

STRATEGIES FOR DEVELOPING HUMAN RESOURCE CAPACITY TO SUPPORT SUSTAINABILITY OF ICT BASED HEALTH INFORMATION SYSTEMS: A CASE STUDY FROM TANZANIA

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ABSTRACT

Information and Communication Technologies (ICTs) are typically introduced in organizations with the promise to help manage resources, increase efficiency, increase work productivity and reduce workload. In the context of developing countries, the lure of these promises is magnified given the existing conditions and inefficiencies. International aid agencies play an important role in shaping this promise. However, introduction and use of ICTs in developing countries has proven problematic due to failures or unsustainability resulting from many factors. One important factor is the lack of appropriate human resources both with respect to quantity and quality. This paper emphasizes that human resource capacity building in developing countries is an urgent issue of concern for the sustainability of ICTs. Drawing on concepts of sustainability, ICT literacy, and human capacity building, this paper analyzes challenges related to human resources in health information systems (HISs) and ICTs in the health sector of Tanzania and suggests some strategies to address the problem. Specifically, the paper focuses on initiation of ICT based HIS in the context of the health sector and argues for human resources with a mix of skills to understand the meaning of data, information, and the use of computers.

Keywords: ICT literacy, human resource capacity, sustainability, HIS, health sector, Developing countries, Tanzania.

1. INTRODUCTION

The use of Information and Communication Technologies (ICTs) can help healthcare sectors in developing countries to potentially plan, monitor, control, and improve health services as well as communicate more effectively across organizational hierarchies (Bhatnagar, 1992; Braa and Blobel, 2003; WHO, 2005; Chandrasekhar and Ghosh, 2001; Mosse, 2005). However, the literature provides a number of examples where assumptions about ICTs being critical for bringing about change in developing countries have been problematic (Avgerou and Walsham, 2001; Madon, 1993; Chandrasekhar and Ghosh, 2001; Silva and Figueroa, 2002). A key challenge in developing countries is the lack of sufficient awareness and use of ICTs and the lack of well trained ICT professionals (Bhatnagar, 1992; Walsham et al., 1988; Sahay, 2001; Waema, 2002).

Historically, at the end of colonial regimes in Africa between 1950s and 1970s, many African countries were left without appropriate human resource capacity and infrastructure to support a good quality of life. The post colonial phase started with programs to develop basic literacy skills (e.g. reading and writing) and the provision of basic social services for the people. However, achieving higher levels of literacy remained problematic as a result of the

poor economy, the low quality of education, and the uncondusive political, social, economic and administrative environment (Wangwe and Rweyemamu, 2001; Sahay, 2001; World Bank, 1999a). For example, in 1991, Tanzania had a work force estimated to be slightly less than half of its 34.5 million; of this population only 8.5 percent had post primary education (Tanzania country web site: <http://www.tanzania.go.tz/>). Moreover, the internal conflicts in some of these countries adversely affected the existing post colonial infrastructure and weakened national capacity building efforts (see description of these issues in Mosse and Sahay, 2001). In addition, quite a few educated elites migrated to developed countries in Europe and USA (Wangwe and Rweyemamu, 2001).

The use of ICTs in developing countries is very low, estimated to be only 2.5 % of population living in developing countries (HRDR, 2003). One of the many problems attributing to this is ICT illiteracy (HRDR, 2003; UNDP, 1999). A study by Braa et al. (2001) in the health sector of Mozambique indicated that only very few people had basic skills in ICTs and only few health workers at health facilities understood how to interpret health data. Likewise, Ndumbaro's (2003) Tanzanian health sector survey of ICT applications in 5 out of 26 regions in Tanzania indicated that only a few health professionals had received formal training in ICTs with the actual usage of ICTs being very low. The problems cited by Ndumbaro (2003) were scarcity of expertise and skills in ICTs.

The UNCTAD's information economy report (2005) attests to the importance of knowledge capital for ICT use. Typically, ICTs cannot deliver any benefits on their own unless they are supported and enhanced by skilled and educated human resources and appropriate institutional capacity. The international aid agencies have often included initiatives for the development of literacy as part of their aid projects in developing countries. However, these provide only basic training that does not lead to appropriate skills to sustain the projects after foreign experts have left (Korpela et al. 2000; Heeks 2002). This consequently leads to a situation of unsustainability of ICTs (Heeks et al. 1999; Heeks and Baark, 1998; Braa et al., 2004; Paul, 1995) as locals with little knowledge find it difficult to act independently to manage and maintain ICTs over time. Similarly, projects initiated by local government without donor support lack attention to continuous human and institutional capacity building. The insignificant spending in social services and lack of resources in developing countries adversely affects the quality and quantity of training and skills development.

The key question to be addressed in this paper is: What are the challenges of human resource capacity in the health sector and how can human resource capacity be developed to support the initiation of ICTs and contribute to sustainability of Health Information Systems (HISs)? The paper sheds light on the ICT capability and information skill gaps that exist in the health sector of Tanzania and suggests ways in which human capacity can be improved to support use of ICT based HIS. The empirical data used in this paper is drawn from the study of both existing paper and computer based HIS and some lessons learned from the on-going adoption of the Health Information System Programme (HISP) in Tanzania.

The Tanzania HISP is part of the broader network of action research initiatives being undertaken in various public health care organizations of developing countries specifically aimed at improving Primary Health Care (PHC) delivery through streamlined ICT based HIS and appropriate human resources to use information for local action (See the description of this programme in Braa and Hedberg, 2002; Braa et al. 2004; Muquingue et al., 2002). HISP uses the District Health Information Software (DHIS), a free and customizable database application for collecting, processing, and analyzing health information for health administration purposes. The key intervention strategies employed are training programs and

participatory customization of the DHIS (Kimaro and Titlestad, 2005) to facilitate leaning and use of ICTs. Influenced by the anatomy of health care organizations, HISP teams in each country are composed of inter-disciplinary researchers in public health and ICTs. The public health professionals help in training and participatory discussions towards improving routine working procedures, understanding of the meaning of data, and use of information for decision making. The ICT professionals in the HISP team are engaged in customization of the DHIS to fit it into the local setting and training of health workers and managers on computers use. Both the mode of formulation of the HISP team and the processes of adaptation of ICT are intended to address the key practical problems of the lack of appropriate capacity to support the use and sustainability of ICT based HIS.

The paper aims to contribute to the IS community literature and to guide IS project managers and donors in understanding the practical challenges of human resource capacity in the context of the health sector in developing countries. The paper is organized as follows. The next section describes the issue of human resource capacity and its link to the sustainability of HIS and ICT literacy. Details of the research setting and approach are provided in section 3 and in section 4, a case study of HIS from Tanzania is presented. Following this, the analysis and discussion of the human resource problem and strategies to address these challenges are presented in section 5. Conclusions are presented in section 6.

2. HUMAN RESOURCE CAPACITY BUILDING: ICT LITERACY AND SUSTAINABILITY

This section describes the issue of human resource capacity building and its link to the issues of sustainability of HIS and ICT literacy.

2.1 Human Resource Capacity

The problem of human resource capacity in developing countries is reported in a number of publications (see, Walsham et al. 1988; Bhatnagar, 1992; Waema, 2002; Sahay, 2001; Sahay and Avgerou, 2002). It is not uncommon to find a health manager with limited computer skills (Waema, 2002) and a lack of motivation to learn. This results from factors such as unconducive environments and lack of training resources (World Bank, 1999a; Paul, 1995).

Ideally, capacity building goes beyond development of basic skills, extending to technical skills, planning, policy analysis and formulation, and management of ICTs. It involves activities related to the development of human resources through training, formal education, and promotion (Targowski and Deshpande, 2001; Ball, 2001). It is also a continuous process whereby people and organizations develop their abilities individually and collectively to perform activities, deal with problems and manage according to set objectives (UNDP, 1994; Paul, 1995). Human capacity building depends on the institutional capacity to provide a conducive environment for learning. Institutions with unclear objectives, inadequate structures and resources, lack of incentives or weak practices are unlikely to achieve a productive and motivated work force (Paul, 1995) because these factors do not lead to a conducive working and learning environment. Thus, local governments and donors need to create an enabling environment, supportive of capacity building and effective use of knowledge to ensure the development and use of sustainable ICTs in developing countries.

2.2 ICT Literacy

ICT literacy adds new demands to traditional literacy (Harvey, 1983), which include the use of hardware, software, and communication networks. ICTs also redefine the manner in which information (e.g. text) is traditionally represented e.g. indexing, zooming in and out, etc. (Selfe, 1996; Cesarini, 2004). However, ICT literacy is not static as technology changes over time, and thus old skills need to be upgraded (e.g. change from DOS to Windows). In

addition to technical skills, ICT literacy includes skills for dealing with information and understanding the impact of ICTs on work processes. Most health care organizations of developing countries are overloaded with information but lack capacity to manage and analyze data using ICTs and to use the generated information for decision making (WHO, 2004 and 2005). ICT literacy initiatives are required and must involve a variety of people from different functions and roles (e.g. health workers, health managers) (Volti, 2001).

Training in ICT literacy is dependent on the social context of use whereby existing cultures and politico-economic structures influence individual's learning and participation in training (Williams, 2003; Kimaro and Titlestad, 2005). Thus, the building of literacy involves cultivation of new cultures of ICT use including ways of processing, analyzing, and using data in HIS (Heeks, 2002; Ingram and Clay, 2000). Cultivation is a gradual yet progressive process involving institutional changes based on learning (Clemens and Cook, 1999) through local adaptation, use and the creation of new routines (Braa and Blobel, 2003). Thus, a new setting is developed which in turn demands long term training and learning. This implies examining not only individual literacy but also the socio-cultural, political and economic factors that shape literacy (Gee, 1999), as well as the institutional context (Kling et al. 2000; Braa et al. 2004; Hanseth and Monteiro, 1998).

2.3 Sustainability

Sustainability of ICTs implies the ability to identify impacts and manage risks threatening the long-term viability of ICTs (Reynolds and Stinson 1993; Korpela et al. 1998). The failure rate of ICT projects in developing countries is considerably higher than in developed countries (Heeks, 2002) mainly due to the lack of appropriate skills and knowledge to identify and deal with the risks associated with ICTs on a long term basis (Heeks 2002; Mursu et al. 1999, Korpela et al. 2000; Kimaro and Nhampossa, 2005).

The risks associated with ICTs, some of which are related to the use of ICTs, can lead to failures (Dhillon and Blackhouse, 1996). For example security of ICT systems involves dealing with computer viruses, hackers, systems faults, bugs, and access control which often requires ICT professionals with the ability to provide complex technical solutions (Baskerville, 1991). Apart from technical risks, there are other risks associated with the intended users of the ICTs (Mursu, 2002). For example, failure of the system to meet expectations, capability, and interests of the users or organization often leads to rejection, ultimately resulting in the system becoming unused and obsolete. There are also risks that emanate from the organization's environment. For example, changing scope, objectives, and needs of the organization over time can lead to a system that does not meet new demands, thus leading to its abandonment or replacement. Therefore, development and adaptation of ICTs requires people/managers with a mix of skills that entail management, organizational, and technical areas (Bhatnagar, 1992; Waema, 2002) and the ability to be able to deal with social, organizational, and technical risks.

Having appropriate ICT learning and training measures in place is critical for the sustainability of ICTs (World Bank, 1997; Braa et al. 1995; World Bank, 1999a; Kimaro and Nhampossa, 2005). ICTs can have an impact on organizational work practices when people have the necessary capacity to use, maintain, develop and sustain them (Braa et al., 1995; Walsham, 2000). Otherwise, ICTs become obsolete and unused, and resources are wasted without any benefits of ICTs in enhancing economic growth in developing countries (Indjikian and Siegel (2005). Indjikian and Siegel (2005, P. 1) have argued that developing countries must address two key challenges to be able to maximize social returns to IT investment. First, they must address "a lack of knowledge of best practices in IT usage". Second, they must address "IT-related skill deficiencies in the workforce" through learning

and training. The process of learning and training involves adaptation of ICTs in new contexts of use and the establishment of routines for support and maintenance (Kenny, 2000; Braa et al. 1995).

Donor agencies are often the conduit through which most ICTs such as computers are introduced in developing countries. Thus, most institutions in developing countries do not necessarily lack computers. Donors and associated donor experts tend to focus primarily on the use of ICTs for solving the “information” problems in developing countries (Bjørn-Andersen et al., 1990). However, once computers and software are installed, they often require regular support, maintenance, training and upgrading, something which local institutions fail to afford in practice due to lack of institutional capacity and appropriate human capacity. Typically, the cost required to meet regular training, support and maintenance of ICTs over time far exceeds the cost of acquisition of ICTs such as computers, which most developing countries fail to afford in practice, given the existing conditions (Wade, 2002).

Traditionally, donors have used foreign experts to fill professional gaps and transfer skills to developing countries (Kimaro and Nhampossa, 2004; Korpela et al. 2000) at the expense of developing local human capacity. The process of transferring skills often is not possible due to the nature of the projects which place relatively little emphasis on training. Donor projects are typically used to mobilize resources (e.g. vehicles, computers), rather than developing appropriate human resource capacity (Wood-Harper and Bell, 1990; Sahay and Avgerou, 2002; Paul, 1995). Such donor projects generally include poorly designed and short term training programmes (Wangwe and Rweyemamu, 2001) which are culturally incompatible with the local situation. Thus, the availability of ICTs needs to be complimented by the availability of well designed training and practices to develop human capacity with appropriate skills and knowledge to sustain ICTs over time.

2.4 Health Information System

A Health Information System (HIS) is a combination of people, tools (e.g. ICTs) and routine procedures to provide and use health information (Boerma, 1991). A sustainable HIS can be simply defined as one that reliably meets the information needs of the healthcare sector over time. However, sustainability of ICT based HIS is a complex process as it involves the capability (skills and knowledge) of humans to collect, analyze, use and disseminate information as well as to deal with risks threatening ICTs. Thus, ICTs may be used as a tool and become part of HIS with people remaining the cornerstone for understanding the significance of the information collected, making sense of the information and using it for action, thus providing for the sustainability of HIS. Lippeveld (2001) emphasizes the training of health staff to obtain knowledge and skills to use and explore ICTs so as to bring effectiveness and efficiency in the HIS.

...introducing computer technology is not necessarily the silver bullet that creates effectiveness and efficiency in health services. On the contrary, lack of appropriately trained staff and hardware and software problems sometimes result in the decay and obsolescence of expensive computer equipment, without any gains in decision making (ibid,p.24).

In the health sector, limited scaled HIS may not produce anything useful for health managers, who typically need full area (district, region(combination of districts), national(combination of regions)) population coverage data (Braa and Hedberg, 2002; Braa et al., 2004) for making informed decisions on health and administrative issues. Scaling up of HIS implies transfer of the ICTs, associated approaches and techniques from one setting to

another to be implemented or developed there. According to Sahay and Walsham (2005), the process of scaling of HIS cannot be viewed merely as a technical issue, but also as socio-technical, involving technology (computer and software), people (e.g. health workers and managers), processes (e.g. procedures within HIS), and the institutional context. Even if scaling up is necessary, it must be manageable, in the sense that while moving to the next setting, the efforts and resources established in previous settings must be continuously supported and sustained to achieve intended benefits of HIS over time. This could be, for example, by providing refresher/upgrading/new training to staff on a regular basis. Thus, the decision to scale up depends on sustainability of the previous setting's achievements.

3. RESEARCH SETTING AND APPROACH

The case study presented in this paper is based in Tanzania, a developing country located in Eastern Africa. The country faces serious constraints related to poor physical and communication infrastructure while depending significantly on donor agencies for the provision of funds to rehabilitate infrastructures, alleviate poverty, and to support the improvement of public health services including the Health Information System and deployment of ICTs. The quality of the country's education is affected in general by the low morale of teachers and trainees, poor environment for learning, poor conditions of work, and lack of modern educational resources. (UNDP, 1999; Juntunen, 2001). About 81% of the labour force is self employed in agriculture and is situated in rural areas whereas the majority of the urban workforce lacks appropriate skills and knowledge (UNDP, 1999), especially in ICTs. The Ministry of Health (MoH) in Tanzania has for over a decade been attempting to implement reforms in the HIS, including the computer and paper based systems, in order to better monitor the performance of health care and service delivery. The National Health System (NHS) administration is comprised of various interconnected hierarchical levels including health facilities, districts, regions, and national levels making it a complex organization shaped by various human resource capacities demands on the HIS and ICTs.

This research is based on a longitudinal interpretive case study, carried out in the national health system of Tanzania. Using an interpretive perspective (Walsham 1993; Orlikowski and Baroudi, 1991), I seek to understand different perspectives on HIS practices and what may be the underlying reasons shaping such views. Specifically, I want to know the existing capacity; the underlying reasons for the lack of capacity and type of training required. The study was conducted through an in-depth review of secondary data including official reports and registers used to collect data from the different health facilities. In addition, primary data were collected through 33 semi-structured and in-depth interviews with staff from different functional areas and administrative levels (specifically, health workers, persons dealing with statistics, health managers/secretaries, and planners).

Observation of work practices surrounding the collection, processing and use of information and computers/software was similarly conducted. Data was collected over three time periods: June to August (2003), January to April (2004) and January to July (2005). Data collection was carried out in the Ministry of Health (MoH) and in the coastal region including the two health districts of Kibaha and Bagamoyo. A research diary was maintained to document relevant notes over time and some notes were also cross-checked with the concerned respondents. Both Swahili (spoken by health workers at health facilities) and English (used by health officials at other levels (district, regional and national levels) were used for the interviews and discussions depending on the type of respondents: Swahili notes were subsequently translated into English during the phase of analysis. At the health facility, questions were primarily related to work practices around HIS, and how these were

influenced by the lack of adequate skills and resources for information collection, processing, analysis and use. The respondents were asked questions related to the training requirements and consequences of the lack of understanding of the meaning of information. Specific focus of the questions was on the use of information, computers, and training around HIS. This helped the author to analyze the extent of challenges of human resource capacity.

In addition to the study of human resource capacity of the existing paper based HIS at various health facilities, the author was also engaged in the introduction of a new computer based system (called district health information software - DHIS (Braa and Hedberg, 2002)) under an action research project called HISP (see details of this programme in Braa et al., 2004)) in the two health districts. HISP Tanzania was made up of an inter-disciplinary team of researchers (in public health and ICT), working together with health workers and managers at different levels. The public health professionals helped in training and participatory discussions towards improving routine working procedures, understanding of the meaning of data, and use of information for decision making. The ICT professionals in the HISP team were engaged in customization of the DHIS to fit into the local setting, training of health workers and managers on computers use as well as assessing the existing HIS. Thus, the project involved various activities including the conduct of several training programs and workshops for health staff, developing the local DHIS database, participation, and support. Experiencing the field level problems as I engaged in these activities helped me to interpret some of the challenges related to human resource capacity and how these influenced the performance of HIS and the use of ICTs.

The analysis of the empirical data collected involved identifying various themes related to the human resource capacity challenge. Initially, attention was paid to understanding the challenges experienced in the routine HIS and ICTs at various levels. Subsequently, the author tried to relate these challenges to the human resource capacity, such as how the cultural and organizational context helped or constrained capacity building efforts. The analysis thus helped to delineate some challenges and strategies on human resource capacity building.

4. INTEGRATING USE OF TECHNOLOGY IN THE HEALTH INFORMATION SYSTEM IN TANZANIA'S HEALTH SECTOR

In this section, I first provide an overview and description of the HIS in Tanzania (in 4.1-4.2), followed by a description of the integration and use of IT with the HIS (in 4.3- 4.4). In all these subsections, the key focus is on aspects of human resource capacity. In subsection 4.5, I discuss the HISP initiative and associated training programs in Tanzania.

The Tanzania health system was derived from the colonial, urban, curative- based health system run by earlier colonial regimes which had neglected equity and accessibility. Tanzania took deliberate efforts after its independence in 1961 to ensure equitable distribution of health services and facilities to improve the well being of the entire population in both rural and urban areas. Thus, since its independence, Tanzania has made remarkable progress with regard to the distribution of health facilities (85% of the population can reach a health facility within a range of 5 or 10 kilometres). However, health services remain poor due to various reasons including lack of adequately skilled health staff and the presence of inaccurate and unreliable information unfit for making informed decisions.

In 1989, the MoH started the process of developing a comprehensive paper based Health Management Information System (HMIS) followed by its implementation and computerization in 1993 (Rubona, 2001; Mwangi, 2003; MoH, 1992; HERA, 2000). Top

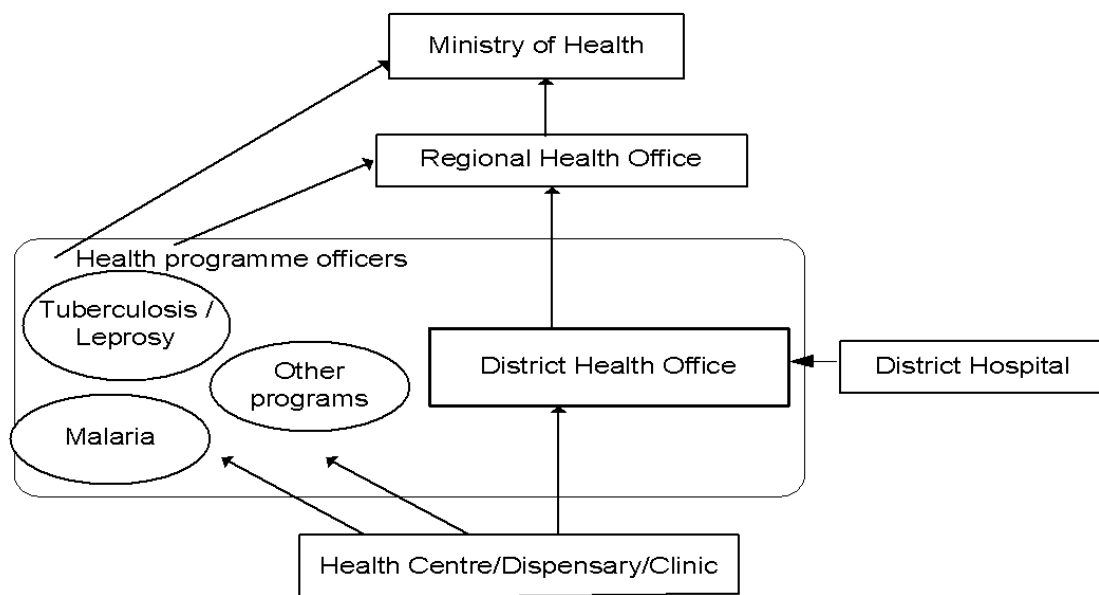
managers/officials at the MoH assisted by an external health consultant with financial support coming from different donors (MoH, 1993; Rubona, 2001) were strategically enrolled in the development and implementation processes. The main goal of these efforts was to improve the performance of health service delivery through providing stronger information support. The HMIS design followed the four level administrative structures namely; health facility, district, regional and national (see Figure 1) and was intended to include all vertical programmes (MoH, 1993). The implementation of the computer database (in Dbase) originally took place only at two levels: the regional and the national.

However, in 1997, the paper based HMIS was subjected to major changes (in terms of reporting frequency and additional reports) which necessitated the development of a new computer database in MS Access replacing the earlier Dbase. The new database, however, experienced similar technical and design problems and minimal use due to the centralized approach of its development and a lack of appropriate human resource capacity.

4.1 The Operation of the HMIS System

The health facility is the origin of the most routine health data for the HMIS. Data for the HMIS is collected at the health facility from patients attending health services particularly outpatients, inpatients or for Maternal and Child Health (MCH) on a daily basis. The national level (MoH), via the district level, provides the health facilities with a set of HMIS forms, registers, and tally sheets to fill in data and prepare reports for the different services they offer on a daily, monthly, quarterly, and annual basis (Mwangu, 2003). Data is transcribed in reporting forms where quarterly totals are aggregated and then summarized annually. Data handling involves a group of health workers from different sections of the health facility (usually called HMIS data people). Health facilities vary in terms of the skills of health workers, infrastructures, quantity and quality of health services they provide. A health worker at a health facility is provided with various HMIS registers for health data registration. Health staff are required to collect data for reports to donors as well as the government. As a result, many vertical programmes keep the health staff busy filling non-HMIS forms.

Figure 1. Flow of Health Information from Local Levels to National Level



Data reports from health facilities are sent to the respective district health manager's office. The reporting frequency can be weekly, monthly, quarterly or yearly depending on the type of data. The district information coordinator manually integrates all health information

within the district, on a quarterly basis, and prepares a summary for the regional health manager. At the regional level, this data is entered into the MS access HMIS software to produce an electronic version on a diskette to send to the national level (MoH) for overall national data analysis by using the similar HMIS software (See figure 1).

Figure 1 indicates how data from health facilities is transferred to the respective district health manager's office upwards to the regional health officer's office and onwards to the MoH. Data from vertical programmes (e.g. Tuberculosis/Leprosy) are channelled directly to the respective programme coordinating officer in the MoH through regional programme offices.

4.2 Data Collection and Processing at Peripheral Levels

Administratively, district health authorities are responsible for data supervision and collection from health facilities. The data reporting is often delayed by one or two months and is often incomplete. Also, there exist a few health facilities that do not report data at all. For example, in one of the districts visited, two health facilities had never reported data.

One of the strategies used by the district health authority to obtain data reports was to link up the (health facility in-charge) salary payment with data reporting, thus promoting unverified and untimely data reporting. On one of the district visits, the district information coordinator was just back from a one week trip to collect three months of over due data. Despite such a delay, the district information coordinator managed to collect data from 22 out of 37 health facilities. When asked about the remaining health facilities, he responded [dated: 09 February 2004]:

They will bring their reports when they come to collect their salaries. But even the reports collected have several deficiencies. As you can see some parts of the reports are not filled in [he showed the reports] though they offer such services.

When asked about the reason for the inefficiencies, he further replied:

I think it is because of little understanding. I have been there several times trying to assist them but they do not do any better. Again, it is also because of negligence. This is just their character. You will see that there are some doctors who provide medical services to patients but do not document it in the record. This makes it difficult to calculate how many patients a doctor has attended each month.

When asked about steps taken to solve the problem, he continued:

I collect the reports and learn the problems so that next time I may inform them. However, close supervision is needed but we have no time to verify the data. In order to go deep we need to have enough time. The problem is that you have to visit a larger number of facilities per day which means that there is no time to verify the data. Since, we do not have the time to audit data, it gives them a chance of just filling the forms the way they want. You will have to spend like three hours to verify the data. During the past, we used to go through all data. But if you employ this approach you cannot manage more than two facilities a day.

Some of the health workers only received just a single training class related to how to fill in data registers and that was more than 8 years ago (during the introduction of the HMIS). Yet others had not received any formal training. Lack of regular training on HMIS further contributed to the lack of skills and knowledge on data collection, processing, and analysis. For example, a few of the new health workers, often motivated by job security, tried to obtain some instructions on how to compile data or fill in registers from the district information coordinator (when they came to collect data reports from health facilities). Indeed, in most of

the health facilities visited, there was no evidence of the use of information apart from stock information about medicine available and used. When the district health administrative secretary was asked to provide comments on the data handling procedures, he replied: [dated: 12 February 2004].

In order to improve data collection we need to ensure that health workers are empowered by building skills. The problem is that most of the time they are busy with issues of direct health services. And you know this is more an administrative issue. There need to be personal commitment and incentives. The issue of reporting is there but the only problem is that data is mostly reported very late.

However, some of the health facilities were grossly understaffed; others had a maximum of two or three health workers who lacked time for data handling due to the pressure of providing health services. They thus regarded the data handling work as secondary, requiring additional incentives, which were however not provided.

Also, the blank HMIS registers were often received by districts from the national level, more than five months after the end of the year. These registers were procured and distributed behind schedule because of a lack of reliable funding to support timely printing and transport logistics from the central Ministry of Health to all primary health facilities in the country. This delay in turn caused the delay in the process of collection, compiling, and reporting health information at the health facilities. It also led to some health facilities using rough papers to record data which created inconsistent and unclear information. In the districts visited in February 2004, it was noted that they had not received new registers for 2004. One of the district information coordinators said:

Last year (2003), the registers were received late in May. These registers are being used now (2004). So the books entitled '2003' are being used for the year '2004'. We have contacted the MoH people but they said that, they have not received the registers from the printing unit.

Although, the lower levels (districts and regions) had some financial resources as well as computers and printers, they had no skill capacity to design and produce their own forms for data transcription.

Despite a large collection of the existing HMIS data registers (such as outpatient register, child register, delivery register), some datasets/data elements were identified as missing. As a result, various vertical health programmes (such as Malaria, Tuberculosis/Leprosy, etc.) had decided to design and distribute their own additional forms to the health facilities for use in recording their own data, resulting in further increased workload to health workers. When asked about incorporating missing data elements into the HMIS registers to reduce the influx of multiple forms from vertical programmes, one of the national technical managers replied: [dated: 17 June 2003]

When the changes are introduced, it means a need to train individuals on those changes nationwide, which may take a long time and lots of financial and technical resources. It took more than two years for some people to understand how the current data register books and procedures work. Even though currently there are some regions that have not been able to utilize them properly.

This statement reflects a lack of training resources and capacity of the MoH to conduct the training of HMIS countrywide.

Another important concern was how HMIS was integrated and used with computer technology, which is now discussed in the subsections 4.3 and 4.4 respectively.

4.3 Integrating Use of HMIS with Computer Technology

In 1997, the paper based HMIS was subject to a major evaluation by the donor. As a result, a number of changes were suggested to the paper-based system. For example, new forms were introduced and the reporting frequency for health facilities was changed from a monthly to quarterly basis. These changes were introduced hoping that it would reduce the health workers' burden and wastage of resources, thus improving the performance of HMIS. However, these changes also implied fundamental changes to the Dbase software. Although, the MoH had source code, the capacity to upgrade the Dbase system was not available. Instead, the MoH was advised to search for new software. The MoH, with assurance of funding from the donor, contracted a local vendor to develop new software using the MS-Access database management system. This vendor delivered an executable version of the software, retained the source code and provided a 6-month period post delivery guarantee. However, bugs were continuously identified, even six months after delivery, with the consequence that the MoH needed to secure extra funding from donors to improve the system every time new bugs were identified.

The MoH lacked required skills, experience, and expertise to participate in the development of the new software and instead wanted to invest in proprietary software packages. The executable version of ready made software was handed over to the MoH by the software vendor. The vendor provided an initial overview of the software product to one of the HMIS unit's employees at the MoH who was expected to train others. The HMIS unit then took responsibility for the overall activities related to implementation, training, and user support despite the severe shortage of skilled human resources and a lack of institutional capacity that existed in the unit at the time. Despite this, the HMIS unit started implementation of the new software at various regional health offices through installation of the software on their computers and provided an overview of how to operate it in terms of entering data and generating reports. No additional training was provided (HERA, 2000).

Generally, the HMIS unit failed to provide adequate training on the paper and computer based HMIS due to a lack of sufficient training capacity to meet the training needs of the entire health sector (all health facilities, health districts, and regions). When analyzing the skills of the staff working at the national HMIS unit, while most (if not all) had a background in statistics and basic computer skills, their knowledge was not at the level required to deal with the complexity of ICTs, or help in upgrading of the existing software. For such advanced knowledge, the MoH had to hire external consultancy services, such as local ICT vendors, which were extremely expensive and short term and again depending on the availability of donor funding to cover such expenses. The role of the donor organizations has often been in providing funding to support the HMIS.

4.4 Analyzing Use of HMIS Software and Computer Technology at Peripheral Levels

The survey carried out by the author in March 2004 indicated that each health district had at least one computer with some of the regions having more than one. For example the Coast region had five computers and other accessories, acquired through the MoH or donor support. However, these were primarily used for secretarial services and not for HMIS. When asked about the use of computers, the regional health programme coordinator replied: [dated: 3 March 2004]

We do not have an epidemiologist here. So if you could help us with making graphs that could help. Sometimes I want to show data on a graph but I find it difficult. People know what they want from data but cannot use the computer to show or represent it.

The HMIS software installed at the regional office was primarily used for producing an electronic version of data for the national level. No one had skills to explore or fix bugs (MoH, 2000; Boehning, 2002; MoH, 2002), or deal with the lack of technical support. For example, in one of the health districts, one computer had been put aside for more than five years which the author suspected to have a hard disk problem. A similar case was found in another district where a nearly new computer that had no anti-virus software installed on it failed, leading to a loss of all stored data. Although lower levels had some financial resources, they had no technical or managerial skills apart from some very basic skills (such as how to use MS Word). They also regarded a computer as something so advanced that it never had any faults.

Until recently, the peripheral level directly reported computer problems to the national level but most issues had been delegated to the respective level depending on their financial capability to hire someone from a private company for computer services and maintenance. However this approach was criticised for being too expensive while only solving simple technical problems such as fixing cables and installing software. When asked about employing a permanent person to take care of such technical problems, the regional health administrative secretary replied. [Dated: 3 March 2004]

Currently the MoH want to have a manageable size of staff. In order to introduce a new professional such as an IT skilled person that does not exist within the MoH, the department of civil servants must approve it. Otherwise later on we will not be able to promote him. If we employ someone, he or she will just stay here for years without getting any promotion. ... It is important to know which department will deal with such peoples' promotion.

4.5 HISP Initiative and Training Programs in Tanzania

The initiative to introduce HISP in Tanzania began in 2002 when academic staff from the University of Oslo visited the Department of Computer Science, University of Dar es Salaam. The initial task for the introduction of HISP involved defining terms of collaboration with the University of Oslo, creating the Tanzania HISP team comprised of medical and ICT professionals as well as involving the Ministry of Health (MoH) in the collaboration. MoH collaboration was vital for local capability and sustainability of the HISP initiative. Given the substantial problem of lack of human capacity in the health sector, one of the main objectives of HISP was to develop capacity of health workers in the area of HMIS and ICT.

The public health professionals within the HISP team took responsibility of conducting training and carrying participatory discussions towards improving routine working procedures, understanding the meaning of data and use of information for decision making. The team started by organising a workshop to present HISP objectives and approaches as well as the DHIS at the MoH headquarters. The health information obtained from the Bagamoyo district was used for demonstrating the capability of the DHIS tool in analyzing and presenting data. After this workshop, the HISP team established two pilot districts namely Kibaha and Bagamoyo, while aiming for project acceptance by higher MoH authorities.

The HISP team started implementation of HISP in the Bagamoyo and Kibaha health districts, mainly focusing on three activities: training of health workers/health managers on data management and information use, customization of the DHIS to fit in to the local setting and assessing the HMIS. Since 2002 different on/off site training programs of health information workers from different levels have been organized. For example in July 2002 initial training was conducted in the pilot districts whereas in June/July 2003 refresher

training was conducted followed by continuous user support on request and on a regular basis. In parallel with regular training programs, the HISP team has been involved in populating the DHIS with routine health information and generating reports to identify anomalies on data for the health managers to take action. However, in 2004, the HISP team decided to scale up to three other districts in the city of Dar es Salaam following interest shown and financial support by the city health manager. While the health workers participated in the training programmes, the team could not get hold of the busy council health managers into the training.

4.6 Building Collaboration with Donors and Participating Institutions to Support Human Resource Capacity Building

HISP local activities and initiatives are linked with global HISP network objectives of sharing skills, learning and experiences in the area of HIS and ICTs (Braa et al. 2004). The collaboration between the Tanzania HISP and the global HISP resulted in establishment of an official one year HMIS course programme for health information workers and managers as a way to scale up training that started in the pilot sites, so as to include more health information workers at various levels in the health sector. The HMIS course which started in February 2005 was hosted by the department of Computer Science at the University of Dar es Salaam, Tanzania. The author was one of the course organizers and trainers. The HMIS course was structured into three phases: theory, practical (field), and thesis preparation. Students were taught HMIS concepts and other aspects such as health sector reforms, data quality, planning, and standardization of HIS, computer and DHIS use as well as research methods. After the theoretical part, students developed a study on HMIS problems at their own working place (districts, regions, and national level). The aim was to enable them to try to come up with findings and provide practical recommendations that they could implement in their respective working place after the programme.

The HMIS course involved local and international instructors (from health and ICT) enabling the sharing of local and international expertise in the area of health (HMIS) and ICTs. For example, the instructors who participated in teaching and supervision of the HMIS course came from Norway (ICT), Mozambique (Public Health), South Africa (Public Health), Ethiopia (Public Health and ICT), and Tanzania (Public Health and ICT). The strength of the course was its emphasis on HISP case experiences at local, national, and international levels (local and global experiences). In 2005, most of the health information workers who were selected to join the HMIS course came from Tanzanian mainland (particularly from the HISP pilot districts such as Bagamoyo and Kibaha) and Malawi -funded by the Norwegian Agency for Development Co-operation (NORAD) as well as from Tanzania Zanzibar-funded by the Danish International Development Agency (DANIDA) through Ministry of Health Zanzibar. While collaborating with graduate students to strengthen the use of the DHIS and improvement of the HMIS, in 2006, the plan is to further scale up to enrol health information workers from other districts and regions in Tanzania and Malawi with the help of MoH officials (head of national HMIS unit) in the selection of trainees and teaching. In order to conduct this programme over time, efforts were underway to seek financial support from the Ministry of Health Tanzania Mainland as well as from other donors who support the health services in Tanzania such as German Development Agency (GTZ).

4.7 Human Resource Capacity Building Challenges

Most health workers at health facilities have primary and secondary education whereas most health workers at the district level have a slightly higher education level (certificate or diploma). Health managers are however trained to handle curative care (nursing and prescription of medicine) with little emphasis on computers training and ways to deal with

preventive care (planning and informed decisions). The lack of adequate basic education and training as well as a heavy workload contribute to the inadequate human resource capacity to support the computer based HMIS at all levels.

The HISP team has faced challenges related to the lack of appropriate human capacity coupled with the lack of time for managers to participate in the project and the poor quality of data. At the facility level, the data handling process is carried out by health workers who have little or no background in basic statistics or use of computers. The district information coordinators, apart from their engagement with the HMIS system, were also responsible for providing direct health services (clinical services) and coordination of vertical programmes leading to work overload and fragmentation.

To address the above challenges, the HISP team organized several on-site training programs for health information coordinators/compilers on computer hardware and basic software skills (e.g. Word, Excel, and Access) which were then followed by training on the adaptation of the DHIS. However, the participation of health managers had not been possible due to their lack of time. Moreover, as a result of the lack of funding from the HISP and local institutional support, the on-site training classes were only organized for durations of five days, which did not give trainees enough computer skills and practice. The lack of health managers' participation made it difficult for the HISP team to have an in-depth understanding of the actual district organizational needs and to develop necessary computer literacy to the health managers.

Despite efforts to conduct on-site training programs on computer literacy, there were some trainees who were not appropriately selected. This is said on the basis of the fact that in one of the pilot districts, one of the HISP members had to sort through a long list of potential trainees excluding those trainees who had no direct involvement with data handling. Only eight of the listed trainees were eligible. The others wanted to participate for financial gain rather than to learn and acquire skills. The plan was to have two separate training sessions, but the second training session was postponed because trainees were absent as one of the participants explained "some of our colleagues thought there were no training allowances that is why they dropped out". Thus, participation of the local trainees in the training program was not regarded as free of charge.

The health workers required per diems for attending on-site training and workshops as a way of supplementing workers' low salary. Health workers and officials were motivated by good incentives to participate in HISP initiatives and related meetings, something which the HISP had no budget for. Trainees often complained that no training allowances were available. Thus, participation in training and the use of the DHIS seemed to be influenced by economic motivation rather than for learning purposes and improving their work. Health managers did not participate in the training programs as they claimed to be busy with administrative duties. However, after the trainees received training they did not have time to practice and apply the skills they had learned due to varied functional responsibilities attached to them. For example when the author visited one of the pilot districts to evaluate the usage of the DHIS, the district information coordinator who had received training said: [dated: 09 February 2004]

All the data entered into the DHIS are needed but the knowledge to generate a general report is not yet clear. Also I do not have enough time to settle down and sit at the computer. I need to learn more...

Originally, the new HMIS software had many problems that had not been fixed due to lack of funds. In 2004, the MoH secured some funds from donors to pay the developer to fix

the bugs. The MoH officials decided to re-install the old system with new upgraded HMIS software at the regional and national level as well as installing the HMIS software at the districts including the HISP pilot districts. However, there was no concrete training given on how to use the installed software. When one of the district information coordinators was asked about the HMIS Software he said “there is no formal training that has been organized, we expect someone from the regional level to come to instruct us on how to use the HMIS software” [dated: 13 April 2005].

This case study has explored several challenges related to human resources in the health sector of Tanzania together with various training initiatives conducted by the HISP to improve the existing human resources. In the next section, the case material is analysed and recommendations on how to deal with the lack of human resource capacity in the context of health sectors of developing countries are provided.

5. ANALYSIS AND DISCUSSION

In this section, I analyze and discuss problems that have led to weak human resource capacity in the health sector and suggest strategies to develop human capacity to contribute to the sustainability of ICT based HMIS.

5.1 Lack of Appropriate Strategies for Human Resource Capacity, Continuing Training and Practice

The case study has shown that health workers lack skills and time for training and practice as a result of unconducive working environments (Paul, 1995). Health workers collect the routine data out of habit and for the sake of satisfying their superiors' needs rather than using the data for action. They spend a lot of time dealing with large datasets, filling in different registers of the HMIS and dealing with various vertical programmes that follow a data-led tradition (Mwangu, 2003). This was in contrast to the HISP philosophy of using small datasets and following an action-led approach to support local use of information (Sandiford et al., 1992). If training was given, it was only once, not followed up, and was ineffective and not provided to the appropriate health workers. Thus health staff continued to face problems with data handling, interpretation and use of data for action, using computers and basic applications. However, even when health workers were trained they did not have time to utilize the skills acquired. The focus on training with lack of time to practice the acquired skills resulted in a waste of resources and absence of mechanisms to ensure sustainability. Thus, the existing cultures, such as lack of practice and tendency of trainees to attend the training for the sake of getting allowances, influenced both individual's learning and participation in training (Williams, 2003).

The available ICTs in the health sector continue to be regarded as primarily political symbols as a result of the lack of appropriate ICT literacy. This makes it difficult for health staff to utilize, maintain, and sustain the ICTs or to understand their impacts in the performance of the overall health sector. Most of these ICTs are obtained through donor support and do not have any long term human resource policies or strategies to utilize or sustain them. Typically, during the development of the HMIS software, donors provided financial support only during the first life cycle, and both parties took for granted the availability of appropriate human resources in the health sector. The developer (financed by the donor) developed the software without transferring necessary skills to the MoH and deliberately retained the source code for further financial gains. Moreover, top officials from the MoH did not have enough skills (systems analysis or development skills) to foresee the impacts of donor policies, development processes on the HIS operational activities (Kimaro and Nhampossa, 2005). Even when MoH received other funds from other donors to pay the

developer to solve existing bugs in the HMIS software, the upgraded HMIS software was further implemented without appropriate training strategies, thus making the lower level unable to benefit from the installed software.

The acquisition of ICTs in the health sector in short term training and without appropriate strategies is not enough as it creates a great burden as a result of ineffective usage and training, lack of maintenance, and failure to fulfil the promise of improved health services. The capacity of existing human resources needs to be upgraded based on particular needs and work at each level of the health sector. This can be done through appropriate and well designed training and creating a conducive, enabling and open learning environment. However, this requires long term strategies beyond the first life cycle support. It also requires support and a strong commitment from the MoH (local government) and the donors to continuously mobilize resources for sufficient training and building basic analysis and long term ICT skills. The training needs to be viewed as a continuous process to allow workers to learn from practice and experiences and to respond to organizational and ICT changes (UNDP, 1994; Paul, 1995) at all levels of the health sector to facilitate a sustainable HMIS.

A team of technical professionals (in Health and ICTs) from local universities in collaboration with other external researchers can act as an institutional base for providing long term training on ICT and HIS as for the case of HISP. However, such initiatives require strong institutional and financial support and long term strategies from the user organizations (in this case the MoH) in order to guarantee sustainability of achieved benefits. Strategies are also needed to make sure skills acquired through training and (action) research are used for improving the HMIS as well as making fundamental changes on the operation of HMIS as a result of learning (Clemens and Cook, 1999).

5.2 Lack of Participation of Health Managers and a Lack of Culturally Compatible Training

In the study it was evident that ICTs in the health sector had not produced expected benefits due to presence of poor data that was inappropriate for action as well as a lack of skills and knowledge. In this situation, the health workers need a continuous and well developed training programme which starts with the basics (entering data and making reports), building up to advanced skills.

However, although training initiatives are necessary to empower health workers with skills, such initiatives must also include processes of developing a culture where information is a valued and reliable foundation for action (Mukama et al., 2005). This implies building new understandings and perceptions (through training and action research) towards information and social values (Ingram and Clay, 2000) related to the collection, reporting and use of information. However, the creation of an information culture is not possible with the non-participation of health managers (Kimaro and Titlestad, 2005) in the design and execution of new structures and the understanding of ICTs (as illustrated by the HISP training example).

Multiple levels of the health sector (national, regional, and district and health unit) though interlinked require different information, human resource capacity, work procedures and resources. These differences required large institutional and human capacity (including that of health managers) to handle and manage different training programs and to provide support after training within and across different levels. Non-participation of health managers in the training programmes often affects not only capacity building efforts in their own setting but also causes difficulties in making any operational changes in the performance of the HMIS and hampers efforts to train data compilers at the health facilities. In most cases,

health workers except health managers who acquire knowledge through training do not have sufficient administrative authority to bring about real change.

5.3 Strategies for Developing Appropriate Human Capacity in Developing Countries

5.3.1 *Combining Resources and Policies to Deal with Weak Capacity*

Donors are quite diverse in terms of policies (time, priorities, and operations) and allocation of resources (Chilundo and Aanestad, 2004; Paul, 1995). However, health care support is a priority of many international aid agencies, given the poor health services and resources as well as epidemics such as HIV/AIDS, malaria and tuberculosis in developing countries. By pooling resources and combining policies to work out the problems of weak institutional and human capacity in the health sector/developing countries; donors could better contribute to the health sector by training sufficient numbers of health workers and institutionalizing good information practices. For example the HMIS course which was funded jointly by NORAD and DANIDA has enabled a large number of health information workers from both the Tanzanian mainland and Zanzibar to be trained on HMIS aspects and information handling and use practices. Thus, donor funded/ vertical programmes through combined resources can work out the problem of weak capacity by jointly organizing training programmes on specific subjects about HMIS and ICTs. This approach may avoid or reduce short term training programs that are organised independently and associated with multiple incentives and objectives, with little emphasis on concrete skill development, follow-up, and practice.

5.3.2 *Building on Local Expertise to Develop Culturally Compatible Capacity*

For some time, developing countries, such as Tanzania, will continue to depend on donors both technically and financially. As a result ICTs will continue to be unsustainable as long as capacity building efforts are ignored (Wade, 2002). As ICTs continue to change, new needs will arise and thus new skills will continuously be needed. The local governments must develop and sustain their own skilled and educated labour to effectively anticipate and respond to new ICTs and institutional needs without having to depend on the assistance of external expertise. However, capacity building goes beyond technical skills (such as trouble shooting, installation, updating etc.) since information systems like HIS also involve processes and practices (Gee, 1999; Walsham et al. 1988). Thus, appropriate and adequate human and institutional capacity is needed in the area of information handling and interpretation, ICTs use and management (including skills in project and health service management, and contract writing), in addition to database administration and systems development. These multiple skill requirements in turn require a pool of well trained trainers with a mix of skills (ICT and Health) to conduct the training programmes over time.

The lack of adequate capacity building efforts within the health sector has also been caused by the lack of sufficient and well trained trainers/facilitators (both quality and quantity) in the area of HIS and ICT, whose limited efforts have been unable to provide adequate training in various levels in the health sector over time. Bringing the knowledge base of public higher learning institutions professionals together can help strengthen capacity building efforts both in terms of quality and quantity. While donors and local government can strive to provide financial support, the MoH officials and local university researchers can work jointly to contribute to developing training and conducting (action) research on ICTs that suits local needs and is culturally compatible with the local situation. Figure 2 depicts the roles of these three major actors. Higher learning institutions despite playing a long term role of training the trainers are also mandated to provide recognised official certificates to trainees that can be used as basis for promoting and motivating staff. The training and (action) research will need to go along with a cultivation of new cultures of ICT use including ways

of analyzing and using data in HIS, which requires active participation of health managers from all levels as decision makers.

Figure 2. Role Played by Three Major Actors (MoH, Higher Learning Institutions, and Donors) to Facilitate Long Term Training Programs

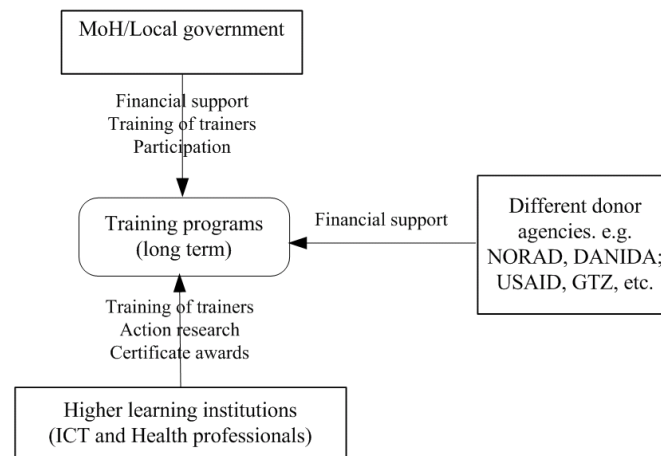


Figure 2 shows the roles that the three major actors can play in the process of developing long term and effective training programs in public organisations (like health care) in developing countries as demonstrated by the HISP example. Each key actor can play a different role (financial, administrative, or technical) necessary for creating appropriate institutional and human capacity in developing countries.

6. CONCLUSIONS

The creation of a conducive, learning, and adaptable environment is a priority in order to develop motivated and appropriate human capacities (Paul, 1995) which in turn requires joint efforts and long term policies of local governments and donors. Sufficient funding is needed to support long term training and practice as long as people and user organisations (health sector) need new skills and knowledge in HIS and ICTs. The promotion of workers based on their skills and work efficiency would be likely to reduce the possibility of people participating in training only for financial gain and create an incentive for learning. The selection of appropriate trainees can be done by the respective health manager in close collaboration with the organizer of training to avoid any bias. In-house training for capacity building is possible with some financial capacity and ICTs available at the levels of the health sector. However, the lack of policy guidelines makes it difficult for health managers to employ or contract ICT professionals for ICT support and training.

Human capacity building required in the health sector is more than just technical basic skills and includes strategic thinking about the meaning and use of information for action. This demands a mix of skills to understand the meaning of data, information and ICTs. The skills of using ICTs are needed for a large number of people, whereas skills in ICT management and systems development are needed by a few people at each level, who understand most of everything about ICTs. Thus, the required 'mix of skills' is radically different among health sector decision-making levels depending on specific needs, work practices and responsibilities. For example health workers and managers at the lower levels will have different skill requirements compared to the MoH officials who interact with donors, consultants and vendors, and develop health and ICT policies.

Local institutions of higher learning have shown that they can play long term and crucial roles in developing and upgrading human resource capacity (Braa et al. 2004) in local public organisations, such as the health sector with relatively low cost, using public training resources of local universities. On the other hand, donors could also seek to utilize qualified professionals working abroad who possess particular ICT skills to contribute to knowledge and research in developing countries. The experts working in developing countries should aim to develop local skills and knowledge on ICT and use of information and help support training of trainers.

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