Selecting Requirement Elicitation Methods for Designing ICT Application in Minority Community

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Abstract—In recent years, Information and Communication Technologies or widely known as ICT has rapidly acquired a place in society. ICT facilitates communities in terms of providing the latest information updates on various fields such as business, education, sports and many more. Various ICT applications have been developed to cater these arising needs. In ensuring the developed ICT applications achieving its purposes, user requirements must be fulfilled. Thus, gathering requirements from communities during system development is an important phase. A suitable elicitation technique is needed as this will determine the quality and accuracy of the requirements gathered which ensures success of the developed system. The same applies when developing systems for minority communities. Hence, this paper explores the existing requirement elicitation techniques to gain insight for constructing a suitable requirement elicitation technique for minority communities. As a result, a proposed framework for eliciting requirements in the minority community will be discussed.

Index Terms—Minority Communities; Requirement Elicitation; ICT Application Design.

I. INTRODUCTION

There is an arising need for ICT assistance from NGOs communities which are set up by ordinary citizens for a cause either to help a group of people or the environment. Such communities exist are for women and children, single mothers, old folks, health related illnesses, disabilities and wild life care. Among the ICT assistance needed is on website development, related information systems and technical support to manage the community and information dissemination.

According to Encyclopaedia Britannica, *minority* is a culturally, ethnically or racially distinct group that coexists with but is subordinate to a more dominant group in the field of social sciences. As technology advances, these minority communities are also in need of ICT applications and technical support to manage the community and information dissemination.

In recent years, Information and Communication Technologies or widely known as ICT has rapidly acquired a place in society. ICT facilitates communities in terms of providing the latest information updates on various fields such as business, education, sports and many more. The impact of ICT has changed the lifestyle of society in general as well as the minorities. As for minority communities, ICT has been used as a tool for promoting cultural diversity for example in Europe to increase the possibilities for economic and social participation as well as integration [1].

Improving digital literacy and competences is crucial where minority communities can gain benefit from the use of ICT applications. However, there is still lack of customized services and community oriented ICT applications which fulfill the needs for minority communities. Minority communities in this research context are referred as groups of people that are formed based on their psychological, social and cultural characteristics [2]. These communities are represented by NGOs and associations.

II. RELATED WORK

Requirements elicitation is all about learning and understanding the needs of users and project sponsors with the ultimate aim of communicating these needs to the system developers [3]. Requirements elicitation is applying certain techniques in order to gather system requirements and needs from users. Applying the technique consciously and in a fashion appropriate to the situation at hand allows for tailoring the requirements elicitation process which takes into account project constraints so that requirements may be elicited as completely and comprehensibly as possible [4].

As mentioned by [5], the selection of an appropriate elicitation technique out of the plethora of available techniques greatly affects the success or failure of requirements elicitation. An example of minority community is the single mothers' community formed based on a common social status, other common attributes such as age, education background, and job experience are varied among individuals. Hence, the appropriateness of elicitation technique used also will be affected by these values. It is important that these factors are considered upon setting up a profile that contains background information concerning ICT in terms of their awareness, access, usage and attitude [6]. As also mentioned by [7], the complexities of the community, its contexts as well as the needs of targeted user are to be included which should not only covers technological aspects.

There are many ways of gathering information from users regarding their needs and expectations from the developing system or ICT applications. Elicitation techniques can be in the form of survey (interview and questionnaires), creativity (brainstorming), document-centric, observation and support (mind mapping, workshop) [4]. Every technique is most effective in collecting one type of requirements as well as in one domain for requirements collection. In certain scenarios, different techniques can be combined together to create methodology for implementation in the requirements gathering phase. Most importantly, this process has to be in such of a way that requirements which include significant use of resources such as time, budget and efforts are successfully collected. The specified features or characteristics of requirement elicitation technique will guide on how a project should be implemented but may not be satisfactory. Hence,

the higher frequency of using various elicitation techniques will increase the understanding of the use, features, drawbacks and appropriateness conditions.

According to [8], conditions may cause the analyst to perform a step using a specific elicitation technique. However, conditions are changed due to this and the analyst may decide to apply other technique. Hence, the end product of elicitation would be a list of possible requirements or some kind of model for system solution or both.

At present, no single effective technique has been identified because there is not enough available data for making decisions. Furthermore, [9] have also highlighted qualities of good elicitation techniques are having capabilities which include finding most and high valued requirements and finding tacit requirements. Other than that, the technique should also accomplish the goals with minimal use of resources such as time and budget. It should also be non- redundant.

Selection of appropriate elicitation techniques specifically for the minority community (single mothers) has not been researched. Nonetheless, research has shown that there are few factors can be considered when making selection. Other than that, [5] recommended that every situation demands an elicitation technique that is best suited for that situation. This means that elicitation technique attributes needs to suit the situational characteristics.

Using content analysis, [10] have identified four factors that can be used as a practical guide which could assist analysts to determine the appropriate RE techniques for a given project. These four factors are technique features, stakeholder characteristics, requirements sources and project environment. [9] have also suggested these factors such as the type of system and requirements, stakeholders involved, available resources, expertise and skills as well as experience using the technique and how it is done (settings).

There have been few proposed general models for better requirement elicitation process. Task Characteristics model of requirements elicitation was proposed by [11]. The model was effective in eliciting more requirements than other techniques and helps analysts and users to understand the problems. However, the concentration on the quantity of requirements rather than quality is one of the drawbacks of this model. Another proposed model is a unified model which includes both of the elicitation and selection techniques processes [12]. This model helps analyst to choose the appropriate technique during the elicitation activities. Nevertheless, the model depends on the knowledge about the project and domain in selecting the techniques, but not the knowledge of stakeholders or users which may also affect the selection process.

Furthermore, [13] has pointed out that socially oriented methodologies provided more support for user involvement in design. This promotes a closer working relationship between users and designers. A four-dimensional framework (adapted from [14] is outlined and used to perform comparative analysis on selected four different methodologies. The study concluded that communication perspective should be included for a successful requirements phase and system design as this perspective adds a more holistic approach.

Another model is proposed by [15] that handles the difficulties faced during requirements elicitation in rural environment. The model is proposed to be applicable in a specific context (i.e. Dwesa in South Africa). As mentioned by [16], the challenges faced in the Indian rural area is much more difficult as finding useful information where the community understand what the problems are and asking the 'right questions' as for the developers to get the 'right answers'. The community may not be able to express themselves correctly as these are all learnt skills (interpersonal). In addition, there is also research done in studying the culture effect on requirements elicitation practice in developing countries. The results show that culture effects deeply the technique gets chosen for requirement elicitation [17] and [18].

Another related works that involved with software development for rural community is PRISMA which has been used in developing rural e-health initiative and development of an Indigenous Knowledge Management System [7]. PRISMA is a software development methodology amalgamated from the Participatory Action Research (PAR) approach. PRISMA is made up of two parts, a social change process and software development process which also include the (hard) technology aspects. The methodology emphasizes the "soft (humanistic) aspects" which involve the requirements or wants of the community and their reasons for it, as well as the roles for the people and multiple stakeholders within various environments affecting the community. One of the steps in the methodology is rapport building with the community. The non-technical factors are viewed as important to be addressed in the methodology as user requirements may be affected and will caused problems in system design, user interfaces, project timeline and budget.

III. REQUIREMENT ELICITATION FOR MINORITY COMMUNITY

Figure 1 shows the proposed framework for eliciting requirements from minority communities. It is constructed based on literature analysis (non-empirical) of the related works [5], [7], [10], [13], and [14].
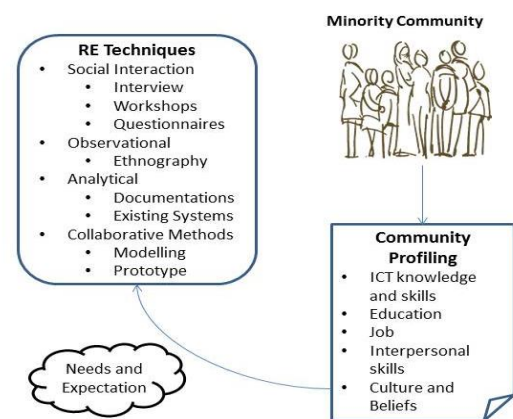

Figure 1: Proposed Framework of Requirement Elicitation for Minority Community

This paper seeks to assure that ICT applications development takes place in an appropriate way in order to fulfill the needs of psychologically, socially and culturally community. Hence, a community profiling needs to be done by finding out what the community needs and expects from the ICT application or project. In determining community

needs and expectations, needs analysis will be performed in the form of questionnaires. The aim is to determine the community needs and expectations in terms of opportunities and problems as well as issues and the means of how ICT can assist them.

Apart from that, personal background information such as education level, job, religion, race, and any other related data (e.g. marriage status, total children) will be gathered as for identifying culture and beliefs involved as this also affects the selection of requirement elicitation techniques. From the questionnaires, it is also important to ask other related issues that can be a factor in a system development project such as experience using the Internet, computers, smart devices as well as other information systems to determine their level of ICT knowledge, skills and experiences.

Table 1
Recommended Requirement Elicitation (RE) Techniques for minority community

Categories	Techniques	Justifications *(how it suits a minority community setting)*
Social Interaction	• Interview • Workshops • Questionnaires	Interviews are essentially human based social activities, they are inherently informal and their effectiveness depends greatly on the quality of interaction between the participants. Interviews provide an efficient way to collect large amounts of data quickly [3]. Interviews (unstructured) may be used to analyze the wishes, needs, or opinions towards a certain topic in an open way [19]. Questionnaires are useful when we need to gather some general requirements quickly. Questionnaires are considered more useful as informal checklists to ensure fundamental elements are addressed early on, and to establish the foundation for subsequent elicitation activities [3].
Observational	• Ethnography	This technique involves observing users performing their daily basis routine and it is effective when the need for a new system is a result of existing problems with processes and procedures, and in identifying social patterns and complex relationships between human stakeholders.
Analytical	• Documentations • Existing Systems	For minority setting, it can be an option to further seek more information if required depending to the needs of the community and ICT application.
Collaborative Methods	• Modelling • Prototype	Prototypes are typically developed using preliminary requirements or existing examples of similar systems. This technique is particularly useful when developing human-computer interfaces, or where the stakeholders are unfamiliar with the available solutions. It is common that prototypes are used in conjunction with other elicitation techniques such as interviews and JAD [3]. Other methods include such as digital storytelling [16], JAD, scenarios/storyboards.

Based on the gathered data, the appropriate RE techniques will be selected. The techniques are adapted from [10] combined with the approach of community centered. Table 1 explains the selection of these techniques in the context of minority community setting. There are four categories which is social interaction, observational, analytical and collaborative methods. Two categories which are social interaction and collaborative methods are based on the emphasis of the importance of communication between developers with users as pointed out in the earlier literature.

IV. CONCLUSION AND FUTURE WORK

Requirement elicitation is the very first and important phase in requirement engineering as well as in the system development. This paper discusses available requirement elicitation methods in the effort of constructing a minority community centered requirement elicitation. Through the literature analysis, it can be concluded that communication perspectives applied in a socially oriented methodologies will increase user involvement. Based on the nature of a community, culture also plays a vital role in selecting the suitable requirement elicitation techniques. Further work will be to seek empirical evidence using the framework in a minority community setting.

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