Research Paper Management Science

MICRO-ENTREPRENEURS MAY BENEFITS BY TECHNOLOGY FOR RURAL COMMUNITY

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ABSTRACT

ICT is used in rural area in developing countries are still end users are lacking in the knowledge of the potentials of these technologies. To enhance the usability and promote the acceptance of information technologies into their daily life, the medium of interaction should be able to meet the capabilities and cultural preferences of the target users. User interface design for products and services targeting rural users is a big challenge and requires adequate effort, proper understanding of the users and their socio-cultural environments. A study was conducted to design a mobile user interface for users in a rural community in South Africa. The aim of the study is to bring information technology services closer to the people and encourage micro-economic activities in the community. The objective is to design a user interface that will be easy to use and meet users' cultural preferences. We have applied user-centred design methods and collected both qualitative and quantitative data to guide the design process. This paper presents the design of a shop-owner user interface and a mobile commerce application to promote rural micro entrepreneurship and economic development. The evaluation of the user interface with the target users was conducted and the technology acceptance model was used to measure users' perception of the shop-owner user interface. The statistics analysis of the data shows that users perceive the application and interface as useful, easy to use and intend to use the system.

KEYWORDS | ICT, Micro- entrepreneurship, technology

1. INTRODUCTION

People in remote rural areas in developing countries are often faced with socioeconomic

challenges that seriously affect their living standards. Technology infrastructures and amenities are inadequate or not exist in these areas. The introduction of Information

technologies (e.g. mobile phone) in rural areas has created a positive impact. Technology has created small business opportunities for the people (e.g. the sale of prepay cards and mobile pay phone services).Rural communities are in no doubt without a lot of business potentials. They have economic potentials in farming and micro-business activities (e.g. art and craft and tourism). They need ICT (Information and Communication Technology) services in education, health care, tourism, micro-economic, farming, and government information and services for development. The objective of this study is to promote rural micro-entrepreneurship using a mobile commerce application as a platform for marketing locally produced goods in a rural community. To achieve this, we designed a mobile user interface for micro-entrepreneurs that is easy to use and culturally sensitive.ICT development in rural areas is faced with several challenges such as the remoteness of some communities, poor infrastructures, low literacy level, technology illiteracy, poverty and cultural barriers (Sood, 2002). Also, the poor usability of these technologies is another problem that hinders information technology use in rural communities User interfaces that do not meet their capabilities, needs and expectations will always be counterproductive (Lalji and Good, 2008).

The spread of mobile technology in rural communities is gradually narrowing down the digital gap and promoting information accessibility in rural areas. The mobile platform is a potential for socio-economic development in rural communities. Through usable interfaces, this potential can be harnessed for the benefit of the rural people. It is very important to consider the usability of such ICT products and services in rural areas, because their capabilities and expectations are different from users in commercial environments (Lalji and Good, 2008). Both the design process and the product should be able to accommodate the social and cultural context of the users. A usable interface is one that is intuitive, easy to use, and most importantly conforms to users' culture preferences and aesthetics Users differ in culture and preferences. These differences also influence the way technology is perceived and used in different regions and cultures The differences emanate from individual's socio- cultural context Knowledge and understanding of cultural background, values and perceptions of the target users will enhance interface design and

1.1 Background

Tribal rural community in Akole , District Ahmednagar , faced with numerous social and economic problems ranging from poor access roads to poor social infrastructural development. Poverty and low level of literacy are other challenges facing the inhabitants. The occupation in the area is mainly subsistence farming and micro-business activities such as crafting, forest based products like honey same herbs and processed vegetation used for medicinal use . They need corporate intervention, for the commercialisation of the activities

The facility provides Internet services to the community and also serves as a platform for design, testing and deployment of ICT related software projects with the aim of supporting the community with ICT services for social and economic improvement and better rural livelihood.

2. CULTURE USER INTERFACE DESIGN THEORIES

Research in user interface design supports the use of cultural elements and preferences to

improve usability. Culture sensitive user interface provide natural interactions, makes the users to have the feeling that the artefact belongs to them and also promote technology acceptance. There are several recommendations and guidelines for designing culture sensitive

interfaces studied different cultures and came to the conclu-

sion that every society can be identified by its culture dimensions. The dimensions being culturally inherent influence the way people interaction with one another, the environment and the way technology is perceived and used The culture dimensions include:

Power Distance (PDI) – refers to the level of social and economic inequalities that create

class differences in a society and the degree to which lower class citizens respond to the

leaders/authority or those in the upper class.

Collectivism vs. Individualism **(IND)** - individualism refers to a situation where a society lays more emphasis on individual life and responsibility to only oneself, while in collectivism

emphasis is on group existence and responsibility for one another as a collective unit, while

members in return remain loyal to the group.

Masculinity vs. Femininity (MASC) – in a masculinity society emphasis is on differences in

responsibilities or gender roles (different jobs or responsibilities for men and women),

aggressive behaviours are common in masculinity society. In a femininity society, division of

responsibilities is absent, roles overlap between genders.

Uncertainty Avoidance (UAV) – refers to the general belief system of the members of a

society, the extent in which people react or believe in what is unknown as against their

believe or reaction to what they know and can explain.

Long-term vs. Short-term orientation (LTO) – refers to peoples' perception of existence and the practical way of living in a society. Long-term emphasize virtue, dedication, patience,

perseverance, and good relationship in behaviours. While in short-term orientation, emphasis

is on the societal beliefs, truth, divine providence and easy success or miraculous achievements. The culture dimensions depict users' behaviours and culture preferences and can be mapped to user interface attributes and elements: appearance, metaphor, metal models,

interaction, and navigation (Marcus and Gould, 2000). It involves adaptation of the user

interface to a culture sensitive artefact for the target users. Several analyses of cross-cultural

user interface preferences in different cultures have been conducted using the culture

dimensions. The results show differences in preferences among users from one culture to

the other. These differences manifest through social behaviours, cultural backgrounds and educational levels. Culture preferences on the user interface are in the form of interface markers: metaphors, icons, text, colours, labels, images, dates, language, currency, and layout if culturally adapted to the culture of the target users. A culture sensitive user interface

enhance visualization, gives the users a natural sense of interactions and improves usability.

3. THE USER-CENTRED DESIGN PROCESS

Usability is a major requirement during software design. Several design approaches have

been proposed for usability design in human-computer interaction and user-centred design

. These design approaches specify methods and guidelines for successful user interface design Successful implementation of these design approaches has largely been in commercial environments where accessibility of the users is not in doubt and literacy level is equally high (Lalji and Good, 2008). Notable user interface design approaches include the Logical User Centred Interface Design and the scenario-based design approach. These design methodologies acknowledge the significance of iterative design process with the involvement of the users. The involvement of the users provides information of who the users are. The design is centred on the views or mental model of the users and provides empirical data that will ultimately shape the design to meet users' expectations and satisfaction . During design different methods or techniques are applied to gather user data: conducting observational or ethnographic study to identify how the users carry out their work activities in the work environment, analysis of the users tasks and goals, organizing focus groups with prospective users, conducting user evaluation of prototype through Wizard-of-Oz technique, think-aloud method, conducting post-test survey and interviews to collect evaluation data for analysis.

Software development in rural environments presents different demands and challenges. Apart from being costly, technology illiteracy and accessibility of the users to

participate in the design process are some of the hindrances . In order to successfully apply user-centred design approach and techniques in rural areas, adaptation will be necessary due to the peculiarities of these environments (Lalji and Good, 2008).

3.1 The User Interface Design Approach in a Rural Community.

In order to design the mobile user interface for micro-entrepreneurs in Tribal rural community in Akole , District Ahmednagar, we adopted user-centred design approach. The design processes and techniques were considered based on the characteristics of the users and the socio-cultural environment. The methods were adapted to enhance users' participation in the design process. The design approach is an iterative process with the following activities

§ *User and environment analysis* – a study to identify and understand the potential users, the social and cultural environment;

§ *Tasks analysis* – Analyze the users' tasks, goals and the system's functions;

§ *Scenarios design* – design scenarios of users' activities, information content, interface screens and users' interactions

§ *Prototyping* – develop prototype incrementally and evaluate with the users;

§ *Investigate Cultural issues* – analysis of cultural requirements for adaptation of the user

interface to a culture sensitive user interface;

§ *User evaluation* – evaluate the prototype with real users to determine their satisfaction or

otherwise;

4. METHODS

In order to design the mobile user interface for rural micro-entrepreneurs, we used both

qualitative and quantitative methods for data collection. The qualitative methods include site

visits, interviews, focus groups, audit of similar applications and the physical environment.

Stakeholders in the community include crafters and others (e.g. farmers, school learners,

educators, local clerks). The data collection methods are briefly described below.

4.1 Data Collection Methods

4.1.1 User and Environment Data Collection

§ Site visits and computer skills acquisition programme for members of the community.

Study of the business environment and constraints to identify area of needs for

application development.

§ Held focus groups to understand business activities and social life in the community.

Identified business areas for ICT interventions, learn methods of social and cultural

interactions.

§ Held focus groups to determine technology landscape and technology literacy

(Internet, computer literacy).

§ Conducted a survey to collect user data. The data required include the user profile,

technology and educational literacy (n = 120). The survey was also to provide data on

level of ICT awareness and use, mobile phones and level of familiarity with different

interactions.

§ Interviews with local micro-entrepreneurs (crafters) to collect data concerning their

products and also introduce our design intention and its benefits.

4.1.2 Task Analysis

§ Audit of e-commerce and mobile websites, study of tasks, information flow and

interactions. The information gathered includes tasks and goals, interactions, and

possible feedbacks from the system.

4.1.3 Interviews and focus groups with micro-entrepreneurs:

§ Focus groups were held with micro-entrepreneurs for evaluation of the first prototype

(scenarios design). Data were also collected for other crafted products for the system

database.

4.1.4 Prototyping and formative evaluation

§ Formative evaluation of the first concrete prototype, and obtained users' feedback for

prototype redesign.

4.1.5 Investigation of cultural issues for interface adaptation:

§ A survey to determine the culture dimensions of the target users using the Value

Survey Module

§ Interviews and focus groups were held with community members (n = 37) to collect

data concerning interface culture-components.

§ Audit of the environment for culture data collection, e.g. navigation signs, symbols,

artefacts, local tools, and artworks with meanings and are common to the people on

daily day basis.

4.1.6 Post-test interviews and survey:

§ Interviews and questionnaire were used to get feedbacks from participants after the

evaluation sessions. The TAM (technology acceptance model) was adopted for users'

post test data collection.

4.2 User and Environment Data Collection

In order to identify the user profile and the environment, different data collection methods

can be used to collect both quantitative and qualitative data. Site visits, interviews, focus

groups are common qualitative methods. Quantitative methods include survey and others.

A study was conducted to understand the users and the environment (e.g. the user

profile, social interactions, needs, available technology infrastructure to support the

application when implemented). Computer skills training programmes were also organized

for members of the community. A survey provided data on the demography of potential

users, technologies literacy and use, and educational literacy. Qualitative methods- interviews

and focus groups were used to understand business activities and social life in the

community. Focus groups were also used to educate the community on the benefits of ICT

and the proposed application. Data concerning micro-business activities in the community,

needs and constraints were also collected. The quantitative data were analyzed using

descriptive statistics method.

4.3 Collecting Data About Users' Tasks/Goals and Analysis
Different data collection methods are applicable for users' tasks identification and analysis.

These methods include observation of the users in their place of work, interviews, focus

groups, scenarios and other methods. Mobile commerce was identified as the application area

for micro-entrepreneurs in Tribal community due to resource availability. The availability of

mobile phones as the media for interaction and information accessibility will enable local

shop owners to have access to their online shops at anytime and anywhere. An audit of

existing e-commerce and mobile web applications was conducted to identify users' tasks,

goals, interactions and system functions. Tasks for a customer/ buyer, the local shop-owner

and the system functions were identified and analyzed. The potential shop-owners (e.g.

crafter) from the community have little or no knowledge and experience in e-commerce or in

any work practice in relation to the application area. An audit of similar applications to

identify and design the tasks without potential users' involvement remained the best

alternative. The tasks for the customer and the local shop-owner were analyzed and a

hierarchical tasks design was produced including a specification of the inputs/outputs

formats, system information feedbacks. Two separate sets of users' tasks/goals were

classified; one is a set of tasks the customer will perform to achieve the goal of purchasing an

item from the online shop and the other one is the set of tasks the shop-owners will perform

to achieve the goal of managing the online shop. Figure 1 illustrates the upper level tasks tree

for the shop-owner.

4.4 Scenario Design
In a rural community, it was necessary to apply prototyping methods that ease understanding

and improve participation. Different methods can be applied to engage the users during the

design process either for requirements elicitation or for evaluation purposes. Due to

constraints identified (section 1 and 3), scenarios design and evaluation was used as the

starting point for the system prototype. Scenarios are narratives or stories and very simple and easy to present orally contrary to complex tasks diagrams. In rural areas, oral form of communication (word of mouth) is very common and very easy to comprehend information too. We felt that presentation of users' tasks in the form of scenarios to people who are technologically illiterate would improve their participation, understanding and contributions. The scenarios were also a means to further elicit other artefacts data to be sold on the online shops The scenarios comprised of activities, information, and interface interactions as well as the screens and interface elements/attributes (menu, labels, icons, and layout). Scenarios present a simple prototype for users' evaluation and suggestions. The evaluation was through focus groups and the participants include crafters and other community members (e.g. educators, clerks). The process was successful and the participants understood the presentations and expressed happiness for the application. Few criticisms and contributions were received, participants were confident in making their contributions.

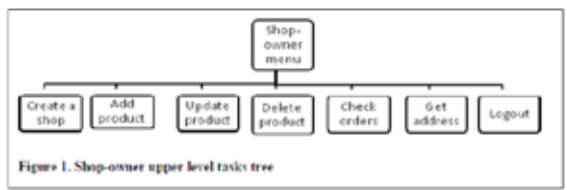

Figure 1. Shop-owner upper level tasks tree

4.5 Prototype
The tasks analysis and scenarios design provided the background and data needed to develop

a high-fidelity prototype. A literature survey of user interface design guidelines also provided useful information for the user interface design. Tangible prototypes or real programs usually motivate the users to participate better in subsequent interactions The prototype provides two separate user interfaces, one for the customers wishing to place an order in an online shop in the application and the other for the shop-owners to manage their online shops. The user interfaces are designed to display very well on mobile browsers. The system is designed with server-side and mobile technologies. The system functions were designed using server-side technologies- PHP and MYSQL relational database engine. XHTML-MP and WCSS scripting languages were used for the mobile user interfaces. Openwave phone simulator provided the platform for design and testing of the application. Wireless Abstraction Library (WALL) open source tool was also used to further adapt the application to suit mobile browsers using Wireless Markup Language (WML) or Compact HTML (cHTML). The prototype provides a platform for local micro-entrepreneurs (e.g. crafters,farmers) who may want to sell products or produce to buyers through the Internet. Crafted products from local crafters have been used as a starting point to design, evaluate and demonstrate the potentials of the prototype. The application provided room for addition of other products and online shops in the future. The prototype architecture is presented in Figure 2.

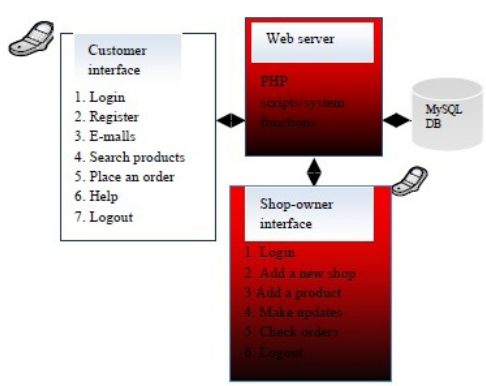

Figure 2. The Prototype Architecture
The customers' tasks include registering, browsing through the online shops and

products, picking products and placing order for items and other activities using the mobile

phone. The shop-owner is presented with a localized user interface for managing his/her

online shop. The shop-owner tasks include: creating a new online shop, add a product to the

online shop, update an existing item in the shop , remove a product from the shop, check for

any existing order made by a customer, and other tasks using the mobile phone . The

prototype has followed an iterative design process with each phase evaluated by the

participants from the community and then redesigned. Focus groups and interviews were the

method we adopted for each of the prototype evaluation session, although single participant

evaluations were also performed at some points. Figure 3 (a-d) presents screen shots of the

prototype, (a- displays the home page for the customer/buyer, b- crafted products presented

for sale in an online shop, c- displays menu showing available online shops, and d- presents a

localized shop-owner main menu).

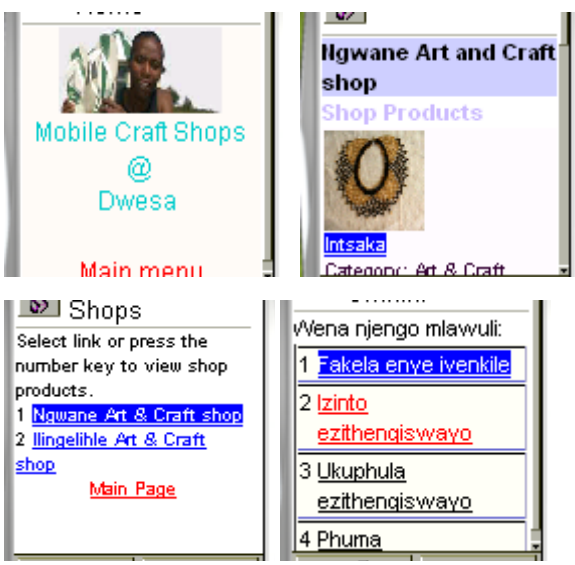

Figure 3. (a) The home page for the m-commerce application, (b) Product in an online shop, (c) Available online shops, (d) A shop-owner main menu.

4.6 Investigating the Culture for User Interface Adaptation

Adapting the shop-owner user interface to the culture needs and preferences of the target

users was very important for the shop-owner user design and use. To achieve this process,

different design and data collection methods were used. The data collection methods include

surveys, interviews and focus groups. A survey was conducted using the value survey module

to determine the culture dimensions of the target community. The data on culture dimensions provide a basis for determining possible users' preferences and cultural expectations. Qualitative data are also necessary to support the ratings on the culture dimensions. Hence, structured interviews were conducted to eliciting data on user interface cultural markers and cultural preferences with participants in the community. The prototype was also used as a tool for illustrations and as a means of clarification during enquiries and discussions. A survey was also conducted with post graduate students (culture experts) who are computer experts and share the same culture with the target users .Data on user interface culture components were elicited, translation was done and meaning given to the identified components in the local culture. An audit of the physical environment was conducted to identify cultural artefacts that are common within the community. The data elicited include cultural markers to represent metaphors, icons, navigations, and symbols/images. Data filtering and validation with cultural experts and community participants was necessary to pick the right ones to present on the interface. The shop-owner user interface was redesigned using the data collected and then evaluated with participants in the community.

4.7 Prototype Evaluation

There are different methods for evaluating a user interface prototype. These include expert

evaluation methods where heuristic methods are used to evaluate the interface against

existing design guidelines. Other methods include the use of think aloud protocol where the

users verbalize their thought processes while they are observed as they perform task on the

interface, and evaluation using the real users of the system. Any method that is chosen depends on the available resources and constraints.Engaging real users in evaluating a system is very common in software development. A pilot test was conducted at the early phase of the prototype to examine the shop owner user interface menu system, the look and feel, layout, the input/output format, size and positioning of elements on the screen and others. The evaluation of the localized shop-owner user interface was conducted through focus groups and single individual evaluations in the local environment where the application is intended to be use. a b c d

4.7.1 User Evaluation

User evaluation usually unfolds critical issues that may occur after the system have been

implementation. Novice users may sometimes uncover system problems that would have

been overlooked by expert evaluation. Two separate evaluations were conducted- the first was to test task performance time and error rate among the participants and the second was to find out participants' perception of the shop-owner interface and the application. For both experiments, each session starts with an introduction and then a demonstration of tasks on the interface. The participants were then allowed to perform tasks on the interface while we observed and recorded performance and outcome for each task. In the second experiment, participants were interviewed and then given a post-test survey to fill. The survey consists of the technology acceptance model (TAM) . TAM was adopted to evaluate participants' perception of the shop-owner interface. The model has been used previously to evaluate cultural preferences among users of globalised software also used TAM constructs to examine users' behaviour towards an e-commerce applica-

tion. used the model to examine clinicians' perception of a diabetic foot care system.

5. RESULTS AND DATA ANALYSIS

5.1 Quantitative Data and Analysis

The data gathered through a survey provided information on the demography and occupation

of the people. From the responses (n = 83) the occupation distribution of the inhabitants

includes: farmers, crafters, school learners, teachers (educators), clerical staff, local clerks

and the unemployed. The mean age distribution of the respondents is 33 years. 77.4 percent

of the respondents owned mobile phones. Awareness and use of information technologies is

very low based on the responses. The chart in figure 4 gives a graphical representation of

awareness and use of four information technologies. The chart shows that only 31% of the

respondents have minimum computer literacy skills, 19% have little knowledge or have used

an m-commerce application before, 28% are aware of the Internet or have used the Internet

before. 22% of the respondents have awareness and used an e-commerce application. This

result indicates the technology landscape in the community.

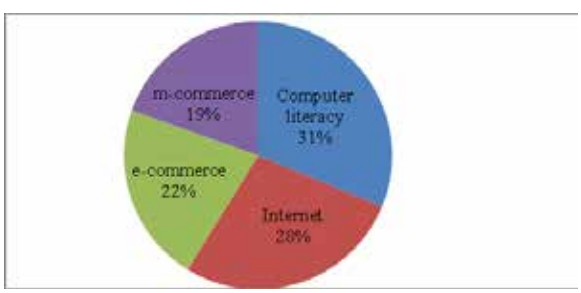

Figure 4. ICTs awareness and use

Information on how mobile phones are used in the community was necessary in our

study. We examined mobile phone ownership and use in the community and the modes of

interaction and the different services commonly use. The responses (figure 5) showed that

mobile phones are more prevalent among the older adults from 51 years and above (26.1%),

while the 36 – 40 years age group had the least number of people with mobile phones. 80%

of the respondents in this group are unemployed and are few in number within the

community due to migration to urban areas in search of better life. 10.9% of the respondents

in the age bracket 0f 14-19 years owned mobile phones, while only 8.7% owned mobile

phones in the 20-25 and 31-35 years age brackets. 13% of 26-30 and 46-50 age brackets ,

and 19.6% of the 41-45 age bracket owned mobile phones. Among the different age groups,

the productive age or those who sustain their families economically are adults from 35 years

and above. The local crafters and farmers are people above the age of 40 years. The mobile

commerce application is essentially targeting this group in the community with the aim of

providing a platform for micro-economic sustenance. The populations within the ages of 14

to 25 years are mostly people who depend on their parents or older adults who may be

farmers, crafters or other occupations. These ones will benefit from the application when

those that they depend on are impacted economically through the application.

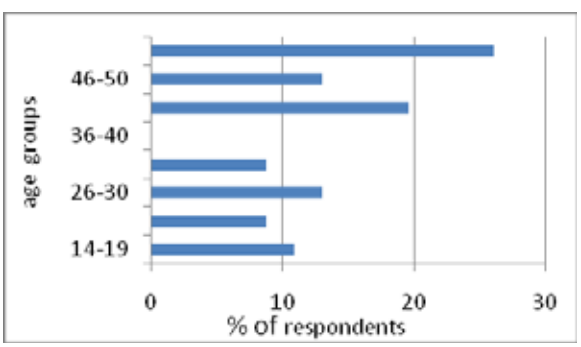

Figure 5. Mobile phones owners

Mobile phones are equipped with different interaction modes depending on the

quality of the device. Keypad and graphical interfaces are very common on several phone

devices. It was necessary to get information on type of mobile devices and common

interaction modes for phone users in the community. The essence is to identify the

capabilities and type of interface and interactions that will be most common for

implementation. 80.16% of the respondents used phones with only keypad and screen for

interactions, 19.84% use phones with soft keys. 60.18% use phones with cameras as an

additional facility and 13.21% use phones with touch screen for interactions. The use of

graphical user interface and keypad is more common among the respondents; making voice

calls is a general issue.

5.1.1 Culture Dimensions and User Interface Design

Three of Hofstede's culture dimensions (masculinity vs. femi-

ninity, Uncertainty avoidance

and individualism vs. collectivism) were considered for the survey to determine the culture

dimensions of the target community. The value survey module (Hofstede, 1994) was used to

determine the ratings for these dimensions. We felt that these dimensions were more

significant because they are more closely linked to an individual's behaviours and

perceptions. Secondly, users in this community cannot be classified into an organizational

structure or work culture and environment, the result for power distance dimension may not

produce the right result. 35 questionnaires were administered in the community. Table 1

shows the scores and ratings obtained from the survey.

Table 1. Culture dimensions rating

Culture Dimension	Score	Rating
Masculinity vs. Femininity (MF)	68	masculinity
Collectivism vs. Individualism (IC)	-24.5	Strong collective culture
Uncertainty Avoidance (UA)	122.50	High uncertainty avoidance

5.1.2 The Implications of Dimensions Rating on User Interface Design

Based on the culture dimensions and ratings, we can deduce users' cultural preferences for

the user interface design. This group of users will prefer an interface that is very simple and

devoid of hidden information, metaphors and images that express their collective existence

and consistent with their culture and environment. They would favour images that are gender

oriented and colours that are gender sensitive. These users value their local institutions and so

institutional icons on web or user interface are appropriate. Navigational icons should be

simple and depict what is familiar and common within their environment. Familiar colours

and clear input formats and adequate feedbacks that give clear meaning to the interactions

and outcome. They also prefer short help items provided to aid the interactions and short

menus or shallow menu hierarchies with simple and clear navigations. They will also favour

clear information without implicit meanings. Interactions should be direct to the tasks and

complete. Their mental model is tasks oriented with clear options and precise tasks without

deep hierarchies.

5.2 Qualitative Data and Analysis

Business activities within the community are very low due to poverty and lack of patronage.

Very poor access roads contribute to high cost of transportation preventing producers from

taking their products to markets outside the community. Service delivery from the

government and infrastructural development is very poor. The few employable jobs are

within the local schools and health centres. There is a high level of unemployment and crime

within the community. People could engage in voluntary services like road repairs for

rewards from road users (commercial motorists). The inhabitants usually travel to the nearby

town (Wilowsvale) a distance of 47km on a rough un-tarred road to buy their household

needs. The market within Dwesa is very low, and a small number of people engaged in petty

trading (kiosk owners). Local micro-entrepreneurs (e.g. crafters) are not very encouraged due

to low patronage. 61% of the people interviewed were computer illiterates. Time constraints,

the nature of their occupation and long distances away from the SLL facility are some of the

factors that prevent them from becoming computer literate.

Table 2 presents a summary of colour markers and their meaning. Culturally these

colours are used by the people through dressing to reflect different situations or occasions. It

implies that the colour selection for the interface should reflect a message that will capture

the interest of the users.

Table 2. Cultural Colour Markers and Meanings

Colour marker	Meaning
White	Represent purity, or peace
Black	Represent darkness, evil, or death
Brown	Represent beauty, symbol of manhood
Yellow	Considered as a national colour.
Green	Signify farming occupation in the community
Blue	calm, peaceful
Red	Blood, danger

Table 3 presents a summary of the users' preferences and expectations for the shop-owner
interface.

Table 3. User Interface Preferences

Text	Text should be presented in Isixhosa language for quick understanding
Numbering	Users are comfortable with the conventional numbering system (1, 2, 3...)
Interaction elements	Users feel they will be more attracted to an interface with interaction elements (e.g. icons, navigation metaphor) that are common in their local environment
Menu and layout	Short hierarchical menu system that is shallow and preferably a list presentation and centrally positioned
Labels and buttons	Labels in local language Button text in local language
Images and graphics	Use of cultural graphics to represent actions.
Help item	Users will want short help provided on the interface to provide quick information e.g. information to assist in navigation

Table 4 contains some of the culture-components elicited from the environment for the shopowner

user interface design. These are items or artefacts that are very common in the

environment and culture. If the users see interaction elements that they are already familiar

with on the interface, it will be easy to understand and a sense of naturalness during

interactions will be created. The artefacts in Table 4 are used to adapt the shop-owner

interface to a culture sensitive user interface.

Table 4. Cultural Metaphors/Icons

Function	Metaphor	Name/Meaning	Source
Home		A local hut/house or residence	
Forward or backward		An arrow represents navigation	
Login/logout		A door as an entry or exit point	
Shopping basket		An Isidulu local basket for collecting items	
Delete		A trash container for waste disposal	

5.3 Design Evaluation

5.3.1 Pilot Testing

A pilot test was conducted to assess understand of the interaction elements, the layout and

presentation of the interface elements on the shop-owner user interface. The testing was

conducted through focus groups with participants from the community ($n = 9$). 80% of the

participants were crafters. Participants were asked to assess the interface elements, the look

and feel, layout of the menu, navigation elements, labels and input/output formats and

positioning, the appropriateness of interface colours and other culture-components. The

participants were satisfied with the interface colours, the list menu format and the layout of

the interface elements. Other inputs were made by participants and were used to make

adjustments on the shop-owner user interface.

5.3.2 User Evaluation

Experiment 1 – Task performance time and errors.

The first test was conducted to assess tasks completion time and the error rate on the shopowner

user interface. The aim was to determine the level of usability and problems that may

occur during interactions for redesign of the shop-owner interface. The participants (n = 13)

comprised of 3 school learners, 4 crafters, 3 local school staff, and 3 educators. The

participants were selected based on the user groups identified in the community and

availability for the test. The participants performed two separate tasks on the shop-owner user

interface and the time to complete each of the tasks and errors made were recorded for each

of the participant. Table 5 present the mean time for three trials of each task.

The results in Table 5 show that participants' improved significant for each

subsequent trial on every task performed. The decrease in time variation in subsequent trials

indicates an improvement in tasks performance and precision (in second and third trials) for

each of the tasks. It is also an indication that participants were able to learn the interface,

gained confidence and improve their tasks performance each time they used the interface. To

create an online shop, a mean time of 83.01 seconds (SD = 19.11) was recorded for the first

trial. There was a decrease in time variation and general decrease in time among the

participants for the second and third trials respectively. It is an indication that participants

understood the interface and had better performance and accuracy in each subsequent trial.

For adding a product to an online shop as the second task, a mean time of 91.18 seconds (SD

= 20.01) for the first trial was recorded. The subsequent trials also showed that there was

significant improvement in the understanding and use of the interface by the participants.

Participants being first time users completed the tasks despite their lack of experience with

the technology. Table 6 also presents the average error rate for all the participants during

tasks performance.

Table 5: Users' Performance (time) to Complete Tasks.

Task	Trial	Mean time (in seconds)	SD
Create an online shop	1st	83.01	19.11
	2nd	60.27	12.06
	3rd	50.64	8.50
Add a product to the online shop	1st	91.18	20.01
	2nd	78.63	14.11
	3rd	61.43	10.52

The average error rate was low considering the environment and the average

technology and educational literacy level of the participants. User interface localization could

be a contributing factor that helped to facilitate easy understanding and improve performance.

In table 7, the mean errors committed by participants for the first task is 2.20 (SD = 1.12),

and for the second task, the mean = 2.32 (SD= 1.07). The result shows that the participants

found the interface easy to learn and understand. There was little variation on the level of

errors encountered among the participants. The results also indicate a considerable level of

tasks performance accuracy by the participants.

Table 6. Tasks Performance Errors

Task	Mean error rate	SD
Create your online shop	2.10	1.02
Add a product to your online shop	2.12	1.07

Experiment 2 - User's perception

The second test was to determine participants' perception of the localized shop-owner

interface and application. The demographic information of the participants is shown in Table

7. The sample consists of 40% male, 60% females. The participants were also selected to

represent the user groups in the community as indicated in Table 7. The descriptive statistics

analysis of the post test data collected (the questionnaire in Appendix A) is presented in

Table 8.

Table 7. Participants' Demographic Information

Participants	Demographic information	Frequency (person)	Frequency (%)
Gender	Male	6	40
	Female	9	60
Mean age	31.53		
Occupation	School learners	4	26.67
	Educators	3	20
	Clerical staff	3	20
	Crafters	5	33.33

Table 8 - Mean Scores of Participants' Perception of the System
(5 = strongly agree; 1 = strongly disagree)

Participant #	Usefulness of localization	Perceived usefulness	Perceived ease of use	Perceived Intention to use
1	3.67	5.00	4.71	4.33
2	4.33	4.00	3.87	4.67
3	4.56	4.00	3.71	4.67
4	4.00	4.00	3.43	2.00
5	3.00	4.67	3.71	4.00
6	4.00	4.67	4.14	4.33
7	5.00	4.00	3.71	4.33
8	4.00	3.33	4.29	4.67
9	3.50	3.50	3.29	3.00
10	3.67	4.00	3.14	3.67
11	3.50	3.33	4.00	4.67
12	3.33	3.67	3.83	3.67
13	4.00	5.00	3.71	4.33
14	4.00	4.29	3.67	4.67
15	3.50	5.00	4.00	4.67
Mean	**3.87**	**4.16**	**3.81**	**4.11**
SD	**0.49**	**0.57**	**0.38**	**0.74**

The overall results in Table 8 show that participants have a positive perception of the

system. The mean score for usefulness of localization (*Mean = 3.87, SD = 0.49*) indicates a

positive perception on the usefulness of interface localization. They feel that the localization

of the shop-owner interface made it easy to understand it. They also have a positive

perception on the ease of use of the interface (*Mean = 3.81, SD = 0.38*); they perceive the

shop-owner interface as easy to use. There was a high positive score for the prototype in

terms of perceived usefulness (*Mean = 4.09, SD = 0.56*) and perceived intention to use

(*Mean = 4.03, SD = 0.76*). The participants feel the application will be very useful to the

community and they intend to use the system when deployed. The participants also made

positive comments about the system during the interviews (e.g. "it is good for our

community", "it will help business in our community", "I like the interface"). The

participants were first time users who were not very familiar with the process of evaluation

and m-commerce technology. They were able to participate effectively and recorded

minimum errors during interactions. They also said localization of the shop-owner user

interface contributed in making it easy to understand and use.

6. DISCUSSION AND CONCLUSION

User-centred design methods are effective in designing usable interfaces and enable users to

be part of the design process. For effective participation of users in remote areas, adaptation

of the methods to suit the capabilities and culture of the users is necessary to achieve the

expected results (Smith et al., 2004). This is very important in rural communities where these

processes and technologies are still novel to the users. The culture and capabilities of the users influence how they participate with the techniques used during design and testing processes. For instance, the use of the focus groups prominently for data collection and evaluation processes helped the participants to participate better. Being in a group with other participants was a motivation for everyone. It was different in cases where we used single individual participations. We also noticed that cultural barrier and low literacy prevented users from participating effectively when we applied the verbal protocol evaluation technique. Talking while performing a task was difficult for participants and communicating in English language was also a problem. The user testing and evaluation proved to be highly effective with novice technology users. The use of TAM is informed by its simplicity and ability to predict users' behaviour . It is widely used to predict users' adoption of IT systems Interface localization for a target group of users will facilitate technology acceptance . This is supported by the positive results on users' positive perception on the usefulness of localization and intention to use the system. We note here that due to the constraints on the mobile device and the cost of wireless services, limited amount of

graphics on the user interface should be applied during localization. With new mobile technologies, there is a convergence between mobile web 2.0 and web 2.0 making the same web application and content accessible to both the desktop computers and the mobile devices.Technology illiteracy and media accessibility are challenges facing ICT developmentin rural areas. Desktop applications meant for rural users remain under utilized due to limited number of desktop computers and low literacy levels. Media availability for mobile applications is not a constraint in rural areas anymore. Mobile phones provide easy access to information at anywhere and anytime including the rural communities.Conducting a research in a remote rural community is a very big challenge, especially in situations where the researchers and the target users are separated by long distances, differences in language and culture. Communicating with the users in English was a problem and the remoteness of the community made regular interactions with community members a bit difficult.

For our future work, we are working on a voice user interface to support interactions

on the application for both the shop-owners and customers.

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(2001) Global-Software Development Lifecycle: An Exploratory Study, | SIGCHI'01, March 31 – April 4, Seattle, WA, USA, 2, 1, 104-111. | EJISDC (2010) 43, 2, 1-19 | The Electronic Journal on Information Systems in Developing Countries | http://www.ejisdc.org | 19 | Appendix A. Post-test questionnaire | Gender: | Age: | Occupation: | Do you have a mobile phone? | 1. This system will help advertise our products outside the community | 2. This system will promote business in our community | 3. The system will help to increase people's income in the community | 4. The interface is easy to use | 5. The interface is easy to understand | 6. The interface is not difficult to use | 7. The interface is not difficult to understand | 8. The interface does not require special skills or training to use | 9. It is not frustrating to use the interface | 10. I do like the interface | 11. I will prefer to use the interface | 12. If the system is available, I intend to use it | 13. I am satisfied with how the interface look and feel | 14. The use of IsiXhosa culture on the interface made it easy to understand | 15. The use of IsiXhosa culture on the interface made it easy to use | 16. There is adequate information provided on the interface | The questions are positively stated and the user responds using a 1-5 Likert scale. 5 indicates | Strongly Agree and 1 indicates Strongly Disagree. |