanisms in Uganda exist for various products and services, this research focused on the extent to which they support management of utility bills. This is because payment

mechanisms of most utility bills in Uganda (such as water, electricity, tax payments, school fees, television services subscriptions, Internet service payments, and other service subscription payments) have been made electronic to improve service delivery (Foster et al., 2012). Thus, row 2 of table 4 indicates that the survey targeted potential users of e-payment systems in settling household utility bills.

- In row 3 of table 4, the three specified districts were selected because respondents therein have easier access to key infrastructure requirements for realizing and utilizing e-payment transactions (i.e. Internet services or relatively stable telecommunication network, and gadgets for e-payment transactions).
- In row 4 of table 4, purposive sampling was used to select three target districts for carrying out a survey. This is because purposive sampling is used to engage a specific type of targeted sample (Feffermann and Rao, 2009). In addition, cluster sampling was used to select only two divisions or sub-counties from each of the three selected districts due to cost related issues. Cluster sampling is a sampling technique used when relatively homogeneous groupings or clusters are evident in a population, and thus a simple random sample of the groups is selected (Feffermann and Rao, 2009). Row 4 further indicates that purposive sampling was used to select respondents from respective divisions. Respondents selected were those who had an understanding of what e-payment means and the various avenues for e-payment available in the country. Ideally simple random sampling would have been the most appropriate technique to select subjects at division level, but it was not possible to acquire or create an accurate sampling frame of subjects within selected divisions.
- In row 5 of table 4, a sample of 384 subjects was used. This is based on the matrix for determining sample size by Krejcie and Morgan (1970), which recommends 384 subjects for a sample drawn from a target population size of at least 1,000,000 subjects. In order to acquire 384 respondents, a sample of 500 subjects was considered as shown in the last column of table 5. The last column of table 5 shows that most respondents were selected from divisions of Kampala district due to reasons associated with proximity and research budget. The survey was conducted in the period of June to August 2015.

Table 5: Summary on Selection of Sample Size

#	District	Total number of divisions within a district	Estimate poputation of target respondents (Source: UBOS, 2016)	Name of two divisions selected from each district	Response rate per division
1	Kampala	6	1,507,080	Nakawa	182 out of 200
				Kampala central	45 out of 80
2	Mukono	10	596,804	Mukono municipal	64 out of 75
				Goma	4 out of 30
3	Wakiso	9	1,997,418	Kira town council	67 out of 75
				Nansana	22 out of 40
				Total	**384 out of 500**
				Response Rate	**76.8%**

- In row 6 of table 4, data collection instruments were designed based on factors in figure 2 and table 3. Specifically: (a) the individual and social attributes of a customer (in table 3 and figure 2) helped to determine relevant background characteristics of the sample, as presented in appendix 1; (b) the attributes of e-payment systems (in table 3 – column 1) that could be investigated in the survey context were used to formulate questionnaire items that yielded findings presented in table 6; and (c) attributes

of service providers and governance mechanisms of e-payment systems (in table 3 – columns 2 and 4) were used in categorizing qualitative survey findings as presented in table 8 and appendix 1.1.

Discussion of Quantitative Findings from the Exploratory Survey

Quantitative responses were analyzed using factor, correlation, and regression analysis as follows.

Factor Analysis of Factors that Influence Adoption of E-Payment

Factor analysis eliminates redundancies from a set of correlated variables, by deriving a manageable set of independent factors that describe the correlated variables (Norman and Streiner, 2003). Factor analysis herein was done to identify the structure of two key independent variables in the study, i.e. perceived usefulness and perceived ease of use. Descriptive analysis was also done to determine the level of agreement on the items/factors concerning perceived usefulness and perceived ease of use of e-payment. Results are presented in appendix 2. From appendices 2.1 and 2.2, perceived usefulness of e-payment is influenced by three independent variables, i.e.: convenience in using e-payment, security of user data, and accessibility of e-payment. From appendices 2.3 and 2.4, perceived ease of use of e-payment is influenced by three independent variables, i.e.: compatibility, simplicity, and flexibility of e-payment. Factor analysis results were further assessed using correlation analysis.

Correlation Analysis of Factors that Influence Adoption of E-Payment

Correlation analysis assesses whether a relationship exists between variables, and resultant values of the correlation coefficient are always between -1 and +1, where: a correlation coefficient of +1 indicates that two variables are perfectly related in a positive linear sense, -1 indicates that two variables are perfectly related in a negative linear sense, and 0 indicates that there is no linear relationship between two variables (Nikolić et al., 2012). Herein correlation analysis was done between each independent variable (i.e. usefulness, ease of use, Behavioral Intension To Use (BITU), knowledge/awareness about e-payment system, and external factors) and a dependent variable (i.e. adoption of e-payment). Results of this are presented in table 6, and the last shaded row shows the correlation coefficients.

Table 6: Correlation analysis of factors that influence the adoption process

Variable (N=384)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Usefulness (1)	1											
Convenience (2)	.730**	1										
Accessibility (3)	.797**	.390**	1									
Security (4)	.748**	.328**	.374**	1								
Ease of use (5)	**.534****	**.466****	**.387****	**.373****	**1**							
Compatibility (6)	.431**	.355**	.352**	.276**	.734**	1						
Simplicity (7)	.371**	.305**	.231**	.316**	.751**	.285**	1					
Flexibility (8)	.428**	.410**	.306**	.269**	.817**	.404**	.461**	1				
BITU (9)	**.514****	**.452****	**.409****	**.316****	**.630****	**.507****	**.373****	**.567****	**1**			
Knowledge (10)	**.490****	**.356****	**.423****	**.334****	**.566****	**.408****	**.404****	**.490****	**.571****	**1**		
Externals (11)	**.229****	**0.087**	**.214****	**.210****	**.195****	**.152****	**.173****	**.125***	**0.066**	**.168****	**1**	
Adoption (12)	**.217****	**.271****	**.139****	**0.097**	**.389****	**.307****	**.254****	**.332****	**.388****	**.234****	**-0.022**	**1**
***Correlation is significant at the 0.01 level: 2-tailed with p<0.01 for all*												

Major observations from the correlation coefficients (in the last row of table 6) indicate:

- A positive relationship exists between perceived usefulness and adoption of e-payment (r = 0.217), a positive relationship exists between adoption of e-payment and two constructs of perceived usefulness (i.e. convenience with r = 0.271 and accessibility with r = 0.139), and a loose relationship between adoption of e-payment and security (since r = 0.097).
- A positive relationship exists between perceived ease of use and adoption of e-payment (r = 0.389), and a positive relationship exists between adoption of e-payment and each of the three constructs of perceived usefulness (compatibility with r = 0.307, simplicity with r = 0.254, and flexibility with r = 0.332).
- A positive relationship exists between adoption of e-payment and: (a) behavioral intention to use e-payment (r = 0.388); (b) knowledge or awareness about e-payment (r = 0.234).
- A negative loose relationship exists between external factors and adoption of e-payment (r = –0.022).

Regression analysis of factors relevant for adoption of e-payment

Regression analysis estimates the magnitude of change in a dependent variable caused by a change in one or more independent variables, whereby the p-value used to consider the significance is any value less or equal to 0.05 and a higher significance is achieved at 0.00 (Armstrong, 2012). Following findings from the correlation analysis, herein regression analysis was done to determine whether adoption of e-payment was influenced by perceived usefulness, perceived ease of use, behavioral intention to use, knowledge/awareness, and external factors. Results of this are presented in table 7 and values that show high significance of the variables are highlighted in grey shade.

Table 7: Regression analysis of adoption of e-payment

	Unstandardized Coefficients		**Standardized Coefficients**	**T**	**p(Sig.)**
	B	Std. Error	Beta		
(Constant)	2.244	.308		7.274	.000
1. Perceived usefulness	–0.033	.083	–0.023	–0.398	.691
2. Perceived ease of use	0.393	.091	.283	4.339	.000
3. Behavioural intention to use	0.279	.072	.253	3.889	.000
4. Knowledge about the system	–0.057	.076	–0.046	–0.755	.451
5. External factors	–0.115	.069	–0.081	–0.676	.095
R Square	*0.194*			*F Statistic*	*18.21*
Adjusted R Square	*0.183*			*Sig.*	*.000*

Table 7 shows that adoption of e-payment is significantly influenced by perceived ease of use (beta = 0.283, p<.01) and behavioral intention to use (beta = 0.253, p<.01). However, the magnitude of change was not found to be significant between adoption of e-payment and perceived usefulness (beta = –0.023, p>.01), knowledge or awareness about e-payment (beta = –0.046, p>.01), and external factors (beta = –0.081, p>.01). This implies that perceived ease of use and behavioral intension strongly influence adoption of e-payment and should be highly prioritized by e-service providers.

Model specification: The regression model on adoption of e-payment is significant and well specified (as indicated by F = 18.21, p<.01 in table 7). This implies that the five factors in table 7 are appropriate predictors of adoption of e-payment. The predictive power of the model is 18.3% (as indicated by Adjusted R Square = 0.183 in table 7). This implies that the variation in these five factors accounts for 18.3% variation in adoption of e-payment. Next section presents qualitative findings from the survey.

Requirements for Enhancing E-Payment Adoption in a Developing Economy

Column 2 in table 8 summarizes qualitative responses from the survey on challenges hindering increased e-payment adoption (coded C1–C11), while column 4 presents requirements to address them (coded R1–R11). Column 5 presents design features/variables that e-payment solutions should exhibit in order to address a specific requirement (coded DV1–DV11). The requirements in column 4 and variables in column 5 and are inspired by insights from the literature-based synthesis and taxonomy in table 3 and figure 2 as justified in the preceding sections.

Table 8: Requirements for enhancing adoption of e-payment in resource constrained economies

#	Challenges	#	Derived requirements	Variables/features of e-payment systems
C1	Insecure e-payment systems	R1	Enhance security of e-payment systems	[DV1] Security capabilities
C2	Mistrust of e-payment systems	R2	Devise means of managing feedback and control for e-payment systems	[DV2] Quality & trust-ranking capabilities
C3	Limited awareness of e-payment systems	R3.1	Devise creative means of disseminating information about e-payment systems	[DV3.1] Availability of information about supported functions
		R3.2	Consistently disseminate security-related information to users & provide guidance	[DV3.2] Availability of operational and security information
C4	Inadequate training of users	R4	Devise multiple avenues of training users of e-payment systems	[DV4] Availability of training & help desk services
C5	Complexity of some e-payment systems	R5	Customize e-payment systems to suit norms of heterogeneous local communities	[DV5] Simplicity capabilities
C6	Incompatibility of e-payment systems with some devices	R6	Enhance compatibility and portability of e-payment systems with affordable user gadgets	[DV6] Compatibility capabilities
C7	Limited flexibility of e-payment systems to accommodate specific contexts	R7	Devise means of accommodating constraining aspects in urban & rural environments	[DV7] Flexibility capabilities with respect to environmental constraints
C8	Limited country-wide access to e-payment agents & end-user support	R8	Devise means of increasing accessibility and user convenience features of e-payment systems	[DV8.1] Accessibility capabilities
				[DV8.2] Convenience capabilities
C9	Unreliable country-wide network infrastructure for e-payment	R9	Strengthen country-wide network infrastructure and technical capacity	[DV9.1] Reliability capabilities
				[DV9.2] Reliability of country-wide network infrastructure
C10	Low income level of users vs. high charges for e-payment services	R10	Devise affordable preconditions for using e-payment systems	[DV10] Affordability of preconditions for use

C11	Unclear policies governing e-payment	R11	Develop policies for e-payment, sensitize users, elicit user feedback, and effect required amendments	[DV11] Legal capabilities

Table 8 uses codes C1-C11, R1-R11, and DV1-DV11 to simplify cross-referencing of particular items in the table during subsequent discussions of table 8 in the next section. Since variables DV1 to DV11 in table 8 are key inputs to the design of the research artifact/solution, they are further classified and discussed in the next section.

DESIGN OF A FRAMEWORK TOWARDS ENHANCING ADOPTION OF E-PAYMENT

The "action taking" phase of this research requires extending an appropriate technology adoption model to devise a holistic mechanism that provides a comprehensive understanding of requirements and interventions for addressing e-payment challenges (as indicated in table 2). Thus, basing on insights in the preceding sections, this section presents the design of a **F**ramework for informing stakeholder interventions towards enhancing **A**doption of **E**-**P**ayment (FAEP). FAEP aligns major variables and factors that facilitate adoption of e-payment in a developing economy in order to inform key stakeholders involved in e-payment initiatives. This section first presents the design of FAEP as the output of the "action taking" phase of this research, and then presents the "evaluate and specify" learning phase of this research. These phases are specified in table 2.

Variables of FAEP and their Alignment

The design of FAEP involved alignment of variables DV1 to DV11 in table 8 into a holistic solution to guide reasoning on e-payment initiatives. In order to coherently align these variables and accommodate survey findings in the preceding section, TAM was adapted as justified in section three. Accordingly, figure 3 shows the design of FAEP as an extension of TAM (whose components are labelled T1 to T6 in figure 3), that accommodates and aligns variables DVI and DV11.

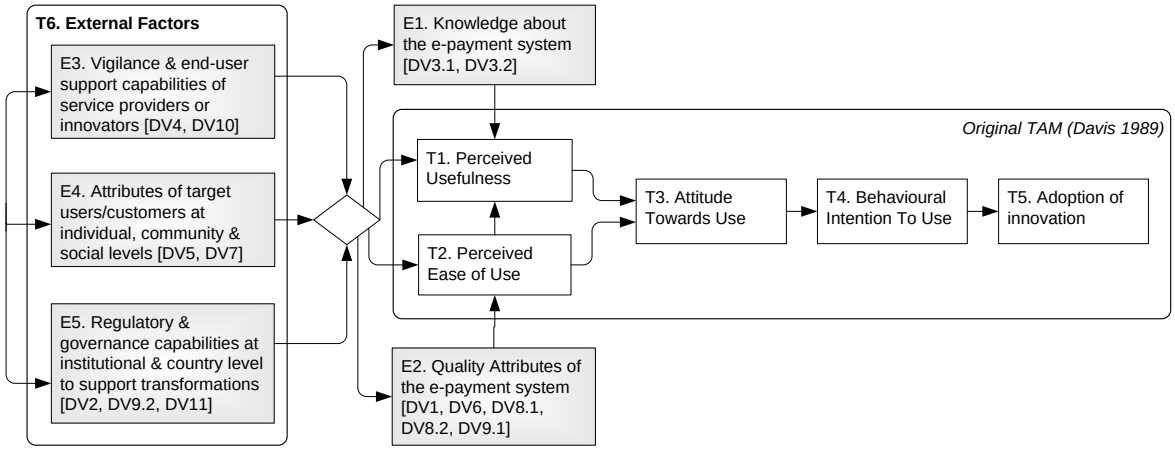

Figure 3: The Design of FAEP

FAEP extends TAM by adding components represented by boxes labelled E1 to E5 in figure 3. E1 to E5 represent compound variables derived by clustering variables DV1 and DV11 (in table 8). The compound variables were formed in order to improve the "recall" and "understandability" features of FAEP. This was raised as a major concern from the evaluation of FAEP version I in appendix 3 (see next section for details). Thus, Figure 3 is the refined version of FAEP after the evaluation of FAEP version I (that is presented in appendix 3). Details of this evaluation are discussed in the next section.

Confirmation of TAM components T1 to T6 in FAEP

Correlation analysis results in the preceding section confirm a significant positive relationship between perceived usefulness and adoption of e-payment. This implies that interventions made towards enhancing the level of usefulness of an e-payment system, directly translate into enhancing the level of e-payment adoption. Hence linkages illustrated by T1-T3-T4-T5 in figure 3. In addition, correlation and regression analysis results in the preceding section (tables 5 and 6) confirm a relationship between perceived ease of use and adoption of e-payment. Also, correlation results indicate that perceived ease of use has a more significant effect on behavioral intention to adopt e-payment system, which consequently affects adoption of e-payment (see preceding section). This implies that interventions towards enhancing the level of ease of use of an e-payment system as perceived by the users, directly translate into enhancing the behavioral intention and the level of adoption of the system. Hence linkages illustrated by T2-T3-T4-T5 in figure 3. In addition to the correlation and regression findings that confirm links T1 to T6, additional country-context factors that affect T1, T2, and T6 are represented by components E1 to E5 (in the grey shaded boxes in figure 3). Components E1 to E5 are discussed below.

Extensions E1 to E5 in FAEP

E1 to E5 draw from survey findings and the literature-based taxonomy presented in preceding sections.

E1 – Knowledge about the system and adoption of e-payment: Correlation results in table 6 indicate that a high level of knowledge/awareness of e-payment positively affects perceived ease of use, perceived usefulness, and adoption of e-payment. Figure 3 indicates that variables DV3.1 and DV3.2 constitute E1. Thus, possible interventions to actualize DV3.1 and DV3.2 require e-payment service providers and regulators to:

- *Devise an e-payment knowledge sharing platform for profiling existing e-payment innovations and sharing information on operational and security capabilities about e-payment solutions.* The platform can: (a) be utilized by e-payment service providers (such as banks and telecom companies) to share information on technical and economic benefits of specific e-payment systems; and (b) prompt e-payment users to openly share feedback on capabilities of e-payment innovations and user experiences.
- *Design customized information packages that subscribe to norms and beliefs of various types of ethnicities.* These information packages can be used when: (a) conducting periodic sensitization campaigns for advertising e-payment solutions to rural or unprivileged communities; (b) engaging famous and reputable personalities to serve as as advocates for e-payment and exemplary leads in using e-payment innovations; (c) training as indicated in DV4; (d) customizing e-payment systems to ensure flexibility as indicated in DV7.

E2 – Quality attributes of e-payment system: Correlation results in table 6 indicate a positive relationship between adoption of e-payment and constructs such as convenience (DV8.2), accessibility (DV8.1), compatibility (DV6), simplicity (DV5), and flexibility (DV7). These can be perceived as quality attributes of technology-enabled innovations (see table 3). Others attributes include: security (DV1), reliability (DV9.1). Thus, stakeholder efforts can be directed towards *developing a holistic and detailed score card for evaluating e-payment innovations/solutions* to ensure that they score highly with respect to these quality attributes. For such a score card to be holistic, it needs to include both technical non technical features/indicators of each quality attribute listed above. For example, under security non technical aspects such as security declarations, accessibility of security policies, and perceived security influence perceived trust in e-payment innovations (Barkhordari et al, 2017).

E3 to E5 – External factors and adoption of e-payment: Correlation results in table 6 indicate a loose relationship between external factors and adoption of e-payment. Inspired by the taxonomy in figure 2, external factors have been categorized into three as shown in figure 3. The categorization used is mindful of two major categories of target users of FAEP, i.e.: (a) regulators of e-payment systems in a country; and (b) service providers, researchers, and consultants on e-payment or other technology-related solutions.

- *E3 – Service provider vigilance and end user support capabilities:* This comprises DV4 and DV10, which demand that e-payment service providers plan initiatives towards ensuring: (a) affordability of preconditions for using e-payment systems; and (b) availability of end-user support services such as training and help desk services. Rather than telephone-based help desk services as the current practice, there is need to *develop a help desk electronic forum/platform that can enable quick reporting of anomalies or unusual incidents by users and to track performance indicators associated with management of user complaints by the service provider.* In addition, using the customized information package in E1, conduct periodic training or community outreach campaigns via various media avenues in rural and unprivileged communities. These efforts can empower customers with knowledge on how to use an e-payment system, manage any possible arising matters, productively use electronic solutions and appropriately re-orient their: (a) perceived risk on use of e-payment systems and risk attitude; (b) initial trust or past experience of using e-payment systems.
- *E4 – Attributes of end users and customers:* This comprises DV5 and DV7, which demand that service providers or system designers and developers endeavor to prioritize simplicity and flexibility of an e-payment system. Thus, there is *need to develop an evaluation checklist and mechanism to support the capturing of user feedback on the simplicity and flexibility levels of a given e-payment system.* Examples of critical user attributes include: literacy levels, language variability, cultural beliefs, and physical disabilities that can affect system usability (on aspects of entry and view/retrieval of data in form of text, image, audio, and video).
- *E5 – Regulatory and governance support capabilities at institutional and country level:* This comprises DV2, DV9.2 and DV11. DV2 *underlines the need to develop publicly accessible quality-ranking and trust-ranking platform for e-payment systems as a feedback and control mechanism for informing regulation of e-payment service providers.* Such a mechanism, if not compromised, reveals the public and online image of an e-payment service provider and helps to build user trust for e-payment systems. Awareness of possible fraudulent acts and corresponding counter measures enhances perceived trust in a service (Barkhordari et al, 2017) and trust positively influences ease of use and e–payment adoption (Nguyen and Huynh, 2018). Therefore, the quality and trust ranking platform should accommodate capabilities where users can share experiences on possible fraudulent risks and mitigation or prevention measures.

  DV11 indicates the *need to develop a legal framework for e-payment systems that accommodates concerns of users and informs the formulation of terms and conditions that are set by e-payment service providers.* Although some efforts towards developing a legal framework for informing electronic engagements have been undertaken at an international level (as indicated in UNCTAD (2015)) and at a country level (as indicated in appendix 1.1), there is still *need to investigate critical contemporary scandals and issues in e-payment that can be addressed through instituting a sound legal framework for e-payment initiatives and sensitize communities on issues associated with such a legal framework.*

  DV9.2 echoes the need for capital investments and partnerships towards enhancing availability and reliability of infrastructure for facilitating use of e-payment systems.

Evaluation of FAEP Design

FAEP was evaluated to determine its applicability in guiding stakeholder interventions towards enhancing adoption of e-payment in Uganda (as an instance of developing economies). Table 9 summarizes key factors considered in setting up the evaluation of FAEP design, and evaluation findings are subsequently discussed.

Table 9: Setup of FAEP Evaluation

<table>
<tr><th>#</th><th>Parameter considered</th><th colspan="2">Details of how the parameter was addressed in FAEP Evaluation</th></tr>
<tr><td>1</td><td>Evaluation method</td><td colspan="2">Expert walkthroughs</td></tr>
<tr><td>2</td><td>Target users</td><td colspan="2">Researchers and practitioners in computing and e-payment service providers in a developing country – Uganda</td></tr>
<tr><td>3</td><td>Evaluation criteria</td><td>• Easy to understand
• Logical design or arrangement of FAEP components
• Level of detail of in FAEP concepts</td><td>• Level of interdependency of FAEP components
• Applicability of FAEP concepts
• Recall features of FAEP</td></tr>
<tr><td>4</td><td>Evaluation checklist</td><td colspan="2">Questionnaire with responses based on a 5-point Likert scale, and mean score of FAEP was derived with respect to evaluation criteria listed above</td></tr>
<tr><td>5</td><td>Sampling method</td><td colspan="2">Purposive sampling and criteria used to select experts who participated in the evaluation are specified below</td></tr>
<tr><td rowspan="5">6</td><td rowspan="5">Sample size</td><td colspan="2">Due to resource limitations, only six (6) experts were selected to evaluate FAEP and below are the criteria used to select the sample and corresponding sample characteristics.</td></tr>
<tr><td>Selection criteria for the 6 experts</td><td>Disaggregation of 6 experts as per criteria</td></tr>
<tr><td>• Area of specialization: actor's ability to evaluate FAEP with an understanding of knowledge fields associated with e-payment and with FAEP components</td><td>• Two information systems mangers
• Two lecturers in business computing
• Two senior lecturers in computing</td></tr>
<tr><td>• Field of work: actors from academia and industry</td><td>• Two experts with industry experience
• Four experts from academia</td></tr>
<tr><td rowspan="2">• Ability to objectively critique FAEP: Actors with a Masters or PhD and actors with reasonable working experience</td><td>Masters: PhD respondent ratio = 5:1</td></tr>
<tr><td>5 years: 10 years respondent ratio = 1:5</td></tr>
<tr><td>7</td><td>Duration of expert evaluation discussions</td><td colspan="2">• Sharing of write-up on FAEP version 0 (see appendix 4) one week before evaluation
• Average duration of one hour of walkthrough evaluation discussion with each expert</td></tr>
</table>

FAEP evaluation yielded both quantitative and qualitative feedback. The former is presented in table 10, while the later is presented thereafter.

Table 10: Mean scores of FAEP with respect to evaluation criteria used in expert walkthroughs

#	Variable (N=6)	Mean	Std. Deviation
1	Factors/variables/components leading to adoption of e-payment are logically arranged	1.17	0.41

2	Components of the framework are interdependent	1.00	0.00
3	The framework design is easy to understand	1.00	0.00
4	The framework and its components are explained in detail using understandable terminology	1.33	0.52
5	The logical design of the framework and its components can be easily recalled by the user	4.12	0.35
6	The framework factors/parameters/components are applicable in a developing country	1.17	0.41
Response options in evaluation tool were based on a 5-point Likert scale (of 1- strongly agree to 5- strongly disagree)			

Qualitative evaluation feedback towards improving FAEP

Insights from the expert evaluation of FAEP version I (in appendix 3) pointed out the following weaknesses of FAEP, which were addressed as specified below to improve the design of FAEP:

- Factor DV3 is ambiguous as it does not specify the required type of knowledge about an e-payment system. There is need to contextualize the knowledge referred to in order to improve understandability. To address this, DV3 has been divided into DV3.1 and DV3.2 in order to specify the specific type of information and knowledge about an e-payment system (see table 8 and figure 3).
- The relationship between "benefits and quality of an e-payment system" and "perceived ease of use" is not demonstrated. This was rectified by changing the position of the component that represents variables clustered as "benefits and quality of an e-payment system" from the top part of the model to the bottom part in order to properly indicate the relationship that had not been demonstrated (see figure 3). Also, the name of the cluster of variables was modified to be "quality attributes of e-payment system", since the name in FAEP version I was mixing up benefits and quality in the same cluster.
- Under external factors (see T6 in FAEP version I – appendix 3), the category of user attributes needs to specify examples of the local or situation-specific contexts or attributes that the service providers or regulators of e-payment systems need to consider when addressing user attributes. This was rectified by specifying user attributes in the discussion of FAEP (see preceding subsection).

CONCLUSION AND FUTURE WORK

Motivated by literature that indicates low adoption of e-payment systems or solutions in developing countries, Uganda is used as a case study in this research which aimed at exploring factors that account for low adoption of e-payment solutions and suggesting possible interventions. Thus, this study involved three themes, i.e.: (a) assessing literature and using a content analysis approach to derive a taxonomy of common factors that are responsible for low adoption of e-payment and other related technology innovations; (b) conducting an exploratory investigation on factors hindering use of e-payment solutions in Uganda; and (c) synthesizing the literature-based taxonomy of challenges in theme (a) with findings in theme (b) into a coherent framework (coined as FAEP) that can inform and guide interventions by key stakeholders towards enhancing adoption of e-payment systems. Key stakeholders to benefit from findings herein can be perceived in two categories, i.e.: developers of e-payment solutions; and regulators/authorities responsible for overseeing e-payment implementation.

Although this paper presents findings on the three themes (a) to (c) above, the main research contribution is FAEP, which is an output of theme (c). FAEP was developed using a Participatory Action Research approach. *Diagnosis and Action Planning* stages were executed by: reviewing literature

on challenges hindering technology adoption and critical success factors; conducting a survey on challenges hindering e-payment adoption and possible solutions; and using factor analysis, correlation analysis, regression analysis, and thematic analysis to identify factors influencing adoption of e-payment. *Action Taking* stage was executed by extending TAM to derive FAEP as a holistic framework that provides an understanding of requirements for increasing adoption of e-payment in a developing economy. *Evaluate and Specify Learning* stages were executed by subjecting FAEP to expert scrutiny using walkthroughs.

FAEP extends TAM to accommodate survey findings on e-payment adoption and insights from the literature-based taxonomy of factors affecting technology innovations. In the extension, FAEP adds five compound factors, i.e.: knowledge about e-payment systems, quality attributes of e-payment systems, vigilance and end user support abilities of e-payment service providers, attributes of target users/customers, and regulatory capabilities for e-payment systems. These five factors were identified as instrumental in strengthening perceived usefulness and ease of use (as key variables of TAM) in efforts towards increasing adoption of e-payment. Key aspects that underlie each of these five factors are also presented in the discussion of FAEP in order to provide insights for shaping strategies or interventions towards enhancing e-payment adoption. Thus, apart from only undertaking strategies towards strengthening weak technology infrastructure (which is a frequently cited hindrance to low adoption of technology-related innovations in developing countries), this research gives insight into other aspects that need interventions (that can be undertaken in parallel with interventions towards strengthening infrastructure) to enhance adoption of e-payment systems.

Accordingly, findings herein inform future research on technology adoption by proposing interventions that can be developed or explored further to address challenges affecting e-payment adoption. This implies the need for future work to evaluate FAEP by undertaking a step-wise implementation of the strategic interventions suggested by FAEP components, and thereafter conducting exploratory surveys to examine the extent to which each strategic intervention proposed/implied by the five components of FAEP enhances adoption of e-payment or other technology-related innovations.

ACKNOWLEDGMENTS

Authors appreciate all participants in the exploratory survey and evaluation stages of this research, as well as reviewers of the earlier versions of this paper.

REFERENCES

Aboelmaged, G. (2010) Predicting e-procurement adoption in a developing country: An empirical integration of technology acceptance model and theory of planned behavior, *Industrial Management & Data Systems,* 110, 3, 392-414

Ajzen, I. and Fishbein, M. (1980) Understanding attitudes and predicting social behavior. Englewood Cliffs, Prentice-Hall, New Jersey.

Akudo, C. A., Absalom E. E., Sale, E. A., (2012) Electronic Payment System (EPS): Facilitating the Development and Adoption in Nigeria, *International Journal of Computer Science Issues*, 9, 2, 462-467

Aljifri, A., Pons, A., and Collins, A., (2003) Global e-commerce: a framework for understanding and overcoming the trust barrier, *Information Management and Computer Security*, 11, 3, 130-138.

Amin, H. (2007) An analysis of mobile credit card usage intentions, *Information Management & Computer Security,* 15, 4, 260-269.

Armstrong, J. S. (2012) Illusions in Regression Analysis, *International Journal of Forecasting,* 28, 3, 689-694.

Bagozzi, R. P. (2007) The Legacy of the Technology Acceptance Model and a Proposal for a Paradigm Shift, *Journal of the Association for Information Systems,* 8, 4, 244–254

Barkhordari, M., Nourollah, Z., Mashayekhi, H., Mashayekhi, Y. and Ahangar, M.S. (2017), Factors influencing adoption of e-payment systems: an empirical study on Iranian customers. *Information Systems and e-Business Management,* 15, 89-116.

Baskerville, R. (1999) Investigating Information Systems with Action Research, *Communications of the Association for Information Systems*, 2, 3, 1–32.

Baum, F., MacDougall, C., Smith, D. (2006), "Participatory action research". Journal of Epidemiol Community Health Vol. 60, pp. 854-857.

Bonacin R. and Baranauskas M. C. C. (2006) Usability in the Organizational Context: a Semiotic-Participatory Approach, State University of Campinas, Sao Paulo, Brazil

Benedetto, D., Calanton, J., and Zhang, C. (2003) International technology transfer: Model and exploratory study in the People's Republic of China, *International Marketing Review*, 20, 4, 446-462.

Bolt, W., Humphrey, D., and Uittenbogaard, R. (2014) Transaction Pricing and the Adoption of Electronic Payments: A Cross-Country Comparison, *International Journal of Central Banking*, 4, 189-123.

Bonera, M. (2011) The propensity of e-commerce usage: the influencing variables, *Management Research Review,* 34, 7, 821-837.

Brown, S. A., and Venkatesh, V. (2005) Model of Adoption of Technology in the Household: A Baseline Model Test and Extension Incorporating Household Life Cycle, *MIS Quarterly,* 29, 4, 399-426.

Chen, M. F., and Lu, T. Y. (2011) Modeling e-coupon proneness as a mediator in the extended TPB model to predict consumers' usage intentions, *Internet Research,* 21, 5, 508-526.

Cheong, H., and Park, M. C. (2005) Mobile internet acceptance in Korea, *Internet Research,* 15, 2, 125-140.

Cho, H., and Fiorito, S. (2009) Acceptance of online customization for apparel shopping, *International Journal of Retail & Distribution Management,* 37, 5, 389-407.

Chong, Y. L., Ooi, K. B., Lin, B., & Tan, B. I. (2010) Online banking adoption: an empirical analysis, *International Journal of Bank Marketing,* 28, 4, 267-287.

Chuttur, M. Y. (2009) Overview of the Technology Acceptance Model: Origins, Developments and Future Directions, Sprouts: Working Papers Information Systems, Indiana University, USA.

Davis, F. D. (1989), Perceived usefulness, perceived ease of use, and user acceptance of information technology, MIS Quarterly, 13, 3, 319–340

Featherman, S., Miyazaki, D., and Sprott, E. (2010). Reducing online privacy risk to facilitate e-service adoption: the influence of perceived ease of use and corporate credibility, *Journal of Services Marketing*, 24 No. 3, pp. 219–229.

Fishbein, M. & Ajzen, I. (1975). Belief, attitude, intention, and behavior: An introduction to theory and research, Addison-Wesley Reading, Massachusetts.

Florkowski, W., and Olivas-Luja´n, R. (2006) The diffusion of human-resource information-technology innovations in US and non-US firms, *Personnel Review,* 35, 6, 684-710.

Foster, T., Hope, R., Krolikowski, A., and Cohen, I. (2012). Mobile Water Payment Innovations in Urban Africa, University of Oxford, United Kingdom.

Gathumbi J. O. K. (2015) Factors Affecting Electronic Payment Adoption by Matatu Owners Saccos in Nairobi City County, University of Nairobi, Kenya

Hsiao, K. L. (2011) Why internet users are willing to pay for social networking services, *Online Information Review,* 35, 5, 770-788.

Ho, L. A., Kuo, T. H., and Lin, B. (2010). Influence of online learning skills in cyberspace, *Internet Research,* 20, 1, 55-71.

Hurst, L., (2012) Economic Intelligent Unit, Government E-Payments Adoption Ranking (GEAR), retrieved Jan 23, 2016 from https://usa.visa.com/dam/VCOM/download/corporate/media/2011_GEAR_Study_Overview.pdf

Khanlou, N., Peter, E. (2005) Participatory Action Research: Considerations for ethical review, *Social Science and Medicine,* 60, 10, 2333-2340.

Kolodinsky, M., Hogarth, M., and Hilgert, A. (2004). The adoption of electronic banking technologies by US consumers, *The International Journal of Bank Marketing,* 22, 4, 238-259.

Krejcie, V. R, and Morgan, W. D. (1970) Determining sample size for research activities, *Educational And Psychological Measurement,* 30, 607-610.

Liao, C. H., Tsou, C. W., and Huang, M. F. (2007) Factors influencing the usage of 3G mobile services in Taiwan, *Online Information Review,* 31, 6, 759-774.

Li, P., and Xie, W. (2012). A strategic framework for determining e-commerce adoption, *Journal of Technology Management in China,* 7, 1, 22-35.

Low, C., Chen, Y., and Wu, M. (2011) Understanding the determinants of cloud computing adoption, *Industrial Management & Data Systems,* 111, 7, 1006-1023.

Lule§, I., Omwansa, K., and Waema, M. (2012). Application of Technology Acceptance Model (TAM) in M-Banking, *International Journal of Computing and ICT Research,* 6, 1, 31-43.

Lunceford, B. (2009) Reconsidering Technology Adoption and Resistance: Observations of a Semi-Luddite, *Explorations in Media Ecology,* 8, 1, 29-47.

Maghrabi, T., and Dennis, C. (2011) What drives consumers' continuance intention to e-shopping? *International Journal of Retail & Distribution Management,* 39, 12, 899-926

McKechnie, S., Winklhofer, H., and Ennew, C. (2006) Applying the technology acceptance model to the online retailing of financial services*, International Journal of Retail & Distribution Management,* 34, 4, 388-410.

Miller E. J. (2006). Air Force Research Laboratory, Participatory Design Methods for Command and Control Systems, retrieved Jan 23, 2016 from http://www.dodccrp.org/events/11th_ICCRTS/html/papers/027.pdf

Ndiwalana, A., and Popov, O. (2008). Mobile Payments: A Comparison between Philippine and Ugandan Contexts, in IST- Paul Cunningham and Miriam Cunningham (Eds) *Proceedings of the IST-Africa 2008 Conference,* ISBN: 978-1-90 5824-07-6, May 7 – 9, Windhoek, Namibia

NetHope and MEDA (2012) Uganda mobile money assessment: examining cash payment streams amongst USAID implementing partners, retrieved March 23rd 2015 from https://solutionscenter.nethope.org/assets/collaterals/Uganda_Market_Assessment_and_Case_Studies_Final.pdf

Nguyen, T.D. and Huynh, P.A. (2018). The Roles of Perceived Risk and Trust on E–Payment Adoption, *Econometrics for Financial Applications, Studies in Computational Intelligence, 760,* 926-940.

Nikolić, D., Muresan, R.C., Feng, W., Singer, W (2012) Scaled correlation analysis: a better way to compute a cross-correlogram*, European Journal of Neuroscience,* 1–21.

Norman, G. R. and Streiner, D. L. (2003). PDQ Statistics (3rd Edition) ISBN-9781550092073, PMPH, USA.

Nysveen, H., Pedersen, P. E., and Thorbjørnsen, H. (2005) Explaining intention to use mobile chat services: moderating effects of gender, *Journal of Consumer Marketing,* 22, 5, 247–256.

Okifo J. and Igbunu R. (2015) Electronic Payment System in Nigeria: Its Economic Benefits and Challenges, *Journal of Education and Practice,* 6, 16, 56-62

Oliveira, T., Thomas, M., Baptista, G. and Campos, F. (2016) Mobile payment: Understanding the determinants of customer adoption and intention to recommend the technology, *Computers in Human Behavior,* 61, 404-414

Peansupap, V., and Walker, D. (2005), Factors affecting ICT diffusion: A case study of three large Australian construction contractors, *Engineering, Construction and Architectural Management,* 12, 1, 21-37.

Pfeffermann, D. C., Rao, R. (2009). Handbook of Statistics A Sample Surveys: Theory, Methods and Inference. ISBN 978-0-444-53124-7, Elsevier B.V.

Porter, M. (2013) Adoption of Electronic Health Records in the United States, Kaiser Permanente International, California.

Seock, Y. K., Norton, M. (2007) Attitude toward internet web sites, online information search, and channel choices for purchasing, *Journal of Fashion Marketing and Management,* 11, 4, 571-586.

Seth, A., Momaya, K., and Gupta, H. (2005). E-Service Delivery in Cellular Mobile Communication: Some Challenges and Issues. *Global Journal of e-Business and Knowledge Management,* 2, 2, 30-42.

Schepers, J., Wetzels, M., and Ruyter, D. (2005) Leadership styles in technology acceptance: do followers practice what leaders preach, *Managing Service Quality,* 15, 6, 496-508.

Sidek, N. (2015) Determinants of electronic payment adoption in Malaysia: the stakeholders' perspectives PhD Thesis, School of Agriculture and Food Sciences, The University of Queensland. doi:10.14264/uql.2015.696

Sumanjeet, S. (2009) Emergence of Payment Systems In The Age of Electronic Commerce: The State of Art, *Asia Pacific Journal of Finance and Banking Research,* 2. DOI: 10.1109/AHICI.2009.5340318.

Teoh, M. Y., Chong, C., Lin, B., and JChua, W. (2013) Factors affecting consumers' perception of electronic payment: an empirical analysis, *Internet Research,* 23, 4, 465-485.

Timmor, Y., and Rymon, T. (2007) To do or not to do: the dilemma of technology-based service improvement, *Journal of Services Marketing,* 21, 2, 99–111.

Uganda Bureau of Statistics [UBOS]. (2016) The National Population and Housing Census 2014 Main Report, Kampala, Uganda.

United Nations Conference on Trade and Development (UNCTAD, 2015) Cyberlaws and regulations for enhancing e-commerce: Case studies and lessons learned, retrieved 12th December 2017 from http://unctad.org/meetings/en/SessionalDocuments/ciiem5d2_en.pdf

Venkatesh, V., Morris, M. G., Davis, G. B., and Davis, F. D. (2003) User acceptance of information technology: Toward a unified view, *MIS Quarterly,* 27, 3, 425-478

Venkatesh, V. and Davis, F.D. (2000) A theoretical extension of the technology acceptance model: four longitudinal field studies, *Management Science,* 45, 2, 186-204

Wang, Y. S., Wang, Y. M., Lin, H. H., & Tang, T. I. (2003) Determinants of user acceptance of Internet banking: an empirical study, *International Journal of Service Industry Management,* 14, 5, 501-519.

Xu, B., Lin, Z., and Shao, B. (2010) Factors affecting consumer behaviors in online buy-it-now auctions, *Internet Research,* 20, 5, 509-526.

Zhou, T. (2011) An empirical examination of initial trust in mobile banking, *Internet Research,* 21, 5, 527-540

APPENDIX 1. SAMPLE CHARACTERISTICS

Characteristic	Category	Percentage	Characteristic	Category	Percentage
1. Gender *(considered due to gender-related influence on adoption)*	Male	51%	**5.** Whether respondents use e-payment systems	Yes	83%
	Female	49%		No	17%
2. Marital status *(considered due to spouse influence issues)*	Married	28%	**6.** How respondents heard about e-payment *(considered to determine availability of information about e-payment)*	Media	65%
	Single	70%		Friends/family	30%
	Others	2%		No response	5%
3. Highest education level *(considered to show comprehension ability of respondents to provide relevant responses)*	> = Diploma	74%	**7.** Electronic device owned by respondent *(this can inform service providers to devise mobile based e-payment) mechanisms)*	Mobile phone	76%
	Certificate, Secondary, & Primary	24%		Laptop or computer workstation	23%
	No formal education	2%		No response	1%
4. Occupation status *(considered due to income influence issues)*	Employed	57%	**8.** What respondents used e-payment to pay for	Utility bills	42%
	Unemployed	43%		Television services	15%
				Products/services	11%
9. Means used by respondents for e-payment transactions *(Since majority own mobile phones, results show that mobile based e-payment mechanisms are widely used. Also, mobile money transactions are restricted to local transactions and have a ceiling on maximum amount to transfer. Use of VISA cards is low yet they facilitate global transactions.)*	ATMs	37%		School fees	12%
	EFT, PayPal, Credit Cards at point of sale, VISA card	9%		Others	19%
			10. Respondents views on benefits of using e-payment	Saves time	53%
	Mobile money	44%		Convenient due to flexible time and location	11%
				Accessibility of payment information	5%
				Low transaction cost	16%
				Provides payment data security/proof	7%

Appendix 1.1. Findings from Interviews with Regulatory Authorities on e-payment

Parameter	Details
Aim	To gain insight into efforts undertaken by regulatory agencies in Uganda that are responsible for supporting adoption of e-payment on aspects such as infrastructure, training, and policy
Respondents	Two subject matter experts from Uganda Communications Commission (UCC) and National Information Technology Authority Uganda (NITA-U)
Findings on government efforts towards encouraging adoption of e-payment systems	• Encourages use of e-payment systems in delivery of services offered by some government agencies (such as Uganda Revenue Authority, PPDA, Uganda National Bureau of Standards) and private sector agencies, and frequently used e-payment systems are: mobile money, EFT, and the Integrated Financial Management System (IFMS) as a compulsory system for financial transactions in government agencies.
	• Provides training on e-payment systems in government agencies to users at institutional level.
	• Embarked on a mission to improve the network connectivity in the country through the ongoing establishment of the national backbone infrastructure to enhance e-service delivery.
	• Developed an e-transaction act as a policy on e-payment systems (implemented by Bank of

	Uganda UCC and NITA-U).

APPENDIX 2. FACTOR ANALYSIS OF VARIABLES DERIVED FROM SECTION 3.2

Appendix 2.1: Factor structure of perceived usefulness of e-payment systems (i.e. usefulness of e-payment is interpreted in terms of convenience, security, and accessibility)

#	Item/factor	Convenience	Security	Accessibility
1	The electronic payment system is time saving	0.782		
2	I can check my transaction details and statement	0.621		
3	I use electronic payment for emergency payments	0.619		
4	Service provider is reliable in correcting erroneous transactions		0.722	
5	I believe having a password to my payment system is extremely important		0.681	
6	I have concern with the requirement to register before using e-payment system		0.522	
7	Having internet has influenced me to use e-payment			0.706
8	I get assistance from the service providers			0.612
9	Having a mobile phone has influenced me to use e-payment			0.585
Eigen Value (only factors that yield an Eigen value that is greater than 1 are retained)		*1.870*	*1.849*	*1.733*
	Variance (%)	*15.583*	*15.408*	*14.439*
	Cumulative Variance (%)	*15.583*	*30.991*	*45.430*

Appendix 2.2: Descriptive analysis of perceived usefulness of e-payment systems

Variables and items that describe perceived usefulness of e-payment systems	Mean	SD
Convenience		
The electronic payment system is time saving	4.38	0.86
I can check my transaction details and statement	4.13	0.92
I use electronic payment for emergency payments	3.65	1.28
Accessibility		
Having internet has influenced me to use electronic payment	3.10	1.40
Having a mobile phone has influenced me to use electronic payment	3.85	1.22
I get assistance from the service providers	3.54	1.16
Security		
I believe having a password to my payment system is extremely important	4.39	0.94
I have concern with the requirement to register before using electronic payment system	3.40	1.29
Service provider is reliable in correcting erroneous transactions	3.12	1.31

Appendix 2.3: Factor structure of perceived ease of use of e-payment systems (i.e. ease of use of e-payment system is interpreted in terms of compatibility, simplicity and flexibility)

#	Item/Factor	Flexibility	Simplicity	Compatibility
1	Making payments to people who are not registered with e-payment system services	0.669		
2	I use the system for different financial transactions	0.659		
3	I find electronic payment systems flexible to interact with	0.655		
4	The interaction with electronic payment system requires a lot of mental effort		0.943	
5	It is easy to use electronic payment system to accomplish my financial needs		0.682	
6	It is easy for me to become skilful while using electronic payment system		0.619	
7	Not having to use all the electronic payment products to register for electronic payment services			0.858
8	I have confidence in electronic payment services			0.787
9	Not having to use all the electronic payment products to register for electronic payment services			0.430
	Eigen Value	*2.238*	*1.731*	*1.100*
	Variance (%)	*24.87*	*19.234*	*12.226*
	Cumulative Variance (%)	*24.87*	*44.104*	*56.33*

Appendix 2.4: Descriptive analysis of perceived ease of use of of e-payment systems

Variables and issues that describe perceived ease of use of e-payment systems	Mean	SD
Compatibility		
I have confidence in electronic payment services	3.68	1.15
Electronic payment is consistent with my values	3.45	1.11
I do not have to use all the electronic payment products to register for electronic payment services	3.41	1.09
Simplicity		
It is easy to use electronic payment system to accomplish my financial needs	3.77	1.19
The interaction with electronic payment system requires a lot of mental effort	2.91	1.38
It is easy for me to become skilful while using electronic payment system	3.83	1.13
Flexibility		
I find electronic payment systems flexible to interact with	3.83	1.09
I use the system for different financial transactions	3.84	1.06
I can make payments to people who are not registered with electronic payment system services	3.57	1.24

APPENDIX 3. FAEP VERSION I – BEFORE EVALUATION PHASE