Development and Evaluation of an Automated e-Counselling System for Emotion and Sentiment Analysis

Emmanuel Awuni Kolog, Calkin Suero Montero and Markku Tukiainen
School of Computing, University of Eastern Finland, Joensuu, Finland
emmanuk@uef.fi
calkins@uef.fi
markku.tukiainen@uef.fi

Abstract: Given the challenges associated with the analysis of emotions in text by counsellors, we present an intelligent e-counselling system for automatic detection of emotions and sentiments in text. The system- EmoTect- was developed using a supervised support vector machine learning classifier. Therefore, students’ life stories were collected and developed into a corpus for training and evaluating of the classifier. EmoTect allows users to label instances of the training data based on their own perception of emotions, and then gradually learns to classify emotions according to the user’s perceptions. The EmoTect interface provides a visualization of the emotional changes from automatically analysed students’ submissions over a selectable period. In this paper, the EmoTect classifier is evaluated with a gold standard corpus obtained from students but annotated by counsellors. In addition to the classifier evaluation, the EmoTect prototype was evaluated with counsellors in their settings. From the experimental results, the EmoTect classifier for the sentiment classification achieved comparable accuracy to that achieved with a gold standard when presented with unknown data. The contextual evaluation of the system indicates counsellors’ satisfaction and sense of enthusiasm for using EmoTect for counseling delivery.

Keywords: Counselling, Design science research, Emotion classification, Evaluation, Sentiment analysis, Support vector machine

1. Introduction

Emotion analysis forms an integral part of students’ emotional and personal-social development (Barner & Brott, 2011). Personal-social domain of counselling partly encapsulates the strategies of helping students to unearth and manage their latent emotional and personal-social challenges (Alexandria, 2014). With variation in students’ emotions and personal-social needs, school counsellors are mandated to facilitate the emotional learning opportunities and restorative approaches of students. Therefore, being able to deduce the emotional intensity of students, counsellors can predict the behaviour of their students towards academic engagements and performance (Ji, 2015; Pekrun et al., 2002). In effect, counsellors are expected, as part of their profession, to devise strategies for understanding the emotions of their students, thereby motivating a successful academic achievement (Kolog, 2014, Paulus & Yu, 2012). Meanwhile, counsellors often counsel students through their own intuitional effort, especially in the context of counselling in Ghana (Kolog & Montero, 2017). For this reason, complementing the intuitional efforts of counsellors with Information and Communication Technologies (ICTs) is a way of ensuring efficiency and consistency in counselling delivery (Kolog & Montero, 2017).

While analysis of emotions in text has widely been studied in the domains of psychology and behavioural sciences, there is an increasing interest from the computer science researchers. This interest is mainly centred on the use of the computational approaches for detection and analysis of emotions in text. Computational tracking of emotions in text is useful in counselling delivery as it can be used to complement the consistencies in decision making processes (Kolog et al., 2017). This is especially relevant when large volumes of data are involved. Baumeister and Bushman (2007: p. 61) define emotions as ‘a subjective state, often accompanied by a bodily reaction and an evaluative response, to some event’. Thus, emotions can be manifested physiologically (Tobin et al., 2016; Chopade, 2015) and linguistically (Hancock, 2007). In either case, emotions could be expressed through blood pressure, speech, facial expression (Damasio, 2000) and text (Schalke, 2014). However, the focus of this work is to detect emotions of students in text.

Textual submissions by students towards seeking counselling are most likely contain emotional expressions (Kolog et al., 2016). With this, emotions in text can be spotted by analysing the linguistic information in them, usually through Natural language processing techniques. Linguistic information in text document is valuable for identifying emotion words, thereby aiding decision making processes. Paradoxically, manual analysis of...
linguistic information in text is not efficient when it concerns large volumes of text documents. The application of automatic emotion analysis is diverse and the field is steadily being applied in different sectors, such as education, business, and health sectors. For instance, business organisations use sentiment analysis (Coarse-grain emotion analysis) applications to study the perception and opinions of their customers regarding products and services (Balabantaray et al., 2012). Educational text mining is one of the domains in Computer science that has attracted a considerable interest for the understanding of learners’ behaviour, usually through students learning diaries and course feedback (see for example: Munezero et al., 2013).

Vinluan (2011) believes that counselling has benefited from ICT for many years. While we agree with Vinluan (2011), we also believe that more work in ICT-mediated counselling is still needed, especially for exploring how indigenous knowledge could be integrated into ICT (contextualisation). ICT-mediated counselling simplifies the work of counsellors and provides opportunities for students with diverse backgrounds to vary their counselling accessibility (Kolog, 2014). Since school counsellors are humans their emotional states, at a point, could directly or indirectly influence their judgement when analysing emotions of their clients in text (Kolog et al., 2016; Lerner, 2003; Paulus & Yu, 2011). This is consistent with the findings of Han et al. (2007) who pointed out that different emotions expressed by individuals, could affect their perception of emotions, and perhaps clown their judgement when making decision. Therefore, to minimise the influence that counsellors’ own emotions have on the perception of emotions on others while analysing text documents, we have developed a system for automatic emotion and sentiment classification, which is based on the Plutchik’s basic emotions. The system, called EmoTect, is multi-functional and comprises two components: contact counsellor and emotion detection. The contact counsellor form allows students to contact counsellors anonymously through text, and the textual submissions are then passed on to the ‘emotion detection’ phase for the automatic classification of emotions and sentiments. The primary purpose of EmoTect is to complement the work of counsellors by aiding them in their decision-making process concerning students. The development of EmoTect followed a design science research (DSR) process with end-users (students and counsellors) participation. The prototype version of EmoTect and its classifier is evaluated and presented in this paper. Hence, this paper forms part of the initial stages of an ongoing DSR project.

2. Background

Automatic detection of emotions in text has widely been applied in diverse domains. Its relevance is eminent given that a lot of people are accepting to use ICT in their daily life activities, especially through social media and other personalised platforms. This, in turn, brings about a considerable increase in online data, which has fuelled the need for big data analytics with the aid of computational algorithms (Shina & Choib, 2014). In this section, we delve into discussing machine learning, some related works on emotion detection and a Design science research with participatory design approaches.

2.1 Machine learning

Machine learning (ML) is an application of Artificial intelligence that provides systems with the ability to automatically learn and improve from experience without being explicitly programmed. Machine learning has widely been used in diverse areas of Artificial Intelligence. For instance, domains such as NLP, affective computing, human computer interaction uses ML algorithms for extracting knowledge from data or text. Machine learning in text classification comprises two main learning approaches: supervised and unsupervised.

On the one hand, the supervised machine learning involves the use of labelled data to train a classifier, thereby creating a model for classification. After the classifier is trained, a model is obtained and is made to predict unclassified or unknown data input. Mathematically, let \( T \) denote text and \( s \) denote a word, sentence or paragraph that contains emotion features, where \( s \in T \). In addition, let \( n \) be the number of emotion class \( E = \{x_1, \ldots, x_n\} \) where \( i = 1,2,3...n \). In some cases, researchers include ‘non-emotion’ or ‘neutral sentiments’ in the categories \( E \). The aim of supervised machine learning in emotion classification is to tag \( x_i \) to \( s \) as accurately as possible, as in a mapping function \( f(s) = x_i \), such that an ordered labelled pair of \( (s, x_i) \) is obtained. The mapping is obtained based on a model after a classifier is trained.

On the other hand, the unsupervised learning does not require labelled data for training a classifier. Rather, patterns from unclassified data are detected using cluster algorithms. When labelled and unlabelled data are combined to train a classifier, the resulting method is termed semi-supervised learning. The supervised ML has

---

1 EmoTect is available at: http://nlp4counselling.com/login.jsp
been found to perform better than that of the unsupervised learning (Sigdel et al., 2015). Most efficient, accurate and commonly used classifiers for supervised ML are support vector machine (SVM), neural network, decision tree and Naïve Bayes (Munezero et al., 2013; Joachims, 1998; Hassan, Rafi and Shaikh, 2011; Matwin & Sazonova, 2012). With this in mind, we employed a multi-class SVM classifier in building the EmoTect system.

Support vector machine (SVM) is a ML classifier for supervised classification. The algorithm is predominantly used for text classification. SVM is a discriminative algorithm in a sense that it is defined by constructing a hyperplane or a set of hyperplane in a high dimensional space (Hashem & Mabrouk, 2014). The hyperplane in the higher-dimensional space is defined as the set of points whose dot product with a vector in that space is constant. When training data is presented to SVM, a model is built which consists of data points chosen from input data space and their class labels. SVM outputs optimal hyperplane which classifies unseen or unclassified data after a model is built. Intuitively, a good separation is achieved by the hyperplane that has the largest distance to the nearest training-data point of any class (the so-called functional margin) since in general the larger the margin the lower the generalization error of the classifier (Hashem & Mabrouk, 2014). SVMs find solutions of classification problems that have "generalization in mind" and they are able to find non-linear solutions efficiently.

2.2 Related works

A similar platform to EmoTect is the one developed by Munezero et al. (2013). Munezero et al. (2013) employed a supervised machine learning technique to build an emotion and sentiment classification system. According to the researchers, their system allows teachers to automatically track the emotional changes of students through their learning diaries. Munezero et al. (2013) used Plutchik’s (1980) eight basic emotions as the predefined emotion category while the sentiment part used negative, positive and neutral. However, some of the Plutchik’s emotions were combined to give secondary emotions of anxiety and frustration which were considered as part of the emotion categories. Ascertaining the efficacy of their system, Munezero et al. (2013) evaluated their system with a collection of students’ learning diaries which they collected from Newman’s et al. (2008) corpus. As reported by the researchers, their system was found to perform well to their expectation.

Furthermore, Lu (2006) developed a system for the retrieval of data from the web through keyword queries. The system further extracts emotion from the retrieved data in real time and output the results in visual form. As reported by the researchers, the purpose of system was to extract and visualise emotions from the web. With this approach, two natural language processing techniques were explored: web mining engine and semantic labelling techniques. While the web mining engine allow search by specific keywords and provide answers to lexical questions, the semantic labelling tool implements semantic role labelling for semantic parsing and eventual extraction of the emotions. Lu (2006) built the system based on a manual procedural approach for creating an emotional model. Hence, their model considered seven basic emotions: happiness, Sadness, Anger, fear, disgust, surprise and neutral.

Rahman and Ahmed (2014) developed a web-based emotion detection system for social media content processing and event monitoring. Their system, termed MediaTagger, is an open-source software that was built on Naïve-Bayes classifier. The MediaTagger has two different components which work together as one. The components are the web data and emotion extractor. While the web media extractor retrieves data from the social media sources such as Facebook and Twitter, the emotion extractor takes the data and further extracts emotion words. Rahman and Ahmed (2014) did not use any predefined emotion categories, rather their system returns the emotion words from the data. Contrary to our system in this work, we used predefined emotion categories from Plutchik on which unseen input text is predicted by a classifier model (see Figure 3). However, our system also returns emotional words from unseen text document. By ascertaining the efficiency of their web-data and classification algorithms, Rahman and Ahmed (2014) evaluated their system with sample text document, and with end-users. Rahman and Ahmed (2014) reported higher working efficiency of their algorithm with end-users appreciating the functionalities of MediaTagger.

2.3 Design science research

There are various ways by which design science research (DSR) is characterised in terms of the guidelines associated with its application in artefact development. The guidelines are dependent on the discipline and the type of artefact. This is because several academic disciplines have gradually accepted design science as a research programme (Weber, 2010). An example of such disciplines include engineering (Archer, 1984; Eekels
DSR has widely been used in information systems and computer science artefact development. The fundamental base of DSR projects usually starts by understanding the context and identifying the problem on which the intended artefact is meant to solve (Au, 2001; Mramba et al., 2016). March and Smith (1995) consider DSR a pragmatic approach of building an artefact by involving end users in the developmental process. March and Smith (1995) further concluded that the relevant products of DSR are either constructs, models, methods, instantiations or a combination thereof. With this, the end product adopting DSR, in this work, is the creation of an artefact (EmoTect).

Before developing EmoTect, preliminary studies were conducted to gather the requirements for the EmoTect development (see Section 3.1). Students and counsellors are the users of the EmoTect system, hence they were actively involved in the EmoTect development. For instance, we investigated the behavioural intentions of students towards accepting and using e-counselling in Ghana (Kolog et al., 2015). The study was an exploratory research which was empirically conducted by involving students. The findings from the study motivated the need for DSR, thereby involving counsellors and students in the developmental process. Based on Peffer’s et al. (2006) DSR model (redrawn in Figure 1), we have simplified the various steps into three main components interlinked iteratively and sequentially. From Figure 1, the three components: analysis and requirement, implementation and evaluation are deduced and explained elaborately in the subsequent subsections.

Figure 1: DSR model redrawn from Peffers’ et al. (2006)

In the development of EmoTect, counsellors and students were consulted to give their input, especially during the requirement and the evaluation stages. This process is termed a participatory design (PD). PD is a design approach that attempts to actively involve stakeholders (thus, students and counsellors) in the design process, thereby ensuring that the results based on the design meets stakeholder’s expectation. According to Roberston and Simonson (2012: p.6), “during a Participatory Design process all participants increase their knowledge and understandings: about technology for the users, about users and their practice for designers, and all participants learn more about technology design.” Duveskog et al. (2009) undertook a similar project in Tanzania regarding a digital tool for counselling people living with HIV/AIDS. Duveskog et al. (2009) adopted a PD consisting of teams of secondary school children, university counsellors, HIV counseling experts and experts in ICT were involved in the implementation process.
3. EmoTect implementation

In this section, we present the development of EmoTect in line with the DSR process shown in Figure 1. This section is divided into three sub-sections: Problem and requirement identification, EmoTect development and the user guide. To pre-empt is that EmoTect does not crawl data online for analysis, it is rather a tool that tracks emotions and sentiments from the textual submissions of students during counselling.

3.1 Problem and requirement identification

We have shown from our previous study that students have inherent life challenges that hinder their academic development (Kolog et al., 2014). However, students rarely or do not discuss their life challenges with their school counsellors concerning their academic and life challenges (Kolog et al., 2014). Awinsong et al. (2015) have reported similar findings in a study conducted in Ghana. The researchers found high rate of students’ being reluctant to seek counselling face-to-face. This, Awinsong et al. (2015) attributed the reasons to lack of trust students have in their counsellors. A related study from other parts of the world have also attributed students’ reluctance on seeking counselling to lack of trust in their counsellors (see for example: Le Surf & Lynch, 1999; Jenkins & Palmer, 2011; Mushaandja et al., 2013). Students who are willing to be counselled, in most cases, advocate for counselling through anonymity and this partly motivated this line of research. Currently, most of the counsellors in Ghana receive, analyse and adjudicate on students’ emotions based on their intuitions. This process is not efficient, and as well a costly process, especially that students’ population keep increasing over time. Most schools in Ghana do not have professional counsellors at the helm to give counselling to students (Essuman, 2014). For this reason, some schools have turned teachers into counsellors. This has become a problem since such counsellors lack the professional and technical expertise to give counselling to students. In this light, we believe that our e-counselling system could complement the work of counsellors regarding their decision making of students, especially the novice counsellors.

Given the fast growing of social media platforms and easy accessibilities of the internet, we found text-based medium of information exchange as the most commonly means by which most students exchange information. In addition, Witten (2005) pointed out that the most common vehicle for formal information exchange is through text. This motivated the idea of developing a text-based NLP system for automatic emotion and sentiment analysis. To the best of our knowledge, there is no existing NLP tool for emotion analysis to complementing the work of counsellors in Ghana. This partly informed the decision of taking up this research line by employing NLP for counselling, particularly for assisting counsellors to efficiently help students to manage their emotional and personal-social life challenges.

Coupled with our preliminary findings, we organised a semi-structured interactive discussion with selected counsellors and students from three senior high schools in Ghana before the commencement of EmoTect’s development, forming part of the participatory design. One counsellor and students, each from the three selected schools in Ghana, participated in the discussion. The session was organised in the respective schools of the participants. Altogether, three counsellors and 30 students contributed to the discussion. The essence of the meeting was to outline to the participants the preliminary requirements for the commencement of EmoTect’s development based on previous encounters. By so doing, we expected the participants to contribute to the discussion before taking the next step to implement the initial (pre-defined) requirements for EmoTect. The initial preliminary requirements and brief description of the various components of EmoTect, as discussed with the participants, are shown in Table 1.

Table 1: Proposed requirements from our preliminary studies and investigation

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact counsellor’s widget form</td>
<td>Presentation layer where students can contact counsellors on the grounds of seeking counselling (anonymous).</td>
</tr>
<tr>
<td>Emotion extraction and visualisation</td>
<td>The domain logic that extracts and visualises emotions of students’ submissions automatically.</td>
</tr>
<tr>
<td>Sentiment extraction and visualisation</td>
<td>Where emotional valence (sentiments) from students’ submissions are to be extracted. Only positive and negative valence is considered.</td>
</tr>
</tbody>
</table>

While the aforementioned proposed requirements were welcomed, the participants suggested further ideas that were worth considering in the development of EmoTect. Counsellors, for their part, requested that the
intended system be able to assist them in monitoring the emotional changes of their students over time. This generated the idea of creating a database to store the extracted emotion categories (results) for future reference. Therefore, by designing the database, this author considered two different functionalities of EmoTect.

On the one hand, the database is meant to house the annotated corpus (life stories of students) meant to be used for classifier training. On the other hand, the database is to store the extracted emotions for future reference, which is made available in visual form at the EmoTect interface, as proposed by the participants. Additionally, counsellors were concerned about emotion keywords from students’ textual submissions, which according to the participants, would prompt further review of students’ submissions should the need arise. This resulted in the idea of extracting and outputting emotional keywords for counsellors at the EmoTect interface for users. The reason connected to the output of the emotional keywords is that counsellors will be able to consider students’ textual submission holistically, should there be any suspicious keywords. For instance, emotion keywords like kill, suicide, worry and die found in students’ submissions will give a clue to a counsellor about what a student may be up to. With the aforementioned emotion keywords, one may interpret that the student is either threatening suicide or he or she is only talking about suicide and death.

Students expressed their concerns about the poor internet connection in the country, which partly forms the challenges associated with the implementation of e-counselling in Ghana. This concern was raised given that EmoTect is a web-based platform. Though the counsellors are not technically inclined, we still explained to them the basic idea of training a classifier. We explained the concept as part of the requirement that users will be made to tag the training data based on their understanding of each instance of the training corpus. As expected, there were no opposing questions or ideas to that effect. The final requirements for the implementation were itemised for the development to commence.

3.2 EmoTect Development

Peffers et al. (2006) have suggested that a critical attention should be given to a desired functionality and architecture of an intended artefact while eliciting or gathering requirements for its development. For such idea, March and Smith (1995) also agreed that design science research artefact should satisfy the needs of end-users. In this work, the implementation of EmoTect began after gathering the needed requirements for its development (see Section 3.1). In addition to the implementation phase, Peffers et al. (2006) suggest that “resources required moving from objectives to design and development include knowledge of theory that can be brought to bear in a solution.”

As pointed out in the requirement identification, we deduced a three tier process development for the EmoTect: interface (presentation layer), domain logic and database design. The presentation tier was developed from HTML5 and Java server pages. The presentation tier is the point of interaction between the users and the system. The second tier is the domain logic, which is responsible for the pre-processing and extraction of emotions and sentiments from input text. By developing the domain logic, the following main packages were used: NLTK2 and Weka’s SVM classifier3. Part-of-speech (POS) tagger from the Natural language toolkit (NLTK) was used for syntactical parsing the input text. In addition, lemmatisation package form NLTK was used in Lemmatising of the input text. The last and third tier is the database. We used MySQL as the database server and Apache Tomcat for the webserver. After pre-processing and extracting of emotion/sentiments, the output is provided in JSON (JavaScript Object Notation) format which is then sent to the front-end for further processing, and it is being displayed in HTML5 tables and visualisation charts. Corpus building, training of the classifier and the classification phases are elaborated in the subsections below.

**Classifier training phase**

The classifier was trained by considering the contextualisation strategies adopted throughout this study. With this in mind, the classifier training did not only follow the traditional approach of using all-in-one inter-annotators’ agreement gold standard data, but an individual’s perception of emotions/sentiment was also considered. This motive was driven by the fact that the intra-annotation agreement of emotions by individual counsellors was found to be almost perfect for all three counsellors. By so doing, emotional antecedents in a form of stories regarding students’ academic development were collected from selection of schools in Ghana.

---

1 http://www.nltk.org/
2 http://weka.sourceforge.net/doc.dev/weka/classifiers/functions/SMO.html
Before undertaking this study, the selected schools were presented with an official letter asking for their cooperation to conduct this study. The schools were made aware that their participation in the study was voluntary. Students who participated in the study were made to sign an informed consent form after they learned details about the essence of the study. It was therefore agreed that any details that might identify the students should not be included in their written response to the questionnaires.

After that, the students’ life stories were pre-processed into a suitable granularity for annotation. The stories were then given out to the three counsellors (hereafter: C₁, C₂ and C₃) to annotate emotions in them (stories) using Plutchik’s eight basic emotions. The use of the Plutchik’s basic emotions was motivated by our previous study (Kolog et al., 2016) where a focused group discussion was organised with counsellors to extract from them the common contextualised basic emotions that students expressed in counselling. Based on the outcome we concluded on using Plutchik basic emotions. Negative and positive polarities were used for the sentiment analysis in the EmoTect system.

Two rounds of annotation exercise were carried out by the counsellors on the same corpus in two different times and days. Hence, the exercise took a lot of time to complete since the data was large (2, 200 instances of the students’ life stories). After the annotation exercise, we had meeting with the participants to consider some of the disagreements in the emotion and sentiment annotation. It resulted in an improved kappa scores. Intra- and inter-counsellors’ annotation agreement of emotions was computed. While obtaining Inter-annotators agreement kappa score of 70.3% and 80.5% for the emotion and sentiment respectively, the intra-annotation agreements from all the counsellors yielded almost perfect average kappa greater than 85% in both the emotions and sentiments.

Training of the classifier did not only follow the traditional approach of using inter-annotators’ agreement gold standard data, but counsellors’ perception of emotions was considered as well. By default, the EmoTect system was trained on annotated life stories after obtaining a good inter-annotation agreement kappa score. However, we have made provision for the users in EmoTect to make changes to the emotion categories based on their personalised perception of emotions. With this, counsellors are expected to annotate the stories based on their own perception of emotions before using the EmoTect system, else the default setting trained from all-in-one inter-annotated corpus is maintained. For instance, different counsellors may tag different emotion categories to the same instance of a story. Counsellors are expected to do so at the front-end of EmoTect before starting to use the system. At any point in time, counsellors are able to make changes to the emotions they had labelled should the need arises. Figure 2 is the interface for users to effect changes to the default training data where necessary.

![Figure 2: System training page](image)

---

4 Inter-annotation agreement of emotions refers to the comparisons between counsellors’ annotated emotions in text corpora.

5 Intra-annotation is the annotation agreement of emotions for each counsellor based on the various rounds of annotation.
classification phase

From the EmoTect architecture in Figure 3, the system comprises two classification phases: training and prediction. On the one hand, the annotated life stories are first made to train the EmoTect classifier for a model to be created. The implication is that the support vector machine classifier learns from the training text and then predicts the unlabelled or unseen text. The prediction phase, on the other hand, is where the classifier model extracts and classifies the emotions and sentiments from the input text according to the predefined emotion and sentiment categories.

From the EmoTect architecture in Figure 3, the system works by first tokenise the training data (life stories). After that, the tokenised words are tagged by their parts of speech, which is accomplished by a Part-of-speech (POS) tagger from Natural language toolkit (NLTK) package. The POS tagging helps to determine the ‘stopping words’; they are removed afterwards. To this end, the emotion features are extracted from the text after the removal of the stopping words. At the training phase, the feature words at this point are lemmatised before feeding them into the classifier. Lemmatisation refers to doing things properly with the use of a vocabulary and morphological analysis of words, normally aiming to remove inflectional endings only and to return the base or dictionary form of a word, which is known as the lemma. At this stage, the feature words are then fed into the classifier (SVM) as a training feature set. After the training, a classifier model is created, which then predicts unseen input text once it is fed into the classifier model.

At the prediction phase, just like the training, the unseen input text goes through similar pre-processing stages where the unseen text is converted into feature sets. The feature sets are then fed into the classifier model, which generates the predicted labels (thus, emotions and sentiment). Emotional feature words are also spotted and output to the system interface.

Figure 3: EmoTect Architecture

3.3 EmoTect description and user guide

In this section, we present the Use case model of the EmoTect accompanied with the step-by-step process of using the system to facilitate counselling delivery. Use case (UC) is a unified model language (UML) which identifies, clarifies and organises system requirements. Use case details the sequence of interactions between systems and users in a particular environment. Additionally, UC explicitly give general overview to the various stages of using an information system artefact. The term ‘actors’ in UC model are referred to users of an EmoTect. The actors of EmoTect system are school counsellors, students and administrators of the system who is responsible for technically managing the system. Figure 4 represents the use case model of EmoTect showing the various actors and their interaction.
The various stages required to use the EmoTect system are: create group, view groups, emotion detection, sentiment analysis, system training and feedback report. Figure 5 shows the stages as it appears in the EmoTect interface, and these are expanded in the subsequent paragraphs.

Creating access account

To use EmoTect, users are expected to create a user account for their respective schools by registering from the project’s page (http://nlp4counselling.com/dashboard.jsp). Once the account is created, login credentials are obtained and can be used to access the system at any time provided there is internet connection.

Creating group

Once logged in, users are expected to create a group database for their schools. This can be done by clicking on the “create group” label at the navigation pane of the EmoTect main page (Figure 5). We recommend school administrators or counsellors to use the name of their schools as group names. At this point, EmoTect can be used to analyse students’ textual submissions from other external sources such as email. This can be achieved by copying the content and pasting it into EmoTect for both emotion and sentiment classification.

Generating scripts

At the navigation pane of the EmoTect interface (Figure 5) is ‘view group’. The “view group” shows users their account database. On the same page, users are expected to generate and copy JavaScript codes to the HTML header of their school websites. As a result, a ‘contact counsellor’ form appears on their respective school
web pages. The widget form provides a frontend view for students to contact counsellors. As seen in Figure 6 all the entry fields are required except for the students’ name field. This is in line with our previous findings where students have advocated for anonymity in counselling. The essence of the email field is for the counsellors to contact their students’ after deciding on their textual submissions. Should the need arise, based on counsellors’ discretion, counsellors can ask for face-to-face session with the students through their emails. Figure 6 shows sample text that was collected through the “contact counsellor” form. The text and the emails shown in Figure 7 are fictitious and do not represent any real data from the students. The following is a sample script that generates the “contact counsellor” widget form on the users’ page.

```html
<html>
  <head>
    <script src="http://nlp4counselling.com/assets/js/widget-contact.js" type="text/javascript"></script>
    <script>document.createWidget('2');</script>
  </head>
  <body>
    ------webpage content here ******
  </body>
</html>
```

![Figure 6: Contact counsellor widget form](image)

![Figure 7: Submissions from the “contact counsellor” widget form](image)
Emotion and keywords extraction

Students’ textual submissions through the ‘contact counsellor’ form is analysed automatically by the EmoTect system. The results for both the emotion and sentiment are made available to the user at the feedback report section shown in Figure 5. The extracted keywords from the text are also outputted to the systems interface as well. Figure 8 shows the emotion detection and visualisation interface of EmoTect.

Figure 8: Front-end visualisation view of the emotion extraction part of EmoTect

The main essence of the EmoTect system is to help counsellors monitor the emotional changes of their students over a period. The automatically extracted emotions from students’ submissions through the “contact counsellor” form can be visualised graphically for a selectable period. Figure 9 shows 4-month emotional pattern of test sample.

Figure 9: Sample view of the emotional changes in students’ submission in text

Sentiment classification

The EmoTect system tracks, detects and outputs the emotional polarities (sentiment) from text. Negative and positive emotional polarities are the output. However, if there are no emotional words from input text, the system outputs the extracted keywords from the content and indicates 00% for the polarities. Figure 10 shows the emotional polarities (negative and positive) from predicted sample students’ text.
There is a growing interest for e-counselling platforms, especially in the domains of health and education (King et al., 2014). However, Ghana and perhaps some developing countries are still lagging behind in terms of ICT-mediated counselling (Kolog et al., 2014). This may be due to the challenges associated with the high levels of illiteracy, poor internet connectivity and lack of ICT-mediated tools for counselling delivery. Regardless of these challenges, counsellors who are regarded as impeccable professionals by students, are expected to devise a strategy in helping students to fortify their motivation towards academic achievement. Consequently, advance in technology keeps widening the scope and methods on which counselling is delivered, which provides opportunities for diversification of counselling delivery.

4. Evaluation and discussion

The EmoTect classifier and the prototype evaluation are presented in this section. This is accompanied with the discussion of the results.

4.1 Classifier evaluation

Two evaluation processes were conducted in this study. First, we evaluated the SVM classifier to ascertain its efficacy by comparing with humans (i.e. counsellors) in terms of the sentiments and emotions. Secondly, the prototype version of the EmoTect was demonstrated in the study’s environment with the intended end-users of the system in line with Peffer’s et al. (2006) DSR framework.

Three hundred sixty instances of the students’ life stories, representing about 16% of the total data (2,200 instances), were used as test data, whereas the remaining 84% was used as the training data. The sampling of the test data was done randomly. Just like the training data, we computed the kappa (k) scores for each of the counsellors (i.e. intra-annotation agreement). In the end, the intra-annotation agreement of emotions in the test data was found for each counsellor to be almost perfect \( C_1 \) \( (k = 0.94) \), \( C_2 \) \( (k = 0.87) \) and \( C_3 \) \( (k = 0.91) \), which was deemed suitable as gold standards for comparing with the outputs from EmoTect. In terms of the sentiments, the intra-annotation agreement kappa scores from the annotated stories were equally found to be almost perfect for all the counsellors (all yielding beyond 90%). These represent the kappa scores for the test data. Table 3 displays test data and the output from the EmoTect (counsellors) and human prediction.

<table>
<thead>
<tr>
<th>Instance</th>
<th>Emotion</th>
<th>Sentiment</th>
<th>Keywords extract</th>
</tr>
</thead>
<tbody>
<tr>
<td>“I am the shy type hence I find it difficult to approach the teachers in my school but life in school is cool.”</td>
<td>C_1: Fear; C_2: Disgust; EmoTect: Fear</td>
<td>C_1: Negative; C_2: Negative</td>
<td>Shy; difficult; cool</td>
</tr>
</tbody>
</table>

Table 3: Sample instance with prediction from counsellors and EmoTect
"I have lot of things helping me to go through life. Only that I have bad habit like stealing but my mother beat me over it."

C1: Disgust
C2: Sadness
C3: Sadness
EmoTect: Sadness
EmoTect: Negative

Table 4 and 5 are the proportion of the human annotated instances of the test data and the output from EmoTect (for the sentiment and emotion categories). Since the counsellors performed two rounds of annotation the tables are a single representation of the agreements of both round of annotation for each counsellor. The annotated training data obtained from the counsellors were, at different points, used to train the EmoTect classifier. The unlabelled test data was fed into EmoTect system for both emotion and sentiment classification (prediction). From our observation, whatever the difference in the training data, the same results were obtained after running the test data repeatedly with EmoTect. This may be so because there was no significant difference in the intra-annotation agreement kappa score for all the counsellors. In the end, the output from the EmoTect classifier was then compared with the gold standards corpus from each of the counsellors. We employed three standard evaluation matrices: Recall, Precision and F-measure. Recall, also known as sensitivity, measures the fraction of labelled instances of the gold standard that were identified and extracted by the system (i.e., the coverage). Precision measures the fraction of the automatically extracted data that was labelled correctly in the gold standard (i.e., the accuracy).

Table 4: Results from EmoTect’s (sentiment) classifier with the gold standards

<table>
<thead>
<tr>
<th>Sentiment</th>
<th>EmoTect</th>
<th>C1 Agreement (C1 vs EmoTect)</th>
<th>C2 Agreement (C2 vs EmoTect)</th>
<th>C3 Agreement (C3 vs EmoTect)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Positive</td>
<td>130</td>
<td>125</td>
<td>111</td>
<td>106</td>
</tr>
<tr>
<td>2. Negative</td>
<td>201</td>
<td>205</td>
<td>170</td>
<td>196</td>
</tr>
</tbody>
</table>

Table 5: Results from the EmoTect (emotion) classifier with the gold standards

<table>
<thead>
<tr>
<th>Emotions</th>
<th>EmoTect</th>
<th>C1 Agreement (C1 vs EmoTect)</th>
<th>C2 Agreement (C2 vs EmoTect)</th>
<th>C3 Agreement (C3 vs EmoTect)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anger</td>
<td>7</td>
<td>14</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>Happiness</td>
<td>28</td>
<td>51</td>
<td>26</td>
<td>62</td>
</tr>
<tr>
<td>Disgust</td>
<td>26</td>
<td>29</td>
<td>8</td>
<td>33</td>
</tr>
<tr>
<td>Sadness</td>
<td>110</td>
<td>116</td>
<td>68</td>
<td>97</td>
</tr>
<tr>
<td>Trust</td>
<td>54</td>
<td>65</td>
<td>26</td>
<td>61</td>
</tr>
<tr>
<td>Fear</td>
<td>40</td>
<td>38</td>
<td>20</td>
<td>23</td>
</tr>
<tr>
<td>Surprise</td>
<td>9</td>
<td>17</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Anticipation</td>
<td>35</td>
<td>14</td>
<td>4</td>
<td>30</td>
</tr>
</tbody>
</table>

Classifier performance

Results from evaluating the EmoTect classifier and the prototype are reported and discussed in this section. We examined the performance of the EmoTect algorithm by comparing with the gold standards obtained from each of the three counsellors. We report the recall, precision and f-measure per each category of the emotions. In addition, the overall score of the recall, precision and f-measure for the emotion are reported. Whereas the precision takes into account the proportion of the retrieved data that was correctly labelled, we took a critical interest in the recall scores, which measured the instances of the baseline (gold standard) that was identified and extracted by the EmoTect from the extracted data. The test data was repeatedly ran for five times with the EmoTect algorithm. Upon repeated exercise, the same results were obtained. Our results from the entire evaluation of the classification algorithm is shown in Tables 6.

Table 6: Evaluation results of EmoTect classifier (Emotions)

<table>
<thead>
<tr>
<th>Emotions</th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Recall (%)</td>
<td>Precision (%)</td>
<td>F-measure (%)</td>
</tr>
<tr>
<td>Anger</td>
<td>35.7</td>
<td>71.4</td>
<td>47.6</td>
</tr>
<tr>
<td>Happiness</td>
<td>92.9</td>
<td>51.0</td>
<td>65.8</td>
</tr>
<tr>
<td>Disgust</td>
<td>30.8</td>
<td>27.6</td>
<td>29.0</td>
</tr>
<tr>
<td>Sadness</td>
<td>61.8</td>
<td>58.6</td>
<td>60.2</td>
</tr>
<tr>
<td>Trust</td>
<td>48.1</td>
<td>40.1</td>
<td>43.7</td>
</tr>
<tr>
<td>Fear</td>
<td>50.0</td>
<td>52.6</td>
<td>51.3</td>
</tr>
<tr>
<td>Surprise</td>
<td>41.2</td>
<td>77.8</td>
<td>53.8</td>
</tr>
<tr>
<td>Anticipation</td>
<td>11.5</td>
<td>25.0</td>
<td>15.7</td>
</tr>
<tr>
<td>Overall</td>
<td>53.1</td>
<td>47.4</td>
<td>50.1</td>
</tr>
</tbody>
</table>
As indicated in Table 6, happiness (92.9%) and sadness (61.8%) yielded the highest recall with C1. This implies the proportion of the labelled instances of the gold standard from C1 that were identified and extracted by the classifier. The corresponding precision scores for happiness and sadness are 51% and 58.6%, respectively. The F-measures for happiness and sadness are 65.8% and 60.2%. This implies that the classifier performed well for identifying the happiness and sadness categories of emotions. However, the lowest recall, as compared with the C1 gold standard, was found in anticipation (11.4%) and disgust (30.8%). In the same vein, the recall values for anticipation and disgust were respectively low at 25% and 27.6%. The corresponding F-measure for anticipation (15.7%) and disgust (29%) was found to be poor.

With regards to the comparison with the gold standard data from C2 shown in Table 6, the emotion categories with the highest recall are happiness (75%), fear (72.7%) and anticipation (78.9%). Meanwhile, sadness yielded the highest (69.1%) precision at the cost of low recall (44.7%) with the C2 gold standard. Surprise had the highest recall (60%) at the cost of poor precision (33.3%). With the classifier performance with the C2 gold standard, predicting sadness was found the highest for the F-measure (68.6%) score while predicting surprise was the lowest in the F-measure (30.8%).

By examining the performance of the EmoTect classifier with the gold standard obtained from C3, the emotion categories that yield the highest recall are fear (73.9%) and sadness (68%). However, surprise (22.2%) had the lowest precision, while the highest precision was found in trust (70.4%). In the corresponding score of the F-measure in Table 6, trust is the highest (66%), implying a somewhat good performance of the classifier.

As already anticipated, the perception of emotions by the counsellors varied (Kolog et al., 2016). Therefore, the overall performance of the system concerning each of the counsellors also varied, but slightly. The variation in the emotional perception by the counsellors could be attributed to the subjective and subtle nature of emotions (Zadra, 2011). In addition, the variation in the emotion perception by the counsellors shows how different people interpret and perceive emotions in text at a particular time. From tables 6, it can be deduced that the overall recall, precision and F-measure scores for all the counsellors looks promising for its purpose, though the performance of the EmoTect classifier with some of the emotion categories was found to be poor. All in all, an increasing trend was observed in the overall recall, precision and F-measure. That is, the performance of the EmoTect classifier against the counsellors increases from C1 to C3 for precision, recall and the F-measure, where: recall: C1 (55.3%) > C2 (53.5%) > C3 (53.1%), precision: C1 (57.6%) > C2 (54.0%) > C3 (47.4%) and F-measure: C1 (56.4%) > C2 (53.8%) > C3 (50.1%). With this observation, based on the methodology used in this dissertation, no particular reason could be attributed to the increasing trend from C1 to C3 other than the variations in the scores for each counsellor.

Though these findings came as no surprise, our interest in the evaluation was to ascertain the performance of the EmoTect classifier with the counsellors’ gold standards. While the overall recall, precision and F-measure scores were somewhat good for each of the counsellors, we believe that the algorithm can still be improved when more of the annotated, emotionally charged students’ stories are used to train the algorithm further. With this, more attention will be given to the emotion categories that yielded the lowest recall and precision, such as happiness and surprise. To this end, it can be deduced that the EmoTect algorithm achieved comparable accuracy to the gold standard, even when presented with unknown data.

The performance of the EmoTect classifier was examined with regard to the detection of sentiments in the test data. Just like the emotion detection part, the annotated sentiments by the counsellors were compared with the EmoTect algorithm. Table 7 depicts both the negative and positive sentiments yielding almost perfect for recall and precision with the gold standards corpora from the three counsellors. The implication is that EmoTect extracted a higher proportion (recall) of sentiments from the gold standards and predicted most of them correctly (precision). The same can be said about the overall recall and precision of the classifier with the gold standards from the counsellors. The F-measure for all the counsellors in terms of the classifier performance in the sentiments performed very well, and this can be said the same about the overall score for the F-measure. This indicates the EmoTect algorithm – the sentiment part – achieved accuracy comparable to the gold standards, even when presented with unknown data. That is, EmoTect performed well when presented with unclassified data for prediction.

In the nutshell, the EmoTect algorithm for the sentiment detection achieved comparable accuracy to that achieved with a gold standard when presented with unknown data. However, the performance of classification
algorithm for the emotion detection component was not as efficient as we expected. With this revelation, we
deduced that more training data is required to train the algorithm thereby improving the level of accuracy in
the prediction of emotions. That notwithstanding, we believe that EmoTect algorithm is capable for
complementing the work of counsellors in the educational arena.

Table 7: Evaluation results of EmoTect classifier (Sentiments)

<table>
<thead>
<tr>
<th>Sentiment</th>
<th>C1 Recall (%)</th>
<th>C1 Precision (%)</th>
<th>F-measure</th>
<th>C2 Recall (%)</th>
<th>C2 Precision (%)</th>
<th>F-measure</th>
<th>C3 Recall (%)</th>
<th>C3 Precision (%)</th>
<th>F-measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>82.9</td>
<td>84.6</td>
<td>87.1</td>
<td>90.5</td>
<td>90.0</td>
<td>81.7</td>
<td>92.3</td>
<td>90.0</td>
<td>83.1</td>
</tr>
<tr>
<td>Negative</td>
<td>88.8</td>
<td>85.4</td>
<td>83.7</td>
<td>91.4</td>
<td>73.8</td>
<td>90.3</td>
<td>92.5</td>
<td>75.4</td>
<td>91.2</td>
</tr>
<tr>
<td>Overall</td>
<td>85.0</td>
<td>84.9</td>
<td>85.0</td>
<td>90.8</td>
<td>83.6</td>
<td>87.1</td>
<td>92.4</td>
<td>84.0</td>
<td>88.2</td>
</tr>
</tbody>
</table>

The evaluation techniques used in this study has demonstrated that EmoTect can predict sentiments in text as
accurate as human while the prediction of the emotions still requires more data for higher predictable
accuracy. With this revelation, we deduced that more training data will be required to train the classifier,
thereby improving the level of prediction against humans. The method of evaluation used in this study is a
widely used technique, where its success largely depends on the quality of the training data and the
annotation strategies. The implication is that if the data is poorly annotated there is a higher tendency for poor
prediction. For this reason, it is imperative to give annotators a lot of time and training to carry out the
annotation task. With this evaluation technique, EmoTect would have predicted poorly if the training data was
poorly annotated with the emotions and sentiments. This is the reason why three different counsellors were
trained to annotate the data for training the classifier. The challenge remains that since emotions are a
subjective phenomenon it is difficult to actually ascertain a definite accuracy in terms of the human
annotation. While in this study, we believe that the annotation strategies worked, we intend to compare the
results from this study to that of the existing and similar tools such as WEKA. This is another level of evaluation
to further ascertain the efficacy of the algorithm. From our experience, this evaluation technique should be
conducted in ample time periods depending on the size of the data for annotation. Annotators should also be
given enough training on the annotation exercise.

4.2 Prototype evaluation

Kies et al. (1998) proposed three iterative stages of evaluating information system artefact. The stages are
initial design, prototype, and final design evaluations. At this stage of the implementation, we demonstrated
the prototype version of the EmoTect to the end-users in their settings (schools). Students and counsellors
were selected from three senior high schools to participate in the exercise. The various functionalities of the
EmoTect prototype were explained to the participants. Altogether, six counsellors and thirty students
participated in the evaluation exercise. The purpose, as part of the DSR framework, was to find from the
participants if the EmoTect prototype met the requirements suggested in Table 2. The method of data
collection was through observation and interview. This was conducted while the demonstration was ongoing.
During the data collection, we were interested in the participants’ perception of the usability and functional
components of the EmoTect. All in all, this stage of evaluation is preliminary, since we intend to deploy the
final version of the system in the environment and evaluate the system further in the future. For this reason,
the data from the interview and the observations are qualitatively reported in this study.

Findings from Prototype evaluation

Given the capacity of humans to introspect, people have a tendency to opt for an alternative that meets their
requirements. The simplicity of an artefact is undeniably one of the key elements that influence people’s
decision of adopting an Information Technology tool. We showed and demonstrated the EmoTect prototype
to the participants as Hevner et al. (2007) advocated for rigorous DSR artefact evaluation. The demonstration
was done by comparing the system with the prior requirements of EmoTect development (see Section 3.1).

A majority (90%) of the participants agreed that the EmoTect system had captured all the requirements they
had proposed in the early stages of the work. To this end, the system was generally seen by the participants as
tool suitable for complementing their work in delivery of counselling to students. During the demonstration,
we made some observations that is worth considering in the next phase of EmoTect development. One of the
counsellors said and I quote:
“The software is good, because many students will be offered opportunity to contact counsellors. However, my concern is the unavailability of internet connection in my office. Usually if I have to do anything I move from my office to the ICT laboratory to use the internet. In this case, it will be difficult for us to use the software. Apart from that I think the software is good and it almost predicted exactly what I had predicted already.”

We found that all the participants were quite enthused about the capabilities of the EmoTect system. This was to be expected as there are no existing NLP tools that have been developed contextually in Ghana, with the capability of analysing emotions and sentiments in text. This could also be attributed to the doubt that people have over computational tracking of emotions in text. One of the counsellors said and I quote:

“This is amazing! Though I don’t want to understand the technicalities of the process but I doubted from the onset how ICT can be used to determine peoples’ emotions. I was particularly expecting to see how the intended platform would do. I really believe that ICT can do a lot of things that goes beyond the comprehension of our imagination.”

We demonstrated to the participants the novelty of our work regarding the training of the classifier. The counsellors saw the relevance in our approach but we could not evaluate their perception regarding the system’s classifier training technique. This was because the counsellors did not really have any idea about computational analysis of emotions in text. Regarding the ease of use of the system, the participants did not raise a critical concern. The only aspect that got few of the participants taking was the part where JavaScript is expected to be copied from the EmoTect page to their webpages. In effect, the participants raised some concerns about the technicalities of copying the scripts from the EmoTect page to their respective pages in order to display the personalised “contact counsellor” widget form. Nonetheless, while majority (60%) of the participants had no difficulties configuring the EmoTect system before using it for the first time, some of them (40%) encountered configuration difficulties. Those who had configuration challenges are those who complained of the copying of the JavaScript code for embedding on their page. A counsellor expressed this views on the subject during the interview and we quote:

“I don’t have problem with the system being used to help us, but my concern is the part that require us to do some programming in order to get the message box for our students to contact us. Since you said this is just a demonstration, I don’t have much to say. However, at some point the systems output was not what I expected. Also take a good look at why the response at some point where slow.”

During the discussion, most of the participants did not find any difficulties with the interface, and as well as the aesthetic features of the EmoTect. All the participants found it easy to traverse the various pages of EmoTect. By explaining to the participants, we recommend for them to use the services of their ICT coordinators to help in the initial configuration settings. While demonstrating the system to the participants, minor technical glitches were found. This was to be expected since it is a prototype version. However, the glitches did not affect the output in terms of the text processing. All in all, the majority of the participants expressed satisfaction with the visualisation output.

In the nutshell, the responses from the participants were valuable as we intend to use their feed for the next phase of the EmoTect development. In fact, the technical glitches that were discovered during the demonstration have been considered. As part of the developmental process, we shall return to the participants to test the final version of EmoTect by allowing them to use for a while. This is, particularly, important in information system artefact development. EmoTect, in the future, shall fully be deployed in the environment for counsellors to use.

5. Conclusion

In this work, we have presented a contextualised intelligent e-counselling system for automatic emotion and sentiment detection in text. The system is implemented from a natural language processing using supervised machine learning technique. Therefore, annotated life story corpus was developed from students’ stories and used as training data. The training of the classifier was based on the personalised emotion perception of counsellors where counsellors are given the opportunity to tag the training data with Plutchik basic emotions. The development of the system duly followed Peffer’s design science research (DSR) framework. The system
allows students to contact a counsellor through a personalised web form. The aim of the system is to complement the work of counsellors, thereby helping to automatically analyse emotions and sentiments of students’ textual submissions to inform decision making. Changes in students’ emotions as predicted by the EmoTect system and expressed about their satisfaction about its usability and functionalities in line with the intended purpose.

References


Understanding the Electronic Cheque Clearing System in Ghana

Alexander Ekow Asmah¹, Joshua Ofoeda² and Ken Gyapong³
¹Heritage Christian University College, Ghana, Africa
²University of Professional Studies, Ghana, Africa
³University of Ghana, Ghana, Africa
alexasmah@gmail.com
jkwaku97@gmail.com
klgyapong@gmail.com

Abstract: The widespread use of bank cheques in daily life makes the development of cheque processing systems of fundamental relevance to banks and other financial institutions. Few studies on nature of Electronic Cheque Clearing System (ECCS) have also shown jurisdictional differences in the application of the technology. Despite its increasing adoption in Africa, no attempt has been made to model the process and highlight the challenges to drive policy changes. This study addresses this research gap by studying the nature of ECCS in Ghana to identify the inherent challenges. To achieve the objective, data was collected through interviews, observations and direct participation. Findings suggest that cheques go through five set of processes before they are cleared electronically; different from the four processes indicated in existing literature. These processes are Pre-Conversion, Conversion, Transaction, Security and Storage. The pre-conversion process depends on the banks objective, whilst some banks centralise the process to reduce cost, other banks decentralise the process to enhance service delivery to customers. The remaining processes are the same across all banks in Ghana. The study also found that security breaches at cheque printing houses, poor bank collaboration and manual cheque reviewing process are the main challenges facing ECCS.

Keywords: ECCS, cheques, payment systems

1. Introduction

Traditional payment systems used in many countries were mainly cash payments prior to the emergence of Information Technology (IT), until cheques surfaced and became the major payment method used by individuals and corporations (Asmah, Ofoeda, and Gyapong, 2016). The increasing usage of cheques in everyday lives is due to its ability to allow users to pay bills without visiting physical location designated by service providers and at the same time reducing the risk of theft and loss associated with cash payment (Pasupathinathan, Pieprzyk, and Wang, 2005). In developing countries cheque continues to be the major payment model although the case may be different for some developed countries with several payments options. In Ghana, cheques are the most patronised non-cash forms of payments with about 96.8 billion cedis worth of it presented in 2014 (GhIPSS, 2015).

Clearing cheques drawn on different banks, until recently was tedious and time consuming as clearing houses required physical cheques from all banks to be sorted manually, perused and accepted by the various banks before values are transferred. This required that the cheques be physically moved from the collecting bank to the paying bank as part of the clearing process. With this practice, cheques were cleared using several days (Norman, Shaw, and Speight, 2011).

In the late 1990s, the Bank of Ghana (BoG) (which is the central bank charged to ensure efficiency, reliability and timeliness in clearing cheques), introduced the Magnetic Ink Character Recognition (MICR) technology and the standardization of paper payment instruments to enable the semi-automation of cheque clearing in the Accra Clearing zone in 1997. The problems associated with the manual clearing systems in Ghana and the determination of the BoG to improve cheques clearing led to the decision to migrate to Cheque Codeline Clearing with Cheque Truncation (CCC) under new rules published by BoG (Asmah, et al., 2016). Ghana moved away from the traditional paper based clearing into the full electronic clearing in 2010. Although the system has attracted lots of attention since its implementation, just like any other system, some inherent challenges exist which limits its continuous acceptance and usage. In addition, there are clear evidences of the introduction of e-banking systems which have failed to achieve the intended benefits especially in Ghana. For instance, E-Zwich (a highly secured payment platform) was introduced prior to ECCS, but statistical evidence (Bank of Ghana, 2015) and literature suggest that the patronage has waned drastically since its introduction in
Alexander Ekow Asmah, Joshua Ofoeda and Ken Gyapong

2008 (Agyeiwaah, Anane, Appiah, and Opoku-Ware, 2014; Antwi, Hamza, and Bavoh, 2015). Both Agyeiwaah, et al. (2014, pp. 2) and Antwi, et al. (2015, pp 168-169) identified some inherent challenges that hindered the continuous acceptance and usage of the technology in the country. These challenges if identified earlier could have driven policy changes and saved the system from it collapse.

Efforts have been made by researchers in recent years to model the ECCS in various countries (Khiaonarong, 2000; Jresat, 2007; Al Shibly, 2011; Sreedevi, 2013) which have indicated that the model applied in countries vary considerably. For example, Sreedevi (2013, pp. 185) modelled the ECCS in India which is different from the model adopted by banks in Thailand as studied by Khiaonarong (2000). With these different ECCS models, solutions to their inherent challenges must be tailored specifically to the implemented model. In Africa, specifically in Ghana, arguably no attempt has been made in the literature to model the ECCS process making this study necessary. It will therefore be difficult to implement solutions in other jurisdictions and expect them to work in a country with different cultural background and different level of IT adoption and usage rate. The need to tailor solutions to specific models of the system necessitate the need to investigate the nature and model of cheque truncation in Ghana in order to assess the challenges and propose solutions tailored to the model.

2. Literature Review and Theoretical Framework

2.1 Cheque Truncation System / Electronic Cheque Clearing System

Sreedevi (2013, pp. 184) defined CTS as an online image based cheque clearing system where cheque images and Magnetic Ink Recognition (MICR) data are captured at the collecting bank branch and transmitted electronically without the actual cheque movement of physical cheques. Al Shibly (2011, pp. 463) also defined the automatic clearing of a bank cheque as the extraction and recognition of handwritten or user entered information from different data fields on the cheque such as courtesy amount, legal amount, and date. Given the definitions cited above, it can be gathered that ECCS involves the process of capturing bank cheques electronically and transmitting them to other banks without physical movement of the cheques.

Electronic Cheque Clearing System (ECCS) also known as the Cheque Truncation System (CTS) involves the process of inter-bank cheque settlement by using both cheque electronic records and scanned copy of the cheque (AL-Refai and Nawafleh, 2014). Once the teller in the bank of first deposit (BFD) receives the cheque item, the scanned copy is sent to the paying bank through central bank to be technically and financially cleared through high speed secure connection lines, the reply for that action to pay or reject the cheque is generated from the paying bank to the central bank and then sent back to BFD (Jresat, 2007).

Generally, Cheque truncation is the process in which the physical movement of cheque within a bank, or between banks and clearing house is replaced by electronic records. Implementation of CTS usually brings all the participating banks to a common platform in the cheque processing operations (See Figure 1). Cheque truncation is one of the ways to compress the clearing cycle to provide faster clearance of local and intercity cheques (Sreedevi, 2013). The system enables banks to enjoy greater efficiency and provide better service to their customers.

Cheques are written orders from account holders instructing their banks to pay specified sums of money to named beneficiaries (Hancock and Humphrey, 1998). When customers deposit their cheques to the collecting banks, the scanned copy is sent to the paying bank through the central bank to be technically and financially cleared through high speed secure connection lines. The digital image can also be transferred through a data link, CD-ROM or cartridge (Qatawneh, Aldhmour and Aldhmour, 2016). The collecting banks or the clearing house will capture the transaction electronically and transmit the transaction as part of the transmission of the digital images. The centre of the cheque clearing process is the clearing house, central bank, monetary agency. The role of these institutions is to verify the cheque clearing process and enforce financial procedures, regulations and laws, as well as to monitor and follow up their implementation (Alsoof, et al., 2011).

Truncated cheques will then be presented to the drawee’s bank electronically for verification. The reply for that action to pay or reject the cheque is generated from the paying bank to the central bank and then sent to collecting bank for final payment to the customer (Jresat, 2007). The physical cheques are kept at the collecting bank or the clearing house although the drawee bank may still be able to examine it to make payment decisions.
There is no change to the traditional practice pertaining to the writing of cheques by payers, the deposit of cheques by payees, the schedule of making funds made available by banks and returning of unpaid cheques to payees.

![Figure 1: ECCs Process (Source: Authors' Construct)](image)

### 2.2 Nature of ECCS Models

Literature addressing the nature and benefits has discussed the process of the cheque truncation process in the various jurisdictions. Sreedevi (2013) studied the cheque truncation processes in India (Figure 2), a country which is far advanced in the process, and modelled the process which appears different from what is discussed by Khiaonarong (2000) as the process in Thailand (Figure 3). In Thailand, the process begins with a cheque encoder reader capturing information written on cheques. Second, the information is sent and received through telecommunications links between front-end processor machines located at both commercial banks and the Bank of Thailand. Lastly, cheque information in original physical form is delivered and matched with their electronic versions for verification and settlement in the evening. Sreedevi (2013) and Akshatha (2013) explained that unlike in Thailand, all the cheques are archived in a common warehouse of the presenting bank in India. This is to say that the physical cheques are kept by the receiving bank in India instead of presenting to the central bank for verification as is the case in Thailand. Due to this, the receiving bank in India is responsible for verification of the physical cheque to ensure that it has not been altered in any way.

![Figure 2: Cheque Truncation Model in India](image)
2.3 Automatic Processing of Handwritten Bank Cheque Images

In many countries, the present cheque processing procedure requires a bank employee to read and manually enter the information on a cheque (or its image) and verify the entries such as signature and date (Jayadevan, Kolhe, Patil, and Pal, 2012). Relying on the technology of Pattern recognition, document analysis and biometrics, recent literature (Talele, Nalbalwar, and Rane, 2011; Feng, Ren, Zhang, and Suen, 2014; Mehta, 2010) makes attempt to study the possibility of reviewing bank cheque automatically without manual intervention to streamline the process flow, save cost and time and prevent errors. As many cheques, must be processed every day in a bank, an automatic reading system can save much of the work. Even with the success achieved in character recognition over the last few decades, the recognition of handwritten information and the verification of signatures present on bank cheques remain a challenging problem in document image analysis. Mehta (2010, pp. 761) explained that automatic bank cheque processing systems are also needed to counter the growing cheque fraud menace.

The automatic processing of a bank cheque involves extraction and recognition of handwritten or user entered information from different data fields on the cheque such as courtesy amount, legal amount, date, payee and signature. This is a formidable task and requires efficient image processing and pattern recognition techniques. The only two fields on a cheque that can be processed automatically with near perfect accuracy by character recognition systems are the account number and the bank code as they are printed in magnetic ink. The other fields may be handwritten, typed, or printed; they contain the name of the recipient, the date, the amount to be paid (textual format), the courtesy amount (numerical format) and the signature of the person who wrote the cheque. The multiplicity of handwriting styles although easily recognized by the human brain, is too difficult for electronic systems (Coelho, Batista, Teixeira, and Cardoso, 2008).

2.4 Electronic Interbank Payments Models

According to Chiu and Lai, (2007, pp. 16), there are three main types of interbank payments systems: net settlement systems, real time gross settlement systems, and correspondent banking.

Net settlement is a payment settlement system between banks, in which a vast number of transactions are collated and offset against each other, with only the net difference being transferred and paid by banks. In other words, the participating banks exchange huge sums during the business day and make settlement of net balances at the end of day (Angelini, Maresca, and Russo, 1996).

A clearinghouse acts as an intermediary and collects good funds from due-to banks and releases good funds to due-from banks. Final settlement occurs when the clearinghouse has successfully completed this process. The primary reason that net settlement systems exist is to reduce the cost to settle a given value of payments. If banks had to settle payments individually, they would on average need to hold more reserves (Chakravorti, 2000).
The clearing institution normally completes its daily summarization process and transmits net transfer information to the settlement institution after the cut-off time of the settlement institution. This means that the transfer of funds to the account of the beneficiary bank will be delayed by one business day.

On the economic aspect, the accumulation of huge number of unsettled payments can generate considerable credit exposures among members of the payment system. Moreover, the largest risk in a netting settlement system is the risk that the failure by one participant to fulfil its obligations will lead to a system crash, which is known as the systemic risk (Angelini, et al., 1996; Chakravorti, 2000). The increase of systemic risk in Daily Net Settlement (DNS) systems due to the increasing value of interbank transfers has been a constant concern for monetary authorities. The Bank for International Settlements (BIS) has therefore recommended the adoption of real-time gross settlement (RTGS) systems for large-value transfers (Penaloza, 2009).

**Real Time Gross Settlement (RTGS)** payment systems have replaced the netting systems around the world in the recent decades. A real-time gross settlement system is a payment system in which all payments take the form of transfers of central bank funds from the account of the paying bank to the account of the receiving bank. In contrast, under net settlement system, payment messages are exchanged continuously, and participants' net positions vis-a-vis all other participants are settled on a periodic basis, usually at the close of business. RTGS uses very advanced hardware, software and communications technology and is based on the processing and settlement of a payment transaction on a real time continuous basis (Khiaonarong, 2000). As banks could make payment orders at any time during a business day, comparing with the net settlement payments system, the RTGS payment system takes the advantage, for which transfers are settled individually, and the system effects final settlement continuously but not periodically. Hence, it prevents the sizeable credit exposures between banks, and the credit risk to receiving banks is at least reduced or even eliminated (Chakravorti, 2000). This, however, comes at a higher demand for liquidity. To prevent the credit and liquidity risk, in almost all RTGS systems, central banks provide intraday credit to participating banks. The terms for such credit vary from system to system, though in most cases, credit is only available in limited amounts or at some cost. In some systems, interest is charged for intraday credit, usually at an administered rate rather than at a market rate. Collateral of various types is often required before credit can be granted.

A correspondent bank is a bank that regularly performs services for another financial institution which is usually located in another country. Typical services include handling out of area cheques, trusts and technical services. Overall, a correspondent bank is one that backs up the limitations of a smaller bank, a foreign bank, a merchant bank, or any other financial institutions that would need to “farm out” certain procedures, or services not available at the respondent bank. Many Community banks clear out-of-town cheques through reserve accounts at larger banks. Correspondent banking allows foreign banks to conduct business in the home country and provide services for their customers in areas where the bank does not maintain a physical presence. In a nutshell, foreign banks open correspondent accounts with local banks to avoid the expenses of operating a local bank.

### 3. Research Methodology

The research objective can better be achieved using a qualitative approach because of the provision of in-depth understanding of this methodology. Following this approach, the case study was deemed appropriate. According to Yin (1994, p.13) the case study method is “an empirical enquiry that investigates a contemporary phenomenon within its real-life context especially when the boundaries between phenomenon and context are not clearly evident”.

#### 3.1 Selecting the case firms

The research population comprises Banks, Savings and Loans and other Financial Service providers operating in Ghana. Within the selected institution, clearing officers and IT officers were used as respondents for the study. For this study, only three Banks and one Savings and Loans Company in Ghana were contacted. United Bank for Africa, Guaranty trust Bank and Standard Chartered bank were the banks used for the case study. In Ghana, savings and loans are not given the license to participate directly at the clearing house. As such they clear their cheques through other banks with the full license. Opportunity International Savings and Loan was selected to study how they clear their cheques through the licensed banks.
3.2 Development of Interview Questions

Interviews were used as the data collection method. Both open-ended and close-ended questions were written down as a guide prior to the interview. This was done to avoid deviating from the subject matter during the interview. In developing the interview guide the following issues were considered:

**Time** - 30 minutes of conversation is a limit for bankers due to their busy schedules.

**Types of questions** - the questions were formulated to satisfy the objective of this study. Clarity of the questions was ensured so that they could easily be understood.

3.3 Data Collection Procedure

Data was collected using interviews. The interviews took place in the convenience of the interviewees’ offices. The authors conducted the various interviews with an interview guide prepared on the subject matter. There was however some fluidity in the questioning to allow more insight to be gained on the subject matter and to allow follow up questions. Permission was sought from interview respondents so that a voice recording device could be used to capture all responses whilst putting down notes.

Secondary materials were reviewed, this included the Codeline Clearing rules by Ghana Interbank Payment and Settlement Systems (GhIPSS) and other internal documents from the case Banks that were made available to the authors.

To get first-hand knowledge of the clearing process, the corresponding author used his personal cheque through the clearing process and observed the various activities that transpired to clear. Being an internal audit staff of Private Bank A, the author had full access to all documents, and the right to ask officers any question. The author used the privilege position to conduct an in-depth study on the nature of ECCS in Ghana. Participant observation enabled the authors to learn about the activities of the people under study in the natural setting through observing and participating in those activities (Kawulich, 2005).

3.4 Analysis Techniques

To categorize the qualitative data, the authors used thematic analysis. Thematic analysis is a method for identifying, analysing, and reporting patterns (themes) within data. It minimally organises and describes the data set in (rich) detail. However, it also often goes further, and interprets various aspects of the research topic (Braun and Clarke, 2006). It is a qualitative research technique where the researcher makes notes and sort the data into various categories per identified themes (Hinson, et al., 2009). Qualitative approaches are incredibly diverse, complex and nuanced and thematic analysis should be a foundational method for qualitative analysis (Braun and Clarke, 2006). According to Braun and Clarke (2006), “Thematic analysis can be an essentialist or realist method, which reports experiences, meanings and the reality of participants, or it can be a constructionist method, which examines the ways in which events, realities, meanings, experiences and so on are the effects of a range of discourses operating within society. It can also be a “contextualist” method, sitting between the two poles of essentialism and constructionism, and characterised by theories such as critical realism.”

In the conduct of this study, the recorded interviews were transcribed, sorted, and classified per the major themes gathered through the literature review as the process of cheque truncation in a systematic and interactive manner. Clarifications were sought on nagging issues after the transcription. The data was further categorized per major themes that answer the research question.

4. Case Findings

The main objectives of this study were to explain how cheques are cleared in Ghana and assess the challenges in order to offer solutions tailored to the ECCS model in use. The study used thematic analysis (Braun and Clarke, 2006) to understand how cheques are cleared in Ghana. An iterative review process of the coding and themes was then undertaken to ensure accuracy and consistency of the analysis. Illustrative quotations as well as system images were gathered to support the analysis and results were also identified during this process.
Finally, the findings of the case study were linked to existing models of cheque truncation systems.

4.1 Pre-Conversion

The pre-conversion process is the first process in ECCS. The process begins after a customer has presented a cheque drawn on another bank for deposit into his or her account. The conversion process differs from Bank and other financial institution. Within Banks individual processes differ. To capture the entire process, the three dominant conversion processes are discussed under the cases below:

**Case of Private Bank A**

Private Bank A is a commercial bank with a license to operate at the clearing house. The Bank has 25 branches across four different regions in Ghana, namely Greater Accra, Western, Ashanti and Volta Regions.

The Bank runs a cluster cheque data conversion system. Under this system, cheques are converted to images at a central location but segmented based on the geographical location. Cheques presented within the branches in Greater Accra are dispatched to the Head Office Clearing Units who are tasked to do all the conversion. This is the same for the other regions. One branch is designated the head branch within the region and is used as the clearing unit. All images and captured data from the various clusters are transmitted to the Accra Head Office for onward submission to the clearing house.

When asked why the bank adopts the cluster system the Head of Clearing, explained;

“The system helps the bank to achieve the objective to be a lean bank. With this system, the bank employs as few people as possible for clearing. There is no need to employ clearing officers for each branch and there is also no need to procure hardware and software requirement for each branch.”

She however lamented about the inherent risk with the system explaining that;

“The process of dispatching cheques using motor bikes poses some challenges, for instance on one occasion a dispatch rider was involved in an accident and in the process lost some of the cheques. It also causes delay, as the clearing unit must wait for all the branches to submit their cheques before the scanning process can begin. All cheques must be scanned in a batch before transmission to the GhIPSS. The bank has however put in adequate measures to prevent the reoccurrence of such dispatching issues.”

**Case of Public Bank B**

Bank B is a licensed commercial bank with 52 branches across 8 regions in Ghana which are Greater Accra, Ashanti, Brong Ahafo, Northern, Western, Eastern, Volta and Central Regions.

In clearing, the bank runs a decentralized system where the various branches have been provided with the necessary hardware, software and staff requirement for the clearing process. When a cheque is submitted by a customer, the clearing officer at the branch does the scanning and onward submission to the clearing house.

**Case of Financial Services A**

Financial Services A is a private microfinance company based mainly in Accra. The company is not licensed to operate at the clearing house, as such participate in the clearing process through Private Bank A. Private Bank A deals with the Financial Services A as one of its branches with one sort code and present all its instruments to the central clearing unit of the Bank for clearing.

4.2 Conversion

The actual conversion begins with scanning the image through the scanner and the capture of data associated with the images such as date, amount, cheque number, sort codes, drawer and payee. Before scanning, the clearing officer is required to ensure that the cheque meets basic banking rules and is not a forged or cloned cheque. Clearing Officer for Public Bank B explained

“It is against the clearing rules to present a defective cheque for clearing. The onus lies on the presenting bank to peruse the cheque properly before scanning and presentment. It is also important that the right amount on the cheque is captured else the wrong amount will be paid.”
All banks and their branches have sort codes. These codes have been published by the clearing house and have also been printed on the cheques. The scanner automatically picks the account number, sort code, cheque number from the scanned cheque. The clearing officer is responsible for keying the amount on the cheque which cannot be picked by the scanner. However, in some occasions due to wrong scanning the scanner is unable to pick the sort code and other cheque details. In that instance, the clearing officer is responsible for keying the cheque details manually. It is important that the clearing officer keys in the right sort code.

The Head of Clearing for Private Bank A explained;

“Keying the wrong sort code will result in cheques drawn on a particular bank being sent to another bank. For instance, on an occasion, an error by one of our clearing officers resulted in a GT Bank cheque being sent to Ecobank. Ecobank returned the cheque and the customer threatened legal action against the bank.”

An IT officer at Public Bank B explained that;

“Scanned images must conform to certain laid down procedure enshrined in the Clearing Rule and banks are required to employ vendors who have the requisite technology to conform.”

As mentioned in section 2.6 of the Cheque truncation guidelines and procedures published by GhIPSS, Banks shall ensure that the scanning of physical instruments conforms to the prescribed standards as indicated in Table 1 below. Image quality assurance is required at the scanning stage so that the images meet the processing quality standards.

**Table 1: Image Standards**

<table>
<thead>
<tr>
<th>SI</th>
<th>Image Type</th>
<th>Minimum DPI</th>
<th>Format</th>
<th>Compression</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Front Grey Scale</td>
<td>200 DPI</td>
<td>JFIF</td>
<td>JPEG</td>
</tr>
<tr>
<td>2</td>
<td>Reverse Grey Scale</td>
<td>200 DPI</td>
<td>TIFF</td>
<td>CCITT G4</td>
</tr>
</tbody>
</table>

Figure 4 is an image of a scanner used in the clearing process and Figure 5 shows the scanned image of the personal cheque of the corresponding author which was sent through the clearing process.

**Figure 4: Scanner used in the Conversion process**
Figure 5: Electronic information and image presented through clearing

All scanned images need to be presented for clearing at a time, known as the clearing session. Section 1.4 of the Cheque truncation guidelines and procedures indicates the sessions as below:

Table 2: Session Timings

<table>
<thead>
<tr>
<th>Clearing Session</th>
<th>Weekday Timings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Opening</td>
</tr>
<tr>
<td>Presentment Clearing Session – I (Cheques) (Normal Clearing Session)</td>
<td>6.00pm</td>
</tr>
<tr>
<td>(Previous day)</td>
<td></td>
</tr>
<tr>
<td>Return Clearing Session – III (Cheques) (Normal Return Clearing Session)</td>
<td>2.00pm</td>
</tr>
<tr>
<td>Presentment Express Clearing Session – IX (Cheques)</td>
<td>11.00am</td>
</tr>
<tr>
<td>Return Express Clearing Session – XI (Cheques)</td>
<td>1.00pm</td>
</tr>
</tbody>
</table>

Cheque No: [Image of a cheque]
Bank Sort Code: [Image of a cheque]
Customer Account Number: [Image of a cheque]
Clearing officer for Public Bank B emphasised that;

“The presentment session is the time which the presenting banks can submit their cheques for clearing. The Return session is the time which the paying banks can return any of the cheque presented during the presentment session.” These timelines must be followed as nothing can be done outside the session unless informal among the banks.”

A platform has been created different from the main clearing application which shows whether a session has been closed. In some cases, GhIPSS can extend the timeline depending on some circumstances. The two main sessions are the Normal Clearing Session and the Express clearing session.

The capture system transmits the MICR codeline data and images of the cheques to its Clearing House Gateway (CHG) electronically.

The corresponding author presented his cheque at Public Bank B for deposit into another account drawn on Private Bank A. The image was scanned and sent to the clearing house. Nine (9am) the following morning an image as well as the cheque information as shown in Figure 5 was sent to Private Bank A for payment. After due diligence was conducted on the image the author’s account was debited and kept in a designated office account pending settlement.

4.3 Security

The images along with the cash data are then sent to the clearing house in a secured manner. The clearing house rules require that systems shall be configured to apply digital signatures to individual images and MICR codeline data in the Clearing House Gateway (CHG) using Public Key Infrastructure (PKI). In addition, files shall be encrypted for transmission to the Clearing House (CH). All images and data files shall be transmitted over dedicated networks connecting all the CHGs with the CH.

It is the responsibility of the collecting banks to affix digital signatures on the cheque images and the MICR Codeline data in the CHG before transmission to the CH. Banks shall use Public Key Infrastructure (PKI) for this purpose to ensure data authenticity, integrity and non-repudiation. Banks and GhIPSS shall ensure that images and the MICR codeline data are duly digitally signed and encrypted.

Per Section 4.9 of the clearing rules;

Files and data digitally signed shall conform to the following:

1. Hash/digest algorithm Secure Hash Algorithm (SHA-1)
2. Padding algorithm Public Key Cryptology Standard (PKCS)#1
3. RSA asymmetric encryption with 1024-bit key length.

File encryption shall also conform to Triple Data and Encryption Standard (Triple DES) (3DES, TDES) symmetric encryption with 168-bit key length. The cryptographic keys shall be generated and stored in Hardware Security Modules (HSM).

When asked, the IT officer in charge of the clearing application in Private Bank A explained “Currently images and data are not sent over a dedicated network as recommended by the rules, but with the digital signatures and the PKI system being implemented the system is secured enough. Cost of setting up a dedicated network is huge and would require large investment.”

4.4 Transaction

Images and Codeline data transmitted to the CH are immediately sorted using the sort codes keyed by the collecting banks. These sorted data are made available to the paying banks by CH to download. After downloading the paying bank verifies the cheque data and image to confirm the validity. The signature, amount, cheque number and payee are confirmed before payment. The transaction is confirmed if the paying bank does return the cheque through the issuance of a debit note during the return session as stated above.
The head of Clearing for Private Bank A lamented that “The default principle where the paying bank pays if no debit ticket is sent in some occasion cost the banks. For instance, recently the bank could not send the debit ticket within the stipulated return session because the internet system for our head office was down. However, the debit ticket was sent during the regular presentment session the next day. The presenting bank did not adhere to the debit ticket which was sent on the next day and credited the customer’s account with the full amount of the cheque which was GHS121,250.00. This customer had only GHS4.00 in the account on which the cheque was drawn on. By the next day the customer withdrawn the money from the account making it difficult to retrieve. I recommend that a platform preferably using social media be set-up to aid communication on such occasions.”

The settlement is done on Net basis. The Bank of Ghana account of each bank is Debited and Credited with the net amount arising out of the clearing sessions.

4.5 Storage

Storage of files and documents in the clearing process occurs in two-fold, i.e. storage of physical cheques and storage of electronic document. The practice is for the presenting bank to store the physical instruments. The paying bank can only request for the physical instrument when there is an issue that needs to be resolved with the physical instrument. Mostly all cheques are kept with the presenting banks and not moved along with payment. Electronically, the presenting bank, CH, and the paying bank all store the images and the cash data associated with the clearing transactions. The minimum statutory period for the storage of the file is Six (6) years.

5. Discussion Of Findings

Figure 6 above depict the ECCS process in Ghana. Studies discussing the pre-conversion process among banks in the Cheque truncation process were non-existent. To this end, this study expands current knowledge of ECCS to some extent.

The conversion process is consistent with the process depicted by both Khiaonarong (2000) and Sreedevi (2013) as the processes in Thailand and India respectively. The quality of the images in the clearing process presented is consistent with the quality indicated by Balakrishnan (2010) as the required quality in India. However, Balakrishnan (2010) stated that in India, although the standards required can be Black and White, greyscale or coloured it was decided that the image quality to be the greyscale technology. This is because the Black and white images do not reveal all the subtle features of cheques and coloured images increase storage and network bandwidth requirements.
Table 1: Image Quality Standards

<table>
<thead>
<tr>
<th>Image</th>
<th>Type</th>
<th>Minimum DPI</th>
<th>Format</th>
<th>Compression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front</td>
<td>Greyscale</td>
<td>100DPI</td>
<td>JFIF</td>
<td>JPEG</td>
</tr>
<tr>
<td>Front</td>
<td>Black and White</td>
<td>200DPI</td>
<td>TFIF</td>
<td>CCGITT-G4</td>
</tr>
<tr>
<td>Reverse</td>
<td>Black and White</td>
<td>200DPI</td>
<td>TFIF</td>
<td>CCGITT-G4</td>
</tr>
</tbody>
</table>

Source: (Balakrishnan, 2010)

5.1 Security

The security system in the cheque truncation process is consistent with the systems described by Balakrishnan (2010) and Sreela, et al. (2014). The use of Public Key infrastructure such as digital signature and encryption for protecting cheque images and data need a lot of computation and usage of keys and thus, to reduce the computation and usage of keys, cheque image can be protected using secret image sharing (Sreela, et al., 2014). With secret image sharing technique, a secret image is distributed to some of the participants through splitting the image into different pieces called shares and recover the secret image by collecting the sufficient number of shares from authorized participants.

Kota and Pal (2014) explained that although the transfer of cheques images from the presenting bank to the clearing house and from the clearing house to the paying bank is secured using asymmetric key encryption, the end to end (from the point of scanning the cheque at the presenting bank to the point where decision about payment is made at the payee bank) encryption cannot be adopted because the content of the image has to be accessed at the presenting bank, at the clearing house and at the paying bank for various purposes. Therefore, an unencrypted image of the cheque is available at these processing nodes, leaving the images vulnerable to malicious tampering. They therefore recommended the use of watermarking which will help detect tampering the images.

5.2 Transaction

The net settlement system practice in the cheque truncation process is in line with the system indicated by literature (Angelini, Maresca, and Russo, 1996; Chakravorti, 2000). Clearinghouse acts as an intermediary and collects funds from due-to banks and releases funds to due-from banks. Final settlement occurs when the clearinghouse has successfully completed the clearing session. The primary reason that net settlement systems exist is to reduce the cost to settle a given value of payments. If banks had to settle payments individually, they would on average need to hold more reserves (Chakravorti, 2000).

5.3 Storage

Existing literature has conflicting views on the storage of the physical cheques. Khiaonarong (2000) highlighted that the physical cheques are delivered to the clearing house and matched with their electronic versions for verification and settlement in the evening. However, the process is consistent with the process depicted by Sreedevi (2013) and Akshatha (2013) which places the verification on the presenting bank, thus there is no need for physical movement of the cheques to the clearing house for verifications.

The storage of the image and other electronic information was however consistent in both jurisdictions.

5.4 Nature of Electronic Cheque Clearing in Ghana (Cross Case Analysis)

From the findings and the discussions presented in the earlier sections, it can be noted that in Ghana, cheques undergo five different set of processes before they are finally cleared for customers to have their needed funds. The first stage being the Pre-conversion stage is the process which involves the activities directed at collating all the physical cheques to be scanned. Private Bank A uses the centralised method where all physical instruments are dispatched to the clearing department for scanning. The bank explained that the approach was to reduce cost of hiring clearing officers at the various branches. Private Bank B however recognises the need to employ clearing officers at the various branches to decentralise the process. The Bank explained that the focus is rather on effective service delivery and turnaround time rather than the cost of operations. Financial institutions which do not have license to operate in the clearing house have to adopt the system implemented by the bank clearing their cheques. In effect the differences between the cases are the need to reduce cost (as is the case of Bank A) and the need to enhance service delivery (as is the case of Bank B). Both
cases arrive at the same end were all cheques received from customers are scanned into an electronic format and transmitted to the CH.

The remaining processes (i.e. Conversion, Transaction, Security and Storage) have similar activities across the various banks. With the Conversion, images are scanned using the specially developed scanning instrument. The scanner automatically captures the details such as MICR code, cheque number and sort codes. The amount stated on the cheque requires manual entry as the scanner is not configured to capture handwritten information on the instrument.

The images along with the cash data are then sent to the clearing house in a secured manner applying digital signatures to individual images and MICR codeline data and using PKI.

The paying bank, upon download the image along with the codeline data, peruse the drawers account to verify the signature and the adequacy of funds in the account. A debit note is sent in the return session if the verification identifies any inconsistencies or inadequate funds.

Physical image is stored by the depository bank, whiles the CH, depository and paying banks all store the digital images and the cash data.

5.5 Challenges of ECCS in GHANA

Quality of Scanner: From the interview, respondents lamented about the continuous sophistication of fraudsters who can clone cheques to perfection, to the extents that the scanners are unable to detect some of the forged instruments. This they highlighted lead to huge losses to the banks and the officers involved in the clearing process.

Poor Collaboration Among Banks: In case of fraudulent transactions, the presenting banks usually do not fully co-operate with the paying bank in tracing and retrieving the stolen funds. There is no legislation compelling the banks to co-operate. This practices per the respondents is a huge challenge in fraud recovery.

Security Breach at Cheque Printing Houses: One assurance for the clearing system is the distinctive features of the cheques used in the process. The expectation is that cheques are printed under secure conditions, however in recent times security breaches at the cheque printing companies means that some of the cheques presented through the system, although cloned match all the security features as such go through the process.

Automatic Processing of Hand-Written Cheque instrument: The existing process of manually perusing cheques by the paying banks is a huge task that need automation. Respondents indicated that thousands of cheques pass through the system on daily basis, and manual review of these instruments presents an enormous task to be completed within the session timelines.

6. Conclusion

Clearing cheques in Ghana follows five sets of processes captured as the Pre-Conversion, Conversion, Security, Transaction and Storage. The pre-conversion process differs from bank to bank. Some banks prefer to centralise the conversion process, as such all cheques received from the various branches are dispatched to a centralised location (usually the Clearing Department). Some other banks prefer to decentralise the conversion process, so each branch is responsible for the conversion of the physical cheques into images. The choice of a pre-conversion process depends on the bank’s focus and objective. The pre-conversion process is followed by the conversions process, where the cheque is passed through a scanner to capture the cheque information and generate an image. The cheque information along with the image is transmitted to the CH for onward transmission to the paying bank. The paying bank, on receiving the image, peruse the customer’s account to ensure sufficiency of funds. The transmission of the images is done applying digital signatures to the images and MICR codeline data using PKI. The depository bank keeps the physical cheque, however the digital image is kept by all parties (CH, paying and depository bank).

The cheque truncation process in Ghana, is not without problems. With an increasing interest in the usage of cheques, the manual process of reviewing the hand-written instruments makes the process tedious to manage and require automation based on the pattern recognition approach recommended by Talele, Nalbalwar, and Rane (2011). Again, poor security at the cheque printing house is increasing the levels of cloned cheques. The
central bank should liaise with the relevant law enforcement agencies to enforce adequate security in the printing houses to reduce this menace.

References


Empirical Examination of e-Government in Developing Countries and its Value in Kenya’s Public Service

Kennedy Okong’o and Michael Kyobe
University of Cape Town, South Africa
oknken001@myuct.ac.za
Michael.Kyobe@uct.ac.za

Abstract: In the last two decades, Information Communication Technologies (ICTs) have become a strategic tool of management in developing countries. In specific, Electronic Government enhances governance in the public sector; e-Government being the use of ICTs in public service. Though information systems as a discipline presents some research on the value of ICTs in the private sector, the focus on the public sector is comparatively thin. Informed by the model of public value management, the paper sought to identify the dimensions of the public value of e-Government. Thus, a framework was adapted and tested on data collected in a survey of 340 public service officers in Kenya. Through structural equation modeling, an e-Government public value model was generated, and this formed the main contribution of the paper. At a theoretical level, the model demonstrated cognizance of e-governance multi-faceted nature, and as such may inform the development of full-bodied policies to drive efficiency in public service delivery. The model may aid in elucidation of the drivers which inform the use, or fear of use of e-government infrastructure. In addition, at a methodological level, the paper suggests the place of mixed methods in information systems research. This aids in understanding the unique qualitative and quantitative measures of perception of public value of e-Government. In this regard, the estimated model shows the magnitude of influence of e-Government on various dimensions of public values. In practice, these present a suitable reference to guide the formulation and restructuring of e-Governance policies and strategies in the developing countries. Though the paper presents a positivistic evidence, it is imprecise on whether the evident values enhance or deteriorate public service quality; thus, possible future research is suggested.

Keywords: Developing Countries, e-Government, Information System, Kenya, Public Value Management, Structural Equations Modeling

1. Introduction

In developing countries, a substantial growth in the deployment of ICTs is evident (Meyer et al., 2015). This is due to the realisation that ICT driven public sector reforms improve service delivery (Bwalya & Healy, 2010). Though e-Government has the capacity to re-invent the public sector (Wirtz & Nitzsche, 2013), there is a shortage of value research on e-Government from a developing country’s perspective (Karunasena & Deng, 2012). This is despite the fact that developing countries’ have inefficient administrative systems (Yeboah-Assiamah et al., 2016). Hence the need to match the investments in e-Government with certain facets of public values desired by citizens, for a simple reason that the public sector performance is evaluated in terms of resulting public value (Moullin, 2017). This has informed the African public sector reforms of the 1980s (Basu et al., 2012). Olum (2011) observes that most African countries such as Uganda and Zambia have since undertaken reforms seeking to make governments leaner and functionally decentralized (Mutahaba & Kiragu, 2002; Islam, 2015). For instance, in an attempt to improve the efficiency in Kenya’s public service, a raft of reforms have been undertaken (Kilelo et al., 2015). However, the sector has continued to experience increased corruption and red tape- bureaucracies (Kilelo et al., 2015). Cognizant of Moore (1995)’s argument that the nature of public value must match the citizens’ desires, Rose et al (2015) contend that research has been slow in exploring such values provisional upon e-Government. Thus the research focus was majorly aimed at identifying within the literature, the nature of public values, and then hypothesizing its dimensions in the light of e-government potential. In a confirmatory manner, this was tested using data collected in Kenya’s public service to obtain a validated e-Government public value model, which may guide policy in the application of public sector ICTs.

2. Literature Review and Theoretical Background

2.1 E-Government

First used in the United States (Heeks & Bailur, 2007), e-government entails the use of ICTs in the public service. Bashar et al (2011) argue that the traditional public sector is inefficient and bureaucratic. Figure 1 presents a diagrammatic model of an e-government, whose intention is to transform governance using ICTs:-
It is evident that e-Government conceptions have evolved from a technical to a social artifacts perspective (Uppström, 2017). In addition to delivering government information over the internet (Gudavalli et al., 2014), it does transform relations (Adejuwon, 2012). Decisions of government are taken and implemented over a digital platform (Misuraca et al., 2011), in a convenient, transparent and inexpensive manner (Sangita & Dash, 2005). Given Africa’s continued investment in e-government, e-governance has sprung up with varying conspicuousness (Amagoh, 2015). For example, informed by the need to improve efficiency and optimize informat (Nyanjom, 2011), Kenya introduced an order of devolved governance in 2010. This decentralized certain national functions to regional governments. However, in general, Africa’s public sector grapples with the inefficient and manual processes (Amagoh, 2015), despite the opportunities that e-Governance presents.

2.2 Public Sector

In this paper ‘public sector’ encompasses publicly funded entities (World Bank, 2012). European colonies that form the majority in Africa simply derived a ‘westminster-whitehall’ model of public governance for their own entities (Olum, 2011). The model was characterized by a strict hierarchical bureaucracy (Hughes, 1998), centralized powers with myriad dysfunctions (Guma, 2012). This has prompted the interest to modernize public sector (Olaiya, 2016). Hence, e-government has featured as a transformative enabler (Sundberg & Larsson, 2017). In Kenya, investments in e-governance have been informed by a need to re-engineer performance in the public sector (Ondego & Moturi, 2016).

2.3 E-Governance

Kenya has been used as an empirical setting to understand the theoretical view in this paper. It is a prime ICT hub in Africa (World Bank, 2015) and as such, has witnessed technology exuberance (Kizza, 2013). The country’s critical test now is to implement the devolved governance structure (World Bank, 2016), which Ondego & Moturi (2016) observe that, applied properly, e-governance can enhance its efficiency, offer faster information flow and increased transparency in Kenya’s public service. This can re-invigorate the current management models that have gained negative connotations as being rigid in practice (Guma, 2013). Hence, the search for a more efficient model (Kelly, 2014). Indeed, in Kenya, despite some reforms, efficiency is still a challenge. The inefficiencies in the public sector still sore (Kilelo et al., 2015). Still, the government grapples to modernize the sector (Bwire, 2015). In all these, e-government has featured as having some capacity to re-engineer Kenya’s public service (Ondego & Moturi, 2016).

2.3.1 Towards e-Governance

In 1920s, British colonies in East Africa became linked through a common core network. However, upon attaining independence, Kenya created its own network through Kenya Post and Telecommunications Corporation as a monopoly ICT provider. However, to keep pace with globalization, Bowman (2010) points out that the idea to write a formal ICT policy came to the fore in 1980s and 90s. In 2002, ICT was positioned as a crosscutting pillar of economic progress in Kenya. This occasioned a new order that challenged the then information hegemony (Sihanya, 2012) upon ratifying a new constitution in 2010. The political implication is to improve information flow and efficiency in public service. This has re-emphasized the need to explore e-governance (ibid).
2.3.2 Towards Public Sector Reforms

The immediate post-colonial public service in Kenya was inherited from the colonial masters, the British. The structure was fraught with mistrust (Cohen, 1980). Since it was also racially constituted, Kenyanisation as a strategy was adopted to address the anomaly (Odhiambo-Mbai, 2003). Aimed at replacing the colonial masters with the Kenyans, it led to an inefficient expansion of the public service (Omolo, 2010). Following these consequences, the government embarked on a series of reforms. However, the reforms have achieved minimal results (Achoch et al., 2014) as service quality has deteriorated; while inefficiency and corruption have increased (Buuri, 2013). In parallel, the government has been exploring efforts to integrate ICTs in the operations of the public sector. This is guided by the e-Government strategy paper of 2004, whose objective is to enhance service delivery (Njuru, 2011). Though the strategy paper has been in place for over a decade, there have been limited technical and institutional structures to support its implementation. This has impeded service delivery (Omariba & Okebiro, 2015). Related to the strategy is an ICT Master Plan 2013-2017. Though the mission is not clearly articulated, it appears to pursue an all-inclusive access to public services. It proposes a ‘citizen service portal’ to drive customer centricity in public service. In this front, positioning e-government as a critical enabler in public service.

2.3.3 Theoretical Framework

In his seminal work on public value management, Moore (1995) contends that the generation of public value is a core role of government. The public sector managers respond to the value preferences of the public (O’Flynn & Alford, 2012), through collaboration, instead of competition (Engida & Bardill, 2013). Therefore, in line with the new constitutional order in Kenya (CoK, 2010), the theoretical perspective informs the public value generation. In this regard, there is a need to create public value through decentralizing public apparatus to a more efficient and a more collaborative structure (Sow & Razafimahafa, 2015). In this, Moore (1995) defines ‘public value’ as an equivalent of private sector’ shareholder worth. Though Karunasena & Deng (2012) contend that such perspectives can be buttressed using e-government, research has had a skewed focus towards developed countries. Consequently, they propose a revised framework using Sri Lanka as an empirical setting. Due to the extant similarities between Sri-Lanka and Kenya in terms of context and the maturity of e-government (Biyagamage, 2014), the framework presented in Figure 2 and used in the case of Sri Lanka, was adapted as a starting point to inform this research:

![E-government conceptual framework](adapted from Karunasena (2012))

Indeed, Karunasena’s (2012) observes that Sri Lanka started its e-Government initiative in 2005 under the e-Sri Lanka national project. Kenya’s e-Government strategy was launched in 2004. Sri Lanka, just as Kenya, has experienced a number of challenges in this front. These include ignorance, shortage of ICT infrastructure, inadequate ICT skills and inability to access E-government services in local languages (Karunasena et al., 2011). Still, just as is the case of Kenya, ICT has been positioned as a strategic enabler of economic progress. In the conceptual framework as presented, openness is seen as transparency in public administration (Jørgensen & Bozeman, 2007). Though efficiency refers to productivity, user-orientation entails customer centricity in service provision (Jørgensen & Bozeman, 2007). The public sector online services should be user friendly, comprehensive and non-technology savvy (Walther et al., 2016). There is an expectation of credibility in government information (Kearns, 2004). While the participatory democracy indicates a willingness to listen to
the public opinion to guide policy formulation (Jørgensen & Bozeman, 2007), there is need for equity. This protects the marginalized (Khetarpal, 2014). Thus, service offerings on e-government need to comply with the required standards (ibid). For instance, in terms of environmental sustainability, there is a need to control the depletion of non-renewable resources. E-government has this potential (Masud & Malik, 2012). All in all, Jørgensen & Bozeman (2007) acknowledge that the meanings of the classes of public value differ from setting to setting. Thus, people can define preferences and governments can enhance capacities to deliver them (Zhao et al., 2012). All these aspects combined form the framework that informed the design of the questionnaires to understand the public value preferences in Kenya’s public sector and further facilitated the analyses in the research.

3. Research Framework and Methodology

There are certain philosophical leanings that guide a researcher’s view of the world (Wahyuni, 2012). In this paper, the research problem is informed by the Moore’s public value management as a theoretical perspective. This aided in the identification of the nature and dimensions of the public value that result from the use of e-Government. In this paper, a value framework was hypothesized. Subsequently, this was tested on data collected in Kenya and validated through a path model using structural equations. It is thus evident that public values are a consequence of e-Government, which is considered an independent phenomenon and separate from the researcher. Accordingly, the paper adopts objectivism as an ontology (McManus et al., 2017), positivism as an epistemology and mixed methods as a methodology (ibid). This is because of the existence of a set of well-defined conceptions (e-Government and public value), laws of interaction of the units of interest (signifying the direction of correlation) and a boundary within which the theoretical model holds (public sector) (Dubin, 1978). Further, since the research sought generalizations, the research method is largely quantitative. This includes the use of standardized tests and closed ended questionnaires as presented in Table 3.

Table 3: Perceptions of e-Government

<table>
<thead>
<tr>
<th>A. DEMOGRAPHICS</th>
<th>B. PUBLIC VALUES OF e-GOVERNMENT</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 ICTs in government enhance Quality of Public Information:</td>
<td>1a) Accurate information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2b) Up-to-date information</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 ICTs in government enhance Delivery of Public Services:</td>
<td>2a) Online communication</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2b) Online access to government documents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 ICTs in government enhance Citizen Focused Governance:</td>
<td>3a) User friendly web</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3b) None technology savvy web</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 ICTs in government improve Efficiency in Public Service:</td>
<td>4a) Data sharing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4b) Lean staffing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 ICTs in government enhance Openness in Public Sector:</td>
<td>5a) Online filing of complaints</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5b) Online display of government data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 ICTs in government improve Responsiveness in Public Service:</td>
<td>6a) Online enquiries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6b) Online case tracking or follow-up</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 ICTs in government promotes Equity in Public Service:</td>
<td>7a) Enables access by the marginalized</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
B. PUBLIC VALUES OF e-GOVERNMENT

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7b) Supports people with special needs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>ICTs in government promotes Citizen Trust in Public Sector:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8a) Security in government information</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8b) Credibility of information exchanged</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>ICTs in government enhances Democracy in Decision Making:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9a) Information on upcoming public policies</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9b) Online participation in policy making</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>ICTs in government promotes Environmental Sustainability:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10a) Limits duplication of resources e.g. papers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10b) Enables recycling of consumables e.g. cartridges</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

C. ICT POLICY, e-GOVERNMENT STRATEGIES and PROJECTS

1) You are aware of the existence of a national ICT Policy for Kenya
2) You are aware of the existence of an e-Government Strategy for Kenya
3) You have been involved in public sector ICT policy debates in Kenya

Drawing from Karunasena & Deng (2012), the existing e-Government value frameworks have skewed focus on developed countries with an inadequate consideration of the contexts and perspectives of developing countries. Thus, they propose a revised framework based on the latter’ context. Due to the extant similarities between Sri-Lanka and Kenya in terms of e-Government maturity and context (Biyagamage, 2014), the framework items in Karunasena & Deng (2012) are used in study. Considering that public officers are the major executors and evaluators of public policy (Pourkiani et al., 2014), they were chosen as respondents. Noteworthy is that the questionnaires adopted a Likert scale on an intensity scale for obtaining people’s perceptions (Likert, 1932). The sample size was chosen as informed by Yamane (1967):

**Equation 3:1: Sample Size**

\[
N = \frac{n}{1 + N(e^2)}
\]

where \( n \) is the size of the sample used, \( N \) is size of the population, and \( e \) is the precision level. Given the staff population in the public service (175,510) (GoK: PSC, 2014), the questionnaire targeted at least 333 respondents. The primary data was captured and analyzed using Predictive Analytics Software (PASW) version 20. PASW allows for methodical modeling. The survey responses were further subjected to advanced regression through Structural Equation Modeling (SEM). The Analysis of a Moment Structures (AMOS) as the analytical tool was selected to achieve this. SEM assumes a confirmatory approach (Byrne, 2010). Often, this is achieved through a path analysis (Kaplan, 2009). In Table 4 are model fit indices:

Table 4: Model Fit Indices

<table>
<thead>
<tr>
<th>Gof Index</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \chi^2 ) and, probability value (P-value)</td>
<td>Relatively minimal ( \chi^2 ), P-value &gt; 0.05 (Byrne, 2010).</td>
</tr>
<tr>
<td>Normed Chi Square ( \chi^2/df )</td>
<td>Less than 2.0 (Hair et al., 2010)</td>
</tr>
<tr>
<td>Tucker-Lewis Index</td>
<td>Close to 0.95 (Byrne, 2010)</td>
</tr>
<tr>
<td>RMSEA</td>
<td>Less than 0.05 (Schumacker &amp; Lomax, 2015)</td>
</tr>
</tbody>
</table>

4. Analysis

Firstly, a reliability test was conducted on the measured items. The overall score of Cronbach Alpha (\( \alpha = 0.865 \)) was found to be reliable. \( \alpha \geq 0.600 \) is normally considered as acceptable (Tseng et al., 2006). In total, 340 respondents were interviewed across the eight key government ministries. According to Baruch (1999), this is an acceptable response rate, achieved through ‘drop-&-pick’ tactic (Ibeh et al., 2004). Using PASW 20, demographics was analyzed along age, cadre, education level, income level and the gender. Of the 340 staff, 65 percent were non-manager officers while 35 percent comprised manager level officers. Approximately 28 percent of the officers earn (USD 200-300) per month. Officers earning above USD 300 were approximately 51 percent with only 4 percent earning a monthly income of USD 800 and above. Of the 340 officers in public
service, 51 percent were male while 49 percent were female. Though this is considered as almost balanced, women are still less. In the public service, 42 percent was aged between 31-40 years and 6 percent was under 20 years of age, majority of whom in the non-managerial roles. In terms of level of education, majority of the officers have secondary or primary level of education and as such are either clerical or support staff. Thus, the sample of respondents was considered representative of the population of interest.

4.1 Public Value Items of Measure

Following the descriptive analysis, inferential modeling was conducted. To note is that the research problem was of a confirmatory nature and therefore it was posited to confirm the hypothesized dimensions of public value that results following use of e-Government. The study adopted 20 indicator dimensions as appears in the adapted framework. These include: ‘accuracy and up-to-date information,’ ‘online communication and online access to government document,’ ‘user friendly web and none technology savvy web,’ ‘data sharing and lean staffing,’ ‘online filing of complaints and online display of government data,’ ‘online enquiries and online case tracking / follow up,’ ‘access by the marginalized,’ ‘security of government information and credibility of information exchanged,’ ‘providing information on upcoming public policies and online participation in policy making,’ and ‘limiting duplication of resources and enabling recycling of consumables.’ The ranking of the items of measure of public value are presented in Table 5:

Table 5: Public Value Ranking

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>online communication</td>
<td>3.72</td>
</tr>
<tr>
<td>accurate information</td>
<td>3.69</td>
</tr>
<tr>
<td>online enquiries</td>
<td>3.61</td>
</tr>
<tr>
<td>limits duplication of resources</td>
<td>3.58</td>
</tr>
<tr>
<td>enables recycling of consumables</td>
<td>3.51</td>
</tr>
<tr>
<td>lean staffing</td>
<td>3.50</td>
</tr>
<tr>
<td>data sharing</td>
<td>3.48</td>
</tr>
<tr>
<td>up-to-date information</td>
<td>3.47</td>
</tr>
<tr>
<td>user friendly web</td>
<td>3.39</td>
</tr>
<tr>
<td>online access to government documents</td>
<td>3.36</td>
</tr>
<tr>
<td>supports people with special needs</td>
<td>3.32</td>
</tr>
</tbody>
</table>

Further, the awareness of the respondents on ICT policy and e-Government strategy were tested. While 64 percent of the respondents are aware of the existence of the national ICT policy, 62 percent are aware of the existence of e-Government strategy. Despite this, only 19 percent has been involved in public sector ICT policy debates. This is illustrated in Figure 3:

Figure 3: Awareness of Policy Instruments

4.2 Structural Model Analysis

Structural equation modeling offers a suitable approach to subject a hypothesized e-Government value model to a fitness test (Hair et al., 2010). Using AMOS for analysis, the Goodness of Fit (GoF) statistics are as follows:-
Table 6: Goodness of Fit Indices

<table>
<thead>
<tr>
<th>Fitness Index</th>
<th>Condition for Good Model</th>
<th>Public Officers (N=340)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi Square</td>
<td>Ho: Model fits the data if P-Values &gt; 0.05</td>
<td>121.916</td>
</tr>
<tr>
<td>Df</td>
<td>CR or CMIN/DF &lt; 2</td>
<td>100</td>
</tr>
<tr>
<td>P-Values</td>
<td></td>
<td>0.067</td>
</tr>
<tr>
<td>CMIN/DF</td>
<td></td>
<td>1.219</td>
</tr>
<tr>
<td>Tucker-Lewis Index</td>
<td>&gt; 0.95</td>
<td>0.985</td>
</tr>
<tr>
<td>RMSEA</td>
<td>&lt; 0.06</td>
<td>0.025</td>
</tr>
<tr>
<td>RMSEA (Lower)</td>
<td></td>
<td>0.000</td>
</tr>
<tr>
<td>RMSEA (Upper)</td>
<td></td>
<td>0.040</td>
</tr>
</tbody>
</table>

In terms of validity the model fitted the sampled data ($P=0.067$), at 0.01 level of significance. This is due to the fact that $\chi^2$ value with $P > 0.05$ was obtained and this is adequate for a model fit (Hair et al., 2010). In the path model, regression paths are shown using a single headed arrow in the hypothesized structural relationship in Figure 4:

**Figure 4: Path Model**

In line with the conceptual framework, it is evident that the generated e-government public value model accounts for 58 percent of variances in quality of public information, 99 percent variances in the delivery of public services, 64 percent variances in citizen focused governance, 71 percent variances in efficiency in public service, 88 percent variances in openness in public service, 85 percent variances in responsiveness in public service, 47 percent variances in equity in public service, 43 percent variances in citizen trust in public service, 36 percent variances in democracy in decision making and 26 percent variances in environmental sustainability, all consequent upon use of e-Government in Kenya. The model fits the data with $P > 0.05$ (0.067), Tucker-Lewis index, also called the non-normed fit index or NNFI > 0.95 (0.985) and Critical Ratio, CR < 2 (1.219).

5. Discussion

Though a range of extant literature on the impacts of e-Government exists, much has largely focused on developed economies. In addition, the studies have been less extensive compared to the private sector even
as the value of use of public sector ICTs continues to be a subject of research and policy debate. In the research, the analysis demonstrated the existence of public values as a result of e-Government use. The respondents indicated online communication and accuracy of information as broad dimensions of e-government public value that are of greatest importance. These results reveal that the public sector considers as important improved interactions and enhanced efficiencies in public service. Indeed, Stoker’s (2006) in his postulation argues for a need to change public sector to open systems where processes are more transparent, more accessible and present the much needed value for money. On the other hand, online policy participation is opined as less critical outcome of e-Government. Indeed, it’s until 2010 that Kenya ratified a new constitutional order that challenged the information hegemony. The political implication continues to spur collaboration in policy making. However, despite the provisions, it seems a sizeable proportion of citizens is still ignorant or has no requisite capacity to engage the government in policy making (Murutu, 2014). In addition, limited skills and technological capacities present a barrier to this facilitative potential of e-Government (Amagoh, 2015). Further, socially desirable outcome (0.99) is seen as the most important reflector of public value of e-Government followed by effectiveness in public organizations (0.84) then least important is the quality of public service (0.76). These results lend credence to Lau (2005)’s contention that by minimizing public sector officers’ informational advantage using e-Government, which can be used to the disadvantage of the public, the efforts aid in achieving a socially optimal point. This maximizes the total public value of e-Government. Additionally, 65 percent of those aged between 31 and 40 were aware of the existence of ICT policy. This percentage increases with age. This is similar to the awareness of the existence of the e-Government strategy. This is expected as senior public servants are the major evaluators and executors of such public policy (Pourkiani et al., 2014). In addition, a greater proportion of male than female is aware of the existence of the ICT policy, e-Government strategy and participate more in ICT policy debates. This further justifies the need for engendering ICTs as espoused in national ICT policy (2006). Indeed, the study found out that the interactions that the respondents have had with e-Government platforms or perceive as adding value to their wellbeing is majorly in the use of e-Procurement through Integrated Financial Management Information System (IFMIS), file tax returns, renewal of passport and driving licenses. This is what Stoker’s (2006) public value model emphasizes as empowerment, collaboration and partnerships in creation of public values. This aligns the authority, operational and administrative capabilities to create public value (O’Flynn & Alford, 2012). Indeed, there is a dire need to shift to such a paradigm of access to information (Vyas-Doogpapard, 2011). Santos & Heeks (2003) propose a ‘one-stop shop’ to enhance delivery of the public services. E-government presents a solution to such bureaucratic stagnation (Bwalya & Healy, 2010). On the other hand, the research finds out that the downward side of e-Government includes lack of awareness on its potential, cyber insecurity, unfriendly user portals, and little consideration of access by persons living with special needs as well as those in the marginalized areas.

6. Conclusions

In the study, the participants acknowledged that there is public value in having information that pertains to governance. In addition, there is a need to have a mechanism for public input into policy making. However, there is need to have a facilitative mechanism to challenge the status quo. Indeed, making available and increasing the flow of information in a timely, relevant and credible manner constitutes a critical set of public value. This may aid in achieving a socially optimal point to maximize the total public value realizable to the public. Flowing from these, the study attempted to bridge some theoretical, methodological and practical gaps. The paper demonstrates an existence of a link between e-government value theory and the concept of public value. It demonstrates that public sector pursuit for public value may inform the practice of e-Governance in a developing country context. To the extent of the author’s knowledge, no study has tested and estimated such an association of public value and e-Government using a robust structural equation models from a developing country perspective. In fact, Wright & Wallis (2015) argue that such an integrative analysis is an emergent method, and does expand the scope of studies on the domain of e-Government value research. Further, the paper has demonstrated that a frame of reference emerging from the model may be useful to policy makers to understand the critical variables that constitute a set of public value of e-Government. This comes with empirical evidence of factors that need a focus or refocus. Indeed, one strategic finding that may have some practical implication is that more strategic spending on e-Government may be associated with increased public value. This result can aid in addressing the concern in context, where Kenya’s public service is threatening to cripple due to inefficiencies. In sum, the theories provided a lens through which the research problem was viewed from a number of vantage points; and this may improve the efficacy of policies in developing countries. However, for future research, there is a need to explore the impact that e-Government
may have on service quality as this may aid in comprehensively understanding the entire value system in public service.

References


Effects of Personal Innovativeness on IS Managers' Intentions to Switch Toward Cloud ERP in Saudi SMEs

Karim Mezghani
Al Imam Mohammad Ibn Saud Islamic University (IMSIU), Riyadh, Kingdom of Saudi Arabia
University of Sfax, Tunisia
mezghani_karim@yahoo.com

Abstract: SMEs are increasingly pushed to adopt cloud-based solutions given the risks and costs associated with On-Premise ERP. Cloud ERP systems are considered to offer high scalability and flexibility since they are proposed as a service. Nevertheless, switching toward such systems remains a hard decision since cloud computing is associated to other kinds of risks such as security, data confidentiality, network dependency, vendor lock-in, amongst others. While several studies have focused on attitudes and perceptions as the main determinants of switching decisions, this research investigated the effects of personal innovativeness in the IT domain in respect of intentions to switch toward cloud ERP systems with a focus on moderating effects. The author adopted a quantitative approach based on a structured questionnaire administered to IS Managers in Saudi SMEs that actually use On-Premises ERP. Data collected from 83 firms are analyzed by Structural Equation Modelling using PLS (Partial Least Squares) technique to test the research hypotheses. Among the main results, personal innovativeness is found to significantly moderate the effects of the antecedent (information channels exposure) rather than the effects of the determinants (expected switching risks, satisfaction with current ERP). Unlike previous studies, the results of this study show that personal innovativeness is more crucial when managers develop their perceptions rather than later when deciding about switching toward cloud ERP. From a theoretical perspective, such results steer toward a greater focus on antecedents of intentions to adopt ERP systems. From a managerial perspective, the proposed research model could be used as a framework to help managers assess the opportunities to switch toward cloud ERP.

Keywords: Cloud Computing, Enterprise Resources Planning (ERP), Intention to switch, personal innovativeness, IS Managers.

1. Introduction

Cloud ERP (Enterprise Resources Planning) are beginning to emerge as an alternative solution to On-Premise ERP which is criticized for being a cost and time consumer (Mezghani, 2014). Cloud ERP involves an on-demand access to ERP modules. According to Arnesen (2013, p.47), ERP vendors "are in the process of developing hosted or cloud solutions as the market moves to a cloud environment". Cloud ERP is presented as a suitable solution for SMEs as they lack resources to implement On-Premise ERP systems. However, as a Software as a service (SaaS), cloud ERP presents several risks such as security, data confidentiality, network dependency, and vendor lock-in. Then, switching toward such systems may be a hard decision that needs particular attention. When analyzing previous studies dealing with IT switching or adoption, it is possible to note that most of the research presents attitudes and perceptions as the main determinants of IT switching (Ye et al., 2008; Gangwar, Date and Ramaswamy, 2015; Liu, 2015).

However, some recent research noted that another personal factor which can be crucial in IT switching is personal innovativeness (Bhattacherjee, Limayem and Cheung, 2012; Park and Ryoo, 2013). Indeed, in reference to Agarwal and Prasad (1998), an innovator would intend to try a new IT, given the same level of perceptions as a less innovative person. Such factors could be an important determinant in switching toward cloud ERP since this system is associated with greater uncertainty (Mezghani, 2014). In this way, when exploring switching toward cloud ERP within four Saudi SMEs which actually use On-Premises ERP, Mezghani (2014) stated that personal innovativeness could play an important role in moderating the intentions to switch. However, this result was not deeply justified due to the exploratory nature of this research. Based on these ideas and since personal innovativeness is not well studied in the IT field research in Arab countries, this research aims to deeply study and test the effects of personal innovativeness on IS managers' intentions to switch toward Cloud ERP in Saudi SMEs.
More precisely, the research motivation can be summarized as follows:

- Cloud ERP adoption is still an unexplored area and “there is limited scientific literature related to cloud ERP adoption due to lack of academic studies” (Gupta et al., 2017, p.1057). Thus, this research attempts to give more understanding to cloud ERP adoption issues.
- In general, personal innovativeness is considered to play a crucial role as a predictor of IT adoption (Xu and Gupta, 2009; Ortbach, 2015). It is theoretically presented as a factor that may determine the intentions to switch toward cloud ERP as an IT innovation (Mezghani, 2014). However, this link is not well explained, nor empirically tested.
- The Saudi context is characterized by a rapid development in cloud adoption and use. However, very few experiences about cloud adoption are reported in academic research focusing on such context (Alharbi et al., 2016). Besides, “until recently, there has been little research on cloud ERP adoption, particularly in developing Middle Eastern countries such as Saudi Arabia” (AlBar and Hoque, 2017, p.2). To our knowledge, besides the exploratory study performed by Mezghani (2014), only AlBar and Hoque (2015; 2017) examined academically the intentions to adopt cloud ERP in Saudi firms. Moreover, these researchers focused on intentions at firms’ level by using the Technology-Organization-Environment framework, so less attention was provided to personal concerns linked to switching decisions. As the ERP market is moving toward cloud-based solutions, more research examining cloud ERP issues in the Saudi context are needed.

Based on a quantitative approach, this research has two objectives:

1. To develop and test a research model that presents how personal innovativeness influences the intention to switch toward cloud ERP.
2. To formulate recommendations for SMEs’ managers in respect of cloud ERP adoption as an emergent technology. This research may also be useful to ERP vendors to have a clearer idea about the Saudi SMEs’ readiness to switch toward cloud ERP.

### 2. Literature review

#### 2.1 Personal innovativeness and IT innovations adoption

The concept of personal innovativeness emerged from studies by Rogers (1983;1995) describing "the personality trait of ‘being innovative’, i.e. being early at adopting innovations" and then adopted by Agarwal and Prasad (1998) "who argued that innovativeness must be domain specific rather than global and defined personal innovativeness in the domain of IT" (Ortbach, 2015, p.5). Indeed, Agarwal and Prasad (1998) posit that global innovativeness has a low predictive power when applied to the study of a specific innovation adoption decision or behaviours within a narrow domain of activity.

Thus, to study IT innovations adoption, Agarwal and Prasad (1998, p.206) developed the concept of "personal innovativeness in the domain of IT" (PIIT) and defined it as "the willingness of an individual to try out any new information technology".

These authors state that, when intending to use or adopt a new IT, personal innovativeness intervenes as a moderating factor in two links:

- The link between the perceptions of new IT and the intention to use it. So, an innovator would intend to try new IT, given the same level of perceptions as a less innovative person.
- The link between information about a new IT and the perceptions about it. Indeed, for the same mix of channels, innovators will develop more positive perceptions about a new IT.

Such assumptions are largely adopted in IS studies focusing on IT adoption and use. The PIIT concept is found to fit with different theoretical backgrounds to explain the personal intention to adopt and use new IT. Thus, Xu and Gupta (2009) integrated PIIT with the Unified Theory of Acceptance and Use of Technology, Fagan, Kilmon and Pandey (2012) used PIIT with the Technology Acceptance Model while Hwang (2012) combined this concept with the Self Determination Theory. In all this research, PIIT is found to explain directly or indirectly the intention to adopt new IT.
Nevertheless, from the PIIT-linked literature review, one can note that this concept is mainly related to switching literature. Indeed, many studies focusing on IT switching behaviour integrate PIIT to explain intentions to switch toward new IT both directly (Dernbecher, Beck and Weber, 2013; Park and Ryoo, 2013; Sanford, 2013) or indirectly (Bhattacherjee, Limayem and Cheung, 2012; Mezghani, 2014; Ortbach, 2015). In fact, switching is a challenging matter that can be evaluated both favourably and unfavourably according to perceptions (Park and Ryoo, 2013; Mezghani, 2014). So, in reference to the original ideas of Agarwal and Prasad (1998), PIIT could intervene to adjust the effects of perceptions on intentions to switch.

Thus, PIIT may have crucial effects on switching toward cloud ERP since managers may have different perceptions vis-à-vis the adoption of such systems. Such difference in perceptions can be easily noted when presenting the benefits and risks of cloud ERP.

2.2 Switching toward cloud ERP: benefits and risks

Cloud ERP seems to become a real substitute to on-Premise ERP and firms would likely be "pushed" to switch toward the cloud solution. Such a solution is presented as suitable for SMEs as they lack resources to implement on-Premise systems.

However, as a Saas, cloud ERP presents several risks. Indeed, when ERP is on cloud, firms are very dependent on the vendor so concerns linked to data confidentiality and security may appear (Mezghani, 2014). Also, with such solution, firms are very dependent on the quality of Internet connection. Hence, when losing connectivity, employees cannot access the system or data (Arnesen, 2013).

Based on previous studies comparing cloud ERP to on-Premise ERP, Mezghani (2016) presented the main benefits and risks linked to cloud ERP implementation (Table 1).

<table>
<thead>
<tr>
<th>Table 1: Benefits and risks of cloud ERP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cloud ERP benefits</strong></td>
</tr>
<tr>
<td>• Cloud ERP is a cost saver: moving to cloud ERP reduces costs linked to licensing, maintenance and upgrading (Makkar and Meenakshi, 2012). Also, Cloud ERP requires less hardware investment (Peng and Gala, 2014; Gupta et al., 2017; 2018). In general, &quot;it is estimated that the cost of using cloud ERP was 15% lower than the traditional ERP&quot; (AlBar and Hoque, 2017, p.1).</td>
</tr>
<tr>
<td>• Cloud ERP is time saver: less time is spent in monitoring IT infrastructure. Besides, tests and trainings are conducted from the first steps of the project which can help to save time (Elragal and Elkommos, 2012).</td>
</tr>
<tr>
<td>• High scalability: according to Arnesen (2013, p.49), &quot;you can add or reduce users as your needs change, which works especially well for seasonal businesses or companies on a high-growth path&quot;.</td>
</tr>
<tr>
<td>• Accessibility: &quot;as a cloud based solution, cloud ERP modules can be accessed anytime and anywhere through the Internet&quot; (Mezghani, 2014, p.48).</td>
</tr>
</tbody>
</table>

Source: Mezghani (2016)

Given such benefits and risks, SMEs are facing a true challenge of switching or not toward cloud ERP. The IS manager's intention regarding switching would be determinant as this manager is a key person in the switching decision (Mezghani, 2014). Such intention is closely linked to personal perceptions about the concerned technology. This can be noted from previous studies based on theories such as Technology Acceptance Model (TAM) and Theory of Planned Behavior (TPB). So, perceived switching benefits and risks could play an important role in determining the level of intention.

However, given the same level of perceptions, PIIT can moderate the level of intention (Agarwal and Prasad, 1998). Consequently, when studying links between personal innovativeness and intention, it is important to integrate the perceptions to give better understanding of such links. This will be explained in more detail below.
2.3 Intention to switch toward cloud ERP: a two factor theory perspective

As reported below, when introducing the role of PIIT concept to explain a new IT adoption, Agarwal and Prasad (1998) integrated the perceptions about this IT to deeply understand the effects of PIIT. Nevertheless, like dominant IS theories, Agarwal and Prasad (1998) focused mainly on positive perceptions (enablers) linked to the IT to be adopted. However, according to Cenfetelli and Schwarz (2011), inhibitors may not simply be the opposites of enablers. Moreover, Park and Ryoo (2013, p.162) add that "inhibitors can hinder intentions despite the presence of enablers facilitating those same intentions". Indeed, intentions “can be simultaneously evaluated both favorably and unfavorably” (Park and Ryoo, 2013, p.162). When studying intentions to switch toward cloud ERP through a multiple-case study, Mezghani (2014) noted that the interviewed managers projected to switch toward cloud ERP because they "know" the benefits of such a system. However, these managers do not want to switch "right now" because they "give a great importance to risks considerations when talking about switching" (Mezghani 2014, p.55). This shows that both expected switching benefits (enablers) and risks (inhibitors) are closely linked to switching intentions.

This distinction between enablers and inhibitors refers to the two factor theory of motivation developed by Herzberg who states that factors leading to satisfaction may be different from factors leading to dissatisfaction. Although not largely used in IS research, the two factor theory gives a considerable explanatory power to understand the disconnection between factors leading to adoption or not of an IT service (Lee, Shin and Lee, 2009; Smaoui Hachicha and Mezghani, 2018). Accordingly, intentions can be influenced by dual-factored constructs (Liu, Guo and Lee, 2011).

From the two factor theory perspective, Park and Ryoo (2013) confirm that intentions to switch toward new IT are directly influenced by two dual factors that are the expected benefits and expected risks of such switching. Indeed, when to switch, a manager would think about both expected benefits and risks before deciding about switching. Thus, when considering both benefits and risks it would be beneficial to study more deeply the role of PIIT in IT adoption. A similar alternative was adopted by Bhattacharjee, Limayem and Cheung (2012) who found that PIIT could moderate the effects of dual factors on intentions to switch toward new IT. This means that PIIT could moderate both positive and negative perceptions about switching.

Besides perceptions about the new IT, dual perceptions about the current IT could be integrated as enabler or inhibitor (Smaoui Hachicha and Mezghani, 2018). Indeed, because this study focuses on “switching toward”, as a particular form of adoption which refers to leaving an existing IT to adopt another, perceptions regarding the current system should influence the switching intentions (Bhattacharjee, Limayem and Cheung, 2012).

3. Research model and hypotheses

3.1 Personal innovativeness as moderating the effects of perceptions on intention

When developed by Agarwal and Prasad (1998), PIIT was precisely presented as a factor that moderates the links between perceptions and intentions.

3.1.1 Personal innovativeness and positive perceptions about cloud ERP

Regarding the effect of the positive perceptions on intentions, Agarwal and Prasad (1998, p208) affirm that "the individual with higher PIIT would require fewer positive perceptions than an individual who is less innovative". Similarly, Mezghani (2014, p51) affirms that "persons with high degree of willingness to try any new IT are more likely to perceive it positively and to intend adopting it".

In a switching perspective, it is argued that a person needs to develop more perceptions about a new IT before intending to switch. Nevertheless, PIIT remains a crucial factor as it makes "innovators" more open toward switching (Bhattacharjee, Limayem and Cheung, 2012). As a new way to deal with ERP systems, cloud ERP may generate few positive perceptions. In all cases, PIIT could play an important role in moderating the link between the expected switching benefits and the intention to switch toward cloud ERP. Thus, the first hypothesis is formulated as follows:

H1: PIIT positively moderates the link between the expected switching benefits and the intention to switch toward cloud ERP.
3.1.2 Personal innovativeness and negative perceptions about cloud ERP

Regarding the negative perceptions (risks), it is largely argued that an innovation adoption is closely associated with greater risk, uncertainty, and imprecision (Kirton 1976; Agarwal and Prasad, 1998; Xu and Gupta, 2009). This means that expected risks may make individuals reluctant to adopt and use a new IT. Nevertheless, in reference to Rogers (1995), "innovators and early adopters are able to cope with higher level of uncertainty" since PIIT characterizes "the risk-taking propensity that exists in certain individuals and not in others" (Xu and Gupta, 2009, p.141).

As already mentioned, cloud ERP adoption is related to many risks that should be considered when thinking about an eventual switch. Risks, as security or dependency, may make managers reluctant to adopt cloud ERP. However, PIIT should moderate the risks effects. Such a moderating effect was shown by Mezghani (2014) through a qualitative approach. In fact, when conducting interviews with IS managers, this author found that although the interviewees did not perceive many risks toward cloud ERP, they did not intend to switch because they prefer to wait "for results of other potential adopters" (lack of PIIT). Therefore, it is possible to formulate the following hypothesis:

H2: PIIT negatively moderates the link between the expected switching risks and the intention to switch toward cloud ERP.

3.1.3 Personal innovativeness and satisfaction with current ERP

Previous studies showed that the "switching" behaviour is not only linked to the new IT perceptions but also to the degree of satisfaction with the old one (Bhattacherjee, Limayem and Cheung, 2012; Park and Ryoo, 2013; Mezghani, 2014). Indeed, in reference to Bhattacherjee (2001), ex post expectation toward an existing IT may change with time and this would have effects on continuance or switching intention. Bhattacherjee, Limayem and Cheung (2012, p329) add that "Since IT switching requires user acceptance of the new IT and discontinuance of the old IT, constructs that are salient to users' discontinuance decisions should also be considered as key factors shaping the IT switching behavior".

Through a qualitative perspective, Mezghani (2014) found that even convinced by its benefits, some IS managers did not find it necessary to switch “now” to cloud ERP since they are satisfied with their incumbent ones.

So, besides perceptions about cloud ERP (as the new IT), perceptions about the current ERP (the on-premise one) are added as a determinant of intention to switch whose effect on intention could be moderated by PIIT (Bhattacherjee, Limayem and Cheung, 2012; Mezghani, 2014). In fact, according to these authors, it is possible to link negatively satisfaction with the current system with intentions to switch toward another system. The PIIT could play a determinant role in moderating such a link as "individuals who are highly innovative and enjoy experimenting with new products or services may be open to switching to a new IT if they see it as better than their current IT, or if they are only slightly dissatisfied with it" (Bhattacherjee, Limayem and Cheung, 2012, p.329). This leads us to hypothesize:

H3: PIIT negatively moderates the link between the satisfaction with current ERP and the intention to switch toward cloud ERP.

3.2 Personal innovativeness as moderating the effects of Information channels exposure on perceptions

In reference to the theory of Diffusion of Innovation (DOI), Agarwal and Prasad (1998) affirm that alternate channels of information are utilized to develop perceptions about an IT adoption and use. Several studies argued, from this perspective, that an individual develops perceptions about an IT innovation by synthesizing related information from a variety of channels (Rogers, 1995; Agarwal and Prasad, 1998; Rashed, 2001; Lewis, Agarwal and Sambamurthy, 2003; Mezghani and Ayadi, 2016).

As an IT innovation, perceptions toward cloud ERP can be studied from the DOI perspective. Similar to Mezghani and Ayadi (2016) who studied perceptions about cloud computing, the current study integrates the concept of "information channels exposure" that can be defined as "the knowledge accumulated by an individual about a particular technology through information channels" (Rashed, 2001, p7). Indeed, since cloud
ERP is a new IT with several benefits and risks, IS managers need to be exposed to different information channels to develop their perceptions toward cloud ERP.

Thus, to get a deep idea about the effects of PIIT when intending to switch toward cloud ERP, the effect of information channels exposure on perceptions about cloud ERP is integrated as a link that can be moderated by PIIT.

From the DOI perspective, it is argued that information channels focus on emphasizing the positive value of an innovation (Agarwal and Prasad, 1998). Similarly, since considered as a determinant of the successful diffusion and use of an IT, information channels exposure is likely to favour the positive perceptions (Rashed, 2001; Mezghani and Ayadi, 2016). The PIIT intervenes here as a moderating factor since it is argued that, for the same mix of channels, innovators would develop more positive perceptions about an innovation (Agarwal and Prasad, 1998).

From a two factor theory perspective, factors leading to satisfaction may be different from factors leading to dissatisfaction. Thus, if we consider that information channels’ content can focus on both positive and negative aspects of cloud ERP, it is possible to predict that positive ones would favour expected switching benefits when negative ones would support the development of negative expectations. In this case, an innovator may be more aware of benefits as well as risks. Indeed, an innovator in an IT domain is expected to get more IT knowledge and more receptiveness to information about IT (Jeong, Yoo and Heo, 2009). By the way, such a person should collect more information (about benefits and risks) than would a lesser innovator, leading to more expectations about cloud ERP. Then, two other hypotheses could be added:

H4: PIIT positively moderates the link between the information channels exposure and the expected switching benefits.

H5: PIIT positively moderates the link between the information channels exposure and the expected switching risks.

Based on the formulated hypotheses, it is possible to present the research model as above (Figure 1):

![Figure 1: The research model](image)

4. Research methodology

This research is based on a quantitative approach considered as suitable for hypothetico-deductive research. The data was collected using a questionnaire developed based on items identified from previous research (see Appendix) and measured using a 6-point Likert scale. Regarding the questionnaire structure, the questions were organized into four parts: questions linked to perceptions about the current (On-Premise) ERP, questions related to the cloud ERP (exposure to related information, expectations and intention), questions about PIIT and general details about the respondents and their firms. The questionnaire was reviewed by two academicians and then pretested by 6 respondents.
The questionnaire was addressed, directly and by email, to a sample of IS managers within Saudi SMEs that still use On-Premises ERP. The IS managers are considered as the "key informants" when conducting researches in IT fields (Kearns & Sabherwal, 2007; Mezghani, 2014).

Regarding the population, no official statistics were found about the Saudi SMEs that already implemented ERP systems. So, we referred to Mezghani, Ayadi and Aloulou, (2014) who identified 129 Saudi SMEs. In order to update the list, a snowball sampling was performed. Such a technique is suitable for sampling from hidden or hard-to-reach populations (Heckathorn, 2011). Thus, further contacts were established with SMEs in the region of Riyadh (as the capital and the main attractive region in term of the economic weight with 25% of Saudi establishments according to the General Authority of Statistics website). A total of 180 questionnaires were distributed to those who agreed to participate. A total of 109 responses were collected but only 83 questionnaires were found usable due to missing data for dependent variables in some responses (46.11% as an overall response rate). Most responses were collected from SMEs belonging to the services (36.15%) and manufacturing (20.48%) sectors. The majority of these firms use an Oracle ERP (37.34%).

Since there are many dependent variables in the research model (figure 1), the collected data was analyzed using the Structural Equation Modelling (SEM) as the more suitable method. Because the sample size is limited, the Partial Least Square (PLS) path modeling is performed using XLstat software. PLS is suitable when applying SEM on a small sample size bounded between 30 and 100 observations (Fernandes, 2012). Factor analyses (varimax rotation) were also performed with the XLstat software to purify the measures and verify the uniqueness of each variable.

5. **Findings**

5.1 **Findings of descriptive analyses**

Based on factor analyses, two items (one measuring PIIT and another linked to intention) were deleted due to their weak factors’ loadings. The structure factor of the research model was verified (Table 2).

Table 2: Cross-loadings

<table>
<thead>
<tr>
<th></th>
<th>Information channels exposure</th>
<th>Expected switching benefits</th>
<th>Expected switching risks</th>
<th>Satisfaction with current ERP</th>
<th>Intention to switch toward cloud ERP</th>
<th>PIIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICE1</td>
<td>0.734</td>
<td>0.334</td>
<td>0.459</td>
<td>0.211</td>
<td>0.275</td>
<td>0.139</td>
</tr>
<tr>
<td>ICE2</td>
<td>0.820</td>
<td>0.343</td>
<td>0.348</td>
<td>0.201</td>
<td>0.389</td>
<td>0.121</td>
</tr>
<tr>
<td>ICE3</td>
<td>0.839</td>
<td>0.484</td>
<td>0.176</td>
<td>0.366</td>
<td>0.449</td>
<td>0.197</td>
</tr>
<tr>
<td>ICE4</td>
<td>0.795</td>
<td>0.469</td>
<td>0.130</td>
<td>0.343</td>
<td>0.450</td>
<td>0.160</td>
</tr>
<tr>
<td>ICE5</td>
<td>0.743</td>
<td>0.283</td>
<td>0.241</td>
<td>0.122</td>
<td>0.255</td>
<td>0.060</td>
</tr>
<tr>
<td>BENEF1</td>
<td>0.410</td>
<td>0.898</td>
<td>0.281</td>
<td>0.207</td>
<td>0.762</td>
<td>0.547</td>
</tr>
<tr>
<td>BENEF2</td>
<td>0.494</td>
<td>0.940</td>
<td>0.351</td>
<td>0.244</td>
<td>0.798</td>
<td>0.555</td>
</tr>
<tr>
<td>BENEF3</td>
<td>0.471</td>
<td>0.924</td>
<td>0.198</td>
<td>0.161</td>
<td>0.725</td>
<td>0.347</td>
</tr>
<tr>
<td>BENEF4</td>
<td>0.423</td>
<td>0.914</td>
<td>0.284</td>
<td>0.134</td>
<td>0.767</td>
<td>0.354</td>
</tr>
<tr>
<td>RISK1</td>
<td>0.266</td>
<td>0.269</td>
<td>0.856</td>
<td>0.115</td>
<td>0.294</td>
<td>0.445</td>
</tr>
<tr>
<td>RISK2</td>
<td>0.391</td>
<td>0.261</td>
<td>0.884</td>
<td>0.065</td>
<td>0.219</td>
<td>0.242</td>
</tr>
<tr>
<td>RISK3</td>
<td>0.137</td>
<td>0.196</td>
<td>0.628</td>
<td>0.030</td>
<td>0.170</td>
<td>0.153</td>
</tr>
<tr>
<td>SATISF1</td>
<td>0.295</td>
<td>0.201</td>
<td>0.182</td>
<td>0.886</td>
<td>0.053</td>
<td>0.356</td>
</tr>
<tr>
<td>SATISF2</td>
<td>0.258</td>
<td>0.191</td>
<td>0.063</td>
<td>0.896</td>
<td>0.055</td>
<td>0.310</td>
</tr>
<tr>
<td>SATISF3</td>
<td>0.351</td>
<td>0.203</td>
<td>0.065</td>
<td>0.962</td>
<td>0.124</td>
<td>0.304</td>
</tr>
<tr>
<td>SATISF4</td>
<td>0.332</td>
<td>0.151</td>
<td>0.084</td>
<td>0.900</td>
<td>0.052</td>
<td>0.227</td>
</tr>
<tr>
<td>INT1</td>
<td>0.480</td>
<td>0.759</td>
<td>0.164</td>
<td>0.113</td>
<td>0.835</td>
<td>0.314</td>
</tr>
<tr>
<td>INT3</td>
<td>0.403</td>
<td>0.782</td>
<td>0.255</td>
<td>0.117</td>
<td>0.922</td>
<td>0.429</td>
</tr>
<tr>
<td>INT4</td>
<td>0.358</td>
<td>0.700</td>
<td>0.334</td>
<td>-0.004</td>
<td>0.890</td>
<td>0.466</td>
</tr>
<tr>
<td>INT5</td>
<td>0.418</td>
<td>0.718</td>
<td>0.289</td>
<td>0.098</td>
<td>0.914</td>
<td>0.398</td>
</tr>
<tr>
<td>PIIT1</td>
<td>0.171</td>
<td>0.516</td>
<td>0.350</td>
<td>0.307</td>
<td>0.489</td>
<td>0.901</td>
</tr>
<tr>
<td>PIIT2</td>
<td>0.181</td>
<td>0.405</td>
<td>0.325</td>
<td>0.248</td>
<td>0.314</td>
<td>0.887</td>
</tr>
<tr>
<td>PIIT3</td>
<td>0.127</td>
<td>0.413</td>
<td>0.346</td>
<td>0.322</td>
<td>0.398</td>
<td>0.923</td>
</tr>
</tbody>
</table>
The reliability of each factor was then evaluated by assessing the internal consistency of items within each factor using Cronbach’s α and Dillon-Goldstein (D-G) rho. The validity was verified by analyzing the Average Variance Extracted (AVE) value of each factor. The results are summarized in the table below (Table 3):

Table 3: Validity and reliability tests

<table>
<thead>
<tr>
<th>Latent variable</th>
<th>Cronbach’s α (≥ 0.7)</th>
<th>D-G. rho (≥ 0.7)</th>
<th>AVE (≥ 0.5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information channels exposure</td>
<td>0.846</td>
<td>0.891</td>
<td>0.620</td>
</tr>
<tr>
<td>PIIT</td>
<td>0.889</td>
<td>0.931</td>
<td>0.817</td>
</tr>
<tr>
<td>Expected switching benefits</td>
<td>0.939</td>
<td>0.956</td>
<td>0.845</td>
</tr>
<tr>
<td>Expected switching risks</td>
<td>0.724</td>
<td>0.846</td>
<td>0.637</td>
</tr>
<tr>
<td>Satisfaction with current ERP</td>
<td>0.935</td>
<td>0.954</td>
<td>0.831</td>
</tr>
<tr>
<td>Intention to switch toward cloud ERP</td>
<td>0.913</td>
<td>0.939</td>
<td>0.794</td>
</tr>
</tbody>
</table>

According to Hair et al. (2010), reliability estimates values higher than 0.7 suggest good reliability, "meaning that the measures all consistently represent the same latent construct". Regarding convergent validity, these authors suggest using the AVE for the items loadings on each construct. An AVE of 0.5 or higher indicates a good convergence.

All obtained values are in the acceptance range. So, it is possible to state that the structure factor of the research model is satisfactory. This allows us to proceed to paths analyses within the structural model in order to test the research hypotheses.

5.2 Findings of explanatory analyses

To perform the explanatory analyses, the structural model is built using the PLS Path Modeling (PLSPM) module integrated in XLstat. The moderating effects were integrated within PLSPM using the "interaction" option which creates automatically interaction variables measured by the products of the items associated to PIIT and the concerned independent variables.

A first analysis of the structural model with the PLS method provided the following fitted model:
thus provide a single measure for the overall prediction performance of the model” (Vinzi, Trinchera and Amato, 2010, p.58). According to these authors, “there is no inference-based threshold” to assess the statistical significance of GOF values. But Wetzels, Odekerken-Schroder and Van Oppen (2009) propose a cut-off value of 0.5.

The link between the expected switching risks and intention in addition to the associated moderating link were eliminated as very weak (respectively 0.007 and 0.021). Thus, H2 could not be supported. By doing so, we obtained a second version of the fitted model (figure 3) with a better GOF value (0.786). As stated by Hair et al. (2010), the GOF value indicates how well the specified model represents the data.

Figure 3: The fitted model (second version)

The structural paths analysis shows that the R² values of the dependent variables are satisfactory. Also, many regression links presented in figure 3 are significant at the level of 5% (Critical ratio (CR) > 1.96). All these results are reported in table below (Table 4):

Table 4: Summary of paths analysis results

<table>
<thead>
<tr>
<th>Paths coefficients (CR)</th>
<th>Expected switching benefits</th>
<th>Expected switching risks</th>
<th>Intention to switch toward cloud ERP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information channels exposure</td>
<td>0.230 (7.770)</td>
<td>0.167 (3.978)</td>
<td>-</td>
</tr>
<tr>
<td>PIIT * Information channels exposure</td>
<td>0.282 (10.182) (H4)</td>
<td>0.207 (5.113) (H5)</td>
<td>-</td>
</tr>
<tr>
<td>Expected switching benefits</td>
<td>-</td>
<td>-</td>
<td>0.469 (12.441)</td>
</tr>
<tr>
<td>Satisfaction with current ERP</td>
<td>-</td>
<td>-</td>
<td>-0.120 (-2.107)</td>
</tr>
<tr>
<td>PIIT * Expected switching benefits</td>
<td>-</td>
<td>-</td>
<td>0.368 (15.731) (H1)</td>
</tr>
<tr>
<td>PIIT * Satisfaction with current ERP</td>
<td>-</td>
<td>-</td>
<td>-0.061 (-1.513) (H3)</td>
</tr>
</tbody>
</table>

Based on the paths analysis results, the hypotheses test can be summarized as follows:

Table 5: Results of hypotheses test

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1: PIIT positively moderates the link between the expected switching benefits and the intention to switch toward cloud ERP.</td>
<td>Supported</td>
</tr>
<tr>
<td>H2: PIIT negatively moderates the link between the expected switching risks and the intention to switch toward cloud ERP.</td>
<td>Not Supported</td>
</tr>
<tr>
<td>H3: PIIT negatively moderates the link between the satisfaction with current ERP and the intention to switch toward cloud ERP.</td>
<td>Not Supported</td>
</tr>
</tbody>
</table>
**Hypotheses**

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>H4: PIIT positively moderates the link between the information channels exposure and the expected switching benefits.</td>
<td>Supported</td>
</tr>
<tr>
<td>H5: PIIT positively moderates the link between the information channels exposure and the expected switching risks.</td>
<td>Supported</td>
</tr>
</tbody>
</table>

**Figure 4:** The research model (revised version)

A first look at Table 5 and Figure 4 shows that the PIIT’s negative moderations are not empirically supported unlike positive ones. It seems that PIIT acts as an "incentive" of perceptions and behaviours rather than a "restraint".

6. **Discussion**

The results of means test show that the surveyed IS managers have a good level of PIIT (>4.7 for each item) that played a significant moderating role within many links presented in the research model. The details of such a role are discussed below.

6.1 **The moderating effects of personal innovativeness on intention**

First of all, it is necessary to note that the $R^2$ value of intention is high (0.685). This means that the intention to switch toward cloud ERP is largely influenced by the variables identified in this research. Thus, our research model seems to have a good explanatory power.

The results of the means test show that the surveyed IS managers have the intention to switch toward cloud ERP (>4 for each item). When several studies showed that many managers were still reluctant regarding cloud computing adoption, the present research results align with those of Mezghani and Ayadi (2016) according to which Saudi managers are developing positive attitudes toward cloud-based solutions. According to AlBar and Hoque (2015), the notion of cloud ERP "is gaining more acceptances" among the Saudi firms. Similarly, at a global level, a survey conducted by Panorama Consulting (2016) shows that the implementation of cloud ERP has increased from 11% to 27% in one year.

The results reported in Table 4 show that the most important determinant of intention is "expected switching benefits" (0.469). So, the surveyed managers expect a lot from cloud ERP and are motivated to adopt it. Like the results from previous studies, current results support the fact that expected benefits remain a key factor in deciding whether to switch or not toward cloud-based solutions (Park and Ryoo, 2013). Recent qualitative research on cloud ERP adoption puts the advantages of such a system as the key enabler of its adoption by firms (Das and Dayal, 2016). The obtained results can also be explained in reference to the nature of firms concerned by this research (the SMEs). Indeed, cloud ERP is presented as a suitable solution for SMEs “due to budget limitations” (Al-Johani and Youssef, 2013). So, it is not strange to find that the IS managers among such firms are looking at this cloud solution as a real substitute to legacy systems.
According to statistical results, the PIIT plays an important role in strengthening the link between expected benefits and intention. Moreover, the interaction between PIIT and expected benefits seems to have more significant effect (CR=15.731). Indeed, PIIT is considered as a crucial factor as it makes "innovators" more open toward switching (Bhattacherjee, Limayem and Cheung, 2012). This means that such individuals would pay more attention to the advantages of the considered technology.

Regarding expected switching risks, the results reported in Figure 2 show that the intention to switch toward cloud ERP is not affected significantly by risks. Although it is theoretically known that switching behaviour can be simultaneously evaluated both favourably and unfavourably, the results of the current research are not surprising. Indeed, in recent research conducted in Saudi Arabia, Mezghani and Ayadi (2016) found that IS managers do not consider cloud-linked risks when determining their attitudes toward cloud computing adoption. According to these authors, the IS managers are considered as IT specialists who would be rather influenced by the benefits of cloud-based solutions unlike other respondents in previous studies. Then, since the surveyed managers do not consider risks to determine their switching intention, their "innovativeness" would not be considered in assessing the link between expected risks and intention. This explains the non-significant moderating effect of PIIT found in this case.

A similar result is also noted for the link between satisfaction with current ERP and intention to switch. In fact, although PIIT seems to have a negative moderating effect on such a link (as hypothesized), this effect is not significant at the level of 5% (CR= -1.513). Before explaining this result, it is important to note that the statistical analyses reveal that satisfaction with current ERP influences negatively and significantly the intention to switch toward cloud ERP. Such a result aligns with similar previous studies, mainly Bhattacherjee, Limayem and Cheung (2012). According to these authors, "since IT switching requires user acceptance of the new IT and discontinuance of the old IT, constructs that are salient to users’ discontinuance decisions should also be considered as key factors shaping the IT switching behavior". Hence, managers who are satisfied with their incumbent ERP systems would be hesitant toward cloud-based ERP. As reported above, the results of the current research indicate that PIIT would not regulate such a situation. Thus, even innovators would consider their On-Premises systems when thinking about switching. Such a result, even not supporting H2, is not totally contradicting previous studies. Indeed, it is "extremely difficult to detect significant moderating effects in small samples" (Bhattacherjee, Limayem and Cheung, 2012, p.332). Further research with a larger sample size could provide a different result.

### 6.2 The moderating effects of personal innovativeness on perceptions

To get a deep understanding of the PIIT role in the switching decision, its moderating effects on the links between information channels exposure and perceptions regarding cloud ERP was tested. The results reported in Table 4 show that these effects are significant.

First, it is important to note that the statistical analyses revealed the positive and significant effect of information channels exposure on, respectively, expected benefits and risks. This means that the surveyed IS managers consider different sets of information channels e.g. audio-visual, seminars, and discussions to assess the opportunity of switching. The means' analyses indicate that the surveyed IS managers are often exposed to cloud ERP related information (>3.5 for each item). So, it is possible to affirm that these managers are well informed about cloud ERP although such a system is considered, according to AlBar and Hoque (2015), as an emerging technology in the Saudi context.

From the DOI perspective, it is argued that information channels focus on emphasizing the positive value of an innovation. Nevertheless, the statistical analyses show that information channels exposure favours positively the negative expectations too. So, it is possible to state that information channels content focus on both benefits and risks of cloud ERP. This "dual" effect of information channels exposure can be explained in reference to the two factor theory. According to this theory, factors leading to satisfaction may be different from factors leading to dissatisfaction. Thus, if we consider that information channels content focus on both positive and negative aspects of cloud ERP, it is possible to estimate that positive ones would favour expected switching benefits when negative ones would support the development of negative expectations.

Regarding the role of PIIT, the obtained positive and significant moderating effects (Table 4) show that "innovators" pay more attention to information channels to build perceptions vis-à-vis cloud ERP. This means that managers who are willing to try out any new information technology would be more motivated to collect
related information. This considerable role of PIIT as an antecedent moderator was noted by Agarwal and Prasad (1998, p207) who affirm that "PIIT determines the relative use of alternate channels of information utilized for the development of perceptions". Similarly, Rogers (1995) affirms that innovators are "active information seekers about new ideas".

Thus, it is clear that PIIT can be considered as a key factor not only when determining a person's intention toward cloud ERP but also and mainly when building perceptions about such a solution. As an example, the statistical analyses reveal that PIIT intervenes to identify the cloud-linked risks but loses importance when linking these risks to intention.

7. Research implications

7.1 Theoretical implications

More and more studies are focusing on cloud ERP adoption as IS are moving toward cloud environment. However, there is still a lack of academic research related to cloud ERP adoption (Gupta et al., 2017). The current research attempted to give more understanding cloud ERP adoption issues by examining the moderating roles of PIIT in such adoption.

By combining the model developed by Agarwal and Prasad (1998) with a two factor theory perspective, a research model is proposed (Figure 1) and then revised (Figure 4) to present the PIIT as moderating the effects of both determinants and antecedents of intention to switch toward cloud ERP. Such an original combination allowed us to illustrate more effects of PIIT:

- By focusing on switching decisions, it was possible to integrate perceptions about current ERP and to analyze the effect of their interaction with PIIT on intention.
- While previous studies focused on links between PIIT and positive perceptions (usefulness, ease of use), the current research attempted to combine PIIT with negative perceptions.
- Unlike most studies in which the PIIT's moderating effect is studied directly regarding intention, the proposed research model and the linked statistical analyses showed that PIIT does play an important role in shaping the expectations regarding cloud ERP. Integration of antecedents (information channels exposure) allowed us to obtain a deep understanding of such role.

Although some links were not statistically supported, it is possible to state that the proposed research model has a good explanatory power. In fact, "it is extremely difficult to detect significant moderating effects in small samples" (Bhattacharjee, Limayem and Cheung, 2012, p.332).

The proposed research model pushes also toward more reflections about other factors that could be integrated to explain cloud ERP adoption since the ERP market is rapidly evolving toward cloud-based solutions.

7.2 Managerial implications

Since cloud ERP is considered as an emerging technology in the Saudi context, the current research may be useful for Saudi firms that are thinking about a potential switch toward such a solution. Indeed, few studies on cloud computing adoption focus on the Arab context so their results may not be so relevant for managers in such a context due to cultural differences (Mezghani and Ayadi, 2016). Thus, the proposed research model can serve as a tool for managers and consultants to identify best practices for cloud ERP adoption.

First, managers should be exposed to a set of information channels to learn about cloud ERP linked benefits and risks before deciding about a potential switch. In fact, based on interviews conducted within four Saudi firms, Mezghani (2014) affirms that “lack of knowledge about cloud offerings” is a key reason that makes firms reluctant to adopt cloud ERP.

Second, in light of the results, it appears that managers should take into account their current systems when making switching decisions since cloud ERP could not be always the right alternative due to linked risks compared to On-premises systems. Indeed, from the article's findings, it appears that the surveyed managers strongly consider their current system in switching decisions.
Third, this study showed that the most surveyed IS managers within the Saudi SMEs are considered as "innovators" and that PIIT can play a determinant role in the switching decision. Such a result can encourage Saudi managers to go forward in cloud ERP adoption.

The obtained results could be useful for cloud ERP providers too. Even not generalized, such results give providers an idea about the expectations of SMEs regarding cloud ERP. This would help them to provide the appropriate offers with the appropriate marketing efforts to push their clients toward their cloud solutions. The fact that the surveyed IS managers are influenced mainly by the cloud ERP-linked benefits in comparison to their current systems should encourage providers to focus on such aspects in their marketing discourse.

8. Conclusion

This research aimed to study the effects of PIIT on intentions to switch toward cloud ERP with a focus on moderating links. Indeed, many managers are still reluctant, regarding such solutions considered as an innovative and risky way to deploy ERP systems. Thus, this research attempted to examine if being an innovator could moderate the expectations and the intentions toward cloud ERP. To do so, a research model (Figure 1) that combines the framework of Agarwal and Prasad (1998) with a two factor theory perspective is proposed. In this model, the PIIT is considered to moderate the effects of both determinants and antecedents of intention.

While it is found that PIIT significantly moderates the effects of antecedents (information channels exposure), the results of statistical analyses showed that, among the determinants' effects, only those from expected benefits are moderated by PIIT. When previous studies focused mainly on the role of PIIT regarding the links between the intention and its direct determinants, the current research finds that the principal role of PIIT is played regarding the antecedents. This means that PIIT is more crucial in the early steps, when managers are developing their perceptions rather than later when deciding about switching. In fact, the results of this research show that the IS managers with high PIIT do not consider cloud ERP risks when switching toward such a system. Also, when satisfied with their current systems, the IS managers do not intend to switch toward another system, even being innovators.

The obtained results show that the proposed research model has a good explanatory power although it is considered that the detection of significant moderating effects is difficult in small samples. The proposed research model pushes also toward more reflections about other factors that could be integrated to explain cloud ERP adoption. Indeed, applying multiple perspectives in research focusing on cloud adoption is necessary to get a strong explanatory power (Schneider and Sunyaev, 2016).

The obtained results could also be useful for managers and providers in Saudi Arabia and other GCC countries that have similar characteristics since several studies, as those of AlBar and Hoque (2015; 2017), stated that few empirical studies focusing on cloud ERP adoption are conducted in such countries. Therefore, further studies that integrate more variables and would be extended to big firms are needed to build a deep understanding about cloud ERP adoption and strengthen the validity of findings. As the market is more and more pushed toward such ERP, it would be possible to conduct research with bigger samples and use more confirmatory techniques as LISREL (Linear Structural Relations) resulting in the possibility to generalize findings.

References


Fernandes, V., 2012. (Re)discovering the PLS approach in management science. *M@n@gement*, 15(1), pp.101-123.


Appendix: Items

<table>
<thead>
<tr>
<th>Variables</th>
<th>Items (adapted)</th>
<th>Authors</th>
</tr>
</thead>
</table>
| Personal innovativeness in the domain of IT   | • I like to experiment with new IT.  
• Among my peers, I am usually one of the first to try out new IT.  
• If I heard about a new IT, I would look for ways to experiment with it.  
• In general, I am hesitant to try out new IT.                                                                                              | Agarwal and Prasad (1998), Lewis at al. (2003), Bhattacherjee et al. (2012)                                                    |
| Intention to switch toward cloud ERP          | • I have considered switching from on-premise ERP to cloud ERP.  
• I have no intention to renew with an on-premise ERP.  
• I intend to use cloud ERP in the future.  
• I believe my interest in cloud ERP will increase in the future.  
• I will recommend others to use cloud ERP.                                                                                                 | Zhou (2015), Kalinic and Marinkovic (2015)                                                                                         |
| Expected switching benefits                  | • Changing to new way of working with cloud ERP will enhance my effectiveness on the job than working in the current way.  
• Changing to new way of working with cloud ERP will enable me to accomplish relevant tasks more quickly than working in the current way.  
• Changing to new way of working with cloud ERP will improve the quality of the work I do than working in the current way.  
• Changing to new way of working with cloud ERP will increase my productivity than working in the current way.   | Kim and Kankanhalli (2009), Park and Ryoo (2013)                                                                                     |
| Expected switching risks                      | • It will take a lot of time and effort to switch to the way of working with cloud ERP.  
• Switching to new ways of working with cloud ERP can result in unexpected hassles (troubles).  
• I will lose a lot of my work if I am to switch to the new way of working with cloud ERP.                                                                 | Park and Ryoo (2013)                                                                                                             |
| Satisfaction with current ERP                 | • All things considered, I am very satisfied with the current system.  
• Overall, my interaction with the current system is very satisfying.  
• I am very pleased with using the interface of the current system.  
• I am very contented with using the interface of the current system.                                                                      | Wixom and Todd (2005), Lee et al. (2009)                                                                                           |
| Information Channels exposure                 | • I get exposed to cloud ERP related information through TV or Radio.  
• I read cloud ERP related information in newspapers, magazines, bulletins or other forms of literature.  
• I get exposed to cloud ERP related information through seminars, conferences and conventions.  
• I involve in cloud ERP related discussions with coworkers and associates.  
• I involve in cloud ERP related discussions with friends and family members.                                                              | Rashed (2001), Mezghani and Ayadi (2016)                                                                                           |
EJISE Editorial for Volume 21 Issue 1 2018

On behalf of the editorial team it is with great pleasure to present the first issue of EJISE for 2018. The pervasiveness of the internet has pushed the boundaries of the traditional ambit of Information Systems research. The papers in this issue thus tackle a range of problems in various spheres of our everyday life.

Research into cloud computing adoption features once more in this issue. The focus of the paper by Mezghani is on the SME sector, which in most countries have a critical role in the advancement of the economy. Mezghani’s research takes a fresh look at adoption, by investigating the effects of personal innovativeness in respect of intentions to switch toward cloud ERP systems. The quantitative empirical evidence for this study is derived from Saudi Arabian SMEs. The findings are novel, in that it is demonstrated that personal innovativeness is found to significantly moderate the effects of the antecedent, rather than the effects of the determinants which have been more traditionally investigated in the extant literature.

There are several dimensions of the paper by Kolog, Montero and Tukiainen in this issue which makes it an interesting read and an important contribution. The paper reports on the development of EmoTect which is an intelligent e-counselling system for automatic detection of emotions and sentiments in text. The system is designed to assist school counsellors. The development of the system is based on a design science research paradigm, and the paper provides the results of the evaluation of the EmoTect classifier with positive results. The paper thus makes an important contribution to the IS evaluation literature as it demonstrates a model of evaluation prototypes from a participatory design process, using gold standard data from the users – in this case counsellors. Undoubtedly, the role of the system within schools is important, as the media have reported over several years the fickle mental state of learners, which impacts negatively on performance, and in some instances has even led to suicide. Moreover the potential for such a system, within the larger domain of the internetnetworked world dominated by the big-data of social media, has future value too.

Okong’o and Kyobe introspect e-government in Kenya. Although e-Government is a well developed area in Information Systems research, a deeper understanding is required in developing country contexts. Although the International Telecommunications Union reports steady growth in internet penetration in developing nations, year on year, Governments in such environments are yet to fully harness broadband internet to improve service delivery. This paper identifies the dimensions of the public value of e-Government, and presents results of a survey of 340 Kenyan public service officers. The resultant e-Government public value model demonstrates the multi-faceted nature of the e-Government environment and as such has potential impact on policy development in the African continent in respect of the dimensions that comprise public value of e-Government. Finally the paper provides an understanding of the link between e-government value theory and the concept of public value.

The paper by Asmah, Ofoeda and Gyapong, investigates the electronic cheque-clearing system in Ghana. Whilst this may appear to be an aspect of banking that is well matured globally, the reality is that in some countries, the use of computerized information systems for cheque-clearing is a recent intervention. For example, Ghana only transitioned from traditional paper based cheque-clearing into the full electronic clearing in 2010. The paper therefore makes a welcome contribution to our understanding of Information Systems in a developing country context, given the reported failure of e-banking systems in countries such as Ghana to achieve the intended benefits. The importance of modeling a cheque-clearing system in Africa is important as the peculiarities of this continent’s cultural and ICT adoption and usage norms must be taken into account.

Finally, on behalf of my colleagues on the EJISE Editorial board, I must record our sincere appreciations to the reviewers of the papers in this issue. Without their unstinting support, our commitment to independent assessment and review of the scientific endeavour cannot be upheld.

Yours in scholarship,

Shaun Pather
EJISE, Editor in Chief