

MAKING A CASE FOR THE ADOPTION OF TELE-MEDICINE IN ZIMBABWE

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Abstract. *The shortage of medical professionals in remote areas and the increase in HIV/AIDS related deaths at a time when ICT penetration is improving in developing countries, justifies the adoption of tele-medicine. The quest for the adoption of tele-medicine by developing countries has often been driven by evidence of its success elsewhere. The transfer of health care information systems from the west to Africa has often led to project failure because of contextual differences between countries. In this discussion paper, we developed a frame work for the adoption of tele-medicine in Zimbabwe. The framework is based on evidence from health information systems literature. It attempts to map out how tele-medicine could be adopted in Zimbabwe and it serves as a first step towards informing academia and policy makers about how to implement health information systems.*

Keywords: Health Information System, ICT, tele-medicine

I. INTRODUCTION AND BACKGROUND

The use Information and Communication Technologies (ICTs) for planning and management, of health care in the developing world has been studied by many scholars and development agencies ((World-Health-Organisation, 2006) (Braa, et al., 2007) (Sahay, et al., 2009)). These studies are situated in the discipline of Information Systems (IS)'s sub domain of Information Systems in Developing Countries (ISDC) (Avgerou & Madon, 2005) or Information and Communication for Development (ICT4D). In ICT4D literature, health care improvement is viewed as a key aspect of development. As a result a growing body of literature is being published under the titles of Health Care Information Systems Program (HISP), e-Health, Health informatics and Tele-medicine to name a few.

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International development agencies, academia and governments are collaborating in developing and implementation of healthcare Information Systems in several developing countries (Braa, et al., 2007). For examples, ICTs have been used for supporting maternal health care in Uganda (Vincent, 2010; Musoke, 2007) and In South Africa a mobile application was developed for monitoring HIV patients (Musoke, 2007). In India a tele-medicine project brought healthcare to the village of Aragonda with assistance from the Apollo group of hospitals. The project managed to connect Aragonda and other rural centers to the Apollo hospitals in Hyderabad and Chennai. Several such projects were also implemented in Latin America, Asia and Africa.

Other scholars have documented project success in other developing countries as a way of informing other interventions about the critical success factors of information systems (Kintu, 2007). Their concern has been about how African, Asian and Latin American countries could successfully adopt and adapt technologies from the west. The central aim of this paper is to concertize the reader about realities of health information systems by drawing lessons from the parent domain of Information Systems (IS). There has been a concern with IS project failure and how to avoid it (Heeks, 2003). This led to an interest in social, political and cultural issues that affect the design and implementation of information systems.

In this paper we focus how tele-medicine could be adopted in Zimbabwe. Our concern is how to avoid project failure by accommodating the socio-technical and socio-cultural issues that threaten project success. We also endeavour to develop a framework that servers as a preliminary platform for informing future tele-medicine innovations in Zimbabwe. Zimbabwe is a sub-Saharan country recovering from economic decline due to political instability which saw the crumbling of health delivery system between years 2002 to 2008. It has a very low life expectance of 38 and high HIV infection (UN, 2010). After the formation of a unity government, the main hospitals reopened and basic infrastructure got revived. These gains have not fully diffused to the marginalized communities in rural areas. While most rural areas now have mobile connectivity, they still suffer the effects of both digital and economic divide between rural and urban Zimbabwe. This makes it imperative to harness cutting edge technologies for improving rural health care systems and serving vulnerable lives by harnessing the expertise of medical professionals in remote cities.

According the permanent secretary of Zimbabwe's ICT ministry, the question confronting ICT implementers is no longer 'whether' ICTs can help Zimbabwe but 'how' they can. This calls for a research based approach to IS implementation which is cognizant of the danger of early research project that look up the wrong conceptual lens. We review literature from IS and HISP in order to guide future research and policy making. After this introduction, the paper is organized as follows: the following section discusses the review of the literature followed by the methodology on how the framework can be implemented then the framework itself. The discussions follow and the conclusions wind the paper.

II. TELE-MEDICINE AND MODELS APPLIED IN DEVELOPING COUNTRIES

A. What is Tele-Medicine

Tele-medicine refers to the use of ICTs for connecting patients to medical professionals in distant places. It involves the transmission of patients' data in form of visual image- videos and digital images with a view to facilitating diagnosis and cure.

B. Why tele-medicine?

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Tele-medicine overcomes the lack of medical professionals in remote areas. There is a serious lack of medical staff in remote areas due to unattractive conditions of service, brain drain and low population density.

Developing countries have most of their populations in rural areas which are often inaccessible due to poor infrastructure. The road network is poor and in some cases nonexistent. Such places often lack primary health care facilities. Where they exist, they are often manned by nurses alone yet doctors are needed. The population density in these areas is very low and as a result they are expected to serve geographically spaced patients. During rain seasons, cases of wide spread of malaria and cholera is high. Diseases outbreak sometimes are not reported, because of accessibility this makes monitoring of patients difficult.

Need to save life in the wake of HIV/AIDS, cholera outbreaks and malaria

Patients on ART need to be monitored and tested frequently (Banetar, 2004) yet access to them is complicated by absence of transport system and poor road infrastructure. In some remote parts of developing countries, epidemics like malaria and cholera are recurrent or seasonal. Infrastructures are not being upgraded or repaired and conditions are not improving. Lack of access to health care often leads to premature morbidity due to curable diseases. ICTs could facilitate remote monitoring of ART receiving patients as we discuss below.

Phenomenal increase in mobile penetration

Mobile technologies are being adopted at a phenomenal rate in Sub-Sahara Africa with Zimbabwe penetration leapfrogging majority of African countries (James, 2012). This presents an opportunity to exchange real time information between medical professionals in referral hospitals and remote primary health care clinics. It also makes it possible for mobile primary health care workers to consult knowledge bases in distant centres.

C. What models have been applied by developing countries?

Off shelf applications

These are system and application that were developed in western countries and exported to developing countries for use as they are or with minor adaptation. They have the advantage of being cheap to acquire and readily available. Their disadvantage is that they are less relevant to intended context and they often fail to deliver due to context specific challenges.

Bespoke systems

These are health informatics systems that are developed for a specific organization or country. They are meant to address socially embedded issues through an understanding of local context of power dynamics, hierarchical structures and socio-cultural issues. Such kind of innovation is expensive and non transferable and it takes longer to produce. In spite of these challenges bespoke systems have a better chance of addressing intended needs than off shelf ones.

Projects in literature

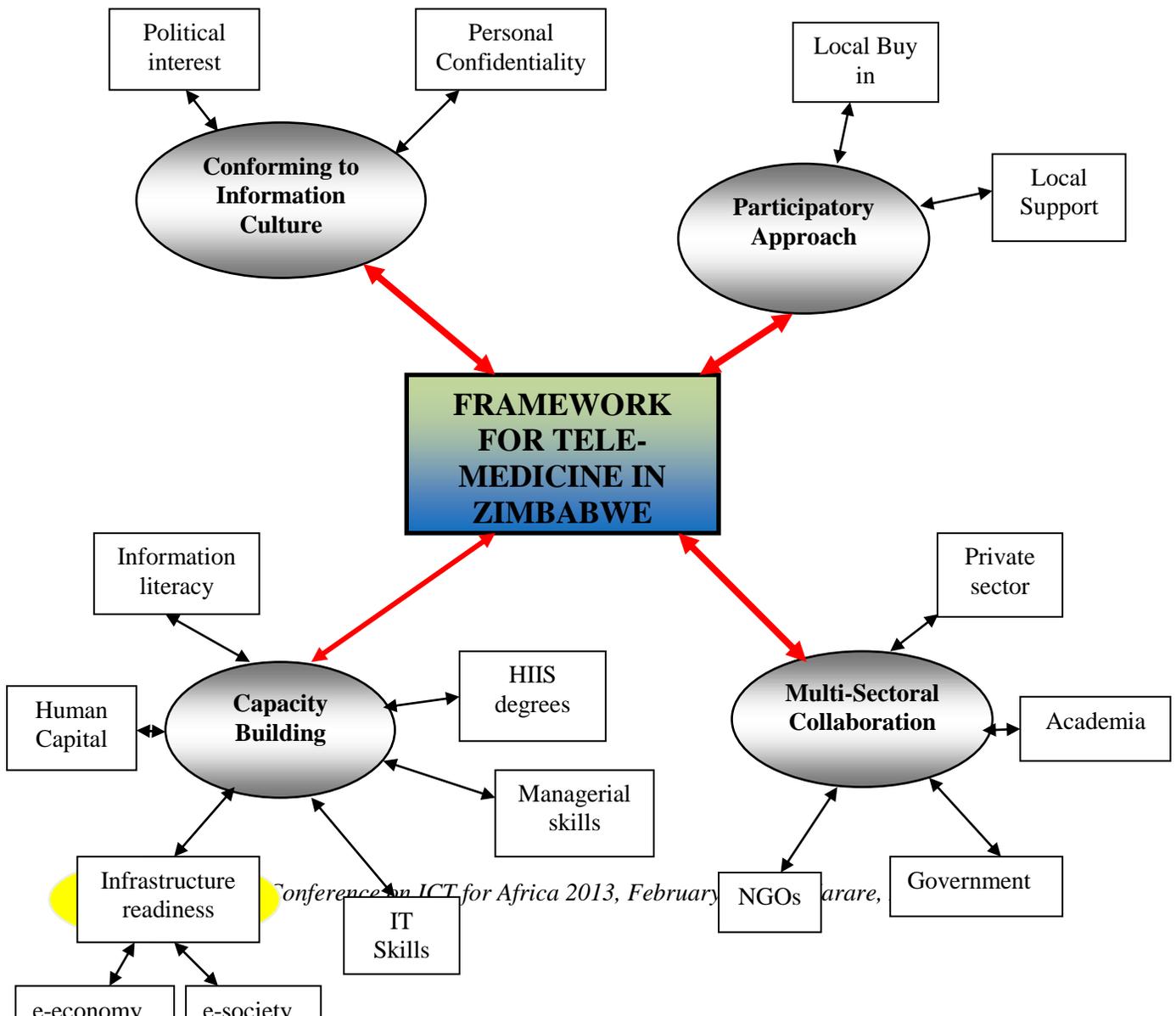
(Silumbe & Bwala, 2007), describe a medical knowledge system desk for a clinic desk in Zambia. The system gives clinic desk officers' access to a knowledge base that only high skilled professional would possess. It consists of a disease-based reasoning systems, medical specialist locators and group-ware systems, which indexes them for access by clinical workers. Other than addressing the shortage of highly qualified medical professional by enabling low skilled officers to perform activities beyond their level of competence it is also capable of reducing time of service.

(Collombatti, et al., 2007), describe Guenue Bissau study and pilot project- SSpace AssistanCE for Drug Resource Enhancement (SPACEDREAM) - which investigates the use of an existing Earth observation for healthcare logistics. It uses Geographic Information Systems (GIS) navigation and telecommunication systems to coordinate the logistic of distributing of Antiretroviral Therapy (ART) and healthcare in Guenue Bissau. (Donner, 2004), elaborated the innovations done in Rwanda for mobile health care and the challenges and risks of implementing such a system. There are a number of projects in literature applied to other countries like Egypt, South Africa, Kenya and Tanzania but their break through is limited due to each country background. Majority incorporates systems that have been used in western countries.

III METHODOLOGY

The research uses information from in-depth literature to come up with a conceptual framework for developing tele- medicine in Zimbabwe. Experiences and applications of tele-medicine by different researchers are going to be incorporated in the framework with knowledge of Zimbabwe health and ICT mobile usage. The researchers intend to map a contextualized framework taking literature from other researchers.

IV A FRAMEWORK FOR DEVELOPING TELE MEDICINE IN ZIMBABWE



A. Conforming to information culture

We have already alluded to the fact that information systems need to be socially embedded for them to succeed (Avgerou, 2000). IS applications are neither a-contextual nor culturally neutral. As we argue below the transfer of IS projects from other parts of the world is problematic and it leads to failure to address local information needs. There is no one size fits all IS projects. (Sahay, et al., 2009), posit that there are political issues that emanate from divergent interests in healthcare systems. These political interests have an impact on people's willingness to integrate health care system. We therefore suggest that Sub Saharan countries like Zimbabwe need to base their approach to HIS on an understanding of social issues that affect their information culture. We do not in any way suggest that a country like Zimbabwe is cultural homogeneous, but we advocate a sensitivity to local majority concerns.

There is evidence that communities have different perceptions of information. It is our hypothesis that in countries where information is politicized, people are likely to be apprehensive about divulging personal information. Under such circumstances health care systems must be sensitive to personal confidentiality. There is evidence that in countries where HIV/AIDS is stigmatized people are less willing to risk having their status in the public domain (Banetar, 2004; Bukachi & Pakenham-Walsh, 2007). Empirical evidence from South Africa suggests that HIV patients often shun ART to avoid stigma associated with the disease (Banetar, 2004). In spite of this a mobile based HIS project was used to avoid this barrier. While mobile phones are personal gadgets in developed countries there is empirical evidence that Zimbabweans in rural areas tend to share them with neighbours while the majority now own handsets. This suggests that a mobile based HIS may not be as socially relevant for confidential innovations like they would be in developed countries. We therefore posit that IS innovation can overcome barriers embedded in a community's culture if they are known and planned for.

B. Participatory approach

Local health professionals need to be involved in identifying local problems and shaping solutions that can address them. This should include local health program managers (from government and NGOs), medical personnel in health care institutions, health care administrators hence a participatory approach to HIS innovation is essential because it improves sensitivity to contextual issues discussed in this paper. Where consultants from abroad are leading a project, there is a need to team up with locals who also speak the local languages and have a cultural rapport with locals.

Development paradigm literature has adequately articulated the need for local buy-in. It is understood that projects that local feel a sense of ownership will gain their support because they do not want their own programs to fail. The lack of local experts often causes international NGOs to implement innovation projects on their own. We suggest that such risk of lacking local buy-in must be resisted for the sake of contextual relevance and local support.

C. Capacity building

There is a lack of health care professionals who are competent in health management information systems in the developing world (Shidende, 2007). It is reported that there is shortage of thousand health care workers in Zimbabwe (James, 2012). A growing body of digital divide studies describes a lack of ICT infrastructure (Gorski, 2005). This is accompanied by a misplaced vision and sometimes an overestimation of what ICTs can achieve (Avgerou & Madon, 2005) in developing countries. It therefore calls for capacity building in human capital, academic competence and ICT and physical hereafter referred to as infrastructural readiness

How to build human capital capacity

Technologies on their own will not solve problems. There is therefore a need for human capital which ranges from strategists who understand the role of information systems to implementers who can use ICT applications. While implementers could be consultants from academia and NGOs there is a need for ICT literate and information literate health care worker to conduct the job.

(Avgerou & Madon, 2005), argue that vision of the information society has often misled developing countries. Their problematisation of a-contextual vision of information society emphasize a need for strategist who understand how to harness the ICTs to meet the information and knowledge goals that are relevant to the way the majority of people in specific communities in developing countries live their lives. We argue that these are IS experts whose decisions are based on country specific empirical research. Such capacity can be developed through the introduction of HIS training at higher degree levels at university and polytechnics. Universities need to produce graduates in medical information systems and e-health.

The relevance of ICT literate health care professionals is easy to see. ICT literacy is the possession of ICT skills that are necessary for the use of ICT applications. This requires the ICT training of user of tele-medicine applications. In addition to competence with ICTs, the users need to be able to use the applications in question. Several Sub Saharan African countries have embarked on short to long term course in health information systems. These include Rwanda (Donner, 2004), Tanzania (Shidende, 2007), Zambia (Silumbe & Bwala, 2007) and Uganda (Kintu, 2007).

(Shidende, 2007), discusses how collaboration between the Tanzania HISP/BEANISH and the global HISP led by the University of Oslo, Norway managed a 9 month course for health care workers. Over and above the need for competence with applications, there is a need for technical staff that will be in charge of maintaining the hardware. Help desk technicians will need training in hardware and computer support course on offer in technical colleges.

Information literacy refers to the ability to understand the meaning of data (Mansell, 2009). In other words it involves the possession of skills to turn data into information. Most systems are designed to make such a task easier since they are normally dedicated to a narrow set of user requirements. In spite of that there will always be situations where the users confront situations that require extra information skills for them to handle peculiar cases. This may make it seem as if information literacy is necessary in exceptional cases, in actual fact the very act of probing a system is necessitated by the realization of a problem which a user knows that a system can solve. In other words information literacy is a day to day requirement of system users.

So how does one develop information literacy? The intervention period is not enough for such a huge task. Information literacy is developed almost tacitly through the education system and day to day life experiences. We therefore conclude that education and development of analytic skills are necessary prerequisites for capacity building of human capital.

Infrastructural readiness

According to (Choucri, et al., 2003), successful IS innovation takes place on robust foundation of e-readiness. E-Readiness refers to the degree to which a country is prepared to pursue value creation

opportunities facilitated by harnessing the power of ICTs ((Dada, 2006); (Choucri, et al., 2003)). E-readiness does not just enable IS innovation, it also acts as an acceptable barometer on which to base policy decisions. Since Zimbabwe last conducted its e-readiness survey in 2005, its tele-density, human resource capacity and socio-economic environment have changed.

Our e-readiness is not just about developing infrastructural readiness i.e. ICT and physical readiness, it is about tailoring our readiness to aspirations and privileges that are relevant '*to the way the majority of people in many communities in developing countries live their lives*' (Avgerou & Madon, 2005, p. 1).

A country's e-readiness objective must be defined by how ICTs are expected to make a difference. Before investing in technology we must investigate how ICT connectivity, internet, mobile, VSAT, ISDN can address current and future aspirations.

The traditional options are described in terms of e-economy or e-society. E-economy refers to the use of ICT to support business and economic growth while e-society targets social benefits. E-society here covers issues of governance and human development. While these two can be mutual exclusive, we argue that Zimbabwe's e-health project calls for a combination of both e-society and e-economy albeit with a biased towards e-society.

D. Multi-sectoral collaboration

In this section we present key examples of collaboration between sectors and institutions of diverse expertise. We argue that private sector, government, academia and NGOs can work together towards a successful tele-medicine project in Zimbabwe.

Private health institutions have entered into partnerships with rural health care centres. For example in India tele-medicine brought healthcare to village of Aragonda with the assistance from the Apollo group of hospitals. The project managed to connect Aragonda and other rural centers to the Apollo hospitals in Hyderabad and Chennai.

There have also been partnerships between international NGOs, institutions of higher learning and health care centers in African countries. The Guinea Bissau SPACEDREAM project described above is multi sectoral project which includes an international NGO, a space technology company and a university department. The team is led by Comunità di Sant'Egidio (CSE), a non-governmental organisation which has run the DREAM (Drug Resource Enhancement against AIDS and Malnutrition) programme for treating HIV/AIDS in Guinea Bissau since 2005. They include an industrial collaborator LuxSpace which handles technical issues, *ranging from the elaboration of system options (integration of GIS, supply chain management and satellite based communication systems capabilities), to the system design, to the implementation of the space-based technologies in the pilot project* (Collombatti, et al., 2007).

The academic technical advice on technology, assessment, evaluation and project management are provided by CISAS 'G. Colombo' (University of Padova, Italy). The university has expertise in space projects, technical innovation and technology transfer as well as managing activities within ESA programmes (Collombatti, et al., 2007).

V. DISCUSSION

Tele-medicine is an appropriate route to take at a time when medical practitioners are far from impoverished victims of malaria, tuberculosis and HIV/AIDS. While most of the rural areas now have mobile network, the deteriorating road infrastructure renders these areas inaccessible. This calls for innovative ways of shrinking the distance between patients and health professionals using tele-medicine.

Zimbabwe has lost many health care professional to the developed world due to brain drain. (World-Health-Organisation, 2006), showed that while sub-Sahara African countries have the lowest number of medical professionals it is also heavily affected by brain drain. These skills may be recovered as social remittances by harnessing ICTs through tele-medicine.

The adoption of tele-medicine has its challenges. Researchers have argued that e-health entails more than the installation of ICT (Sahay, et al., 2009). In this paper we present a combination of physical infrastructural readiness, ICT infrastructural readiness, human capacity building and an approach that is amenable to local socio- cultural as well as socio-economic and political environment. The willingness to share patient's information is affected by people's information culture. Researchers have suggested that it is necessary to integrate patients' records on common national data bases in order to avoid unnecessary duplication. The challenges of combining patients records which is affected by patients' concern about having their records accessible by other practitioners than their own doctors. This is especially true in countries where HIV aids attract a stigma.

Collectivist cultures as opposed to individualist ones are associated with face saving people. Faces saving cultures are known to shun participation in activities that either makes them seem boastful or cause them risk losing their self image (Ardichvili, et al., 2006). We argue that since e-health innovation deals with highly sensitive personal records, they must be tailored to avoid clashing with predominant cultural sensitivities. There has not been research into Zimbabwe's information culture; we call for empirical research in information culture as a key step towards the creation of tele-medicine.

Like any other ICT enabled form of innovation, HIS requires a robust foundation of e-readiness. This study has called for readiness in human capacity, ICT and physical infrastructure. As already mentioned, e-readiness must aim for a known specific outcome (Choucri, et al., 2003). As a result we also call for a pro-poor approach to e-readiness that aims for both e-society and e-economy. This is because a focus on e-economy (economic growth) alone will not justify investment towards availing tele-medicine to the poor who often unable to pay for their own medication. While e-society fosters pro-poor projects like tele-medicine to rural communities, research shows that developmentalist social projects will not work without economic growth i.e. e-economy. In view of this we suggest that e-readiness must aim to achieve a strategic mix of both e-society and e-economy.

Given the choice between the use of off-shelf IS innovations from abroad and developing bespoke applications, we argue for bespoke software since this is capable of meeting the context specific issues. The temptation to use off-shelf solution because of their affordability must be weighed against their relevance to local context. It has been shown that transfer and diffusion of IS innovation is not appropriate for achieving country specific solution (Avgerou, 2000). It therefore results in project failure an uncommon problem in e-projects ((Heeks, 2003); (Dada, 2006)).

VI. CONCLUSION

The paper looks at literature on adoption of tele-medicine from developing countries. From literature a conceptual framework on how tele- medicine can be adopted with Zimbabwe context is highlighted. The framework looks into the capacity building, e-readiness, information culture and participatory approach. Our framework for tele-medicine in Zimbabwe finally calls for multi-sectoral collaboration between NGOs, state and academic institutions. Success stories of multi-sectoral collaboration have been documented. We argue that no single sector can handle the challenge of tele-medicine in a recovering economy like Zimbabwe. This is because the required skills of health care professionals in both the diasporas and academic institutions needs to be supported by NGOs' international experience and financial resources. In addition to this, the political will from government is necessary since innovations need to be aligned with macro-level development objectives in order to avoid policy clashes.

VII. FUTURE RESEARCH

By coming up with the conceptual framework, the e-readiness and the participatory approaches need to be researched in full. Research on the government readiness and willingness should be done. The framework also incorporates various stakeholders and ministries that should be studied on the role they are going to play in the adoption of tele-medicine so as not to have duplicate and well defined roles. The proposed framework should also lead a leeway to identify an appropriate system that is bespoke. The system should be tested by different users thoroughly so that it addresses the needs of the users. Experts need to be drawn from different sectors that also include NGO to test the system.

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