October 2014

Constructing Frugal Sales System for Small Enterprises

Oludayo O. Olugbara
Durban University of Technology, Durban, oludayoo@dut.ac.za

Brenda N. Ndhlovu
Durban University of Technology, Durban, lesmotto@gmail.com

Kennesaw State UNIVERSITY™

Coles College of Business

Constructing Frugal Sales System for Small Enterprises

Research Paper

Volume 6, Issue 4, Month October 2014, ISSN 1936-0282

Olugbara, O. Oludayo
Department of Information Technology
Durban University of Technology
Durban, South Africa
oludayoo@dut.ac.za

Ndhlovu, B. Malese
Department of Information Technology
Durban University of Technology
Durban, South Africa
lesmotto@gmail.com

ABSTRACT

In the current study, the authors report on the application of the design science methodology to construct, utilize, and evaluate a frugal information system that uses mobile devices and *cloud* computing resources for documenting daily sales transactions of very small enterprises (VSEs). Small enterprises play significant roles in the socioeconomic landscape of a community by providing employment opportunities and contributing to the gross domestic product. However, VSEs have very little access to innovative information technologies that could help them manage their challenges that are restricting their effective growth, sustainability, and participation in a knowledge economy. The results of a field-evaluation experiment, involving 22 VSE entrepreneurs using a newly constructed system, *MobiSales*, disclosed that user behavior, which demonstrates confidence, excitement, enthusiasm, energy, and trust varied when employing a mobile electronic device for social interactions, as compared to using it for business transactions.

Keywords

Small Enterprises, Frugal IS, Mobile System.

INTRODUCTION

The South African national small business act (No. 26 of 2003) defines very small enterprises (VSEs) as formal, informal, non-registered and survivalist businesses classified as small, medium and micro

enterprises (SMMEs) that employ 20 or less employees (Government Gazette, 2003). In most cases, VSEs are independently owned by individuals and their close relatives, operating in an informal sector and not officially registered or recognized by legislation. The key characteristics of VSEs include the ability of VSE entrepreneurs to work as subcontractors for large enterprises, their ability to quickly adapt to changing market conditions and to work in marginalized settings that are not attractive to larger enterprises (Antlova, 2009). Small businesses take up a prominent portion of the enterprises in most countries with a low *per capita* income and contribute valuable products and services to their communities, as well as to the global trade industry at large (Allan, Annerar, Beck & Beveren, 2003; Weiner & Rumiany, 2007; Jagun, Heeks & Whalley, 2008; Laporte, Alexandre & Renault, 2008; Herrington, Kew, Kew & Monitor, 2010).

In the study at hand, the authors theorized that VSEs do not properly document their daily sales transactions using information communication technologies (ICTs), due to the lack of effective administrative systems and their capability to do so effectively. Documentation in this study refers to the act of good record keeping. Although ICT plays an important role in VSEs, they are often marginalized when it comes to accessing ICT services that could help them address the challenges prohibiting their effective growth, sustainability, and participation in a knowledge-based economy (Dagdilelis, Satratzemi & Evangelidis, 2003; Heeks, 2009).

Many VSEs are often unable to provide accurate business information as they are not formalized in terms of proper documentation of business transactions (Esselaar, Stork, Ndiwalana & Deen-Swarray, 2007). They are typically accustomed to *ad-hoc* paper documentation of their business transactions, which limits them from effective management of products and services. This *ad-hoc* paper documentation of VSE business transactions promotes huge setbacks, since this practice is prone to inaccuracies, inconsistencies, and loss of critical information (Mourao & Okada, 2010). The documentation of business transactions using ICT is essential for VSEs to ensure efficiency and rapid access to relevant information as well as to view, analyze, and manipulate sales data more effectively (Baudisch & Holz, 2010).

The proliferation of cell phones, of which the global *adoption rates* currently stand at around 87% of the developed countries and 79% of the developing countries of the world (Watson, Kunene & Islam, 2013) has provided a unique opportunity for VSEs to deliver value-added services using ICT. Previous research findings have shown that many small enterprises use cell phones to establish connections with customers as well as for other purposes, due to their high mobility and relatively low operating costs (Esselaar, Stork, Ndiwalana & Deen-Swarray, 2007; Kew & Herrington, 2009). Cell phones require virtually no training to operate, therefore they fit easily into low-literacy populations that have little or no access to personal computers and the Internet (Sinha, 2005). Despite many practical suggestions to promote the growth of small enterprises, academic research focusing on VSE operations is relatively scarce.

In the present study, keeping the shortfall of research findings in mind, the authors explored means as to how a frugal information system, called *MobiSales* (mobile sales), could help support documenting daily sales transactions of VSEs. A frugal information system, *MobiSales* is a mechanism that has been developed and deployed with minimal resources with the aim of meeting the preeminent goals of the clients (Watson, 2013; Watson, Kunene & Islam, 2013). Frugal information systems strive to meet the

following four information *drives*, which make them adequate for supporting the effective delivery of VSE services (Watson, 2013; Watson, Kunene & Islam, 2013):

- The drive to ubiquitously access information unrestricted by time and space (ubiquity).
- The drive to precisely identify the characteristics and locations of entities (uniqueness).
- The drive for information consistency (unison).
- The drive to overcome the friction of incompatibilities of information systems (universality).

LITERATURE OVERVIEW

The academic literature copiously outlines the various growth stages of small enterprises: inception, survival, expansion, growth, and maturity (Churchill & Lewis 1987; Scott & Bruce, 1987). ICT (information communication technology) and Global Entrepreneurship findings have exposed the failure of many small enterprises to progress beyond inception and survival stages because of various contributing factors (Kew & Herrington, 2009; Herrington, Kew, Kew & Monitor, 2010; Ping & Debin, 2010). Moreover, the performance of small enterprises is influenced by their ability to flexibly respond to customer demands and to produce innovative services (Laporte, Alexandre & Renault, 2008; Antlova, 2009; Wadood & Shamsuddin, 2012).

The management of VSE business processes tends to be informal, sporadic and often done in an *ad-hoc* way through rational activities of the enterprise owners. VSE owners seldom keep durable records of business transactions and habitually cannot distinguish between business and personal finances (Esselaar, Stork, Ndiwalana & Deen-Swarray, 2007; Prahalad & Hart, 2009; Heeks, 2009; Herrington, Kew, Kew & Monitor, 2010). The *ad-hoc* business practices adopted by VSEs often create huge gaps in the absence of evidence of financial documentation. Additionally, these business practices inherently cause great challenges regarding legislation and tax authorities and limit effective accumulation and dissemination of business information. It remains difficult for VSEs to seek financial support from suitable institutions (Giandon, Junior & Scheer, 2002; Parikh & Lazowska, 2006; Donner, 2007; Esselaar, Stork, Ndiwalana & Deen-Swarray, 2007; Antlova, 2009).

VSEs often have informal structures that force them to face a lot of difficulties regarding growth (Laporte, Alexandre & Renault, 2008; Wadood & Shamsuddin, 2012). They are faced with restricting registration policies, limited access to broader markets, isolation from other informal businesses, and a lack of institutional support, such as micro financing (Muto & Yamano, 2009). Furthermore, VSEs have a limited life expectancy and are often regarded as high concomitant risks because their growth is highly dependent on various contributing factors, such as human, financial, informational, and technological advancements (Ping & Debin, 2010). In several previous studies, barriers and drivers contributing to the successful adoption of ICTs among small enterprises have extensively been studied (Khazanchi, 2005; Kotelnikov, 2007; Arendt, 2008; Antlova, 2009; Kew & Herrington, 2009; Herrington, Kew, Kew, & Monitor, 2010; Olawale & Grawe, 2010). The mainstream of VSE entrepreneurs has a poor understanding of the intrinsic benefits that ICT could bring to their business endeavours; it can be ascribed to their limited access to innovative ICT resources, low ICT skills, and limited education (Dagdilelis, Satratzemi & Evangelidis, 2003; Sinha, 2005; Kotelnikov, 2007; Prahalad & Hart, 2009; Herrington, Kew, Kew, & Monitor, 2010).

The effective flow of business information using ICT is critical for VSEs to improve the delivery of services and products (Jagun, Heeks & Whalley, 2008). ICT can greatly contribute to shaping VSEs from survival enterprises to formalized enterprises that generate substantial revenues. In addition, accurate and timely information can lead to informed decision-making and improve the performance of small enterprises (Deakins, Logan & Steele, 2001). A VSE does not generally require a full-scale technology integration. Consequently, a VSE's key decision to adopt ICT is about how much it can improve its core business, as well as how the benefits outweigh the expenses (Kotelnikov, 2007). The expenditure of an ICT is permanently an important concern, particularly for VSEs that are in the inception and survival stages, since they are still establishing their grounds. They are habitually not willing to spend extra money on ICT, even if the nature of their enterprises requires a basic customer-management system.

In addition, VSEs need to adopt ICT as part of their core business strategy, regardless of issues that promote slow integration of ICT. However, they do not need to adopt ICT to the same level of sophistication as that for large enterprises (Kotelnikov, 2007). Given the diverse challenges facing small enterprises, it is not realistic to impose proprietary ICT on VSEs. Providing ICT for small enterprises requires a thorough understanding of the contexts in which they operate. ICT necessitates to be provided to VSEs in culturally sensitive, environmentally sustainable, and economically viable ways, while leveraging on their existing infrastructures, resources, and services (Prahalad & Hart, 2009). Frugal information systems come with intrinsic parsimony solutions to serve people in emerging economies, as well as in the universal shortage of resources (Watson, 2013). The foreseeable benefits of frugal information systems have motivated the authors to seek a technological solution for VSEs with the aim of improving their service competence.

METHODOLOGY

The discipline of *information systems* comprises behavioral science research (BSR) as well as design science research (DSR) – as complementary paradigms – with the intention of addressing the fundamental problems that face the productive application of information technology (Hevner & Chatterjee, 2010). BSR is concerned with underlying theories that provide insights and inform researchers about interactions among people, technology, and organizations. On the other hand, DSR addresses fundamental problems of people and organizations through the construction, utilization, and evaluation of artifacts, or systems, that provide the utility to transform an existing situation into a more preferred one (Hevner, March, Park & Ram, 2004; March & Storey, 2008; Venable, Pries-Heje, Bunker & Russo, 2011).

In the present research project, DSR methodology was applied to study how VSEs conduct their daily business transactions, as well as to construct, utilize, and evaluate the suitability of a frugal information system for documenting daily sales transactions of VSEs. The requirements of a typical frugal system were deduced from preliminary interactions with 22 existing VSEs located in Sekhukhune, in the Limpopo Province in South Africa as part of the SAP Rustica Project. The SAP Rustica project seeks solutions to the challenges experienced by rural entrepreneurs such as access to mainstream global supply chains and markets due to long distances, high transaction costs, low economies of scale, physical remoteness, and low economic activity densities (http://wiki.scn.sap.com/wiki/display/Research/Rustica). The preliminary interactions involved unstructured interviews, observation notes, and still photographs to capture the reality of VSE requirements, as well as to provide additional clarity on the dynamics of how VSEs provide services to their customers. The rationale for engaging in

VSEs is grounded upon the fact that the assumptions of the challenges of an enterprise cannot satisfactorily be made without considering the real internal and external factors influencing the nature of the enterprise. These internal and external factors can best be understood by productive engagement with the stakeholders involved.

THE DOCUMENTATION PROCESS

In the present study, the authors discuss seven main entities (objects) involved in a VSE business process, namely: *user, retailer, supplier, customer, logbook, stock,* and *catalogue*. The documentation process of VSEs began with the recording of the descriptions of daily sales, quantity and amounts of sales, type of payment (cash or credit), and date of sales – into a logbook – summarizing the daily sales transactions. The person who was responsible for managing the enterprise was the one allowed to record sales transactions in a logbook to control any fraudulent practices. Some VSEs indicated that they had sold items on credit to selected loyal customers, but non-loyalists and first-time buyers had to pay cash. In the case of credit transactions, customer identity, deposits made, credit payment, and payment due dates were captured in the logbook. Credit arrangements varied depending on customers' profiles and their personal relationships with the particular VSE's owner. For example, pensioners had a different payment due date and credit limits were different for teachers, mine workers, and middle-aged customers.

The logbook was checked for specific due dates that credit payments had to be made and calls were made to customers reminding them to settle their debts. If owing customers did not pay their debts within a specific period of time, their credit benefits were revoked. The VSEs were of the opinion that credit arrangements were a good strategy to attract and retain a strong customer base – it reflected the mutual trust between VSEs and their customers. The customers, retailers, and suppliers participating in the VSE transaction-documentation process could be labelled as mobile users or simply as users. User (object) management allowed customers, retailers, and suppliers to be registered for access to a VSE's service, update user data (identification number, name, and physical address), description of business, home location, and user category – which could be a customer, retailer, or supplier – or remove a user from the registration list.

The retailers were VSE entrepreneurs who transacted business with customers and suppliers, therefore they needed to effectively reach their customers without any barrier. The retailer (object) allowed VSEs to receive orders from their suppliers and to deliver items to their customers and to implement an operation that customers could use to order items. Additionally, the suppliers were the wholesalers who supplied orders to VSEs; they could therefore receive information regarding orders made by their VSEs and respond to it. The supplier (object) allowed the suppliers to reply to the orders made by the VSEs, issue invoices, and deliver orders to their VSEs. The customer object allowed the preference ratings of items bought by a customer to be collected in order to build a user profile, which were four-dimensional ratings of previous items the customer had bought. The dimensions were based on the proximity of a customer to a selected item, the price of the item, and relevance of the item to the customer – 'query and bait' information (Olugbara, Ojo & Mphahlele, 2010). Finally, the customer object implemented two operations that allowed VSEs to track their customers by their home address and to notify them about sales information through text messages (SMSs).

The stock object allowed the VSEs to check stock levels, reconciled sales with the available stock items, and could be alerted whenever the quantity of a stock item had dropped to a predefined threshold. In addition, the stock object implemented an image-content-recommendation algorithm in order to generate

item recommendations for mobile customers. The inputs to the recommendation algorithm are image content and user preference information (Olugbara, Ojo & Mphahlele, 2010). This encouraged the usage of the system by mobile customers, as it eliminated ambiguities, inconvenience, and the reluctance of querying – because of spelling errors or sentence construction-related problems. The attributes of the stock object followed an item-representation model (Olugbara, Ojo & Mphahlele, 2010). The catalogue object managed stock items and allowed VSEs to add, view, update, or remove items from the stock accordingly. In addition, the catalogue object kept information on the quantity of items that had been stocked on a specific date, in order to provide efficient means of reconciling sales.

Figure 1 reveals a structural model of the documentation processes of VSEs, showing object interfaces and semantic associations.
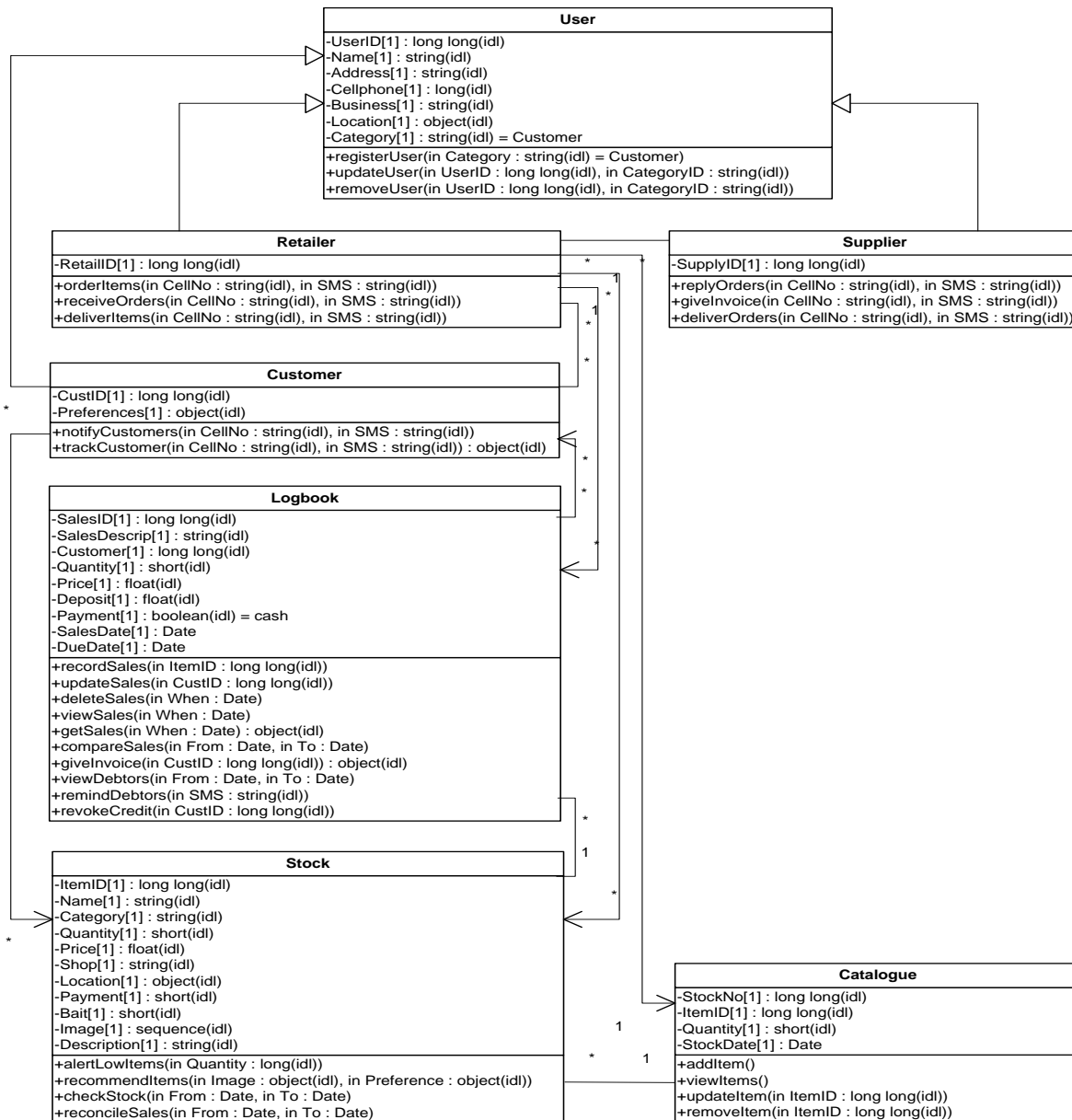

FIGURE 1: Structural model of the documentation process of VSE transactions

SYSTEM IMPLEMENTATION

The implementation of *MobiSales* follows a client-and-server architectural design and the system is deployed in a cloud environment. Mobile cloud computing helps to address inherent problems of mobile computing, such as resource scarcity, frequent disconnection, and mobility by executing mobile systems on provider's resources external to the mobile device (Fernando, Loke & Rahayu, 2013). Cloud computing has been defined as the aggregation of computing as a utility and software as a service where the applications are delivered as services over the Internet and the hardware and systems software in data centers provide those services (Fernando, Loke & Rahayu, 2013).

The *MobiSales* back-end is hosted on Glassfish using CouchDB database. The *CouchDB* is a non-structured query language (SQL) document-oriented database schema that functions well for distributed architectures. In contrast to relational databases, *CouchDB* does not store data and relations between tables. Instead, the database is a collection of independent documents that allows the system to access multiple databases stored on the client and the server systems (Lennon, 2009; Cattell, 2011). One of the appealing features of *CouchDB* is the multi-master replication ability that uses multi-version concurrency control (MVCC) to avoid locking the database file during write-up (Cattell, 2011). The server system hosts all resources for capturing, retrieving, and analyzing data between the mobile client and the server system.

The mechanism for sending and receiving data from the server is handled through the JavaScript-object notation (JSON), which the *CouchDB* engages to store data. The data documents are stored as JSON, which is an open standard-format that uses the *restful* hypertext transfer protocol (HTTP) to transmit the data objects consisting of attributes – the value pairs. The client using a cell phone will only need to make an HTTP request to the server, which will then promptly respond with query results, without invoking any other services. The representational state transfer-based (REST) services can be accessed from the system by creating a REST HTTP call – that is specific to the required service.

However, only REST services have 'read and write' admission to the database. Hereafter, the system makes a call to a REST service to achieve a certain functionality, such as reading or writing to a database as required and return a response message. The request and response strings are in JSON human-readable text; this makes the system lightweight since it consumes minimal resources, which is a good feature of a frugal information system. The system handles text in JSON format and attaches item images when requested by the cataloguer. This process helps to avoid the possibility of incorporating a substantial component in order to effortlessly render services and transactions from a cell phone.

EVALUATION PROCEDURE

The DSR evaluation process mainly focuses on system validity towards changing the user needs to preferred states. *MobiSales* can be deemed inappropriate when it does not present any real value to VSEs. However, DSR involves an interactive process that allows for user feedback and system refinement in order to assist in improving the design quality (Hevner, March, Park & Ram, 2004; Peffers, Tuunanen, Rothenberger & Chatterjee, 2007; Venable, Pries-Heje, Bunker & Russo, 2011; Helfert & Donnellan, 2012). Additionally, *MobiSales* can be regarded as complete and effective when it satisfies the intended requirements within the constraints of the problem being solved. The DSR evaluation process has two forms: a *naturalist* and an *artificial* setting evaluation:

An *artificial evaluation* is contrived in a non-realistic setting and uses methods such as laboratory experiments and simulations (Pries-Heje, Baskerville & Venable, 2008). A *laboratory evaluation* allows for more control over the testing procedure and lowers the costs of experimentation. However, it lacks the realism of user interaction since it does not simulate the real context of users and lacks the desired ecological validity of user settings (Kaikkonen, Kallio, Kekäläinen, Kankainen & Cankar, 2005). *Naturalistic evaluation* involves observing the system's performance in a real custom environment and it engages the actual users in identifying real-system problems.

In addition, the reviewed literature posits system evaluation from *ex-ante* and *ex-post* perspectives. *Ex-ante* systems are evaluated *before* they are implemented. However, systems that follow the *ex-post* perspective are evaluated *after* implementation (Pries-Heje, Baskerville & Venable, 2008). The evaluation of *MobiSales* follows an *ex post* naturalist pattern, using DSR to explore how VSEs would react to the system in a more natural context (Hevner, March, Park & Ram, 2004; Kaikkonen, Kallio, Kekäläinen, Kankainen & Cankar, 2005; Nielsen, Overgaard, Pedersen, Stage & Stenild, 2006; Pries-Heje, Baskerville & Venable, 2008; Helfert & Donnellan, 2012).

Taking all the arguments discussed above into consideration, *MobiSales* was evaluated by observing its *actual operation* in a field experiment. This approach allowed for the acceptance of all the complexities of human behavior in real life against the specified evaluation methods and realistic expectations (Pries-Heje, Baskerville & Venable, 2008). The choice of the right evaluation method was critical for research of this nature and was influenced by the fact that the users came from varied contextual backgrounds. That made it imperative to establish the validity of the evaluation in user context (Henderson, Podd, Smith & Varela-Alvarez, 1995; Cleven, Gubler & Huner, 2009).

Evaluation Constructs

The evaluation of the performance of *MobiSales* is based on the two constructs 'interaction' and 'usability.' Table 1 displays these constructs with their corresponding conceptual measures and associated descriptions. Interaction is here defined as *how* evaluators and systems operate cooperatively, taking into account that devices in a ubiquitous computing environment can be more dynamic than static (Scholtz & Consolvo, 2004). The applicability of the system focuses on the overall user's experience during interactions.

TABLE 1: Evaluation constructs of interaction and usability

Construct	Measure	Description
Interaction	Feasibility	Demonstrates that a process can be followed by simply applying the process (Borek, Helfert, Woodall & Parlikad, 2012).
	Task Fitness	Features that provide support to fit the requirements of a task (Goodhue & Thomson, 1995; Larsen, Sorebo & Sorebo, 2009).
	Feedback	System generated notification given to the user as confirmation or notification after completion of a request or routine task (Godbole & Smari, 2006).
	Performance	Measured in terms of user interaction, with feedback for the user (Scholtz & Consolvo, 2004).
Usability	Simplicity	Ease of use and controls over the user interface of the system (Zhang & Adipat, 2005).
	Perceived ease of use	A combination of attributes that provides the greatest satisfaction to a specified user (Davis, 1989; Bevan, 1995).
	Overall user satisfaction	The extent to which the system achieves efficiency and satisfaction of the users doing the specified task (Bevan, 1995).

Evaluation System

The *MobiSales* system uses an Android dashboard-design pattern (Fulcher, Nesladek, and Palmer & Robertson, 2011) to provide simple and easily accessible system workflows. Figure 2 demonstrates sample screenshots of the projected VSE services on cell phones. The first screenshot (Figure 2) displays the view of *Sunlight soap* (stock item 51) with its description: *dishwasher liquid* and *price* R21-99. The second screenshot (Figure 2) demonstrates a list of *four* debtors and the amounts they owned.
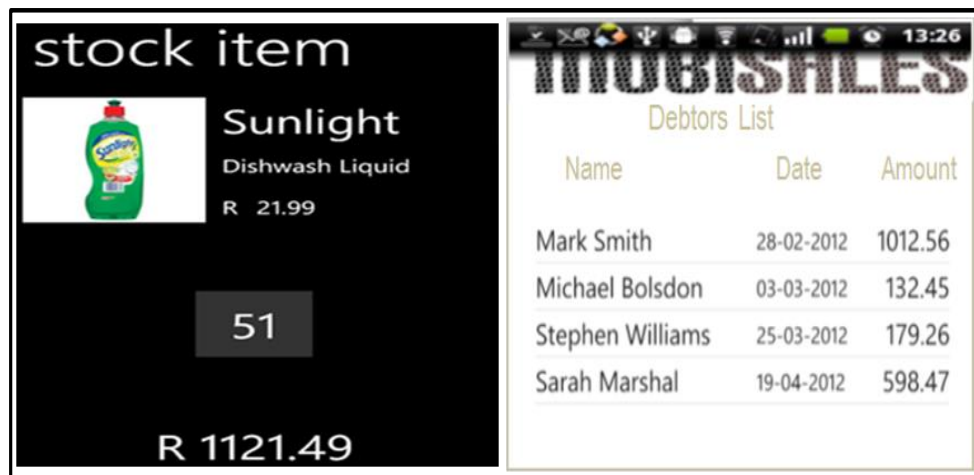

FIGURE 2: Example of an output generated by *MobiSales*

The system requests input from a user to commit a sales transaction. It prompts the user to observe an action that it is about to be performed and notifies the user if an error occurs. The system uses basic confirmatory messages, such as 'OK' or 'Cancel' – shown in Figure 3 – to permit the user to successfully complete a specific transaction and then to promptly exit.

FIGURE 3: Committing sale transactions is guided by confirmatory messages

System Evaluators

In the study at hand, the number of system evaluators was limited to 22, as hosting the system in the 'cloud' had a cost implication. The 22 evaluators used the system on Android-based cell phones with preloaded data bundles. Table 2 reveals the distribution of the system evaluators, who were all VSE entrepreneurs from rural and urban communities in South Africa.

The system evaluators were trained to acquaint themselves with the basic functions of the system. They were specifically instructed to perform the following basic tasks:

- *'Record a new sales transaction using a logbook'*
- *'View a list of debtors using a logbook'*
- *'Use a catalogue's operation to add items to the stock'*
- *'Register new customers using a customer's operation'*

TABLE 2: Distribution of the evaluators' residency

No. of VSEs	Area of residency
8	Rustic Living Lab Sekhukhune, Limpopo Province
6	Spruitview, Gauteng Province
3	Roodepoort, Gauteng Province
5	Kopela Community, North-West Province

RESEARCH FINDINGS

The findings of the current research project are based on a *quantitative evaluation* of a mobile (cell phone) user's interaction with the *MobiSales* system and a *qualitative evaluation* of the system's feasibility, after user's interaction with the system.

INTERACTION RESULTS

The system's interaction-evaluation was aimed at exploring the extent to which the *MobiSales* system provided the required abilities for users to successfully complete intended sales transactions. The *MobiSales* system was considered interactive (providing feedbacks to users), feasible, and fit to replicate the existing VSE business processes. The data were generated from a file server and then exported to Google analytics to test the performance of the system in terms of its ability to manage users, devices, and response times per transaction.

Screen Resolution	Sessions	Mobile Input Selector	Sessions	Mobile Device Branding	Sessions
480x800	19	touchscreen	22	LG	20
540x960	3		view full report	Samsung	2
	view full report				view full report

FIGURE 4: Overview of *MobiSales* devices applied

Figure 4 exposes the number of sessions spent by the system's evaluators and the test devices that were used. Nineteen of the system evaluators used *LG Optimus* models *L9* and *L7* cell phone devices to access the *MobiSales* services and the other three used *Samsung Galaxy II* smart phones with touch screen input features. The mobile device branding reports show the brand of the test devices and the number of sessions created by accessing *MobiSales* from the respective devices (Figure 4). The user preferences of each device varied based on the device familiarity and the device logic for VSEs. It was not necessarily based on the appearance of *MobiSales* logos on the devices. The system was not differently customized for each device as all the test devices were Android-driven cell phones.
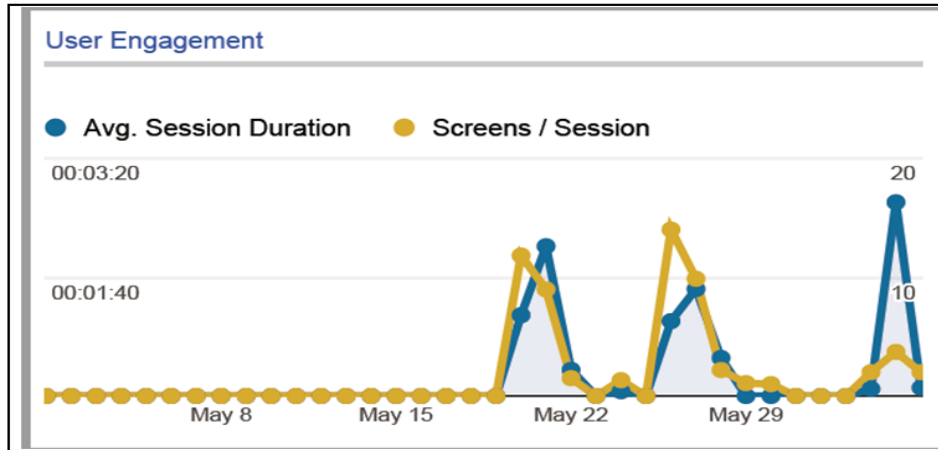
FIGURE 5: *MobiSales* user engagement – session overview

Figure 5 provides an indication of the recorded sessions for a file, based on the testing and distribution of the physical location of each VSE over a period of one month, as well as the average time per VSE session occupying the system. The sessions for each VSE varied by the type of activity performed at a given time. Each system operation, such as registering customers or viewing stock could be performed individually and the system would close the session once the task had been completed. The graph also displays the average access times for each session – the longest was 3 minutes and 20 seconds.

It can further be noted that some activities involved merely a single touch of the keypad. The complexity of the transaction would then be determined at the end of the action. In such an instance, the user was provided with a simple notification when the task was completed. A separate log file was used to provide full descriptions of a user transaction and the related system activities in the activity log file. Figure 5 provides proof that the system was efficient in assisting VSEs to perform their daily sales transactions much faster.
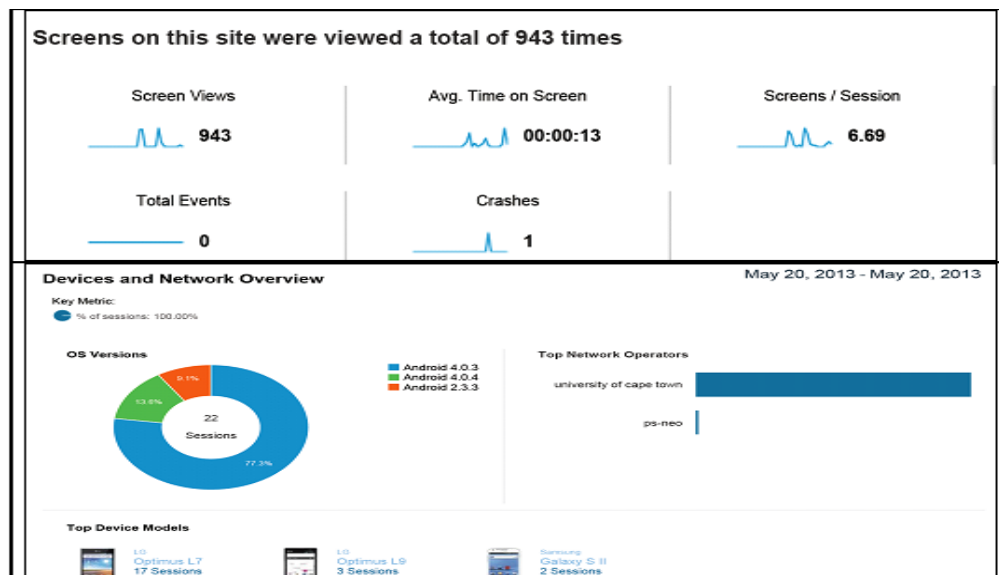

FIGURE 6: *MobiSales* device, operating system and network overview

Figure 6 shows an overview of the functioning of the test devices, the mobile operating system and the computing network – also showing a recorded system failure ('crash'). The average recording time by using the *MobiSales* system was 6.9 seconds. Figure 6 also incorporates different transactions, including administrator simulations of a transaction to verify the stability of *MobiSales* system. The device and network data provide a description of the test devices used in the evaluation and the operating system platform for each device. The *LG Optimus* test device was used by *seventeen* system evaluators based on the simple features of the cell phones. Most of the system evaluators felt it was easy to complete their intended transactions using these devices – familiar to most of the system evaluators using the basic features of cell phones. The *LG Optimus* test devices generated three sessions for three system evaluators and the *Samsung Galaxy II* test devices generated two sessions involving two system evaluators in the Gauteng province.

FIGURE 7: *MobiSales'* activity log overview

In Figure 7, the performance of *MobiSales* is shown for managing transactions, as well as the responses per activity log. The system response time (expressed as milliseconds per transaction) varied, depending on the nature of the task performed and the network connections. The *activity log* displays the description of a typical transaction, time elapsed per transaction, and transaction date. A *log file* is a system performance file that records each activity performed by *MobiSales*, including user activities and system-generated operations. The *log viewer* is updated instantly at each occurrence and it lists all transactions related to the system's activities. This is a basic security feature that provides the possibility to trace transactions for each VSE. It can also reflect any unauthorized actions on the system. This feature is essential, mainly for the administrator to verify the system's performance when responding to requests. The *log level* describes the category of the log, in order to reflect when the system operates normally, or it will report any unauthorized operation. The *message entry* provides full descriptions of the nature of the transactions performed on the system. The *logger tab* shows the details of the rest of the requests. The *time stamp* tab displays the time and activity that has been performed by the system.

Furthermore, the purpose of Figure 7 is to show the time it took to perform an average task on the system in the '*cloud.*' Ideally, most transactions were completed in a few milliseconds – as shown in the figure on the log viewer – providing the most convenient system response to a user's request. In an operational mobile-computing environment, the system would be deemed ineffective if it took longer than one second to complete a user transaction and to provide the system-generated responses. Despite the relatively limited network coverage in rural areas, the system performed at its peak speed between 0.165 and 0.175 milliseconds to complete a transaction.

FEASIBILITY RESULTS

During the informal discussions, system evaluators were asked to express their opinions on *simplicity*, perceived *ease of use,* and *overall satisfaction* with *MobiSales*. Most of the system evaluators responded that *MobiSales* was generally simple, easy to use, user friendly, and functional for the management of VSEs, despite some difficulties experienced in using the system, such as system imperfections (bugs) and time taken for item images to load. One VSE evaluator indicated some reservations, since it was his first time using *MobiSales. "The system seems somewhat easy to use, but not very easy. I would feel more confident using it over time,"* he said. Another VSE owner indicated that – although he used a cell phone – he would not consider himself as '*an active cell phone user'* and therefore, the system would not be very useful, despite its attractive functions. In addition, the same evaluator mentioned that he would prefer to use the system to advertise and promote special sales of his business. The customer function was perceived to be more useful for regularly contacting customers. One owner said, if a customer requests an item that was not available in the stock, he would order the item immediately and use the system to contact the customer, whenever the item was available. He would also make arrangements to deliver the item at the customer's address, to ensure meeting the objective of the transaction.

Generally, the system evaluators indicated that it would not be easy to use the system at peak times, such as weekends, as it takes time to attend to customers. They were concerned that their customers might get anxious and leave. The majority of the system evaluators indicated that the system made it easy to complete various activities on different screens. More importantly, the terminologies used by the system were experienced as simple and appropriate for the basic languages used in the VSE domain. Many VSEs served their customers in their own languages, but they possessed over the basic literacy skills that enabled them to accept *MobiSales* in the English language. Many older VSE owners, from rural communities, were somewhat familiar with the item descriptions in English, but not the basic terminologies *per se*, as they had had very little education. However, because the system terminologies were restricted to the main functionalities of VSEs, they could follow the various system operations reasonably.

On the other hand, some of the system evaluators indicated that technology is not their kind of '*toys*' and they would rather prefer to keep using their existing processes to manage their business transactions. The system evaluators generally expressed their satisfaction with *MobiSales*, however, some indicated they would not be able to provide their overall satisfaction until they were familiar with using the system. Five evaluators found the '*catalogue'* function useful, but mentioned that they bought their supplies in bulk and had a lot of stock on hand. Their stock items were moving steadily and they did not have the opportunity to see some of the notification prompts on low stock levels. They therefore suggested that some of the functions should be simulated to demonstrate how to use them in their VSEs.

The system's evaluators enjoyed capturing item images through the cell phone's camera, selecting the items from the preloaded catalogue and adjusting the quantity of every stock item. There were two system evaluators who were not enthusiastic about the *MobiSales* concept and requested more time to interact with the system before they could give their opinions. They said they would be more convinced about the system once they had '*wrapped a finger around the concept.*'

Furthermore, the system evaluators believed that *MobiSales* was useful and would benefit them to manage their business transactions more efficiently, as expressed by the following quotes:

"The system could help to promote my business, especially promoting specials in the shop by sending my customers an SMS to inform them about specials and discounts. It can also help me to figure out the buying trends of each customer." Mr. Ben Manguwana, Spruitview, Gauteng.

"I never imagined using my cell phone beyond SMSs and phone calls. At most I heard my kids talk about the Internet, but that is something I thought was beyond my generation. Now I can run my business from my cell phone." Mr. Peter Mabuza, Sekhukhune, Limpopo.

The feedback on the system's feasibility generally elicited mixed reactions in terms of the overall user experience. The following factors could have influenced the results of the study: Some of the VSE evaluators – with large customer bases – expressed their intention to use *MobiSales* on *tablet* devices. They indicated that *tablet* devices are better alternatives to cell phones because of their overall convenience. Moreover, they felt that the time taken to get a response from the system should be fast enough, as they became anxious – and assumed they had selected the wrong operation – due to the delays in getting rapid responses from the *MobiSales* system.

DISCUSSION

From a research point of view, the investigation and the field-evaluation experiment done in the current study showed some intriguing and unexpected behavioral aspects that exposed direct links between the *design science research* (DSR) and *behavioral science research* (BSR). One key concern – identified by the research on the *MobiSales* system's feasibility – relates to user confidence, which was directly related to the information communication technology (ICT) skills of the system evaluators. Many of the system evaluators were able to use cell phones only for making calls and sending and receiving text messages, but they were not familiar with using cell phones for business transactions. The novelty of the system may also have contributed to their feeling of inadequacy. *MobiSales* intimidated some system evaluators – they felt they needed more training before feeling confident enough to apply the system.

Moreover, certain system evaluators were concerned that they might 'damage the system' and rather preferred to continue with the manual way of recording their business transactions. It was evident that the levels of confidence, excitement, enthusiasm, and energy of the system evaluators varied significantly when using cell phones for social interactions as compared to using them for business transactions.

However, some system evaluators were quite excited to access Internet services – such as social media on their cell phones – but enthusiasm was soon replaced by anxiety when they applied business services on the very same cell phones. In order to increase the usability of a novel system, it is particularly germane to train the users and to increase their levels of confidence (Satzinger, Jackson & Burd, 2000). User confidence, sometimes referred to as self-efficacy, highlights the attitudes or beliefs of someone's ability to accomplish a specific task (Compeau & Higgins, 1995). Some system evaluators who had not

been acquainted with any form of technological skills before were quite hesitant when introduced to *MobiSales*. They only agreed to give an attempt to access the system after they had developed some confidence and experienced more demonstrations during the training sessions. *MobiSales* is deemed fairly simple to use, but it took some stern efforts to give the system evaluators adequate training to understand the basic operations of the system.

A lack of *trust* is another prominent behavioral aspect that emanated from user interaction with *MobiSales*. Trust, in this context, can be described as a user's belief that the system will '*use*' the generated information and a user's personal information appropriately and not cause them any harm (Scholtz & Consolvo, 2004). Some system evaluators were concerned about the idea of their critical business information being hosted '*somewhere in the cloud*.' When they were probed, they responded: "*What will happen to my critical business information?*" and *"How can I be sure that my information will be safe?"* It was reiterated that, realistically, when using any hosted mobile service, it is necessary to have sufficient security measures to avoid unauthorized access to any user information. Furthermore, evaluators were assured that their information would not be disseminated to any third parties. The results of the present study generally demonstrate that a user-based system's evaluation can be meaningful for improving the system's performance and users' acceptance of information systems (Pries-Heje, Baskerville, & Venable, 2008).

In addition, *age* was identified as an additional and significant factor in the successful adoption of information systems. Some of the middle-aged and older system evaluators were quite certain that their own administrative practices were better than introducing information systems in their businesses. They indicated that they felt too old to learn new technologies. However, another captivating finding is that the older system evaluators from Spruitview (in the Gauteng province) were more enthusiastic to use *MobiSales*, which might possibly be a result of their prior experiences with new technologies. One younger system evaluator mentioned that *MobiSales* could support him in the capturing and tracking his sales of pre-paid airtime and electricity vouchers – which he normally sells through mobile banking. Others suggested that *MobiSales* could incorporate a small financial module to help them manage their cash flow.

CONFINES AND SUGGESTIONS

The current study's scope was confined to the documentation of daily sales transactions of some very small enterprises (VSEs). The field-evaluation experiment was conducted by engaging a number of 22 VSE operators. The research results can, therefore, not be generalized to larger enterprises and should be interpreted in the context of an exploratory academic study. It can subsequently be criticized as *'blue sky'* research. However, the implementation of a *MobiSales* system demonstrated the value of research in solving a real-life problem. The researchers are of the view that, had there been a bigger research budget, the findings may probably have exposed more and different dimensions of the topic of the current study.

However, the determinants of new technology adoption in which value trade-offs and behavioral aspects are prevalent: costs, quality, social and emotional investments (Davis, 1989; Turel, Serenko & Bontis, 2007; Bagozzi, 2007) were only succinctly highlighted and fall beyond the scope of the present project. In the research study, it was not the intention to comprehend *why* VSEs prefer *certain* ICTs for their businesses. Among the VSEs, these behavioral aspects became key factors influencing potential adoption of *MobiSales*.

It is recommended that further research inquiries be made to better understand the aspects of social and behavioral determinants influencing information-systems adoption among VSEs. In addition, in future research, it should be considered to highlight the human and organizational aspects of ICT-adoption among VSEs. The relationship between people and ICT is a continuing breeding-ground for information-systems research.

A deeper understanding of human behavior could assist by closely aligning technology with expectations, as well as to justify the behavioral aspects in exercising personal decisions to use technology (Bagozzi, Dholakia & Basuroy, 2003). The authors propose to incorporate more commanding (i.e. powerful) functions into *MobiSales*, such as a local language interface, mobile payment systems, and the use of ambient technology, i.e. near-field communication.

CONCLUSION

In the study at hand, design science research (DSR) methodology was applied to understand how very small enterprises (VSEs) manage their daily business transactions, as well as to construct, utilize, and evaluate the *MobiSales* system for supporting documentation of the daily sales transactions of VSEs. The *MobiSales* system was designed to develop a management system for VSEs, characterized by low costs and requiring both low education levels and few ICT skills.

The design of the *MobiSales* system is based on the simplification of VSE documentation processes. The research focus was on 22 existing VSE businesses. The *MobiSales* system supports the omnipresent access to VSE services and is a good example of a system designed with ubiquity as a central premise, since it piggybacks on the pervasiveness of mobile telephony and *cloud* computing technologies. The access to VSE services through *MobiSales* is unconstrained by time and place; the system is predominantly based on technologies of cell phones and *cloud* services. In addition, the abridged learning curve of cell phones makes it easy to accommodate the generally low literacy level of VSE users of the system.

The *MobiSales* system fulfills a unique effort, as it is capable of identifying individual users and the proximity from a cell phone – which are predefined by the system. It, therefore, meets numerous users' needs. The system identifies individual users, what information to accept or reject, and what requests to deny, as well as pre-defined information to give the users. The *MobiSales* system signifies a unison drive, since the system includes the metaphors and operations of the system – as well as stock information – represented by their respective labels and images. The metaphors, texts and images are comprehensive enough for VSE transactions, consistent, and easy to comprehend. The system only accepts inputs from authorized users and generates error messages if data elements are received in the wrong format. It also returns confirmatory messages for data successfully received in the correct format. There is no likelihood of conflicting information, as every system user is associated with a unique identity.

In addition, a local-level administrator is responsible for overseeing authorized users, ensuring data integrity. The *MobiSales* system is compatible with the basic features of cell phones available to VSEs who, naturally, also use SMS. The contents of each SMS message cover most of the required information within the limit of 160 characters per SMS. *MobiSales* is based on contextual-embedded technology that controls a standard platform, already owned by the systems' users. The system takes

advantage of low-cost data management procedures and it disseminates quality information in accordance with the individual users' preferences.

By using a universally available technology, *MobiSales* makes any VSE a potential user of the system. In addition, *cloud* technology shields VSE users from acquiring additional expensive resources, besides their cell phones, and therefore allowing every VSE user to access *cloud* resources as on-demand services.

REFERENCES

Allan, C., Annerar, J., Beck, E. & Beveren, J. (2003). A framework for the adoption of ICT and security technologies by SME'S. *The 16th Annual Conference of Small Enterprise Association of Australia and New Zealand*, Ballarat, 28.

Antlova, K. (2009). Motivation and barriers of ICT adoption in small and medium-sized enterprises. *E & M Ekonomie a Management,* 12, 140-155.

Arendt, L. (2008). Barriers to ICT adoption in SMEs: how to bridge the digital divide? *Journal of Systems and Information Technology,* 10, 93-108.

Bagozzi, R. P. (2007). The legacy of the technology acceptance model and a proposal for a paradigm shift. *Journal of the Association for Information Systems,* 8(4), 3.

Bagozzi, R. P., Dholakia, U. M. & Basuroy, S. (2003). How effortful decisions get enacted: the motivating role of decision processes, desires and anticipated emotions. *Journal of Behavioral Decision Making,* 16, 273-295.

Baudisch, P. & Holz, C. (2010). My new PC is a mobile phone. *XRDS: Crossroads, The ACM Magazine for Students,* 16, 36-41.

Bevan, N. (1995). Measuring usability as quality of use. *Software Quality Journal*, *4*(2), 115-130.

Borek, A., Helfert, M., Woodall, P. & Parlikad, A. K. (2012). Design and ealuation of management processes in IS: application of a process-based research approach. *Practical Aspects of Design Science*, 27-37.

Cattell, R. (2011). Scalable SQL and NoSQL data stores. *ACM SIGMOD Record,* 39: 12-27.

Churchill, N. C. & Lewis, V. L. (1987). The five stages of small business growth. *Long Range Planning,* 20, 30-50.

Cleven, A., Gubler, P. & Hüner, K. M. (2009). Design alternatives for the evaluation of design science research artefacts. *Proceedings of the 4th International Conference on Design Science Research in Information Systems and Technology*, ACM, 19.

Compeau, D. R. & Higgins, C. A. (1995). Computer self-efficacy: development of a measure and initial test. *MIS quarterly*, 189-211.

Dagdilelis, V., Satratzemi, M. & Evangelidis, G. (2003). Implementing a nationwide system for training very small enterprises for ICT innovation: The Greek case. *Educational Technology & Society,* 6(1): 26-31.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, 319-340.

Deakins, D., Logan, D. & Steele, L. (2001). The financial management of the small enterprise. *The Association of Chattered Certified Accountants Research Report.*

Donner, J. (2007). Research approaches to mobile use in the developing world: a review of the literature. *The Information Society,* 24(3), 140-159.

Esselaar, S., Stork, C., Ndiwalana, A. & Deen-Swarray, M. (2007). ICT usage and its impact on profitability of SMEs in 13 African countries. *Information Technologies & International Development,* 4(1): 87-100.

Fernando, N., Loke, S.W. & Rahayu, W. (2013). Mobile cloud computing: a survey. *Future Generation Computer Systems,* 29, 84–106.

Fulcher, R., Nesladek, C., Palmer, J. & Robertson, C. (2011). Android UI design patterns, available [online] at https://dl.google.com/googleio/2010/android-android-ui-design-patterns.pdf. Retrieved 22 January 2013.

Giandon, A. C., Junior, R. M. & Scheer, S. (2002). Implementing electronic document management system for a lean design process. *Proceedings of 10th Annual Conference of the International Group for Lean Construction. Porto Alegre, Rio Grande do Sul (RS), Brazil.*

Godbole, A. & Smari, W. W. A. (2006). Methodology and design process for system generated user interruption based on context, preferences, and situation awareness. *IEEE International Conference on Information Reuse and Integration*: *IEEE*, 608-616.

Goodhue, D. L. & Thompson, R. L. (1995). Task-technology fit and individual performance. *MIS quarterly*, 213-236.

Government Gazette. (2003). No. 26 of 2003: national small business amendment act 26, 2003. [Online]. Available at http://www.info.gov.za/view/DownloadFileAction?id=68002 (Accessed 2 January 2013).

Heeks, R. (2008). ICT4D 2.0: The next phase of applying ICT for international development. *Computer,* 41, 26-33.

Heeks, R. (2009). Emerging markets IT and the world's bottom billion. *Communications of the ACM,* 52(4): 22-24.

Helfert, M. & Donnellan, B. (2012). The case for design science utility - evaluation of design science artefacts within the IT capability maturity framework. *International workshop on IT Artefact Design & Workpractice Intervention, Barcelona.*

Henderson, R., Podd, J., Smith, M. & Varela-Alvarez, H. (1995). An examination of four user-based software evaluation methods. *Interacting with Computers,* 7, 412-432.

Herrington, M., Kew, J., Kew, P., & Monitor, G. E. (2010). Tracking entrepreneurship in South Africa: a GEM perspective. *Graduate School of Business*, University of Cape Town.

Hevner, A., Chatterjee, S. (2010). Design research in information systems: theory and practice, integrated series in information systems, 22. Springer, New York

Hevner, A. R., March, S. T., Park, J. & Ram, S. (2004). Design science in information systems research. *MIS quarterly,* 28, 75-105.

Jagun, A., Heeks, R. & Whalley, J. (2008). The impact of mobile telephony on developing country micro-enterprise: A Nigerian case study. *Information Technologies and International Development,* 4, 47-65.

Kaikkonen, A., Kallio, T., Kekäläinen, A., Kankainen, A. & Cankar, M. (2005). Usability testing of mobile applications: a comparison between laboratory and field testing. *Journal of Usability Studies,* 1, 4-16.

Kew, J. & Herrington, M. (2009). ICT & Entrepreneurship–SEDA report, available [online] http://www.gsb.uct.ac.za/files/SEDAICTReport2009.pdf, retrieved 2-01-2013.

Khazanchi, D. (2005). Information technology (IT) appropriateness: the contingency theory of fit and IT implementation in small and medium enterprises. *Journal of Computer Information Systems,* 45, 88-95.

Kotelnikov, V. (2007), Small and medium enterprises and ICT, United Nations Development Program-Asia Pacific Development Information Program. *Asian and Pacific Training Center for Information and Communication Technology for Development*, Bangkok.

Laporte, C. Y., Alexandre, S. & Renault, A. (2008). Developing international standards for very small enterprises. *Computer,* 41, 98-101.

Larsen, T. J., Sørebø, A. M. & Sørebø, Ø. (2009). The role of task-technology fit as users' motivation to continue information system use. *Computers in Human Behavior,* 25, 778-784.

Lennon, J. (2009). Introduction to couchdb. In *Beginning CouchDB* (3-9). Apress.

March, S. T. & Storey, V. C. (2008). Design science in the information systems discipline: an introduction to the special issue on design science research. *MIS quarterly,* 32, 725-730.

Muto, M. & Yamano, T. (2009). The impact of mobile phone coverage expansion on market participation: panel data evidence from Uganda. *World development,* 37, 1887-1896.

Nielsen, C. M., Overgaard, M., Pedersen, M. B., Stage, J. & Stenild, S. (2006). It's worth the hassle: the added value of evaluating the usability of mobile systems in the field. *Proceedings of the 4th Nordic conference on Human-computer interaction: changing roles, ACM*, 272-280.

Olawale, F. & Garwe, D. (2010). Obstacles to the growth of new SMEs in South Africa: A principal component analysis approach. *African Journal of Business Management,* 4(5): 729-738.

Olugbara, O.O., Ojo, S.O. & Mphahlele, M.I. (2010). Exploiting image content in location-based shopping recommender systems for mobile users. *International Journal of Information Technology and Decision Making (IJITDM),* World Scientific Publishing Company. 9(5), 759-778.

Parikh, T. & Lazowska, E. (2006). Designing an architecture for delivering mobile information services to the rural developing world. ACM, 791-800.

Peffers, K., Tuunanen, T., Rothenberger, M. A. & Chatterjee, S. (2007). A design science research methodology for information systems research. *Journal of Management Information Systems,* 24, 45-77.

Ping, Z., & Debin, T. (2010). A Study on the Growth Ability of the Small-Medium Enterprises Based on Fuzzy Comprehensive Evaluation. In *Management and Service Science (MASS), 2010 International Conference,* IEEE, 1-4..

Prahalad, C. K. & Hart, S. L. (2009). The fortune at the bottom of the pyramid. *Revista Eletrônica de Estratégia e Negócios,* 1, 1-23.

Pries-Heje, J., Baskerville, R. & Venable, J. (2008). Strategies for design science research evaluation. *In Proceedings of the 16th European Conference on Information Systems (ECIS),*(Galway, Ireland), 255-266.

Satzinger, J. W., Jackson, R. B. & Burd, S. D. (2000). Systems analysis and design in a changing world. *Thomson Learning*.

Scholtz, J. & Consolvo, S. (2004). Toward a framework for evaluating ubiquitous computing applications. *Pervasive Computing, IEEE,* 3, 82-88.

Scott, M. & Bruce, R. (1987). Five stages of growth in small business. *Long Range Planning,* 20, 45-52.

Sinha, C. (2005). Effect of mobile telephony on empowering rural communities in developing countries. *International Research Foundation for Development (IRFD) Conference on Digital Divide, Global Development and Information Society*. 4-8.

Turel, O., Serenko, A. & Bontis, N. (2007). User acceptance of wireless short messaging services: deconstructing perceived value. *Information & Management,* 44, 63-73.

Venable, J. R., Pries-Heje, J., Bunker, D. & Russo, N. L. (2011). Design and diffusion of systems for human benefit: toward more humanistic realisation of information systems in society. *Information Technology & People,* 24, 208-216.

Wadood, F. & Shamsuddin, A. (2012). Key factors enhancing innovativeness among VSMEs of Pakistan. *International Conference on Innovation Management and Technology Research (ICIMTR), 158-161.*

Watson, R.T. (2013). Africa's contributions to information systems. *The African Journal of Information Systems*:5(4), Article, 125-130.

Watsona, R.T., Kunene, K.N. & Islam, M.S. (2013). View from practice frugal information systems (IS). *Information Technology for Development*, Malacca, 19(2), 158–161.

Weiner, A. & Rumiany, D. (2007). A new logic of reducing the global digital divide in sub-Saharan Africa: from obstacles to opportunities. *ATDF Journal,* 4, 14-21.

Zhang, D. & Adipat, B. (2005). Challenges, methodologies, and issues in the usability testing of mobile applications. *International Journal of Human-Computer Interaction,* 18**,** 293-308.