

Perceptions and Adoption of Information and Communication Technology for Healthcare Services in Tanzania

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ABSTRACT

We present a study on perceptions and adoption of Information and Communication Technology (ICT) in Healthcare Services. The paper regards ICT as tools that facilitate communication, processing, storage and transmission of information by electronic means. This includes a range of ICT tools, from radio and television to telephones (fixed and mobile), personal computers, and the Internet. ICT has a potential to impact every aspect and activity in health sector. However, the adoption of ICT tools can be greatly affected by perceptions of community members. In addition, perceptions can enormously differ from one country to another necessitating carrying out a study in a particular country. In this regard it was important to establish the perceptions and adoption of ICT among community members. The findings show that ICT tools that are positively perceived, in descending order, include Radio, Mobile phones and Television. Although there was no significant difference in terms of percentage of users for Radio and Mobile phones, analysis show that there is a statistical evidence that the proportion of community members that have adopted ICT as a major source of healthcare information significantly differ ($p < 0.001$) between urban and neighbouring rural areas.

Keywords: Perceptions, e-health, Health-care, ICT, Iringa, Morogoro, Tanzania

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INTRODUCTION

1.1 Background Information

This paper regards Information and Communication Technology (ICT) as tools that facilitate communication, information processing, storage and transmission by electronic means. This encompasses the range of ICT tools from radio and television to telephones (fixed and mobile), personal computers, and the Internet (Chetley 2006, Yekini et. al 2012). Ashrafi et al (2008) defined ICT as the wide range of computerized information and communication technologies, which include products and services such as desktop computers, laptops, hand-held devices, wired or wireless intranet, business productivity software such as text editor and spread sheet, enterprise software, data storage

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and security, network security and others.

Adoption of ICT in many sectors is spreading all over the countries including developing ones. The quality of information about the ICT situation in African countries, however, differs from country to another. In general it is limited to a few countries (Ruxwana et al 2010). According to ITU (2012) Tanzania is one of the least developed and connected country. This means that the approaches of e-health might be different from the developed countries. This is one of the reasons to carry out this study.

ICT can be a means to reach a series of desired outcomes such as: better decisions of health workers, quality and safe healthcare services, awareness of the public about health risks, responsiveness of the Government about health needs and better information access and knowledge to the people about ICT (Dzenowagis, 2005). ICT can improve the quality of health-care services (Ruxwana et al. 2010, EU 2009, WHO 2005). The adoption of ICT can result in care that is higher in quality, safer and more responsive to patients' needs efficiently. It has been found that ICT is the main feature and tool for the development of the health care sector (Kurtinaityt, 2007).

Chetley (2006) established that ICT in the health sector has tended to focus on the following:

- Improving the functioning of health care systems by improving the management of information and its access.
- Improving the delivery of health care through better diagnosis, better mapping of public health threats, better training and sharing of knowledge among health workers, and supporting health workers in primary health care, particularly rural health care and
- Improving communication about health, including improved information flow among health workers and the general public.

Furthermore, potential beneficiaries of ICT include various stakeholders in key health institutions such as Health service providers, and the society especially the patients. ICT can be utilized to overcome geographic isolation for the population in rural areas, and it can facilitate access, dissemination, utilization and exchange of information (Yekini et al 2012). If ICT is not adopted in the health sector, common practices in the health care industry place tremendous burdens on patients and healthcare workers, with heavy loads of paper-based documents and inefficient communications through postal mail or fixed phones (Kurtinaityt 2007).

On the other hand, WHO (2005) argues that eHealth is the cost-effective and stressed that research has to be done in to provide evidence based standards and norms. According to EU (2009) the term 'eHealth' can include all medical healthcare services and technologies relying on modern information and communication technologies (ICT). These could include: (a) national and regional healthcare information networks and electronic record systems such as information systems for healthcare professionals and hospitals, online services e.g. electronic prescriptions, databases used for patient care, research and public health, health related portals and online health promotion services; (b) Telemedicine systems and related services; (c) Specialized devices or machines for healthcare professionals and researchers such as robots i.e. systems for diagnosis and surgery; simulation and modeling devices; healthcare grids and tools for training). This paper in addition to the modern technologies, considers conventional technologies such as Radio and Television.

1.2 Statement of the Research Problem

The Ministry of Health and Social Welfare in Tanzania has developed an ICT Policy and Strategy (MoHSW, 2007) for the health sector to improve the efficiency and quality of health care service delivery. This was developed a number of years ago and that it is important to be implemented successfully.

However, the perceptions and the adoption of ICT in provision of health services are not clearly known in Tanzania. This means the acceptability of these technologies in enhancing information provision has not been studied in the literature particularly in Tanzania. Unknown issues could hinder planning and successful implementation of health-care service policies. This study therefore intended to bridge this gap.

Infact a number of researchers have argued that it is important to determine the perceptions and acceptability of the technology using various variables that lead a person to adopt and use a technology. One of the important variables is the perceived usefulness which leads to formation of attitudes towards a certain technology (Wahid 2007; [Walczuch et al 2007](#)). It is therefore imperative to establish the perceptions of the community on the planned technology for successful implementation and adoption.

1.3 Main Objective

The main objective was to provide recommendations on adoption of ICT in health-care service delivery in Tanzania based on statistically determined perceptions of the stakeholders.

1.4 Specific Objectives

1. To establish the perceptions of community members in use of ICT in health service delivery
2. To determine the adoption of ICT and their role in providing healthcare information

1.5 Research Questions

1. What are the perceptions on ICT in healthcare service delivery in Tanzania?
2. What is the status of adoption of ICT in provision of healthcare information and access to health care services?

This paper therefore intends to answer these questions that are guided by the objectives above. The rest of this paper is organized as follows. Section 2 describes the methods used in this study. In Section 3, we present the findings and a discussion of key lessons that are worthy noting. Conclusion, recommendations and future work are given in Section 4. Finally we attach the questionnaire used to collect the data.

2 METHODS

2.1 Area of Study and the Population

The study was conducted in four districts from Iringa and Morogoro regions. Iringa was estimated to have a population of 1,614,000 in 2009 as per projections of 2002 census in Tanzania (NBS 2011, Ngasongwa 2007). Iringa municipality is considered urban and it had a population of 118,000. The neighbouring rural area called Kilolo district had a population of 221,000 in 2009. It is worthy noting that urban areas in Tanzania have relatively more access to electric power than rural areas. Large part of Kilolo district is rural area.

Furthermore, Morogoro municipality and neighbouring rural areas were studied. Morogoro lies between latitude 5° 58" and 10° 0" South of the Equator and its longitude is 35° 25" and 35° 30" East. This is the second largest region in Tanzania. It was projected that its population would be 2,115,000 by 2010 (NBS, 2011)

2.2 Sampling, Data Collection and Analysis

The sample size was 549 drawn from four districts of Iringa and Morogoro regions. This included 490 patient respondents and 59 key informants from healthcare workers. The study involved different health facilities which include hospitals, health centres and dispensaries. The respondents from various health facilities in the four districts were chosen randomly but a preference was given to the in-charge of healthcare facility. The questionnaire was prepared to cater for the key informants from health service providers and patients for the survey.

Data were analysed using popular software called Statistical Package for Social Sciences (SPSS). The research findings are presented in terms of statistical tables and charts. Statistical significance testing was done to gain better understanding of the statistical differences between urban and neighbouring rural areas in terms of ICT adoption and perceptions. This is important in understanding whether there is statistical evidence of a hypothesis. Statistical evidence can help in policy and strategies formulations for improved healthcare services.

3 RESULTS AND DISCUSSION

3.1 Social Characteristics of Respondents

In this subsection, we describe and discuss the social characteristics of respondents. This is important for someone to make generalization to the results described in this paper. As a matter of fact, a representative sample is always desirable in this regard.

Table 1 summarizes the demographic characteristics of patient respondents. Out of 490 patient respondents 52.4% were female. The group of patient respondents which had many (47.4%) respondents was aged between 21 and 30 years. According to CIA (2012) the median age in Tanzania is 18.7. This is inline with the age group distribution in our sample.

Table 1: Respondents Demographic Characteristics

	Iringa Municipality (N=198)		Kilolo (N=192)		Morogoro Municipality (N=53)		Morogoro Rural (N=47)		Total (N=490)	
	Count	%	Count	%	Count	%	Count	%	Count	%
Sex										
Female	110	55.6	101	52.6	27	50.9	19	40.4	237	52.4
Male	89	44.9	91	47.4	26	49.1	28	59.6	233	47.7
Total	198	100	192	100	53	100.0	47	100	490	100
Age										
<21 years	25	12.6	24	12.5	7	13.2	6	12.8	62	12.7
21-30 years	99	50.0	86	44.8	8	15.1	12	25.5	205	41.8
31-40 years	45	22.7	46	24.0	23	43.4	15	31.9	129	26.3
41-50 years	19	9.6	24	12.5	8	15.1	9	19.1	60	12.2
51-60 years	9	4.5	6	3.1	6	11.3	4	8.5	25	5.1
>60 years	1	0.5	6	3.1	1	1.9	1	2.1	9	1.8
Total	198	100	192	100	53	100.0	47	100	490	100
Education										
Primary Education	18	9.1	83	43.2	4	7.5	1	2.1	106	21.6
Secondary Education	41	20.7	66	34.4	37	69.8	32	68.1	176	35.9
College	48	24.2	29	15.1	9	11	3	6.4	89	18.2
University	91	46.0	14	7.3	3	5.7	11	23.4	119	24.3
Total	198	100	192	100	53	100.0	47	100	490	100

Source: Field data

Based on NBS (2006), this kind of distribution does not vary from the Tanzanian Population in terms of age and gender. In other words, the distribution follows the population distributions. Table 2 shows the distribution of key informants from health-care service providers. It is worth noting that for Morogoro region, the sample included almost all health facilities that were available, further expansion of the sample size was difficult.

Table 2: Distribution of Key Informants

	Iringa Municipality	Kilolo	Morogoro Municipality	Morogoro Rural	Total
Health service providers	15	24	15	5	59

3.2 Adoption of CT Tools for Healthcare Information

In this subsection, a discussion on the perceptions that lead to adoption of various ICT tools in the area under study. We further show that, not only, do these respondents positively think about ICT but also they have taken a step of owning various tools.

Table 3 summarizes the ICT tools that are used to access healthcare information. In general, Table 3 shows that 89.6% of the patient respondents use radio, 78.8% use Television, and 86.9% of the respondents use mobile phones. Some patient respondents did not own any ICT tool. They used them from friends or neighbours or paid services.

Furthermore, in terms of adoption and ownership, Table 4 summarizes that 83.3% respondents own mobile phone. 92.7% of respondents own Radio and (78.2%) own Television. Only 24.3% of them own computers. It can therefore be said that traditional ICT particularly radio is taking a greater proportions of Tanzanian who own and most likely use to access various information.

Table 3: ICT Tools Used in Accessing Information and Percentage of Respondents

ICT Tool/Service	Iringa (N=198)		Kilolo (N=192)		Morogoro Municipality (N=53)		Morogoro Rural (N=47)		Total (N=490)
	Count	%	Count	%	Count	%	Count	%	%
Personal Computer	139	70.2	59	30.1	5	9.4	9	19.1	43.3
Internet	111	56.1	47	24.5	5	9.4	8	17	34.9
Mobile Phone	192	97	158	82.3	39	73.6	37	78.7	86.9
Fixed Telephone	118	59.6	45	23.4	5	9.4	5	10.6	35.3
E-mail	99	50.0	44	22.9	5	9.4	7	14	31.6
Radio	192	97.0	191	99.5	24	45.3	32	68.1	89.6
Television	169	85.4	173	90.9	1	1.9		51.1	78.8
Fax Machine	97	49.0	68	35.4	1	1.9	2	4.3	34.3

Source: Field data

It was also interesting to statistically test the significance of the differences. The null hypothesis was that there is no differences between urban and neighbouring rural areas among districts in terms of proportion who own various ICT tools. The alternative hypothesis was that there is a difference between urban and neighbouring rural areas. In general Chi-square test revealed that the perceptions and adoption of ICT tools significantly differ ($p < 0.001$) from those proportions of respondents living in relatively rural areas.

It is however notable that in terms of Radio and Mobile phone adoption there is no statistical evidence of differences. In other words Radio and mobile phones are owned by statistically similar proportion of community members. This finding is important in planning and successful implementation of eHealth system for rural and urban areas. This means if a well thought system is introduced rural communities can also benefit in a relatively short time as they already own ICT tools.

3.3 Public Perceptions on ICT

This Section presents how respondents regard ICT in the health sector. Table 5 reports that 73.3% of the respondent patients said that their work has been simplified by ICT. This shows that the attitudes and the way community members in the surveyed areas regard ICT as important in increasing efficiency and effectiveness in their work. The interpretation would be that ICT is well regarded and accepted in these communities. Policy makers have to create an environment which will enable members of the community to benefit more from ICT tools.

In Table 6, we provide public perceptions obtained from patient respondents. We used the degrees of measure of five scale method of attitude measurement. In addition 55.7% of the respondents strongly agreed that ICT is helping them in accessing new health information. Combining the percentage of those who acknowledged this fact regardless of the scale, this makes 82.8% of the respondents have a positive attitude or perception that ICT is helping them.

Table 4: Ownership of ICT Tools Across Districts

ICT	Iringa Municipality (N=198)		Kilolo (N=192)		Morogoro Municipality (N=53)		Morogoro Rural (N=47)		Total (N=490)
	Count	%	Count	%	Count	%	Count	%	%
Personal Computer	52	26.3	38	19.8	15	28.3	14	29.8	24.3
Internet	33	16.7	20	10.4	9	17	11	23	15.1
Mobile Phone	193	97.5	146	76.0	50	94.3	40	85.1	83.3
Telephone	77	38.9	12	6.3	4	7.5	7	14.7	26.7
E-mail	122	61.6	31	16.1	8	15	8	17	34.7
Radio	190	96.0	183	95.3	42	79.2	39	83	92.7
Television	154	77.8	27	14.1	28	52.8	28	59.6	78.2
Fax Machine	11	5.6	1	0.5	0	0	4	8.5	3.5

Source: Field data

Table 5: Perception on simplification of work using ICT

	Frequency	Percent
Yes	359	73.3
No	131	26.7
Total	490	100.0

Source: Field Data

Most (67.6%) of the patient respondents strongly agreed that training in ICT use is required. In addition, on the same, 28% of the respondent patients agreed making a total of 95.6% of the respondents with the need of training. Furthermore 48.2% of respondents strongly agree while 41% agree that the government should do more on ICT to enhance health services. Table 6 shows that about 48.3% disagree and strongly disagree that cost of ICT services is a major hindrance for the use of ICT for health-care services. This means that although community members are eager to use ICT the cost is not a major problem rather it is inadequate skills that might be hindering in Tanzanian communities.

3.4 ICT tools mentioned as major source of Healthcare Information

In this Section, we specifically focus on respondents that who claimed to use ICT tools or service as a major source of healthcare information. Understanding the ICT tools that have been adopted for healthcare services is very important in formulating, adopting and implementing an eHealth strategy.

Table 7 shows that Radio (74.5%) and Television (52%) were one of the core technologies for healthcare services used by patient respondents. It can also be observed that only a few (0.2%) people in Tanzania use the Internet for healthcare services. It might be surprising that although TCRA (2010) reports that the number of Internet users has been growing at an average rate of 24% per annum as from 2005 to 2010, still community members have not adopted as a means of accessing healthcare services.

Table 6: Perceptions on the Role of ICT in Healthcare Services

	Strongly Agree (%)	Agree (%)	Not Sure (%)	Disagree (%)	Strongly Disagree (%)	Don't Know (%)
ICT is helping us access new health information	32.2	51.4	3.7	1.8	0.8	10
ICT is helping us in interacting with health service providers	55.7	27.1	4.9	3.5	2	6.7
Government must do more to provide ICT for health service delivery	48.2	41	8.6	0	.2	2
More training in ICT use for health services is needed	67.6	28	0.4	2.9	0.4	0.8
Cost of ICT services is a major hindrance to the use for health services	15.9	17.3	14.7	31.6	16.7	3.7

Table 7: Respondents who use ICT as a major source of Information for Healthcare Services

S/N	ICT Tool / Service	% (N=490)
1	Personal Computer	13.9
2	Internet	0.2
3	Radio	74.5
4	Mobile phone	48.4
5	Fixed Telephone	22.7
6	Television	52
7	Fax Machine	10.6

Source: Field Data

We had also a scrutiny of areas surveyed in terms of statistical differences. It was interesting to statistically test the significance of the differences in terms of major sources of healthcare information among community members. The null hypothesis was that there is no proportional difference of community members among districts under study in terms of ICT adoption as a source of information for healthcare services. Chi-square test with Yates' continuity correction revealed that the percentages of respondents that have adopted ICT as major source of healthcare information are statistically different with significant proportions ($p < 0.001$).

3.5 Healthcare Providers Perceptions on the role of ICT

There are 10 variables that were measured in the survey to find out the perceptions of health service providers on the importance of ICT. These variables include diagnosis, emergency services, hospital management, imaging technology, knowledge management, medical services, prescriptions, referral and research services. In Figure 1, it is notable that in the 10 variables larger proportions of the key informants regarded ICT either very important or important. Key informants who were not sure (neutral) were less than 10%. It is worth noting that there were no key informants who did say that ICT is not important. This is the reason why it is not appearing in Figure 1.

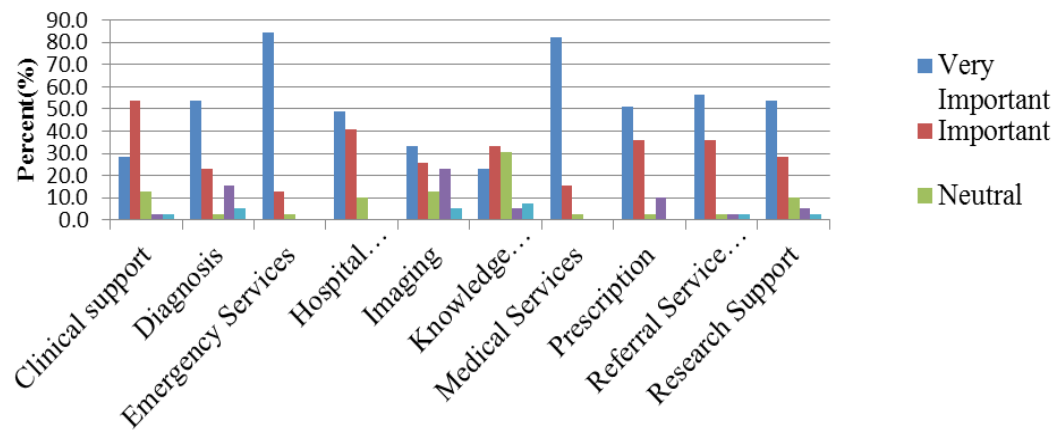


Figure 1: Perception of Health Providers on the Importance of ICT

The findings show that 84.6% of the key informants from health facilities described that ICT is very important to be implemented effectively in emergence services. Furthermore, 82.1% perceived ICT to be very important in medical services such as communication. In general key informants regarded ICT to be an inevitable tool and that it improves health-care services.

Table 8: Perceptions of Healthcare Workers (Key Informants)

Statement	Strongly Agree (%)	Agree (%)	Undecided (%)	Disagree (%)	Strongly Disagree (%)	Don't Know (%)
1 Health service process should be computerized	39	47.5	6.8	6.8	0	0
2 ICT improves effectiveness and efficiency	22	27	13.6	15.3	10.2	11.9
3 ICT improves quality of health services	18.6	30.5	10.2	13.6	16.9	8.5
4 ICT can reduce the cost of healthcare services	33.9	35.6	6.8	11.9	5.1	6.8
5 ICT increases patient's satisfaction	15.3	22	30.5	11.9	8.5	11.9

Source: Field Data

Table 8 summarizes more results on the perception which measures the acceptability of ICT among healthcare service providers. Measuring the perceptions of healthcare workers is important because they are key users of e-health systems if fully adopted. The findings show that 47.5% of respondents who are healthcare workers agree that health service processes should be computerized or automated. Those who strongly agreed are 39% making a total of 86.5%. Generally all statements in Table 8 had a majority of respondents accepting them. This is a good indication that there is less resistance among healthcare workers in adopting ICT.

3.6 Discussion on Key Lessons

The findings in this paper give an insight such that we can draw some lessons from them. Lessons can help in planning, formulating and implementing an e-Health policy and strategy. The following are some of the key lessons that can be of use.

First of all, as it has been shown in the previous sections, various ICT tools are being perceived positively in Tanzanian communities. This situation is promising in implementing e-health for better and cost-effective healthcare services (WHO, 2005). Although the community perceives positively it is important as well to establish standards and training as 95.6% of respondents recommended that more training is needed. The proportions could be quite different from the developed world where ICT is part and parcel of the school curricula. This situation could call for inclusion of ICT in all levels of education. Furthermore user friendly e-Health systems are required for easy adoption and improvement of healthcare services.

The second lesson that we learn from the findings is that Radio as one of the traditional ICT tool is equally used in accessing information in all areas surveyed. This is due to the fact that there was no statistical evidence of showing proportional differences among the areas surveyed. Furthermore Radio is the most (>92%) used instrument by the community members. This implies that although some countries are less using Radio (WT, 2010), Tanzania cannot afford to ignore it in its strategies of improving health delivery to the community.

The third lesson is the spread of mobile phones among community members. As it has been shown in proceedings sections, the adoption of mobile phones ranges from 78.7 to 97.7% depending on the area surveyed. This is a considerable large proportion of the community members. Its implication could be that any e-health information system should involve use of mobile technology with interactive programming. The adoption rate of mobile phones in Tanzania is significantly high. This finding is in line with TCRA (2012) report which claims that the teledensity (penetration) was at 62% by June 2012 in Tanzania. While this is true the growth of Internet remains high in developed countries and adoption of mobile phone still at early stage in the world (Meeker, 2012). It is further worthy noting that there was no statistical evidence of showing user proportional differences among the districts surveyed. This is an indication that mobile phones are statistically found in similar proportions in all areas surveyed.

The fourth lesson is that Television has been adopted by a large proportion (78.2%) of the community members in the surveyed areas. In essence municipalities are considered urban areas and the other two districts can be treated as relatively rural areas. One thing to note is that there is statistical evidence that there are less community members in the neighboring rural areas owning TV sets. In formulating e-Health policy and strategies, it is important to take this into consideration.

The fifth key lesson is related to the combined use of Radio and Mobile phones or Television and mobile phones. This might involve interactive programming to allow the combination of the technologies in healthcare services. The advantage of interactive programming lies in the fact that it provides opportunities for participatory approaches. Furthermore most users could access healthcare information at any time anywhere they are. This can include use of short message services (SMS) including voice communications.

The sixth lesson could be that the Internet is not being used for healthcare services in the areas surveyed. Only 0.2% of the patient respondents could mention it as a major means of accessing healthcare services. This is very low. The reasons for this could be less developed Internet infrastructure and inadequate skills among users. Detailed reasons were not the scope of this study. The implication of this finding could be that e-Health should not wait for increased Internet use. This can be avoided by use of radio, mobile phones/devices as Internet is being adopted progressively in due course.

4 CONCLUSIONS, RECOMMENDATIONS AND FUTURE WORK

4.1 Conclusion

We have presented a study on the perceptions and adoption of ICT in health-care service delivery in Tanzania. The findings reflect the situation in Tanzania and probably in other countries that are least connected. The survey results indicate that ICT is already perceived to be either very important or important in the communities of Tanzanian particularly for health-care services. There is a positively indication that healthcare workers are willing to accept e-health systems.

Unlike the situation in the developed world where personal computers and Internet is heavily used, in Tanzania the conventional ICT such as Radio is still being heavily used. ICT tools that have big role and perceived to be important include radio, television, and mobile phones. These are tools that are perceived by the community to be instrumental in providing access to information and improving health care services. ICT is regarded to improve work efficiency, communication and other health-care related aspects.

4.2 Recommendations

Based on the research findings in this paper, the following are recommended in developing countries such as Tanzania:

1. Establish health services that support mobile technologies reliably to be used including in remote areas and for emergency services.
2. Increase use of radio, TV and Mobile phones for health information access and dissemination. Most patient respondents rely on radios for health information. Radio and TV programmes should be interactive including the use of mobile phones to increase the participation of community members as such reach more people with health information services.

3. Increase the provision of electric power including alternative renewable energy for rural communities. This is due to the fact that ICT tools need electric power for successful use.

4.3 Future Research

This study was limited to examining the perceptions and adoption of ICT as a tool to increase accessibility of health-care services. The study did not include interactive programming of Radio, TV and inclusion of mobile phones which may enhance further usability of ICT. This could be another potential area to pursue further.

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