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Mobile Technology for women entrepreneurs in Iringa, Tanzania: User requirements and architectural design

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Abstract- Mobile phone technology has increasingly been used as a tool for accessing market information in Sub-Saharan Africa. However little has been done in the development of mobile technology applications to improve women entrepreneurs’ empowerment and entrepreneurship. This study aimed to explore the user requirements needed to develop technological innovations for accessing market-related information. Our study employed a design science research (DSR) approach to identify obstacles that women entrepreneurs have when accessing market information in order to develop a suitable mobile application. Results indicate that ingredients and usefulness of products, weight, personal contact, and price information are key elements to incorporate into the technological solution. The significance of our work is evidenced in the development of technology innovations for empowering marginalized societal groups.

Keywords: Design Science Research, mobile technology, User requirements; architectural design; women entrepreneurs

I. INTRODUCTION
The rapid adoption of mobile phones and consequent development of mobile applications (mobile apps) have been changing the way entrepreneurs’ access market information [1]. Access to market information could represent an important asset, particularly to women entrepreneurs in making sound marketing decisions on their products [2]. Recently, mobile phones have become useful tools for obtaining market information on better prices, potential customers and the right distribution channel for the products [3].

Mobile phones enable women entrepreneurs to connect with potential customers and improve their income through expanded product sales. Mpongole, Usanga, and Tedre [4] and Tedesse and Bahiigwa [5] stated that, women enterprise that invested in mobile phone services can generate high revenue and increase consumer welfare by reducing price variation in different markets. Mobile phone usage can also reduce traveling time, allowing women entrepreneurs to concentrate on other activities in their life [4]. Similarly, mobile phones facilitate business networks increase, business publicity and advertisements of products [6]. Therefore, mobile phone usage has the potential to enhance sales, improve the quality of products through customer feedback and increase business networks from afar.

Despite the fact that mobile phones can facilitate the access to market information, little has been done to develop mobile technology solutions that are relevant and accessible to women entrepreneurs for this purpose. The development and impact of a mobile technology solution for accessing market information among women in Sub-Saharan Africa have not been widely studied and more so, in Tanzania, the mobile applications usage remains relatively unpopular. Most of the studies carried out in Sub-Saharan Africa focus on general access to ICT and its impact on the socio-economic well-being of women entrepreneurs [7]. However, women entrepreneurs lack sufficient access to market information about prices, competitors as well as support services and resources, information that they could leverage to be more successful [8]. Women entrepreneurs are relatively powerless in the public sphere where men are considered to be economic producers due to patriarchy ideology that gives more priority to masculine than feminine. Women entrepreneurs are at the bottom in terms of education, employment and economic status hence pose hurdle in business development.

Currently, the majority of users do use mobile phone mainly for maintaining relationships and family ties than for economic or business purposes [2, 4, 9]. Nevertheless, given the advantages that mobile technologies can bring forward, the development of mobile applications for accessing market information by women entrepreneurs cannot be ignored. This work presents the initial stages of a Design Science Research (DSR) study, i.e., problem definition and potential solution, that aims to assists women entrepreneurs’ business development in the Iringa region of Tanzania through the implementation and deployment of a mobile technology solution. Hence, the general objective of this study is to explore user requirements and suitable architectural design in order to develop an appropriate technological innovation for women entrepreneurs in Iringa, Tanzania. This technological innovation is to be deployed in the form of a mobile app to allow easy access to market
information and expansion of business networks. In particular, the study focuses on answering the followings research questions:

- **RQ1:** What are the key business information that needs to be included in the mobile app?
- **RQ2:** What kind of technology innovation implementation would simplify business information access to the end-users women entrepreneurs?

Our work contributes to the development of research components in technology projects of empowering women entrepreneurs and enabled to participate in business on equal footing as male entrepreneurs. In addition, our work contributes to the scanty literature available on the role of mobile technology application to improve businesses in emerging economies.

II. BACKGROUND PERSPECTIVES

Development of phone usage in Tanzania

Mobile and landline phone technology in Tanzania has enjoyed remarkable growth in terms of numbers of operators and subscribers over the past few years. According to the Tanzania Communication Regulatory Authority (TCRA), there are over 39 and half million of fixed landline and mobile cellular subscribers in Tanzania as of March 2016 [13]. This represents a sharp increase of over 10 million fixed and mobile phone subscribers compared to the figures in 2012. The increase in the number of mobile phone subscribers has been attributed to the spread of network coverage throughout the country, the awareness of society about the importance of mobile phone and the affordability of purchasing a mobile handset [13]. The number of telephone operators has also increased due to the converged licensing framework and good regulatory climate in the country, which has been attracting more investors into the market. Increased number of operators has further enhanced competition resulting in improvement of the quality of services as well as reduction of tariffs of postal articles [13].

The increase in the number of mobile subscribers indicates that more Tanzanians have access to mobile phones ownership, which represents an opportunity to support business activities through this technology.

Market Information

A market is defined as a set of actual and potential buyers of products who share particular needs or wants that can be satisfied through an exchange relationship [10]. Women entrepreneurs rely on market information in order to make a sound decision on what to produce and where to sell it [24]. A market information system consists of people, equipment and procedures to gather, sort, analyze, evaluate and distribute needed information timely and accurate to decision makers [11]. Market information entails distribution channels, payment requirements, packaging, potential customers, quality and whole host information needed by a producer to make effective sales. Therefore, market information could enable women entrepreneurs to make a rational decision with regards to the prices, where to distribute the products, and the quality of products demanded by the potential customers. Hence, market information is of paramount importance for entrepreneurs to improve their business sales and expand market size by identifying actual and potential buyers. Not surprisingly, lack of reliable market information has been highlighted as a cause of business failure, due to deficiency of reliable business intelligence regarding where to sell their products, for instance [2].

Mobile phone as a business tool

Recently there has been a high incursion of mobile phones applications to different business aspects. Mobile phone provides a conduit through which transactions can take place and there is no longer a need for physical presence. Kiba-Janiak [12], asserted that mobile phones are important for both producers and customers. Mobile technology alleviates the need for physical space trading as trading exchanges take place in a virtual market space created by mobile phone networks and a layer of application software [14]. The impact of digital technology from an economic perspective is the potential to reduce physical search costs when a buyer is looking for information about new products [1, 14]. Mobile phones could also be suitable as advertisement platforms for products by incorporating interactive features into the online communication through a mobile app [14]. Moreover, mobile phone usage facilitates new contacts with business partners, suppliers, and customers [9]. Therefore, we aim at developing a suitable mobile phone application that will enables women entrepreneurs to access market information timely and at their own pace; while at the same time, providing an outlet to advertise products and increase business networks. To the best of our knowledge, the existing mobile applications in Iringa, Tanzania does not focus on women entrepreneurs in food processing but on general agricultural products prices at the market. The development of mobile applications platform would enable to leverage and empower women entrepreneurs who are disadvantaged in the society to access market information due to socio-cultural hurdles. The mobile platform would enable to improve business of women entrepreneurs by accessing reliable market information and make sound decisions about where and what to sell. The features of products embedded into the mobile technology application may attract customers as they observe the ingredients and other important features of the products and invite friends. Promotion of commodities through mobile phone application is relatively cheaper and covers a wide range of area within a short time.

III. RESEARCH APPROACH

The study employs a DSR approach, which is a rigorous process of designing artifacts to solve problems, evaluating what was designed, or what is working, and communicating the results [15]. Sein, Henfridsson, Purao, Rossi and Lindgreen [16], defined DSR as the integration of action research and design science in a method that contributes to the construction of artifacts where development is dependent on the interaction of the participants of the research. DSR iterates the process of diagnosing, planning, action taking, evaluating and subsequent application of the knowledge elsewhere [17]. According to [15], the goal of DSR is to solve a problem that is found in a given community. It improves the world by developing and studying the impact of technological artifacts from different
perspectives [18]. Furthermore, DSR also aims to contribute both to the practical concerns of people in an immediate problem and the goals of social science by jointly collaborating with a mutually acceptable ethical framework [21]. In the context of our study, DSR approach consists of activities of making changes to women entrepreneurs’ development by transforming situations to achieve improvements in their business through the application of technology [15]. DSR projects start by creating awareness of the problem, then suggesting solutions, followed by developing the potential solutions to the problem and evaluating them. Finally, conclusions are drawn in researchers define which of the developments seem to produce optimal results to the problem [23].

This study presents the problem explication and plausible solutions through user requirement definition stages of DSR on the implementation of a mobile app to assist women entrepreneurs to access market information and build and expand their business network. Here we focus on problem clarifications and requirements definition in order to identify and represent opportunities and potential technological solution for the women entrepreneurs of the Iringa region in Tanzania [19]. The problem clarification involves identification of the issues experienced by women entrepreneurs when accessing market information. The requirements definition sketches possible artifacts that can address the problem.

The study uses a qualitative research design in order to explore in-depth business information that can be simplified by mobile technology application and suggests technological innovation in addressing the problem of accessing market information. The aim of collecting business information is to enable a mobile technology application developer to incorporate information according to the expectations of women entrepreneurs and their customers. The information forms the basis for the application designing and its user-friendly accessibility.

The field study was conducted in Iringa region, in the southern highland of Tanzania. Women entrepreneurs in food processing activities are at the core of this study because they lag behind in accessing market information for their business [2]. Qualitative data was collected through semi-structured interviews and exploratory focus group discussions to aid in defining the problem precisely [20]. Purposive sampling was used for selecting respondents from the target population of women entrepreneurs and customers. Primary and secondary data on women entrepreneurs’ business information that could be simplified by mobile phone application was collected and analyzed using content analysis. At this stage, a comprehensive understanding of the women entrepreneur’s vision, requirements, and ideal design essential for a successful solution was sought.

IV. RESULTS
The results of this study were derived from semi-structured interviews and exploratory focus group discussions. Thirty-three (33) respondents volunteered to participate during the data collection process. The majority of the participants were 35-44 years old (26 out of 33), had completed primary education (28 out of 33) and had six or more years of business experience (25 out of 33). This research aimed at defining the problems that face women entrepreneurs for accessing market information, in order to suggest a technological solution. Women entrepreneurs in Iringa tend to remain in their geographical location, which limits their ability to get market information. In order to access market information in a wide area, a technological application could represent a viable solution.

Requirements definition
RQ1: What key business information needs to be included in a mobile app?

The research set out to identify the information requirements that should be incorporated in the designed mobile technology application for accessing market information. The objective was to identify critical information that could be presented in a simplified manner through the mobile app for the end-user women entrepreneurs and their customers. The results were as presented in the following subsections:

a) Product Information: ingredients, usefulness of products to the health of consumers, weight, and product stock amount. Concerning ingredients, the respondents stated that a product should indicate what is included during the processing and packaging stage. Usefulness of product is of paramount importance to indicate the product benefits, for instance, “garlic paste reduces high blood pressure”, etc. In addition, product weight and stock amount information enables the customer to decide whether to buy in bulk or not depending on their financial capacity. Product information highlights the features of the product in order to attract customers.

b) Product display: price, picture, seller and client personal contact. The price information shows the worth of the product, while the picture shows the outlook of the product. The seller and client personal contact serve as a communication means outside the mobile app to process the order and to deliver the product.

This information types were deemed relevant by the interviewed women entrepreneurs in order to “attract and provide detailed information to customers about products that are available from different producers”.

We also looked into identifying the kind of market-related communication that the women entrepreneurs expected to carry out with their customers through the proposed mobile app solution. Our study found that women entrepreneurs expect to receive orders from customers and make arrangements for product delivery. Furthermore, a customer feedback channel should also be available in order to monitor the customers’ satisfaction with their products either positively or negatively in terms of price, taste, packaging and quality.

The study also identified a need to enable customers who are illiterate to access product description. Based on this, the application design also included accessible voice icons on
which recorded short descriptions of the products could be uploaded. The application development took in this manner an inclusive approach in order to take aboard the needs of those who are illiterate in the market.

Ideal mobile application

RQ2: What kind of technology innovation implementation would simplify business information access to the end-users women entrepreneurs?

User requirements were put forward by women entrepreneurs and customers on the ‘ideal’ technology innovation implementation. A prototype was drawn to aid in designing the user interface based on a user-centered experience. Visual diagrams were used for representing and designing the system and database architectures using Unified Modeling Language (UML). UML describes data structure of mobile applications for the selection of the best algorithm for processing data flow. We explored mobile technology application ideas alongside women entrepreneurs, as well as design ideas for accessing market information. This process enabled the identification of the content that should be included into the design of the mobile application. The mobile application was designed in the native and widely used Swahili language in order to be user-friendly to a large number of end-user women entrepreneurs and customers.

V. SYSTEM ARCHITECTURE DESIGN AND IMPLEMENTATION

Based on the end-users’ requirements, the system architecture was designed such that different end-users connect to internet cloud services, with their mobile devices acting as a cloud family for information exchange and data sharing. The application, which is hosted in the cloud, is created and designed using MySQL workbench. Through the mobile application front-end, women entrepreneurs and their clients (i.e., end-users) work together to conduct business, expand the electronic market, and share news and updates. All mobile phones are connected to the database services stored in a cloud server. This allows the easy access of data from every device that is internet enabled. During the demonstration phase of the application, women entrepreneurs would have phones which are internet enabled.

V. DISCUSSION

The research set out to find what business information would be included in a mobile technology application designed to assist in accessing market information. In
addition, the research sought to find what kind of technology innovation implementation would simplify business information. The results revealed that product information (ingredients of products, usefulness, and product stock amount) and product display (weight, seller personal contact, pictures of products, and prices) are the most relevant information to be included in the mobile technology solution. This information would play an important role in the customers’ decision-making about the products produced by women entrepreneurs, as to choose whether to buy or not. The technology solution is also meant to serve as a platform for advertisement and promotion, covering a wide network area. This mobile technology application has the potential to enhance the end-users’ market by attracting new customers and by improving business networks.

According to our findings, women entrepreneurs’ accessed market information when they visit exhibitions, where people from different parts of the country gather and the entrepreneurs have the opportunity to interact with them. Nevertheless, business exhibitions are organized only at certain intervals, for instance, the International Trade Fair is organized once a year, which implies that women entrepreneurs do not adequately visible as far as their products are concerned. Our field work showed that women accessed market information mainly while walking with their products, looking for customers. Women entrepreneurs walk with their products targeting crowded areas such as the vicinity of malls and market areas where there is a high possibility to meet many people. Availability of potential customers is the main consideration when selecting trading route [22]. We speculate that by having an appropriate platform to virtual networking and product display the finding of new customers could take less time and efforts.

Furthermore, the mobile platform will also allow direct communication between women entrepreneurs and customers for arranging orders and the subsequent physical delivery of products. It is expected that this type of mobile technology application would enable women entrepreneurs to make business at their own pace while maintaining other household responsibilities, as per societal structures in Tanzania. In this way, the technology could empower women who are shouldered with multiple responsibilities in the household by improving their business while maintaining the welfare of the family.

Our findings indicate that wider spread of mobile phone usage could enable women entrepreneurs to use a mobile phone as a business tool for the promotion and advertisement of their products. 29 (87.8%) respondents conceded that mobile phone usage improves business transactions, for instance by receiving an order from customers and sending money through M-PESA when ordering packaging materials. The presence of potential customers in a given market segment could alert the women entrepreneurs to produce more in order to meet the demand of the market and enable them to get reliable business intelligence regarding where to sell their products [2]. Mobile phones used as a business gadgets would facilitate business transactions hence motivate future mobile development projects in the business arena. During our preliminary deployment of the application, the participating women entrepreneurs perceived that the co-created mobile application in our study would be a solution to their business in accessing market information.

Challenges
Concerning the challenges that would affect the deployment and wide intake of the mobile application for accessing market information, we have identified several issues. First, the purchasing price of a mobile handset (smartphone) that supports the developed application poses an obstacle to women entrepreneurs. Nevertheless, the benefits outweigh challenges. The usage of smartphones for business is increasing, as it was revealed that 7(21.2%) of the women interviewed own smartphones with potential for business activity and many others were highly ambitious to use internet enabled phones to support their business activities. The number of telephone operators has increased, this implies high supply of mobile handsets to the community. Second, a challenge in smartphone usage was also raised by some women entrepreneurs. In our study, the majority 26(78.8%) of the participants used simple phones with no internet support. Nevertheless, we speculated that women entrepreneurs potentially have the skills to learn how to operate a smartphone with our developed application, since the application has been co-designed and co-created with them as end-users. The application has a simple user interface that is easy to operate and has been designed in the native language. Finally, poor coverage of cellular networks especially when the users are away from town center represented a challenge that would affect the mobile application effectiveness. However, the increase of cellular towers by telephone operators has great potential of eliminating cellular networks coverage issues because of high competition among service providers in order to increase the number of customers.

The designed and developed mobile technology app could enable the women entrepreneurs to access market information and assist them in making a sound decision about what and where to sell at a given time. Technology innovation implementation would simplify access to business information by women entrepreneurs at their own pace without physical travel to the market and hence reduce costs for the search of market information.

Future work
The study has focused on initial stages of a DSR project, i.e. problem identification, user requirement definition and design and development of a technological intervention [18]. Our next steps in the study will involve a detailed demonstration, evaluation, and re-design of the intervention according to the evaluation feedback [18]. Training workshops, field testing and evaluation meetings will be done in the deployment and evaluation stages of the project. Our DSR project is an ongoing venture in which women entrepreneurs are working with software engineers and researchers on co-creation activities in Iringa, Tanzania to
model on the mobile technology (smartphone) application for accessing market information. The future study will also explore the integration of bookkeeping through the proposed mobile application. In addition, it would be interesting to investigate the cultural aspect during the deployment of the technology.

VII. CONCLUSIONS

Mobile technology can play a significant role in business development if it is utilized effectively. Technology could improve business by simplifying business functions, for instance, to identify potential customers, reduce search costs, receive orders, transfer money and market the products. Our study emphasized the deployment of a DSR project to tackle real problems through a technology initiative in collaboration with societal structures to assist the business development of women entrepreneurs in Iringa, Tanzania.

Our study revealed that the high price of purchasing a smartphone, lack of experiences of using smartphones and poor cellular networks were the major challenges for women entrepreneurs in Iringa, Tanzania in accessing market information through mobile technology. However, the participants in our study perceived that the challenges could be balanced by the benefits that a mobile app solution could offer. This provided the basis of our DSR project for developing a mobile technology application for empowering women entrepreneurs. This has proved to be a pioneer study in Iringa, Tanzania that employs the design research science approach in solving challenges of accessing market information with technology application. The outcome of this project is envisaged to contribute to the development of technology in the field of entrepreneurship in particular for women who are less represented in the societal structure.

References