Information Communication Technology and Knowledge Management for Agricultural and Environmental Planning for Sustainable Development: A Case Study of Shinyalu Kakamega County, Western Kenya

Dr. S.I.D. Khamadi
Department of Information Sciences, Maasai Mara University
P.O. Box 861-20500, Narok.Kenya. E-Mail:Skhamadi@Yahoo.Com

Abstract

ICTs have become a vital tool as they are foundation of modern socio-economic development in agricultural and environmental protection. This is because Knowledge and innovation are important in the development of a society. This study examined the structure of information systems in Kakamega County in agricultural and environmental planning and management in order to develop a model for a frame work on agricultural rural information system (ARIS) for sustainable development in these two sectors. Data was collected from a sample of 2000 representing a total population of approximately 178063 of the rural community in the District which were analyzed using SPSS. The study found that whereas substantial information like indigenous knowledge among the community existed there is limited access to it by the local residents. It was further found that information channels are inadequate making information dissemination poor. Major obstacles to effective agricultural and environmental information systems in the area like: lack of adequate telecommunication infrastructure and utilities such as electricity, telephone access, poor roads, lack of policy guidelines in the management of ICT sector, lack of trained personnel in ICT, among others were identified. The study further revealed that the more educated respondents in particular teachers and students, had more access to information on aspects of health (HIV/AIDS), rainfall amounts and reliability, soils types, crop and food production and environmental resources such as forests, water, among others. The study recommends that modern ICT tools be established and integrated to ensure that local resident have more access to agricultural and environmental information. The study proposes that all stakeholders including government departments information and knowledge management provisions and delivery be integrated in the farming systems. Empowerment of poverty on agricultural and environmental information systems, information policy and institutional framework for effective accessibility and dissemination of agricultural and environmental information in the area using modern ICTs tools for dissemination of agricultural and environmental information in the country as a whole be an integral part of policy planning in the agricultural sector.

Keywords: *Agricultural Information Systems, Environmental information systems, Information Management, Knowledge Management, Digital Divide, Information Technology, ICTs, Indigenous Knowledge.*

1. Introduction

The aim and objectives of this study was to access the ICT as a tool for effective utilization and management of agricultural and environmental information in Kenya including the structure of the existing information system in the study area and to propose and establish a modern agricultural and Environmental Information System to support agricultural and environmental planning and management due to rapidly growing interest for application of modern information communication and technology. Agricultural and environmental Information System in this study is the computerized collection, storage and manipulation of agricultural and environmental data. Agricultural and Environmental data in this context pertains to specific environmental problems in the study area. Data on areas such as geology, soil type, agricultural production, rainfall, elevation, vegetation and land use,

among others, could be included in an environmental data-base to serve the study area.

This study was carried out under the auspices of Moi University as was commissioned by School of Graduate Studies of Moi University by the author as part of his PhD. Studies between 2000 and 2004. The research focused on identifying the processes in agricultural and environmental sectors, their relations with the stakeholders, and the problems and contradictions of these processes in relation to the National Information Policy on establishing ICT with the aim of generating solutions. The research employed both primary and secondary data collection methods and analysis in the study area. ICT was established by UN to promote economic and social development and bring about a real change in the lives of the people of the member states in accordance with MDGs (UN ICT Task Force, 2003). In this study, we argue that the concentration on promoting ICT should not be merely as a sector of economy of efficacious in achieving the ultimate goal, but be more important to take a holistic approach and treat it as a catalyst for all round development through improvements in education, health care, promotion of small and micro-business, utilizing the technologies for bringing about improvements in agriculture, better environment and the livelihood of. the people in rural and in the country.

1.1 Theoretical Framework: The Concept of Sustainability

After the UN Conference on Environment and Development (UNCED), widely known as the Earth Summit, which was held in Rio de Janeiro in 1992, 'sustainable development' was heavily adopted by many member states of the world and whereby the concept became fashionable phrase in our daily conversations as defined hereafter. "That Sustainable development is development that meets the needs of the present without compromising the ability of the future generations to meet their own needs (WECO), 1987, P.63). A

sustainable society is one that can persist over generations, one that is for seeing enough, flexible enough, and wise enough not to undermine either its physical or its social systems of supports. A new environmental and social dimension of development, refereed to as 'sustainable development', emerged in the 1980s. The first formal definition of sustainable development is found in our common future, where it is defined as 'a process that fulfils present human needs without endangering the opportunities of future generations to fulfill their needs. (WECO, 1987)".

This study is therefore based on the premise that the importance of information and communication technologies (ICTs) in the area of sustainable development as highlighted in the Rio Earth Summit of 1992 (UNEP, 1992) which was convened to address worldwide interest in sustainable development on Agenda 21, prepared frameworks for bringing governments NGOs, business and universities into a joint effort to resolve the issues that prevent the practice of sustainable development worldwide. Secondly, the paper is also based and backed by on "The Diffusion of Information Technology" research findings paper by the World Bank in developing countries which was carried out by Hanna, N. (1995). Given the inherently complex nature of the sustainability concept, it is important that planners and policy-makers within the member states are increasingly faced with the problem of finding appropriate approaches and tools like ICT for planning (Quaddus and Siddique, 2001). Chapter 40 of the UNSD Agenda 21 also identifies the need to bridge the data gap and improve information availability for decision-making purposes (UN, 2001). It calls for the production of usable information, the establishment of standards and methods, the development of

documentation and the strengthening of electronic capabilities. It also recommends research into hardware; software and other aspects of information technology as an important means for implementation of these programme areas. Studies have shown that technological innovations such as knowledge-based decision support tools may play critical role in the process of sustainable development goals. This study is based on the premises that ICT if well integrated as a tool, it can be used effectively and be utilized in the planning and management in the natural resources.

Recognizing the fact that technology is a critical ingredient in sustainable development in planning, this paper proposes and presents an innovative decision support tool within the ICT framework which can assist sustainable development plan. Agricultural and environmental information for planning and management of natural resources is thus an important component of sustainable development and the creative approach needed to support development in rural areas in Kenya. The importance of information and communication technologies for decision-making in the area of sustainable development is the topic of Chapter 40 of UN and Agenda 21 on sustainable development in developing countries (UNEP, 1992). The prerequisites for the proper and sustainable use of natural resources are the collection, management, processing and dissemination information to extension advisors, planners, administrators and policy makers who deal with the issues involved in development of Kenya as a developing nation. Innovative and efficient information and computing technologies thus, allow the systematic collection and timely sharing of information across regions, especially in urban-rural areas in aiding sustainability in terms of ecological - land, water, air, and biodiversity and human inputs-economical, social educational and political (Philips and Andriantiats and Andrigianina, 2001).

1.2   Methodology

The study focused on Kakamega District Western Kenya to determine as how an Urban Centre influences the generation and dissemination of agricultural and environmental information. The aim was to reveal the degree of variation information systems between urban and rural areas, and in particular the influence of distance decay on the information systems and delivery in the study area. The primary method of collection of data involved a series of field surveys in the libraries health information centres, media houses, district and documentation centers in search for the relevant information in the subject, were heavily employed. Identification of interviewing variables were accomplished through interviews with the key government information, NGOs and CBOs officials within the study area.

1.2.1. Primary Data Collection

The general approach of the study was the collection of data using the application ICTs as modern tools in the study area. The study sought to deal with questions of adequacy and comprehensiveness of information on community groups who are involved in agricultural and environmental as natural resources. The interviews focused on issues related to the use and implementation of ICTs and consultative processes and their relation to development and the perceived achievement of development. Interviews were directed at government Libraries, District Information Documentation Centres Learning Resource Centres and individuals within the community.

The data collection covered both rural and urban areas in the district. The two divisions in the district had a population of 178, 063 (N=178,063). It was assumed that the information needed could be obtained from respondents of two (2) larger divisions of the district

with a sample of 1500. Using Rogers (1984) method, the proportional constant sampling fraction of one percent was employed. This means that one percent household sample was drawn from each cluster using systematic random sampling technique. The method ensured that eligible respondents had an equal chance of being included in the survey. The questions varied from one village to the other depending on the information required. In addition to the interviews, some of the information in various sections of the paper is based on my personal experience as the principal investigator as a doctoral degree student by then.

1.2.2 Secondary Data Collection and Analysis

This study relied heavily on secondary data collection and analysis on the growth patterns and performance of the Kenyan economy during the period. In particular following materials were reviewed:

- National Development Plans and Regional Development plans.
- Sectoral policies, plans and Acts of Parliament in Information in Kenya.
- Acts of Parliament on Kenya National Library Services and District Information Documentation Centres, Reports, and National Archives.
- ICT policy Framework papers and Government Reports including research materials and books on the development of information in Kenya, among others.

2. Data Analysis

The data collected were coded, processed, stored, retrieved and analyzed using Statistical Package for Social Science (SPSS). Descriptive statistics including frequencies and percentages were used to present preliminary results. Logistic Regression Model was used to test all the two research hypotheses as discussed in the result below:

3. Research Findings and Discussions

The major goal of the study was to provide information for proper planning and management of natural resources with special reference to agricultural and environmental for sustainable environment development in Kenya, in particular, in Kakamega District, and make recommendations for effective utilization and management of agricultural and environmental resources. The paper summarizes the objectives, research questions of the study; discusses the theoretical and practical applications of the findings; and proposes the establishment of an Agricultural and Environmental Information System Model for Effective utilization in Agriculture and Environment Planning and Management for sustainable Development. It also provides some recommendations and suggests the way forward.

## 3.1. Socio-Economic and Demographic Characteristics of the Sample in the Study Area.

While addressing the issues of socio-economic and demographic characteristics in the study area, the study findings indicated that the average household of the survey consisted of seven people, in the family visited. Of these households, nearly half had no production provided a greater amount of the total income occurring from every household. The main income generating activities which existed in the study area were: crop production, poultry production, transport (Main Boda Boda), mining activities, posho milling retailing, among others.

Data analyzed from the distribution of house-hold heads showed that there was a predominance of male-headed household (64%). This can be attributed to a number of factors, for example, there was little migration by men in the

study area to urban centres to look for jobs. The sample indicated that the majority of the respondents (71.7%) were aged between 18 and 57 years. Being the majority users of the existing information, they were the most active group within the community in the area. The results are indicated in the figure 1.

**Figure 1: Percentage Distribution of Heads of House by Age Groups**
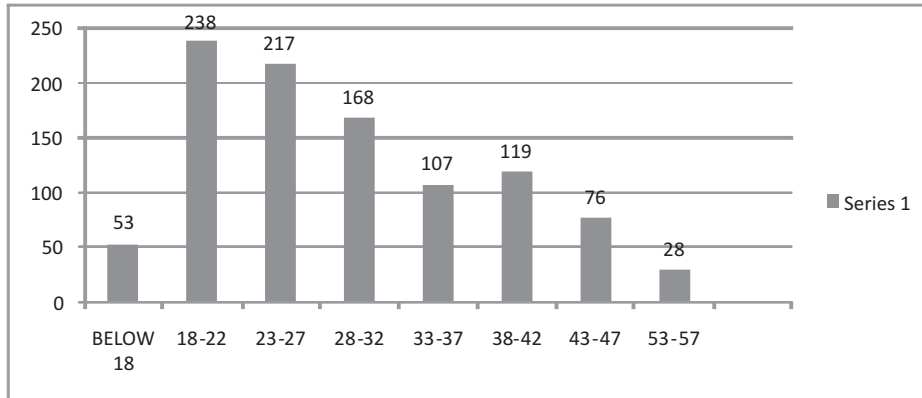
Gericke (1998) in a similar study, contents that some of the significant socioeconomic features of rural communities in ***most*** developing countries are, poverty and underdevelopment, landlessness, food insecurity and high population growth. For example, approximately 40% of rural households in South Africa live below the minimum subsistence level. Only 10% of household income is derived from domestic food production. It further revealed that people in rural areas often have low levels of education. Women - who comprise about 60% to 80% of the rural population or rural farmers,-are often constrained in participating in agricultural development due to lack of education.

3.2 Existing Information Systems and Information Needs of the Community

The objective of this was to assess the impact of ICT as a tool in order to establish its effectiveness in utilization and management of environmental information in Kenya with special reference to rural communities. The study was interested to track down the flow of the information provided by the existing Information Systems (Public, special, college and school libraries, information centre's, DIDCs, Archives, Mass Media, Computer-based Information systems (CBIS), etc) and its effect to the users in the community as to whether they were getting or not getting the type of information they needed for use in the their daily life.

Figure 2: Rating of various types of information users were receiving and not receiving from the area
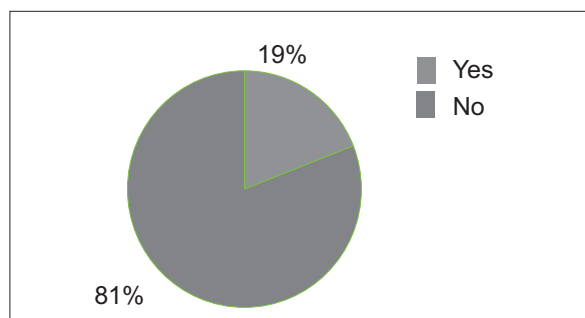
In the analysis, it was revealed that the flow of information from the existing sources of information and its effect on the resident by rating was very poor. In testing the hypothesis, using Logistic Regression Model, the results from the respondents (81.31 %) indicated that the information received from the existing sources was poor. There was overwhelming evidence that there was no provision for sustainability of the existing information systems by the Kenya Government in the study area. It was also found that the sources of information usually consulted were among others: Public academic, Institution, school college libraries, archives, DIDCs, Barazas women gatherings, indigenous knowledge, but none from modern ICTs, since the later were not available in the interior rural save only a few in urban areas.

The Hypothesis Testing of Information services received by households from existing sources was follows:

Ho=There is no significant relationship between the information received and the existing information needs in rural areas in Kenya.

This hypothesis examined the information services received by household in the study region from the government and other sources like, NGOs, church services, public barazas, funeral meeting mass media, etc. It examined six variables of which two emerged to be significant as shown in table 2. The model showed that the variables understudy, (90.31 %) of the information received in the region from the Government and other sources were poor and was not sustained due to lack of proper infrastructure. Other variables in the model which are functional in the region but emerged to be insignificant were Learning Resources Centres (LRCs), Libraries, Archives and Mass Media. Of there, radios, for instance, could have been underrated because they area the most common news providers in rural areas as displayed in the table.

Table 1: Logistic Regression Model

Variable	B	S.E	Wold	Of	Sig	R	Exp (8)
District Information & Documentation Centre	4220	1805	5.4643	1	.0194	.0571	
Resource Learning Centre	.2726	.1897	2.0656	1	.1507	.0079	1.3134
National Kenya Library Services	.3081	.1884	2.6736	1	.1020	.0252	1.3608
Archives	.1182	.1913	.3818	1	.5366	.0000	1.1255
Computer- Based	-4163	.1925	4.6778	1	.0306	.0502	.6595
Information Systems							
Mass Media	.5228	.1791	.0867	1	.7684	.0000	1.0542
Constant	-2.5306	.3776	48.5389	1	.0000		

Chi- Square-Model prediction = 90.31 % df = 6 Sig = 0.0008

3.3 Information Needs and Seeking Behaviour provided by Existing Information Systems

The study sought to find out where the residents obtained their information needs in the study area. A total sample of 279 was interviewed where by the information needs of the residents in the study area and their main sources of information were to be established. In the questionnaire, the residents were asked to indicate where they obtain their information from (for example, on land use, soil, crop production, natural resources, climate/weather, farming, livestock health, water, etc, among others).this is so because agriculture is the main stay of the district economy where over 90% of the population living in the rural areas depends directly or indirectly on agriculture as subsistence. The results as shown in the table indicated that the majority of the residents obtained get their information from among others, the following sources: land use by extension officers 62 (22.2%); baraza's 50 (17.9%), agriculture shows 12.5% (n=55), reading materials 9.7% (n=27) and mass media 37.6% (n=195). The results show that the mass media was the leading source of information followed by: land use 105 (37.6%), natural resources 35.8% (n= 100), soil 25.4 (n=71) and crop production 12.2% (n=34) results are displayed in table 3.

Table 2: Sources where residents obtain information in study area

	Variable information	Extension officer %	Baraza %	Agric show %	Reading materials%	Mass media %	total
- i)	Land use	n=62 (22.2)	n=50(17.9)	n=35(12.5)	n=27(9.7)	n=105(37.6)	n=279(100)
ii)	Soil	N=71.(25A)	n=15(5A)	n=71 (25.04)	n=51(18.3	n=(71.25A)	n=279(100)
iii)	Natural resources	N =78(28.0)	n=25.(9.0)	n=52.(18.6)	n=24.(8.6)	n=100(35.8)	n=279(10)0
iv)	Climate/weather	n=55 (19.7)	n=17(6.1)	n=40(14.3)	n=42(15.1)	n=125(44.8	n=279(100
v)	Land registration	N =72(25.8)	n=54(19A)	n=31 (11.1)	n=85(30.5)	n=37(13.3)	n=279(100)
vi)	Mixed farming	N=72(25.8)	n=51 (18.3)	n=67(24.0)	n=?-	n=34(12.2)	n=279(100)
vii)	Livestock health	n=99(35.5)	n=56(20.1)	n=53(19.0)	n=l *(.004)*	n=19(6.8)	n=279(100)
Viii)	Polluted water and effects	n=26(9.3)	n=95(34.1)	n=69(24.7)	n=-	n=89(31.9)	n=279(100)

N = 279

3.4. Information Communication and Technologies (ICTs) Utilization in the Area.

In the study, the role of information in the rural development was rated as average (45.7 %) as displayed in the table. however, 26% an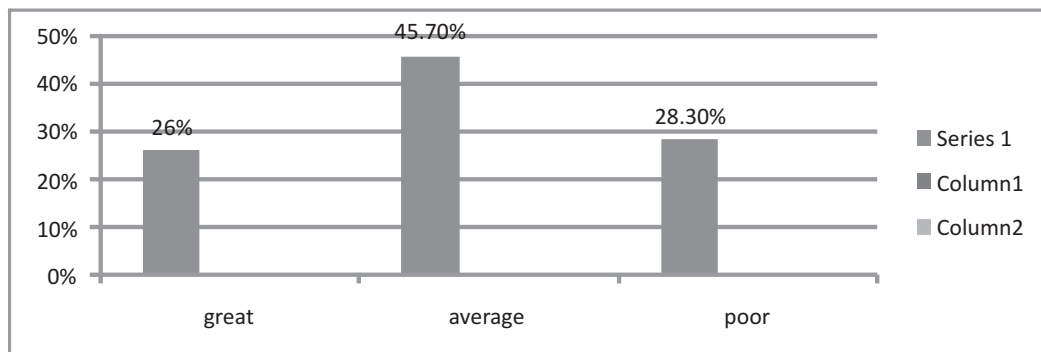d 28.3 % of the sample reported that the contribution of information in rural development was good and poor respectively.

Table 3: Contribution of Information in the Support of Development in the Area

	Frequency	Percent
Great	(n=286)	26
Average	(n=504)	45.7
Poor	(n=312)	28.3
Total	(n=1102)	100

N = 1102

Figure 3: Contribution of Information in the Support of Development in the Area

All these perceptions were below 50% (n =50) hence accounts for the levels of development indicators in the region. The 71.1 % (n =71.1) of the respondents who appreciated the role of information rural development, were mainly farmers who enjoyed the services of extension officers, information officers and NGOs in the region. A similar study survey like the one under the study was carried out in Borno state, Nigeria. It was found that the success of rural development programmes rest squarely on the availability and use of quality information by rural development workers and rural people. Proper planning and implementation of rural programme required the use of quality information at all levels (Camble, 1994). This study which is based on the framework that ICTs are diverse set of technological tools and resources used for creating, storing, managing and communicating information conforms with the agencies such as the FAO, WHO, UNDP and UNHCR which have provided lots of development information in both printed and audio-visual format to the developing countries which state among others that: This study discovered that the residents in the study received information from a variety of the existing information sources as shown in the figure 2. KNLS emerged as the most popular source of information with over 430 respondents. This was attributed to the free library services offered by the library, which made it more accessible to a wide cross - section of people. Mass media was second with about 310 respondents. Radios have advantage of being potable, economical and adaptable to the peoples' needs (since they use dry cells). The recent introduction of radios which use one dry cell makes it even more handy. The rest of mass media is underdeveloped and more often quite expensive in the region. Institutional libraries (Schools, colleges and university) only appealed to students, and the staff. The rest of the available sources of information serve minor sections of the population with special needs in search of specific information. These cadres of people include researchers, tourists, politicians, students and civil servants.

In this regards, the study notes that information should be gathered, reported, analyzed, accepted, stored, retrieved, and be put to use. The system of information management must ensure that the right quantity and relevance of internal and external information is provided to Decision-authority centers by adopting total quality management policies. Hence, information is a key input in the decision making process. Information communication and technologies are enabling organizations to advance more rapidly". Thus the interplay between information communication and technologies, and organizational design is key to the strategic success of organization.

3.5 Obstacles to Effective Utilization of Information in the Area.

In addressing the question on how, to establish the obstacles to effective environmental information systems in study area, the data analysis showed that there were quite a number of factors contributing to inadequacies of information for development in the area. It was found that the problems of the residents were still mainly related to accessibility of information and how it is disseminated. Among these factors were: inadequate of information policy infrastructure (963.2%), inadequate information systems 55.4% (n=55.4); poor reading habits (55.1 %); and inadequate modern information technology (IT) 49.9% (n=49.9). The table below shows the factors contributing to inadequacies of information for use in the area. Lack of information policy infrastructure accounted for 63.2% (n-63.2) of information deficiency in the region, followed by libraries, archives and information centers 55,4% (n=55,4) and poor reading habits 55.1 % (n-55.1). The results of this survey as illustrated in table 4 can be justified on the ground that the study area is situated in the rural set up.

Table 4: Factors Contributing to Inadequate Information in the Area.

	Yes	No			Total
	Frequency	%	Frequency	%	%
Inadequate modern	(n=549)	49.8	(n=553)	44.9	1102(100)
Poor reading habits	(n=607)	55.1	(n=4950	44.9	1102(100
Inadequate libs/archives/inform. Centers	(n=610)	55.4	(n=492)	44.6	1102(100
Inadequate on Inform. Policy infrastructure	(n=696)	63.2	(n=4050	36.8	1102(100

N=1102

The factors contributing to inadequacies of information in the study area are further supported by testing hypothesis two (2) as discussed there below:

Hypothetically, the study tested the problem of inadequacy of information needs in order to prove as to whether it was a major shortcoming in influencing social economic and sustainable development in the study area as follows:

Ha = *Inadequate Information Needs is not a major shortcoming in Influencing Economic and Sustainable Development in Rural Areas in Kenya.*

Ho = *Inadequate Information Needs is a Major Shortcoming in Influencing Economic and Social Sustainable Development in Rural Areas in Kenya.*

This hypothesis examined indecencies of information needs and sought to prove if it was a major shortcoming in influencing economic development in the study area. In doing so, it examined variables.

The model revealed that the variables in the study explained 72.60% (n=72.60) of contribution of information in rural development and was significant at 1 %. This hypothesis was therefore accepted. The findings are presented in table 5.

Table 5: Logistic Regression Model for Inadequate Information Needs as a major shortcoming in Influencing Socio-Economic and Sustainable Development in Area. Logistic Regression Model:

Variable	B	S.E	Wald	df	Sig	R	Exp (B)
B4BII-(IP)=Information Population Control	.2761	.0584	22.3704	1	.0000	.1240	1.3180
B51-(MM)=Mass Media Newspapers, TV, Radio ETC)	.0461	.0571	.6521	1	.4194	.0000	1.0472
B5II - (LIB) =Libraries (Public Academic, Special, College, Sch., etc	.7972	.0626	9.9315	1	.0016	.0774	
B5III - (EW) =Extension Workers	.2328	.0637	13.3554	1	.0003	.0926	1.2622
B5V -(PW)=Public Barazas, Women Groups, etc	-0628	.0599	1.1009	1	.2941	.0000	1.0648
B9II - (mDCs) = District Information & Documentation Center	-0464	.0554	.7020	1	.4021	.0000	1.0475
B9III-(LR)=Literacy & Poor Reading Habits	-0896	.0528	2.8820	1	.0896	-0258	.9143
B9IV-(LTQ)=Training & qualified Manpower	-1024	.0510	4.0354	1	.0446	-0392	.9027
B5I-(INS)=Institutions e.g. NGOs etc	-0404	.0672	3625	1	.5471	.0000	.0604
Constant	-0155	.4003	9.4350	1	.0112		

Chi-Square=Model Prediction=72.60% DF=9 Sig=0.0008

The study also revealed that in the absence of widely available voice protocols, text based protocols remain the most widely used Internet application in Kakamega Municipality. In Shinyalu divisions, language barriers and illiteracy were identified as common obstacles to Internet access. Emerging from the above observation, there is needed to especially equip persons who will work with the varied rural communities, with various skills. One such skill if information communication and technology, especially agricultural information seeking skills. Thus, according to Stilwell (1991: 128); there is recognition of the primary role of communication skills in proposal curricula or recommendation for the training of rural information workers as outlined in the recommendations in paper. The absence of a national information policy is in Kenya has been as a major shortcoming in the establishment and implementation of modern information systems, (ICTs). It is imperative that modern information systems should be provided in the Kenya National Strategic Development Plan.

3.6 Level of Information Sources in the Area and how it affects Development

In assessing the level of rural development in relation to level of agriculture and environmental information systems in the study area, it was found that the majority of the respondents obtained their information from: extension officers 22.2% (n=22.2) Barazas 17.9% (n= 17.9), Agriculture Shows 12.5%

(n= 12.5), Libraries, DIDCs and other information centers 9.75 (n=9.7) and Mass media 37.6% (37.6). The mass media emerged as the leading source of information. This analysis enabled the study to establish that the information gathered helped to respond to the users needs and hence answered the questions

such as: Who needed the information?; What information?; For what purpose(why)?; How is the information sought? When it was needed? And where the information is required? This assessment is in an agreement with this study's concept framework of Information Systems carried elsewhere by researchers in the subject matter.

The majority of the respondents interviewed 60% (n=60) lived within the distance of 10 Km from Hamisi Town. This included 'residents from Vihiga town itself and a few from Tiriki East Division. This situation revealed the degree of variation in information systems between urban and interior areas, and in particular the influence of distance decay on the information systems and delivery in the study area.

4. CONCLUSION

The general objective of the study was partly to assess the impact of ICT as a tool and to determine and establish its effectiveness in utilization and management of agricultural and environmental information in Kenya. Based on the foregoing, this paper focuses on how ICT, a public sector organization and how it could effectively utilize its tools and innovations in order to create an effective framework for obilization of information resources to enhance agricultural and environmental management in the study area and a country as a whole. The results indicated that whereas a lot of information existed in the study area, there was limited access to it by the local community (90%), save only 10%.

The study also found out that information channels were inadequate (72.60%) making information dissemination poor. Major obstacles to effectively utilization of available information sources in the study area included among others: lack of awareness on the part of the users, lack of government national information policy, inadequate government funding hence poor infrastructure (roads, electricity, trained personnel e.t.c.) lack of modern ICT, education and training. The research if implemented will impact knowledge to change the lives of many rural people in Kenya's poverty-ravaged region. The study aims at empowering rural communities in Kenya by strengthening local institutions and community-driven development activities, improving access to information on healthcare, sanitation and hygienic practices, by increasing farm labour productivity, improving food security and nutrition and enhancing community awareness of social behavior and their consequences. Communities in the district are often very poor, with strong socio-cultural traditions and norms, weak institutions and an incidence of HIV / AIDs above the national average.

The paper recommends that ICT as a modern tool be established and be integrated in all government planning sectors. It should be as a tool for effective utilization and use. Planning and Management of Agricultural and Environmental information channels should be established to ensure more access to information, and that all stakeholders including government representatives, NGOs, private sector groups, CBOs in the local community be involved in information provision and delivery as detailed in figure x3.
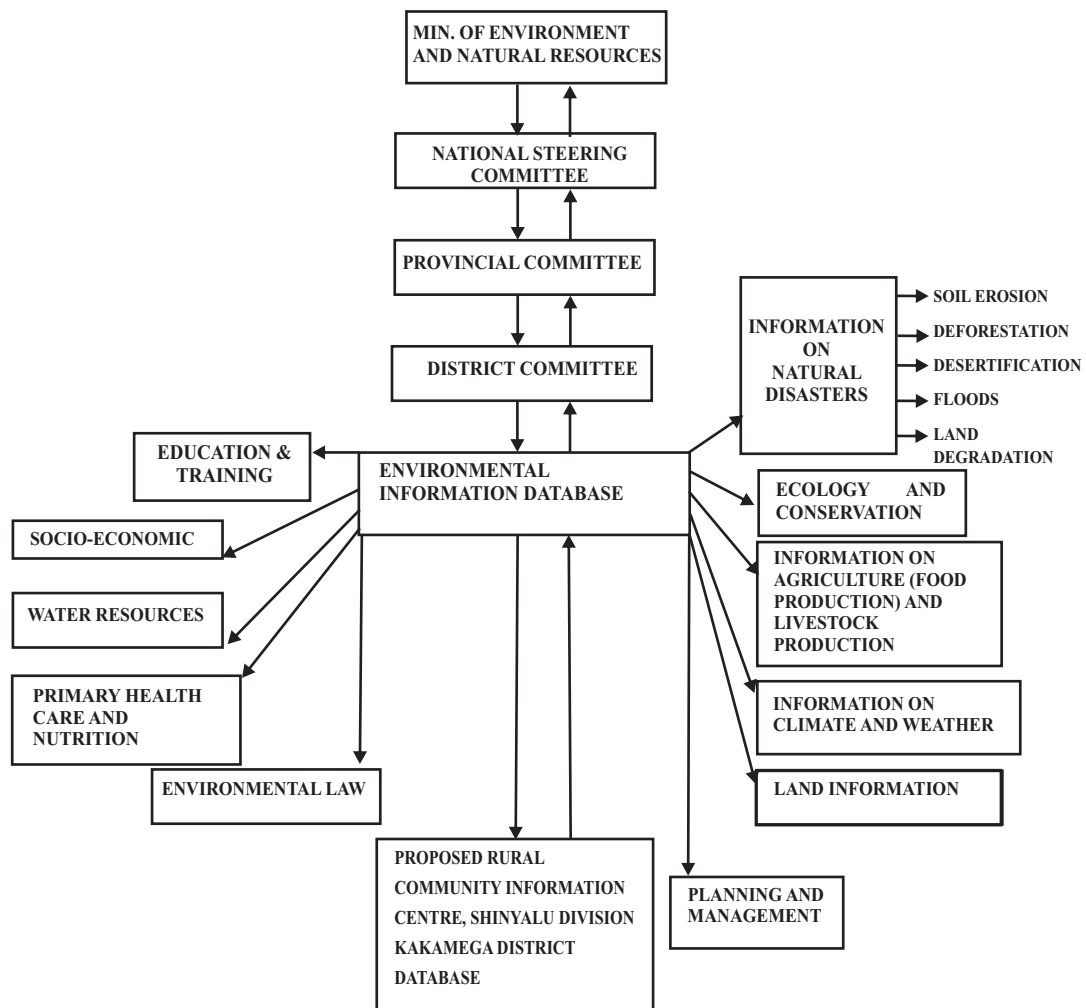
Fig 3: The proposed Integrated Environmental Information Systems Model

The paper suggest that further research into the relationship, application and use of modern ICTs including health information provision, especially on HIV / AIDS should enhance the capacity of educational institutions in ICT in order to improve education especially among the youth and gender levels , and strengthen the participation of women and the youth in planning and management and implementation of ICT as a tool for its innovation and diffusion into environmental information systems and their planning and management.

5 The Way Forward

a) Existing information systems (Libraries, District Information and Documentation centre including available ICTs, i.e. computer based information systems) services were rated as poor in terms of usage and dissemination of information and agricultural and environment issues in the area. This call for the need to establish the services provided by these Agricultural and Environmental Information systems to meet their information needs of the community.

b) Since HIC/AIDS I s major public health, social - economic and

development challenge within the district, more information is required. There is need for urgent research on health information research in the area.

c) Women and youth in the study area, interact with the agricultural and environmental in a variety of activities in many ways. Since they are the major players in natural resources and agriculture and economic development, therefore, they are the majority among the labour force involved in food production. And make significant contributions to food storage, processing and marketing. Women are also major users of wood fuel, water, chemicals and detergents, etc. they have distinct areas of indigenous knowledge of particular environments and plan their ecology and their uses. In this regard, sustainable development agricultural activities can only be achieved with the integration of ICT as a tool in the agricultural and environmental activities in the area.

There is also need for further study to enhance the capacity of educational institutions to improve information and knowledge attainment levels especially in computer skills of both females and males and strengthen the roles of women in design, management, and implementation of population agriculture production and planning and management of the programmes in the study area. Information contributes very significantly to assuming that the agricultural, industrial and service sectors of the national economies like agricultural and environmental of all free market of the country remains competitive in both domestic and international markets. If these ICTs networks are to have an impact on development and the information they transfer is to be meaningful, direct stakeholders (farmers, extension workers, and crafts people including SMEs), must be involved. It is therefore essential that international networks be based on the prior establishment of national networks bringing together not only contributions but also representations of the private sector, including farmers.

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