

# **Challenges and Opportunities of Integrating Primary Health Care Information System: Northern State, Sudan**

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# Abstract

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This study was intended to assess the existing Information System (IS) of Primary Health Care (PHC) programs, as an example of vertical health programs, in Sudan, specifically the Northern State. Particular attention was paid to the issue of fragmentation of the IS, and opportunities and challenges to integrating it.

The study adopted case study design and data were collected through interviews, analysis of relevant documents, and observation of the settings. The results were analyzed using interpretive approach.

The findings of the study revealed that PHC programs IS is ineffective at providing good quality information that is convincing for managers to use to support decision making. The main problems of the system included lack of good infrastructure, inadequate skilled personnel, parallel reporting and lack of coordination. Absence of supportive supervision and feedbacks to lower levels were also major problems contributing to IS dysfunction.

Our study also showed that effort to integrate PHC programs IS might be challenged by absence of uniformity of data handling procedures, and lack of decentralized information management. Adding to the challenges is the difference in interests of the programs' stakeholders as for integration of their IS. On the other hand, opportunities for integration of the programs' HIS lie in the existence of Health Information Center (HIC) which receives collected health data from all parts of the state. Besides, most of the study participants were expressing optimism at outcomes of IS integration.

Therefore, this study intended to inform efforts to integrate the existing PHC programs IS, of challenges and opportunities in the structural, socio-cultural and political contexts of the organization.

# Dedication

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The effort is devoted to my parents, who have been seriously concerned about my education and professional development. Devoted to them for their ever blazing love; and never tired support and encouragement throughout my career.

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I am heartily thankful to my supervisors, Zufan Abera and Professor Gunnar Bjune, whose encouragement guidance and support from the initial to the final level enabled me to develop an understanding of the subject. Deepest gratitude is also due to teachers and coordinators at Department of General Practice and Community Medicine, Institute of Health and Society, without whose knowledge and assistance this study would have, hardly been made possible.

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My sincere gratitude also goes to Faculty of Medicine, Dongola University. I, here would like to express my gratitude to the former Dean of the faculty, Professor Altyeb Osman Sorkati and the current Dean, Dr.Mohammed Osman Abdu-Alaziz, who have made available their support in a number of way to give me opportunity to attend this course. In this regards too, my sincere gratitude goes to my friend Christian Sandjord, whose efforts had contributed to my successful application to the maser course.

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*Thanks to the GOD first and last*

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# List of acronyms

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CPA	Comprehensive Peace Agreement
DC	Developing Countries
DHIS	District Health Information System
DW	Data Warehouse
EDS	Essential Data Set
EPI	Expanded Program on Immunization
FMoH	Federal Ministry of Health
HC	Health Center
HIS	Health Information System
HSR	Health Sector Reform
IS	Information System
MDGs	Millennium Development Goals
NP	Nutrition Program
PHC	Primary Health Care
RHP	Reproductive Health Program
SMoH	State Ministry of Health
WHO	World Health Organization
WHO-AFRO	World Health Organization-African Regional Office

# Chapter 1

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## **1 INTRODUCTION**

The first chapter gives an introduction to the study. First, background information about health information system (HIS), including its role in health sector in general and primary health care (PHC) in particular, is presented. Furthermore, background knowledge on the issue of integration of information systems (IS) is described. Second, problem statement and research questions are presented, followed by the research objectives. Thereafter, I present the research settings, motivation and target audience respectively. Finally, expected contribution of the study and the structure of the thesis are presented.

### ***1.1 Background of the Study***

Health sector development is essential for social and economic development of nations. It is critically demanded in low income countries where health sectors are overwhelmed by the complex health context. Therefore, strengthening of health systems is considered an essential strategy to attain achievements in progress towards the Millennium Development Goal (MDGs)(1). This is particularly true in the context of Developing Countries (DC), where poverty and ill-health occur in a form of vicious cycle. In 2000, the World Health Organization-African Regional Office (WHO-AFRO), in its Regional Consultation on Poverty and Health, proposed important interventions that help to break the cycle through reducing burden of diseases, particularly among the poor and vulnerable groups(2). Furthermore, health sector in number of developing countries has been negatively impacted by economic reform movements to improve socio-economic status of the population(2). Consequently, health sector was weakened of coping with the changing disease context of these countries. Hence, the untoward socio-economic environment called for urgent and comprehensive health sector reform (HSR) through readjustment of national policies in order to ultimately improve health status of the populations (2).

Evidence-based decision making is a core issue in HSR. This is obviously the case since information is central part in the process of measuring health systems performance(3). Thence, one cannot deny the crucial need for HIS, which is capable

of providing sound information to support management in the sector(4-6). As proposed by the WHO-AFRO (2004), HSR emphasizes PHC approach to health care delivery system.

Since the Alma-Ata declaration in 1978, PHC is considered as standard approach to achieve the goal of health for all (7). As put forwards by the World Health Organization (WHO) in 1978, the approach is based primarily on the principles of equity and social justice in terms of provision of health care that reaches all people at affordable cost and that meets their expectations and acceptance. Besides, community participation and self reliance are important components of the PHC approach(8). Nevertheless, as described by WHO (2008), achievement of the ambitious goal of “health for all” is still limited in many places around the world and we could still see many citizens with limited access to health care services. The failure to achieve PHC objectives could be attributed to changing health context with emergence of new diseases and other complex challenges since the Alma-Ata declarations (9).

In this regard, HIS should be instrumental to provide information needs in order to monitor achievement in the areas of equity, people-centeredness, protection of health of the communities and community participation (9). Information is critically demanded by managers to handle issues, such as PHC coverage and quality. Furthermore, evaluating quality and performance of PHC systems largely depends on the presence of IS that is capable of generating quality and timely information in the cultural, economic and social context (10).

Despite the critical need for health information, as mentioned by different researchers, HIS of DC fall shortly before meeting expectations of providing sound information to support health sector management (4;5). The issue is hot spot since sound information is needed for making evidence-based decisions and for monitoring progress towards the national and international goals such as the Millennium Development Goals (11). Nevertheless, in many DC, health planning is still based on the traditional normative rather than strategic planning even after information has been made ready for use(12). This is due to undermining of evidence-based practices. Therefore, it is necessary to enhance information culture among health worker so that they value information and its use(13).

Although lack of resources is usually mentioned as a reason for problems associated with HIS of the DC, in reality, the problem is also attached to lack of wise investment of the available resources. This is indicated by the presence of fragmented, duplicative and un-coordinated efforts (5). In such countries, HIS is rather shaped by economic, legal, administrative and donor influences that have resulted in occurrence of pieces of systems (5;14).

Therefore, it is widely believed that integration of HIS is critically demanded for its proper functioning. Integration of HIS into a unified system can provide means for knowledge and resources sharing. Consequently, unnecessary resources expenditure is cut off and an environment for cooperation is created (13). This could have positive impact on overall health sector performance.

Failure of implementing integrated HIS, in DC in particular, has been associated with narrow minded approach towards merely integrating health data (15). Therefore, it is important to develop wider perspective to consider organizational factors, which might challenge IS integration. The organizational factors to consider include structural, socio-cultural and political issues (16;17). LaFond and Fields (2003) have also addressed the social issues embedded in the IS as it has been overlooked by over emphasizing the technical aspects in the process of integration(13).

Although many studies have been done on the issue of integration of HIS, there has been no study conducted in Sudan. The gap in knowledge has motivated me to study the HIS of Sudan with a focus on integration of PHC programs IS since I believe that having unified HIS at this level can contribute for improvement of health services to the public.

## ***1.2 Problem Statement and Research Questions***

Many studies, as mentioned under the previous sub-heading, show that HIS of DC is crippled by occurrence of sub-systems that run vertically to serve specific health programs. This fragmentation can result in poor quality data and wastage of time and resources through the process of duplication of efforts and lack of information sharing among health staff. The effects may even be more pronounced in places where resources are lacking, such as in Sudan.

Like other DC, Sudan also, has walked only few steps on the way to achieve PHC goals(18). Hitherto, there are citizens who do not have access to health care services(19). Hence, sound and integrated HIS that enables managers to use the available resources effectively in order to improve health care coverage and quality is needed. As described by outcome of the survey assessment of HIS of Sudan, HIS was found to be poorly performing and unable to deliver good quality information(20). The issue is also addressed by the Federal Ministry of Health (FMoH) as to be studied and investigated(21).

Based on the problem statement, the following research questions are formulated:

- What are the weaknesses and strengths of the existing PHC programs IS in the Northern State, Sudan?
- How the existing PHC programs IS works, specifically in relation to having integrated HIS?
- What are the challenges and opportunities to integrate PHC programs IS?

### ***1.3 Research Objectives***

*General:* To describe the existing PHC programs IS in the Northern State of Sudan with particular emphasis on fragmentation of the system and opportunities for having integrated system.

*Specific:*

- To describe weaknesses and strengths of the existing PHC programs IS in the Northern State, Sudan.
- To identify possible fragmentation of the system and its implications on IS functioning.
- To explore challenges of and opportunities for integrate PHC programs IS.

### ***1.4 Research Settings and Context***

The context of this study is Sudan, Africa's biggest country. It has about 2.5 million square kilometers surface area and population of 39.2 million (2008 census). Administratively, Sudan is divided into 25 states (Wilayat). The study was conducted

in one of the states of Sudan, the Northern state. Within the state two localities were selected and two health facilities in each locality were included in the study.

Sudan is rich in natural resources and human resources, though economic growth has not met expectations and the country has large external debt. This is due to challenges faced by ongoing civil conflicts, which is back dated to 1956. The Comprehensive Peace Agreement (CPA) signed between the North and the South of Sudan in 2005 is considered a prominent landmark in the history of the country that gave good opportunities and revolutions to economic and social development.

Sudan has experienced rapid growth in federal government revenue, especially after production of oil in the country. However, expenditure on health sector is considered low. Health care coverage is limited especially for rural and conflict affected areas. This has lead to development of new health policies with more emphasis on inclusion of the disadvantaged and conflict affected populations. Consequently, domestic public expenditure on health sector has been increased to assist making improvements in the deteriorated health care system(20). FMoH recent policy stated the need for provision of minimum health care to all Sudanese citizens. The policy calls for a reform in the health system that emphasizes adopting PHC approach for provision of health care, as well as, decentralization of health care system(18).

The WHO has asserted the importance of strengthening HIS of the DC in order to facilitate the health system reform movement and to improve the system performance(11). In this regard, Sudan national HIS is considered poorly performing and constrained of providing information support for health sector management. Therefore, FMoH developed strategic objective of strengthening the HIS to serve the reform of Sudan health system through enhancement of evidence-based planning and management(20).

### ***1.5 Motivations***

I was able to recognize the importance of IS for health sector development after my involvement in a course on HIS. Besides, my experience of working as medical doctor in Sudan has made me able to conceptualize aspects of HIS performance in the country. Therefore, I found myself motivated to systematically document these aspects. It was of particular interest to explore the issue of HIS integration as focus of

this study. The integration is considered essential to cut off unnecessary resources expenditure and this could have an outstanding effect where resources are already limited, such as in Sudan.

I was also motivated to take PHC programs as pilot for HIS study, since I believe that PHC approach is the standard way to accomplish social justice and welfare in terms of health care. PHC provision is limited in Sudan where many are still not covered by essential and basic health services. Therefore, one cannot deny the importance of properly working HIS that enable to identify problems of PHC and to develop vision for reform.

The study was further motivated by the results of assessment of HIS of Sudan which has revealed shortcomings associated with the system performance. Furthermore, the FMoH has stated a need for conducting researches that could provide understanding of the problems of HIS in Sudan.

### ***1.6 Target Audiences***

Target audiences, which might benefit from the study, are the following;

- Sudan health sector workers including vertical health programs stakeholders at all levels, health facilities managers, national and state HIC personnel, health planners, policy makers and researchers in the sector.
- IS professionals, especially those who are involved in designing or implementing IS projects in Sudan.
- Anyone who is interested to have knowledge on patterns of HIS functioning in Sudan.

### ***1.7 Aims and Expected Contributions***

This is one of the studies that may bridge two disciplines; IS and public health. The study firstly aims to document to audiences the problems of existing HIS of the Northern State, Sudan. Secondly, it aims to show the possible links for lack of integrated HIS so that the need for integration is justified. The study is also intended for informing stakeholder of HIS who are interested to know the possible challenges and opportunities for implementing integrated HIS. A practical outcome of this study can be to allow readers to have understanding of the organizational factors that need to be considered upon designing and implementing integrated HIS.

### ***1.8 Structure of the Thesis***

The thesis is structured in seven chapters. Chapter one presents background to the study that includes problem domain and research questions, objectives of the study, the research settings, motivations, target audiences and contributions of the study. In chapter two, literature review and conceptual framework of the study is presented. A background of the socio-economic and political contexts of Sudan; and the location of the study is presented in chapter three. In chapter four, the methodology adopted to conduct the study is put forward. Thereafter, in chapter five, overview of study findings is presented. Chapter six forth sets the discussion part of the thesis, followed finally by concluding remarks and recommendations presented in chapter seven.



# Chapter 2

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## 2 LITERATURE REVIEW

### 2.1 Literature Review

A comprehensive review of literatures relevant to the study of HIS has led me to recognize important themes of the topic. Literatures review is formulated around the themes that give better understanding of the topic in question. These themes include HIS at large, data quality, use of information for action, HIS integration and, PHC and HIS.

#### 2.1.1 Health Information System at Large

According to the WHO (2003, p116), HIS is defined as “*integrated efforts to collect, process, report and use health information and knowledge to influence policy making, program action and research*”(6).

According to the author, HIS is a corner stone in the process of measuring health systems performance since it provides information for decision makers as evidence-base for planning, policy development, and monitoring and evaluation. In this regard, the role of IS is to collect and process data at three levels: data (raw), information (processed data) and knowledge (information in context)(4). Therefore, HIS is considered as one of the crucial elements for public health management(5).

However, as mentioned by different researchers, HIS performance in DC is constrained by many problems, such as poor quality of data and absence of integrated IS (4;5). This has led to weak utilization of data to support management in health sector. The issue is a hot spot since sound information is needed for making evidence-based decisions and for monitoring progress towards the national and international goals such as the MDGs(11). Although lack of resources is usually mentioned as a reason for problems associated with HIS of DC(22), in reality the problem is also attached to lack of wise investment of the available resources. This is indicated by the presence of fragmented, duplicative and un-coordinated efforts and, as a consequence, poor quality of data(5).

### 2.1.2 Data Quality

Quality of data is described as a core element in the functioning of IS. However, in the context of low income countries data been collected by routine HIS are often of poor quality. This has the implications of impeding evidence-based decision making in health sector(13). Heywood and Rohde (2001) stated that *"No data set is ever perfect"* and they emphasized the importance of applying measures for data quality assurance through verifying its completeness, correctness, consistency, timeliness, relevancy and comparability(23). The authors have also proposed the following measures to improve data quality:

1. Standardization of data elements definitions and reporting procedures.
2. User-friendly data collection tools.
3. Training and supportive supervision of health workers.
4. Computerization of HIS and use of software with minimum/maximum values and validation rules.
5. Feedback on data errors and on information.
6. Use of information.

The authors introduced "SOURCE" criteria suggesting improvement in data collection tools to improve data quality. They recommended that the tools should be:

**S**imple and easy-to-use for collecting data and extracting it;

**O**verlap between tools should not exist;

**U**seful to data collectors locally, supervisors and researchers;

**R**elevant to key functions of the unit;

**C**learly laid out and easy to understand;

**E**ffective.

However, it is believed that over emphasis on technical issues alone to improve data quality may divert attention from the most important issue such as maintaining supportive supervision and feedback to health workers who collect the data (24-26). Moving towards practicalities of user-friendly data collection tools, the idea of using what is known as essential data set (EDS) is widely held. Essential data set implies

the minimum set of data that satisfies the needs for decision making. The intention of EDS is to provide only the required information for each level in the health system hierarchy based on agreement of all stakeholders at those levels. As indicated by the WHO (2006) collection of data should be oriented towards the purpose of its use in order to reduce the burden produced by the traditional method of collecting and reporting huge amount of data(11).

It is indicated that only few well chosen indicators are sufficient to facilitate the management task of different programs in the health sector. This has been emphasized by Heywood and Rohde (2001) as too many indicators may reveal confusing and exhaustive for health workers. Likewise, it negatively impacts on data quality and identification of priority actions to take. Therefore, it is wise to select the fewest possible indicators that could represent and inform management tasks, which in turn facilitates use of information for action. This implies that all collected data should have purpose and be processed into information. Afterwards, the analyzed data (information) needs to be presented in understandable way and to be used for action at different levels in the health system hierarchy.

### **2.1.3 Use of Information for Action**

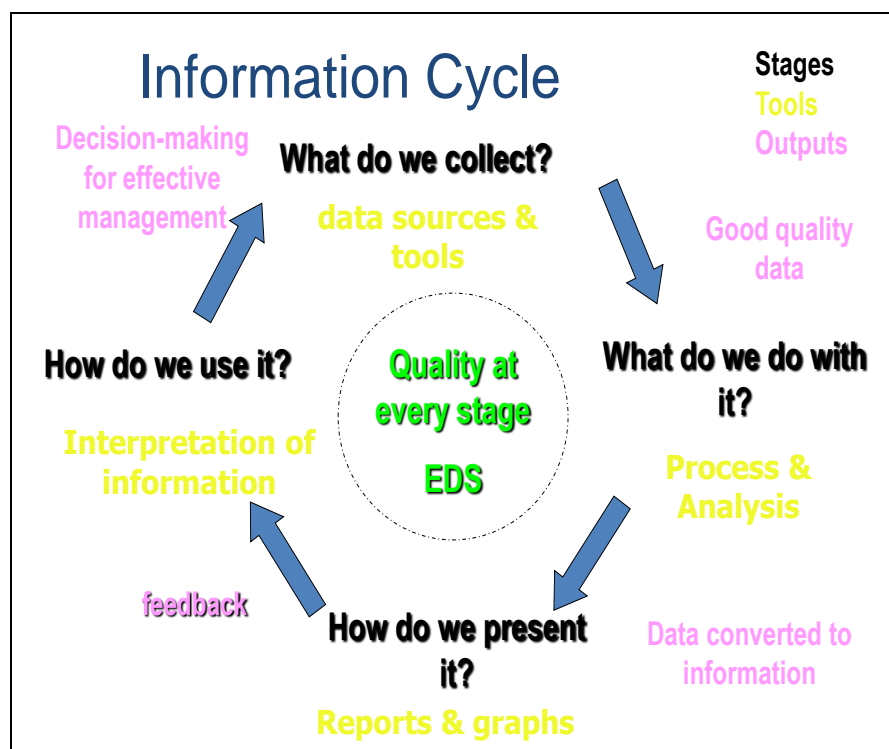
It is known that the hallmark of IS is to provide information for evidence based decision making. Upon implementing HIS, it is quite important to adapt it to the principle of generate specific information needed to match a well defined management function(27). Health information is required at all levels in the health care system. At the community level data are needed for identifying, locating and specifying the needs for services. At the district level it is needed for effective management of facilities functioning and at higher levels it is needed for policy making and allocation of resources(5;11). However, the amount of data needed differs among these levels being the largest at the community level(23).

According to Abouzahr and Boerma (2005) health information needs may fall under the following domains:

- Health determinants (environmental, behavioral, socio-economic, genetic)
- Health system input (policies, personnel, money, equipment)

- Output ( coverage and quality of health services)
- Health outcome - status ( maternal mortality, infant mortality, vaccination coverage)
- Health inequities in determinants, outcome and coverage of services)

Defining the scope of managers in terms of what kinds of decisions they are entitled to take is a key factor to know what kind of information they need to support their decision (action-led approach). In this regard, absence of such definition as well as fear of political consequences of taking an action has limited use of the available information in some places(28;29).



*Figure 1: information cycle model. Source: Heywood and Rohde (2001)*

Information cycle, as shown in the diagram above, is a graphic representation that gives better understanding of different stages of data/information handling in HIS including use of information for decision making.

#### **2.1.4 Integration of Health Information System**

The word “system” implies cohesion and interaction of parts(5). In many DC, cohesion of HIS is not there and it is rather shaped by uncoordinated work and occurrence of stand-alone parallel reporting system (5;14). These program-specific, vertical reporting systems can provide specific information support for central programmatic decisions. Stakeholders of these vertical programs are in more trust of their specific programs IS in granting better quality of information. However, the final result of HIS fragmentation is quite ineffective. Some effects of HIS fragmentation include(30):

- Duplication of work and data. This happens when health workers at grass-root level are required to report the same data items more than once to higher levels or where data collection forms are overlapping.
- Wastage of resources.
- Lack of information sharing.
- Poor use of information for action.

As mentioned by different HIS researchers, existence of disease specific reporting systems might have not occurred by accident. It is of considerable importance to look for and understand the possible influences and contributors for emergence of such phenomenon. Reviewing relevant literatures has revealed the following factors as possible explanations (30-32):

- Differences in characteristics of diseases that shapes the diversity in sets of data required by health programs. For example, information needed by the tuberculosis program managers is rather patient centered since they are more concerned with treatment outcomes. In case of HIV/AIDS, on the other hand, program managers are more concerned with statistical data on prevalence and incidence of the disease.

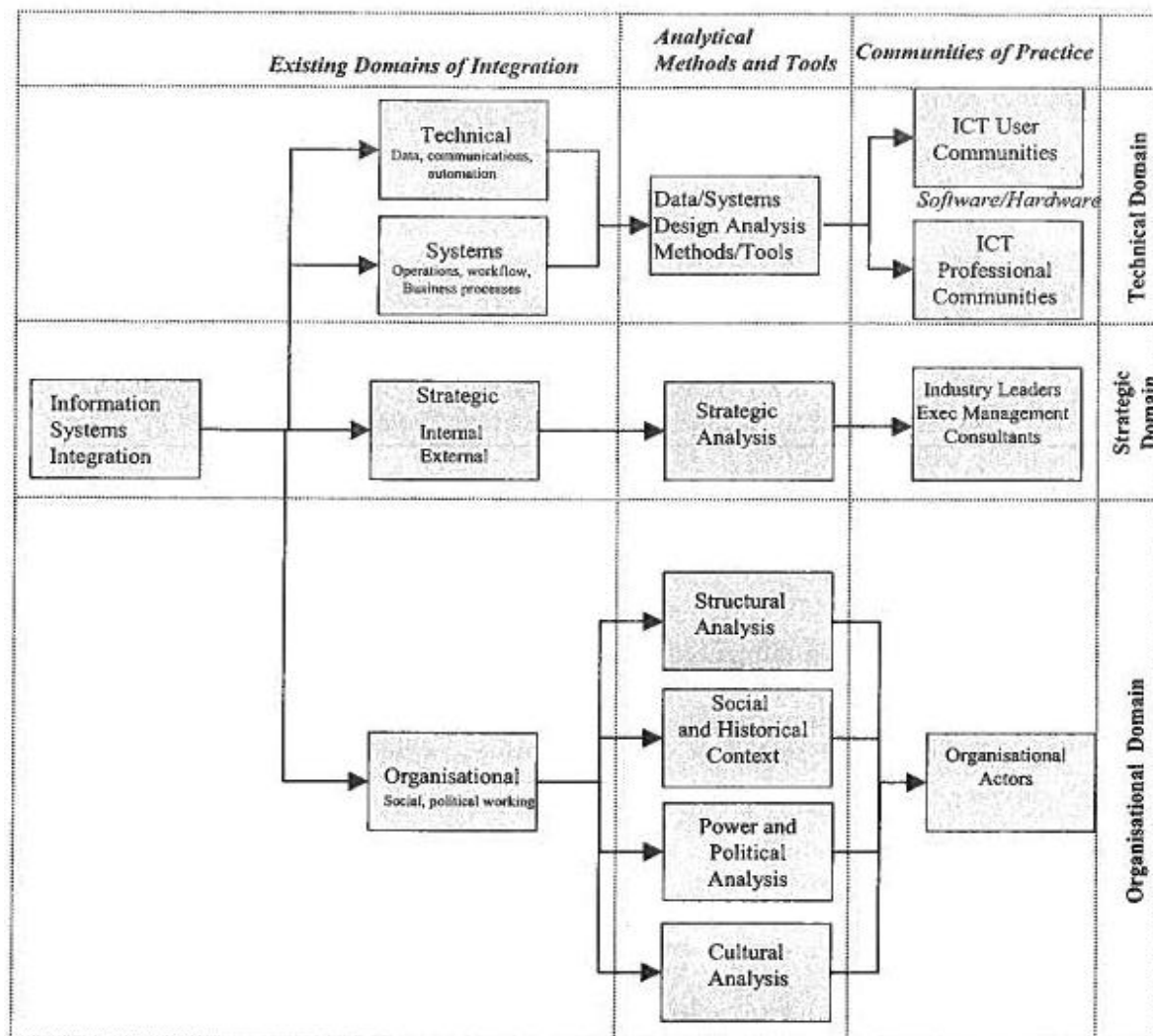
- Donor requirement of specific information to monitor implementations and to ensure wise utilization of money they have allocated. This accounts for historical development of disease-specific vertical programs. However, the ongoing HSR in many low income countries is now adopting the so called “sector wide approach-SWAp” as an interface to regulate partnerships between donor agencies and national governments(31). The author describes the policy as it provides governments more control of priority setting and allocation of resources in the health sector.
- National strategic plans are formulated in a way that provides means for monitoring progress towards national and international goals. Indicators being selected to have such monitoring may not involve indicator on endemic/transmissible diseases.
- Slow response of the routine HIS to provide information required for decision making specifically for sensitive health programs, such as tuberculosis and HIV/AIDS control programs.

In the arena of IS, there has been increasing interest to abandon parallel and fragmented IS and adopting an integrated system. IS integration can be defined in many ways, however, we adopt the WHO definition drawn upon by Lippeveld et al (2003, p53) as;

*“The process of bringing together within and between organizations to solve common problems, develop a commitment to share vision and goals, and use common technologies and resources to achieve these goals” (32).*

The concept of integration has a wide range of understanding alongside a continuum from technical integration to integration at strategic level. Therefore, it might be conceptualized in a variety of manners to different people and this makes it a complex construct (33). Wainwright and Waring (2004) described integration of IS as it includes three major domains; technical, strategic and organizational domains(34). It is wise to mind that the three domains are interconnected and need to be considered all together in the process of integrating IS. Technical integration is basically aiming to employ complex hardware and software to develop database that allows communication and information sharing in settings of an organization. The

strategic domain is incorporating strategic thinking and planning in line with organizational strategy(35). The organizational domain, which is described as being extremely important and sensitive to local context, addresses structural, social, historical, political and power issues (36;37). Implementing integrated IS may bring in organizational changes in terms of work policies, staff power and their inter-relationships(38). Therefore, Failure to address organizational domain has been associated with many failures of implementing integrated IS (34;39). Wainwright and Waring (2004) proposed a strategic model for IS integration as in the following diagram.



ICT = Information and Communication Technology

Figure 2: Strategic model for IS integration. Source: Wainwright and Waring (2004)

An implementation research conducted in the context of developing an integrated HIS in Serra Leone has demonstrated the essence of considering the three domains. As describe by Romain-Rolland et al (2010), strategic domain was the foundation for the initiative. Along with, organizational domain provided a common interface between the diverse interests of the different vertical programs, while developing data warehouse (DW) represented the practical technical solution for developing integrated data repository(40).

DW implies making a repository of data that lets in representations from different data sources which can then be analyzed(40). The author indicated that the process might be challenged by the need for standardization of data and he proposed gradual standardization as an effective measure. Data warehouse provides means for effective integration of data that could be accessed across organization and it adopts decision making standpoint of integration. Therefore, it provides consistent data for the sake of improved management(41). Equally important as considering technical issues embedded in DW development, are the organizational factors that might challenge adoption of the new technique by the stakeholders(40).

Failure of implementing integrated HIS has been associated with narrow minded approach towards merely integrating health data. A study conducted in the context of implementing an integrated health management information system in Tanzania has revealed the hindermost nature of purely managerialist minded approach to such an implementation(15). The authors have emphasized the crucial need for developing wider perspective that consider socio-cultural and political issues which occur in the health sector from top to bottom(16;17). LaFond and Fields (2003) have also addressed the social issues embedded in the IS as it has been overlooked by emphasizing the technical aspects in the process of integration(13). A top-down approach to developing an integrated IS, with policies been formulated at the national level without paying much attention to the grass root level, has also been mentioned as a true constraint in the process. Lack of addressing different practices and social issues associated with health workers at the micro-level is mentioned as major factor contributing to HIS integration failure in DC(42).



An integrated HIS permits correlation of data across different programs and sources(43). Therefore, convincing quality of data is assured and the overall performance of HIS is improved by this kind of integration. The case of integration of HIS in Serra Leone demonstrated that an integrated DW was made as a preparatory stage for further integration and standardization(40). The step was described as successful in gaining more commitment of stakeholders since the data looked more meaningful to them through the evoked process of integration. Furthermore, a unified integrated system can provide means for sharing of knowledge, resources and infrastructure, as well as, creating an environment for cooperation that can help improving the overall health system performance.

Decentralization and empowerment of the grass root level has been mentioned as inevitable for HSR in the context of DC. It has the advantage of promoting interdisciplinary collaboration and integration of IS at lower levels in the health system hierarchy(15). An example of this is the District Health Information System (DHIS) initiative which was implemented by Health Information System Program (HISP) in South Africa in 1994 and has been extended to many other DC. The program derives the process of integration of HIS at the district level. It also focuses on decentralization of health management and processing and use of health data locally where these data have been collected(44).

An additional requirement for integration of stand-alone IS is to develop a consensus with stakeholders at definition and standardization of data elements at all levels in the health sector. Agreement of different actors to what kind of data are needed could yield EDS required by each level in the health system hierarchy(32). This step has been mentioned by many authors as a real challenge facing implementation of integrated HIS (32;40). Health programs are adopting the traditional data-lead approach which is associated with collection of huge amount of data and stakeholders of these programs are reluctant to commit action-lead approach which favors collection of fewer data. The phenomenon is described as obstacle to reach to EDS and thereafter an integrated standardized HIS(45). Nevertheless, Romain-Rolland et al (2010) emphasizes the role of developing an early effective step in the process of integration, describing it as “low hanging fruits” first. This, as the author described in the case of Serra Leone, was achieved by building DW as an initial

step(40). Another component of an effective strategy is to cultivate the installed base for further development instead of starting from scratch. Flexible standardization of data and introduction of changes in a piecemeal fashion rather to rush are also important considerations(45). These strategies have been mentioned as crucial to obtain stakeholders commitment and to get them on board in the process of integrating HIS.

From technical point of view, implementing an integrated HIS in low income countries is challenged by practical hurdles to pass. For example, poor IS infrastructure including, poor power supply and internet service, as well as, shortage of communication facilities, as well as, trained man power are practical hinders(40).

It has been mentioned by different HIS researchers that health workers in many of the DC, particularly at the grass root level, consider data collection as extra work they are not entitled basically to do. Furthermore, if collection at all takes place, data would rarely be used locally for decision making. In this regard Curry and Moore (2003, p94) introduce the concept “information culture”. Its implication is seen form the quotation;

*“A culture in which the value and utility of information in achieving operational and strategic success is recognized, where information forms the basis of organizational decision making and Information Technology is readily exploited as an enabler for effective Information Systems”(46).*

The author also stated that gaps of information culture between stakeholders of organizations have resulted in failure or sub-optimal working of many IS. Therefore, it is crucial for HIS implementers to consider promoting information culture. This may be achievable by bringing in organizational changes that help sharing of information between stakeholders based on valuing information and its need for management. In this regard, developing information culture may create an atmosphere that is supportive of improving data quality and building consensus to have integrated HIS.

### **2.1.5 Primary Health Care and Health Information System**

Primary health care is defined by the WHO (1978, p1) as:

*“essential health care based on practical, scientifically sound and socially acceptable methods and technology made universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination”(8).*

PHC approach has been considered as gold standard for achievement of health for all goal since the declaration of Alma-Ata in 1978. It is regarded as a comprehensive approach targeting the basic health needs of human beings based on the principles of equity and justice in health care provision(7).

In many countries, people are increasingly frustrated at the performance of their health systems, which is unable to deliver health services that meet the demands of populations and adapt to the ever changing world. Health systems need to respond faster and better in the face of these challenges. Even though, the PHC approach is considered as crucial to do that, practically it was not possible to achieve the ambitious dream of “health for all” yet(9).

Accordingly, PHC needed to be reformed in the face of challenges of meeting the changing health needs of individuals and communities. This reform falls into the following areas(9):

- *Universal coverage reform* that ensures universal access to health services and promotes equity and social justice.
- *Service delivery reform* in a way that health services are responsive to community needs and expectations.
- *Public policy reform* that enables public health actions to be integrated with primary care and that enhances inter-sector collaboration.
- *Leadership reform* towards inclusion, negotiation-based leadership instead of reliance on commands and control.

Information system should be instrumental to PHC reform in providing information needed to monitor achievement in the areas of equity, people-centeredness, protection of health of the communities and community participation (9). Information system is critically demanded by managers to handle issues like PHC coverage and quality(47). Evaluating quality and performance of PHC systems largely depends on the presence of IS that is capable of generating quality and timely information in the cultural, economic and social context(10).

Information is needed to see how far we achieved and what we need to do to achieve core targets of PHC like equity, affordability and accessibility of health care services. Lack of such information has been considered as one of the constraints of programs reform on the basis of PHC principles(29). In this regard, IS has the following roles in PHC management(48);

- *Identify and locate people who are in need of services and specify these needs.*
- *Monitoring and evaluation of implementation processes.*
- *Showing program and service outcome including impact on health status of the community.*
- *Show the cost of providing health services.*

Therefore, I found it of much value to take PHC programs as pilot to explore and demonstrate phenomena associated with HIS functioning. In addition, PHC programs IS may represent vertical reporting associated with health programs and hence provide opportunity for studying challenges and opportunities of making integrated HIS.

## **2.2 Theoretical Framework**

### *Information System Integration and Organizational Validity Theory*

It is an opinion widely held among IS researchers that consideration and analysis of the organizational context where integration of IS is to be implemented is extremely important. Wainwright and Waring (2004) stated that organizational factor, as one of the major domains of IS integration, is extremely important to address the possible challenges in the process of integration. The authors mentioned that the domain has been overlooked by many IS researchers and implementers resulting in failures of implementation of integrated IS. Likewise, Solot et al (1980), Weber and Pliskin (1996), Chilundo and Aanestad (2003), Lafond and Field (2003), and Romain-Rolland et al (2010) have emphasized the importance of developing wider perspective that consider the organizational issues such as structural, socio-cultural and political aspects in attempts to implement integrated IS. The authors have also

mentioned the negative impacts of being narrow minded and too focused on technical aspects of system integration.

Schultz and Slevin (1975-cited in Markus and Robey. 1983) are the first authors accredited for introducing the concept of organizational validity. They have first conceptualized it as the accomplishment of a degree of changes in organizational settings needed for successful implementation of a system. Thereafter, Ginzberg (1979) had introduced the concept to management information system and had modified organizational validity definition as to be the degree of match between organizational context and the system.

Organizational analysis is necessary to draw predictions about changes that might accompany adoption of a new system, as well as, exploring the degree of match between the designed IS and structural, political, socio-historical and cultural context of an organization (36). Markus (1983) highlighted the concept of organizational validity theory by stating levels of analysis that include:

- *User-System Fit* which implies the match between IS and individuals motivations and interests, and cognitive processes of people. In this regard, motivations and interests could be increased by widening user's scope of tasks and responsibilities and improving the chance of rewards associated with the new implementation. This has been shown to increase user's commitment to the system. Likewise, IS design should be made compatible with users cognitive style so that the match between user's cognitive processes and the system is achieved.
- *Organizational Structure- System Fit* entails the need for integration of task related activities and communication to be minded on IS designing. An important example of this is the centralization-decentralization dimension of organizational structure. In this regards, the match can be achieved by either designing an IS to match organizational structure or to change organizational structure to meet system characteristics.
- *Power Distribution-System Fit* implies the degree of power redistribution created by adoption of a new system. A system may said to be invalid when

the power redistribution brought up is at odd with the existing organizational context.

The author emphasized that the concept of organizational validity should not be considered as normative and should be used with caution in research or practical contexts. He mentioned that a system that looks highly valid for an organization may bring little improvement in the overall organizational effectiveness when the match is with an existing ineffective measure and rules in a given organization. On the other hand, systems that look more invalid may lead to long term improvement in organizations performance after an initial resistance been experienced:

*“We suggest that the utility of organizational validity does not come from normative applications of the concept. No simple prescriptions can be made about the relationship between the organization and validity of systems and effective system use. On the other hand, we believe the value of the concept in its use as a descriptor of organization-system interaction. By pinpointing the various dimensions on which organization-system mismatch can and do occur, the concept enhances our ability to theorize about organizational impacts and to make intelligent system design choices”.* Markus (1983. p222).

In our study we adopt organizational validity theory proposed by the authors to give reflections on organizational context and to explore possible challenges and opportunities of PHC programs IS integration.

# Chapter 3

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## 3 STUDY CONTEXT OF SUDAN

### 3.1 Geography and Demography

Sudan, the largest country in Africa, is located in the Northeast part of the continent. It has an area of 2.5 million kilometers sq. The country borders nine countries; Central African Republic, Chad, Democratic Republic of the Congo, Egypt, Eritrea, Ethiopia, Kenya, Libya and Uganda. It lies between longitude lines 13 and 22 north of equator line and latitude lines 22 and 38 east. The country has strategic location been linking the Arab and African worlds.



*Figure 3: The map of Sudan*

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Northern part of the country is an extension of Sahara desert, central part is a dry Savannah area and southern part has a tropical forest climate. The landscape is featured by dots of mountains in the East, Northeast, West and South(49).

The River Nile which has total length of 6,695 kilometers from its source to its drainage in the Mediterranean Sea, (50). The Nile is formed by three tributaries. The Blue Nile which feeds the River Nile over 53 % of its water, originates in Ethiopian highlands near to Lake Tana, White Nile arises in Burundi then passes through Lake Victoria and Atbara River whose source is also located in Ethiopian highlands (50). The Nile constitutes the central part of Sudanese natural resources beside the oil. Agriculture which is considered the main income source for major sections of Sudanese population is dependent on the Nile water, especially in the north.

Total of Sudanese population is about 39.2 million [2008 census], out of which 20.44 million (50.9%) are below 15 years of age and 5.95 million (14.8%) are below five years of age(51). Annual population growth is 2.6% and the total fertility rate is 5.9. Rural population constitutes about 68% of the total population; however there is an ongoing process of urbanization. The population of metropolitan Khartoum is growing rapidly exceeding 6 million, including over 2 millions internally displaced persons from the southern war affected zone, as well as, western and eastern war/drought-affected areas (20).

### ***3.2 Socio-economic and Education Profile***

Sudan has enormous amounts of natural resources which have not been accessed until recently. Investment and utilization of the resources have been limited by the deep seated North/South war which was ongoing since 1983 until the implementation of CPA between the North and the South in 2005. Oil production has started in Sudan in 1999 and now the country is ranked the third largest oil producer in Africa(52). This has been contributing to marked economic expansion. However, export of other key products has fallen due to lack of quality to compete internationally. Ongoing conflicts were negatively affecting the economic growth and poverty reduction strategies, which have undermined efforts to achieve progress towards the MDGs. Nationally, estimated poverty rate is about 50%(51).

Sudan is multi ethnic and multi cultural country. Arab and African ethnicities are the dominant two ethnicities. However, there is large number of ethnic and tribal divisions



in the country. Livelihoods of Sudanese population mainly depend on farming, agro-pastoralism, camel and cattle nomadism, and fishing(49).

The literacy status of the population is considered low. As only one in five, children completes primary school. Living standards are considered low with limitation to access improved water resources and sanitation. Sixty five percent of the population have sustainable access to improved water resources, while only 31 % have access to improved sanitation (53).

### ***3.3 Health Sector and Health Problems***

Sudan has 25 State Ministries of Health (SMoH), one in each State. The FMoH is responsible for the development of national health policies, strategic plans, monitoring and evaluation of health systems activities. The SMoH are mainly responsible for policy implementation, detailed health programming and project formulation. Implementation of the national health policy is undertaken through the district health system based on the PHC concept. In addition to federal and state ministries of health, health services are provided through different partners including armed forces, universities, private sector (both for profit and not for profit) and civil society. However, those partners are performing in isolation due to ill defined managerial systems for coordination and guidance(20).

Typical of sub-Saharan Africa, Sudan health problems are dominated by malnutrition and communicable diseases with vulnerability to outbreaks. Hence, the priority health interventions are child health, immunization, maternal health, control of communicable diseases, blindness control and non communicable diseases control(20). Budget allocated for health sector is not sufficient since the total expenditure on health, as for the year 2006, is estimated at 3.8 % of GPD (53). Important health status indicators are published by the WHO (2009), as shown in table (1);

Indicator	Year	Males	Females	Both sexes
Total life expectancy (years)	2007	57.0	58.0	57.5
Under-5 mortality (per 1000 live births)	2006			112
Adult mortality (per 1000 population)	2004	390	304	
Maternal mortality ratio(per 10 000 live births)	2006		1.107	

*Table1: Important health status indicators in Sudan*

The national health policy includes adoption of a minimum package for the essential health care. The package includes promotion of child health that encompasses vaccination against vaccine preventable diseases, nutrition counseling and growth monitoring and implementation of integrated management of childhood illnesses. Besides, the package covers promotion of school health, promotion of reproductive health, control of endemic diseases (malaria, tuberculosis, HIV/AIDS, schistosomiasis, etc), protection and promotion of environmental health and sanitation, treatment of simple diseases and injuries, and mental health (18).

### **3.4 National Health Policy**

The national health policy is built within the framework of 25-year health strategy and existing policies relating to reproductive health, child health, HIV/AIDS prevention and control, as well as, the national drugs policy. The policy also takes insights from the essential PHC package and the 10-year human resources strategy(18). It also restates national and international commitments, such as the Alma-Ata Declaration and the Health-for-All Strategy, the Millennium Summit Declaration and other global strategies, such as Roll Back Malaria (RBM). The national health policy is formulated in the context of the CPA, which has made an end to the exhausting war. It also recognizes the opportunities associated with the economic growth the country developing. The national health policy has the mission of ensuring health care provided to all Sudanese citizens with more emphasis to the disadvantaged and vulnerable groups in order to lead them socially and economically productive(18).

The following guideline principles have mapped the features of the national development policy of Sudan according to FMoH (2007, p5);

- *Health, being central to the process of human development, is a social right of all citizens of Sudan, irrespective of their regional, religious, racial, cultural or ethnic affiliations.*
- *Health will be used to enhance peace building and rehabilitation and to encourage economic development. Support will be given in ways that facilitate a return to a normal situation and promote sustainable development.*
- *The health system will be reformed to ensure the strengthening of the local and national health system based on the principles of PHC. The planning for this reform will be based on solid policies, scientific evidence and critical analysis of the situation.*
- *Capacity in local health management, planning and policy will be built at all levels of governance, including federal, state and local levels. This is to create an enabling environment for decentralized units within the health system.*
- *An equitable and sustainable health care delivery system, especially for the poor, disadvantaged and vulnerable, including those in underserved and conflict-affected areas, will be ensured.*

Accordingly, it looks worthwhile to strengthen the PHC program IS, which can be one vehicle to strengthen the basic health care to all citizens.

# Chapter 4

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## 4 RESEARCH APPROACHES AND METHODS

### 4.1 *Research Design and Approach*

Traditionally biomedical research was dominated by use of quantitative methods. On the other hand, qualitative methods were developed and been mainly used by researchers in the arena of social science(54). In fact, both methods are helpful in health research when seen as complimentary to each other in order to develop better understanding of a situation. Pope and Mays (1995) asserted the importance of using qualitative methods in the field of health and its need to complement quantitative approaches in the following quotation:

*“Although the more qualitative approaches found in certain of the social sciences may seem alien alongside the experimental, quantitative methods used in clinical and biomedical research, they should be an essential component of health services research, not just because they enable us to access areas not amenable to quantitative research, such as lay and professional health beliefs, but also because qualitative description is a prerequisite of good quantitative research, particularly in areas that have received little previous investigation”.* Pope and Mays (1995. P42).

In the health field, with the strong tradition of using quantitative and experimental methods, qualitative approach has been criticized for lack of scientific rigor in terms of validity and reliability of results. The criticism in this regard might have been brought up by the shortcomings associated with qualitative approaches. Mays and Pope (1995) mentioned the drawbacks of qualitative methods as they are attached to mainly the potential for researcher bias, lack of reproducibility and lack of generalizability. However, as mentioned by Silverman (2005), rigor of qualitative approach is attainable with systematic and self conscious research design, data collection, interpretations and communication. Furthermore, qualitative approaches are exploratory for complex contexts that are multifaceted and involve social and behavioral interactions. This may elaborate on the role of qualitative methods in health research where phenomena need to be viewed in a contextual manner(55).

Some researchers look down upon quantitative method, on the other hand, as a more sound in terms of offering better validity and representativeness. Nevertheless, the drawbacks here may simulate that of the quantitative method in terms of dependence on researcher skills and the appropriateness of the questions to be answered by the research participants. Furthermore, in survey research, categories and questions in the questionnaire may not be uniformly shared by the respondents(56).

Research in IS discipline was also dominated by quantitative perspective(57). As stated by Guion (2001), the perspective had been the main stream methodology since it was regarded by many researchers as the “gold standard” scientific approach. Conversely, many researchers see the importance of other perspective to enrich the stock of knowledge in IS discipline(57;58). The authors endorse their argument on the ground of IS being considered as essentially social rather than technical system. While exploring the different methods and techniques being used in IS research, Minger (2001) has made an empirical review of papers published between (1992) and (1998) in the six IS journals for the purpose of evaluating use of different methods and multi-methods use. He found that:

*“Roughly two-thirds of papers contained some form of empirical research, and the dominant forms of research were surveys, interviews, experiments, and case studies accounting for over 80% of recorded examples. Nine other more specific research methodologies, such as participant observation, grounded theory, or soft systems methodology, were almost entirely absent”.* Minger (2001. p246).

The author continued stating that in the domain of IS, there are wide ranges of disciplines-technology, psychology, economics, sociology, mathematics, linguistics, semiotics-resulting in plurality of research paradigms each with particular research methods. Therefore, combination of different paradigms is important to attain more comprehensive knowledge.

In this study, I found it as appropriate to adopt qualitative methods. As mentioned earlier in this section, IS is a social system that entails behavioral, cultural and political elements. Therefore, qualitative approach was chosen to have better understanding of such context. Furthermore, different researchers argue that integration of IS means integration of people with the social, cultural and political elements embedded(34;36;38;40). Hence, the choice of adopting qualitative methods

was further justified by the need to explore challenges and opportunities associated with IS integration.

Case study methods have been extensively applied in IS research(57). The approach seeks thorough understanding of the topic under investigation since it gives an opportunity to ask penetrating questions and to explore organizational behavior (58). Silverman (2005) described case study as using whatever possible research methods to answer the research questions and to develop as complete as an understanding of the case as possible.

Unlike survey, case study includes not only verbal information but also recording of behaviors (55). Therefore, I found it as an appropriate to use the design to study PHC programs IS and to explore issues embedded in IS integration.

## ***4.2 Data Collection Techniques***

Different researchers mentioned that no single data collection method is superior, rather the rightness of a method is measured through its appropriateness to get the research questions answered(55). However, in order to maintain data validity, combination of different data collection methods (triangulation) is considered utile (55). Therefore, in this study data from different sources were collected through interviewing, observation and documents review and analysis. The use of these methods is highlighted below:

### ***4.2.1 Interviews***

The method is quite useful for exploring perspectives and feelings of the respondents. As interviewing required careful handling, I was following the cascade steps asserted by Guion (2001) as follows(59):

*Themetizing:* the purpose of interviews was clarified through recognition of the themes of the study, which were drawn from research questions.

*Designing:* the key step here was to develop interview guides. (See annexes 1, 2 and 3 for interview guides).

*Interviewing:* I was minding the importance of ensuring patience, flexibility, active listening and sharing power with the respondents. Moreover, I was using tape recording to make ease of the process of interviewing.

*Transcribing:* all recorded interviews were transcribed in preparation for analysis.

*Analyzing:* the transcribed material was then analyzed through categorization of data on the grounds of commonalities and identified themes of the study.

*Verifying:* this process was achieved through triangulation procedure and through rechecking with the interviewees to clarify opacifications.

Upon starting each of the interviews, more general questions were posted first in preparation for the next coming in-depth digging questions after a trust and good atmosphere is created. Open-ended questions were administered to guide assessing the existing PHC IS with regard to the availability of resources and performance in general. Furthermore, in-depth interview qualitative questions were used to navigate through more complex issues such as perception of health workers and health managers in relation to unified and integrated HIS.

Interviewing health workers at different levels in the health system hierarchy, as well as, at the HIC provided means for triangulation and verification of data. Furthermore, it gave the opportunity to understand the different potential rationales across macro-micro levels for developing integrated HIS. Informants of the study were found to show some reluctance to disclose information that might have implications of evaluation of their programs performance as it might threaten their career. To relieve such tension and improve openness during interview, participants were first informed that their contribution will be kept confidential and anonymization of data will take place.

#### **4.2.2 Observation**

Observation is crucial to watch what people actually do and to compare it with what they said during interviews in efforts to triangulate data. The drawback of this method is the ethical issue attached to investigating individuals and organizational set up as covert. Besides, there is a potential for personal bias unless the balance of insider-outsider stance is maintained (60). For this study, I was taking observations of the selected settings in naturalistic method. An observation check list was prepared and followed. Field notes were taken as soon as possible after observations have taken

place. The check list (see annexes 1, 2 and 3) highlights the items that have been observed.

### 4.2.3 Documents analysis

During the field work, relevant documents were collected and then reviewed and analyzed. The documents analyzed include data collection formats at PHC service delivery points, monthly reports from facilities under investigation, monthly and quarterly reports of PHC programs administration at state and locality levels. The annual report produced by HIC and available work plans for PHC programs were also reviewed. The method was of much help for me to substantiate findings from other data sources.

## 4.3 Study Area

The study was conducted in the Northern State, Sudan. It has an area of 348, 697 kilometers sq and about 621, 000 populations according to projection for the year 2008. The state has its capital “Dongola” and consists of seven localities; Wadi Halfa, Dalgo, Al-Burgaig, Dongola, Al-Golid, AL-Dabba and Marawi. Health care facilities in the state include one referral hospital, 25 rural hospitals, 82 health centers (HC), 173 basic health units, 45 dressing centers and 8 primary health care units (PHCU).

		Immunizat -ion units	Nutrition units	*ORS units	*MCH units in...		
					Hospitals	HC	Others
Sudan	NO	2673	1102	1000		1006	96
	1000 pop/unit	13.24	32.12	35.40	219.88	35.19	368.7 5
Northern State	NO	214	40	0	26	71	0
	1000 pop/unit	3.05	16.35	0	25.15	9.21	0

\*ORS=Oral re-hydration solution

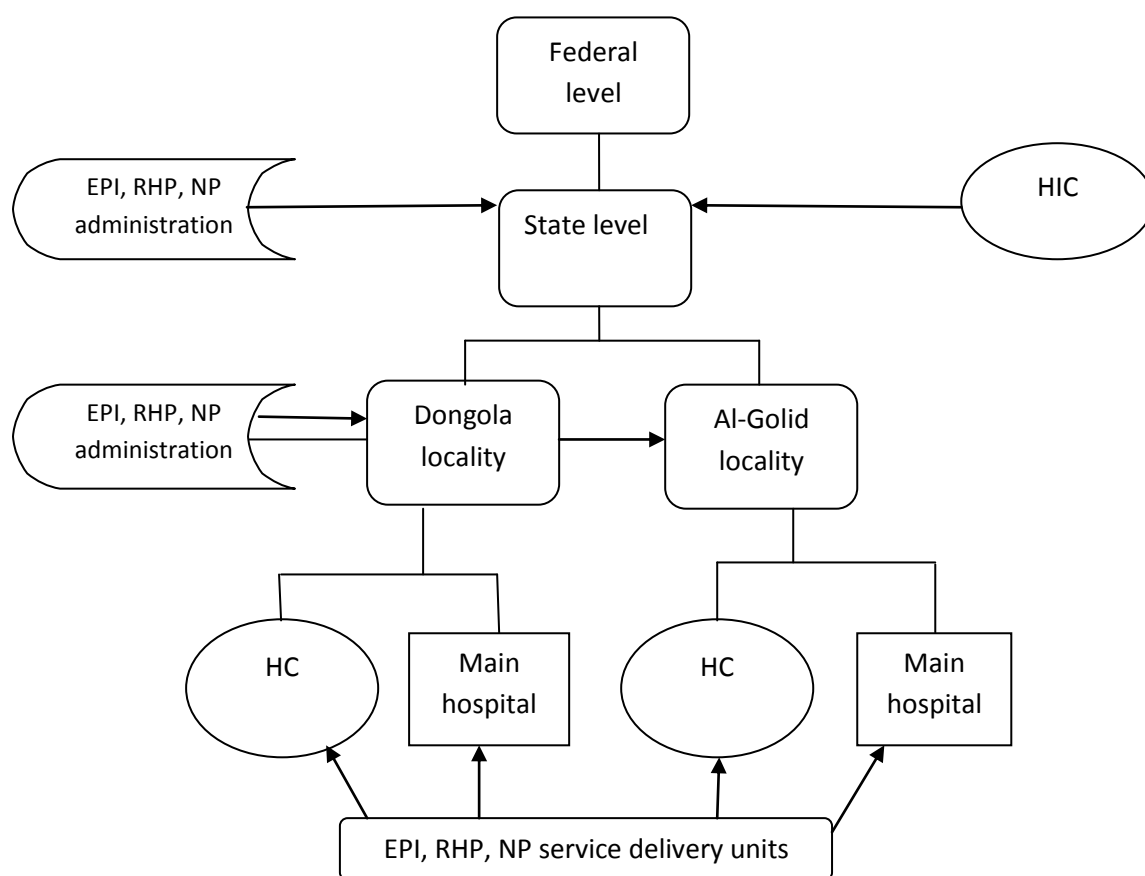
\*MCH=Mother and child health

*Table2: Distribution of PHC facilities in the Northern State. Source: FMoH (2008)*



The state was seen as a better choice as site of the study because it is one of the politically stable states of Sudan. In addition, the area is easily accessible for the investigator since he lives and works there.

Based on the concept of “purposive sampling” two (Dongola and Al-Golid) out of the seven localities of the Northern State of Sudan were selected as research sites. Although the two localities are regarded as rural areas, Dongola where the capital of the state locates, demonstrates better resources and infrastructure. Hence, this selection is based on the theoretical framework of the study since there is an expected difference between the two localities in terms of HIS resources, PHC coverage and quality, donor support and other institutional factors. Silverman (2005) put forward the importance of theoretical sampling in order to enhance validity of qualitative study.



**The arrows mark study sites**

*Figure 4: Graphic Mapping of the Study Sites*

As show in figure (4), in each locality the main hospital and one HC were picked out and the settings of the PHC programs; Expanded Program on Immunization (EPI), Nutrition Program (NP) and Reproductive Health Program (RHP) in the mentioned facilities were the targets of the study.

It was convenient to take one hospital and one HC in each locality as study cases for in-depth analysis of PHC programs IS. The selection was based on the performance of these health facilities. Hospitals have high work load and perhaps more attention and support from the government. Therefore, IS performance might demonstrate different influences among hospitals and HC. This is again depicting theoretical basis of sampling. In addition, locality and state administrative levels of PHC programs were also included in the case study. Besides, HIC located at the state level, was also taking part in the study in order to come up with more complete picture of the context.

#### 4.4 Study Population

A number of 15 informants comprised interviewees of the study. The interviewees represented HIC manager, state PHC manager, directors of PHC programs (EPI, NP, RHP) at the state and locality levels, and health workers of the programs at health facilities in the selected sites.

Position/Administration	RHP staff	EPI staff	NP staff	PHC state manager	HIC head
State level	1	1	1	1	1
Locality level	1	1	1		
Locality level + hospital		1	1		
Hospitals	1		1		
HC	1	1			
		1			

The cells "in common" indicates the participant taking two activities

**Table 3: Distribution of the study participants by position/activity**

Some of the interviewees were taking more than one position, either being serving two programs at service delivery or being taking administrative position in addition to service delivery at health facilities. Recruitment of participant was started by interviewing the key personnel in every organization included in the study and further recruitment was then following the “snow balling” procedure.

#### **4.5 Data Analysis**

Qualitative data analysis, as indicated by Lancy and Luff (2007), involves seeking relationships between data through categorization and themetizing after identification of important themes. The data collected by different methods such as interviews and observations need to be summarized in order to facilitate the process of analysis(61).

In this study, I was first reviewing observation notes, relevant documents and tape recording several times in order to get familiar with the data. Thereafter, interviews were transcribed, summarized and translated from Arabic to English language and anonymized. The transcribed material was then coded using the software “Nvivo” to facilitate analysis process. Coding of data involved categorization of data alongside predefined and newly emerging themes as going through the material. Thereafter, relevant data collected through observation and documents review were introduced to the first analyzed material.

The analysis process in this study has utilized predefined concepts drawn from the literature. In an interpretive way, the study findings were analyzed alongside the framework indentified from literatures based on research questions. Lancy and Luff (2007, p13) described the mode of analysis as “framework analysis” and they stated the following;

*“The benefit of Framework Analysis is that it provides systematic and visible stages to the analysis process, so that funders and others, can be clear about the stages by which the results have been obtained from the data. Also, although the general approach in Framework Analysis is inductive, this form of analysis allows for the inclusion of **a priori** as well as emergent concepts, for example in coding”.*

In order to discuss organizational issues associated with IS integration; I preferred to follow organizational validity theory suggested by Ginzberg (1979). Following such

theoretical framework may facilitate drawing predictions on potential challenges and opportunities for adopting integrated system in the existing structural, political, socio-historical and cultural context of PHC programs in Sudan.

#### ***4.6 Limitations***

This study was conducted in only two localities of the Northern State, Sudan due to time and budget constraints. Therefore, the results of the study might not be considered as reflections for other localities or states in Sudan. The study also included PHC programs as a pilot, which might not fully represent the whole context of health sector. Furthermore, time and budget limitations constrained involvement of the federal level in the study where the nature of challenges and opportunities for HIS integration could have been revealed. However, efforts were made to enhance the quality of this study through improving representativeness and also through triangulation of data. In this regard, the context of this study has included representation from better resources, as well as, poorer resources facilities. Furthermore, inclusion of different levels in the health system hierarchy and the HIC has provided capability for triangulation of data. I, therefore, believe that the findings of the study will be relevant to compliment the efforts of HIS integration in Sudan, and other countries with similar working conditions.

#### ***4.7 Ethical Considerations***

Letters of ethical clearance were obtained from the Norwegian and the Sudanese ethical committees. Confidentiality issue was identified as important for ethical conduct of the study. The participants deserved the right to feel safeguard against unintended consequences of giving information in a hierarchical health system as in Sudan. Therefore, anonymity of data was maintained by giving codes to the data after discarding personal information. As health workers are mostly very busy, appropriate time for interviewing was considered.

# Chapter 5

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## **5 Study Findings and Analysis**

In this chapter, I first present study findings related to general features of IS performance in the context of PHC programs in the Northern State, Sudan. This includes HIS resources, data collection and reporting channels, as well as, data quality assurance and information use. Thereafter, findings relevant to the issues of fragmentation and integration of HIS, the focus of the study, are presented.

### ***5.1 Health Information system resources***

Health information centre (HIC) is a statistical centre located at the SMOH and is responsible for collection and collation of health information for the northern state. In addition to the state referral hospital (Dongola Teaching Hospital), data/information comes directly from the locality administrative level of the five localities of the state. The state HIC is staffed with sufficient human power who has received basic training in statistics and information management. The work in the center is guided by strategies set by the national health information centre. Resources of HIS, in terms of data collection tools, were found to be relatively good since the tools are readily available and shortage rarely occurred, as the head of the center mentioned. It has also been observed that the HIC is supplied with computers and data storage spaces, such as cabinets for keeping records and registers.

While observing data collection procedure at the visited health facilities, there was no shortage of data collection tools. However, at one location (NP at Al-Golid locality) shortage was observed where the health worker in charge was found while preparing hand written forms. Although there was no significant problem related to data collection tools, shortage of budget hindered some activities that would have been run by the state HIC. These include shortage of money for capacity building of the staff, improving communication and transport facilities, providing stationeries for data collection and maintaining regular supervision and support for health facilities.

Concerning the design of HIS, it was found that there is no single unified system headed by the HIC as a unit for integration of information related to different health programs and activities occurring in the state. Lack of integration was demonstrated

by the presence of vertical health programs, including PHC services, which are also run almost independently and do not collaborate with HIC apart from sending the centre a copy of their reports.

In terms of addressing the issue of HIS strengthening, some of the PHC programs were found to have written policies on the issue. For example, the year 2007 work plan of NP of the state stipulated about strengthening the IS by supervising the process of data collection and sending feedbacks to the data collectors.

Inequity in distributing budget was prominent in the settings of PHC programs. For example, EPI is a well funded program and consequently has better resources for IS. The researcher observed that physical resources were better for EPI than other PHC programs. These include shelves for keeping records and other documents, and a number of computers used for storing data in Excel format. Besides, EPI has better human power, so that there is no work load on the individuals. This in turn contributed for betterment of the statistics of immunization and disease surveillance programs run by the EPI in the Northern State. Besides, communication facilities, such as internet and telephone were readily available. This was specifically true at the state administrative level. However, at lower levels, including data collection sites, computers were either not available or, if available, not been used to facilitate HIS tasks. In sum, the budget allocated for PHC programs was limited. This was emphasized by phrasing of the state PHC manager; *"yesterday a health worker of one of the health centers told me through phone that he is unable to deliver the monthly report because it costs 20 Sudanese pounds (about 7 US\$) to deliver it in person"* (October 2009).

Lack of resources sometimes results in lack of incentives and reasonable salaries for health workers. Community midwives, in most cases, are not officially employed in the health system, hence they are partially volunteering. So, they feel that they do not have obligation for sending out reports. However, some of them do it out of their sense of belonging with their bosses. For instance, a community midwife was called for by PHC programs administration to run RHP in a HC and when interviewed she stated that *"I am already retired but they ask me to continue...I receive very small salary.... I am a kind of volunteering, but in fact I do prepare reports about the*

*activities every month”* (November 2009).

This example shows that health workers at the grass root level have no strong accountability to HIS tasks whereas they are entitled to do. This in turn may affect the quality of data collected and reported.

## ***5.2 Health Data Collection and Reporting Channels***

The data related to PHC activities were first collected at the service delivery sites. These include the data generated from PHC programs run in the hospitals and HC. Although data are supposed to be collected in all health facilities, our findings community level activities were the missing units in the IS. Data collected at the facility level were sent to the localities where it undergoes collation as a separate report for each of the health programs and the compiled reports then sent to the state level. Health information center located in the SMoH was found to be receiving a copy of the reports before it reaches the federal level.

Concerning information flow of the EPI in the localities, the respondent described it as reports come from immunization centers (fixed) to the locality administrative level. The fixed immunization centers in turn receive reports from outreach sites, while mobile teams bring their reports directly to locality level.

It has been observed that some health programs in the Northern State are run directly from the federal level. Likewise, information related to these programs is sent directly to the central level. Therefore, PHC administration in the state, have got no information on how these programs are performing. An example of this phenomenon is the basic developmental needs (BDN) program which is an WHO initiative.

Reports from the lower levels were mostly transported in person and the person who is responsible for running the program is requested to present reports to the higher level. However, in some cases, reports were sent by the public transport to the next level when drivers might be asked to convey them. The state PHC manager mentioned that sometimes, health workers need to request public transport drivers to convey the report to us and there is always a risk of losing these reports. Consequently, as mentioned by most of the participants, depending on public transport system was a true constraint affecting completeness and timeliness of data.

Data collection forms were found to be standardized for each of PHC programs in all of the visited facilities. Besides, health workers were mentioning their satisfaction related to the data collection tools in terms of its user-friendliness. However, analyzing the relevant documents showed that the concept of EDS was not applied for data collection. The same data were included in all forms starting from the collection site up to the state level.

Regarding NP run in Dongola teaching hospital, the respondent mentioned that the form includes items on preventive measures only and it doesn't include curative services they provide in the hospital. Another problem encountered in the process of data collection was occasional confusion on definition of data elements. An example of this is how "body weight" is interpreted by health workers. A study participant highlighted this issue as follows: *"body weight indicator has been changed from just the weight alone to weight for height, weight for age and weight for surface area....health workers don't know how to use these new definitions"* (October 2009).

One of the study participants was responsible for running two of the PHC programs (nutrition and immunization) in a HC. He is an example of a single person responsible for running two programs and asked to prepare a separate report for each program and send them to the locality level.

### ***5.3 Data Quality Assurance, Data Analysis and Information Use***

Concerning data quality and the measures applied to assure good quality data, most of interviewees were reluctant to mention shortcomings that happen in this regard. A director of one of the PHC programs at the state level replied that, at that level, they take every measure to ensure good quality data including the conventional methods of checking data error. *"However"*, he said, *"reports coming to us from the localities lack quality in terms of completeness, accuracy and timelines"* (September 2009). He continued to mention that these are probably due to lack of regular training and supervision for health workers at service delivery points.

State PHC manager, when interviewed, mentioned that reports from about 70% of the expected sources reach the state level and the rest either do not send their reports to the next level or do not collect data at all as in the case of community midwives. The respondent continued to say that data are lacking quality in terms of correctness and they do not rely on these data for decision making. One of the



reasons, as mentioned by the study participants, is lack of coordination between the different PHC programs at the grass root level (data collection sites) and this phenomenon sometimes resulted in the presence of conflicting data for the same item. This was happening in the situations where the level of coordination between PHC programs is low at service delivery points.

Analyzing documents in line with data quality has showed shortcomings as in the following examples:

- September 2009 report of NP in Dongola locality indicated that data were 50% complete (coming from half of the expected sources). The same report has included some fields which were left blank. For example, number of visits of children in the age groups (12-24) months and (24-60) months were not filled.
- Data error was seen in a quarterly report (third quarter) for the year 2009. This is shown in the table below:

Normal	Mild malnutrition	Moderate malnutrition	Severe malnutrition	Total
402	9	9	2	424

*Table 4: Example of calculation error*

It is clear that the total of normal, mild, moderate and severe is 422 and not 424. However, the researcher observed that health workers in this facility were using calculators for summation.

It has been observed that there are monthly meetings held at the state and locality levels regularly for each of the PHC programs. These meeting were attended by data collectors at the service delivery point who brought their monthly reports with them, as well as, it was attended by program directors at the locality and state levels. In these meetings, reports were presented, as well as, self assessment and action plan were formulated, based on the reports. EPI director at the state level stated that; *“in this type of meeting we go through every single report, check correctness of the data, suggest action plans and give feedbacks to the localities .....the data gathered come from all expected sources and they are 100% correct because we have measures to check the data quality but, rarely some reports reach us late ..... this is attributed to*

*lack of good transport system”* (September 2009). In this regard the researcher has attended a monthly meeting for EPI at the state level and he observed that there were data quality check procedures and feedbacks given. The quality checking procedures included looking for completeness of data as it is coming from all expected sources, as well as, looking at how data are consistent when it is compared across months, years and relevant indicators. The data checked at this level were already converted to health indicators after they have been processed at the locality level.

In the EPI settings, the head at the state level have also mentioned that they conduct regular supervision to immunization centers and they cross check for data correctness by comparing reports with register books. He said that correctness of data could be granted when there is no discrepancy between reports and register books.

One of the interviewees at service delivery point (RHP in Dongola teaching hospital) mentioned that they record data immediately after they gave the service and there is supervision from both the state and federal levels. It has been observed by the researcher that in the immunization program settings, in the mentioned facility, health workers were immediately recording data after an activity has been taken place.

With regard to analysis and use of data, it was found that there is analysis of data to produce indicators in some of the PHC programs. For instance, data analysis was conducted at the locality and state levels for EPI. However, in other PHC programs, there was no practice of data analysis. For instance, state RHP director mentioned that they do not process data and they rather send reports to the higher levels, as well as, to the state HIC without making analysis. Therefore, it was not possible to evaluate important indicators for assessment and evaluation of maternal health services. At the health facility level data analysis and use was rarely practiced.

#### ***5.4 Fragmentation of Health Information System***

Primary health care programs in the Northern State were found to be an example of vertically run programs. The bottom level included the health service delivery facilities - hospitals and HC. The IS was found to be in correspondence with the disintegrated PHC programs since data flow follows the reporting channels that passes through the

locality and state administration for each program separately, and finally reaches the federal level. Nevertheless, a copy of the reports reaches the state HIC before they are sent to the central level. The only purpose of these copies at the HIC is to prepare the annual report.

A kind of coordination was observed between PHC programs at service delivery sites. For examples, distribution of vitamin (A) and folic acid was taking place in immunization sessions and RHP respectively, while it is supposed to be distributed by the nutrition service. Concerning data on the mentioned activities, respondents in the relevant programs mentioned that redundancy of data was experienced due to reporting of data repeatedly.

Another variety of coordination encountered was the presence of one person who is responsible for running two programs together in the health facilities. For instance, one of the study participants was found to be running NP and immunization in a HC. However, the person was preparing two separate reports for each program.

As for the implications of presence of the non integrated reporting system, PHC state manager emphasized its impact on data quality and exhaustion of the available resources. He stated that some data elements are sent to the federal level twice through two reporting channels and this may results in presence of conflicting data for the same item.

Concerning fragmentation of HIS in the state, the EPI director mentioned that it is the result of fragmentation of the service itself. He then suggested that if there is coordination at the service delivery sites, it will automatically be accompanied by coordinated IS.

### ***5.5 Health Worker's Perception about Integration of HIS***

The purpose of HIC located at the state ministry is to be the single store of all health data in the state and to be the coordinating body for an integrated IS. Although data from health facilities reach the center through localities, data from the vertical programs, including PHC programs are sent vertically to the federal level. The head of the centre, when interviewed, asserted that they receive copies of the reports of PHC programs regularly, while the programs report directly to the federal level as

other vertical programs do. In this regard he said; *“the policy of the centre is to have an integrated IS with health data repository at each level that everyone can take information as required and we are working in this direction .... a prove for that is the unified annual report that we prepare, albeit we could not reach to consensus with different institutions in the health system in order to have an integrated IS”* (August 2009).

Conversely, PHC state manager stated that *“I see good opportunity for integrating the IS at the lower level (locality) since there is corresponding government. This kind of integration will help providing information for all health programs in one place and it gives opportunity to information sharing between stakeholders”* (October 2009). The respondent mentioned a policy called “local governance system” which advice integration of IS at the state level through the HIC.

The state NP director, when asked his opinion about integration of the HIS, replied that the integration may not be reliable because it may bring up some kind of unwanted effects as IS will be the deal of HIC in the first instance. This might happen, as he mentioned, since the HIC is not adequately resourced to take such responsibility.

In the same regard, EPI director at the state level spelled out his opinion about integration of HIS as follow;

*“HIC at the state ministry of health is now collecting and analyzing all health data in the state, but this does not mean that we rely on it, because I think it is good to coordinate the work vertically since we can assure accuracy of our data. We cannot rely on others who do not have enough resources to operate the IS ....He continued... I think integration is good as it permits information sharing between the different programs, though I do not see problems with the existing EPI IS”* (September 2009).

The director of RHP at the state level looked at the reason behind the fragmentation of IS, as it is the result of presence of vertical programs and he mentioned that a potential for making unified system lie on enhancing coordination at the level of service delivery. The NP director at locality level, on the other hand mentioned that the kinds of information needed by different PHC programs are different and this

makes integration of HIS difficult.

### ***Summary***

Studying IS of PHC programs in the Northern State, Sudan, has revealed shortage of resources to operate the system. Lack of resources has limited training of health workers to build up their capacity of information management, as well as, limiting improvement of transport and communication facilities. In addition, supervision and feedback activities to health worker at lower levels in the health system hierarchy were constrained by shortage of budget. However, data collection tools were fairly provided adequately. The tools were found to be standardized for each of PHC programs. Nevertheless, there was no standardization in data collection procedures since some of the programs were reporting processed data, while others were sending raw data to the higher levels.

Data collection in the setting of the three PHC programs was started at the facility level and then reported higher up through localities and the state levels to the federal level. As the reports being transferred to the next level in hard copy, means of transport of the reports was a real challenge for completeness and timeliness of the reports. There was no coordination seen between the programs with regard to IS. The finding of the study also showed that data quality was poor, as well as, processing and analysis of data was taking place infrequently. Therefore, information was rarely used to support decision making in the context of PHC programs.

Health information center, which is located at the SMoH, was found to be well staffed with personnel who have received basic training in IS. However, the center had limited budget, which constrained carrying important activities, such as offering supportive supervision to the health workers, in order to improve HIS performance. The center receives reports from all part of the state and entitled to integrate these data. Concerning integration of PHC IS, most of the study participants were optimistic about integration of the system. Nonetheless, some of them were expressing their satisfaction on the existing IS performance, as well as, their fear of unintended consequences brought up by HIS integration.

# Chapter 6

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## 6 DISCUSSION

In this chapter, discussion of the study findings is presented in two sections. The first section discusses the overall patterns of PHC programs IS. The second section adopts the strategic model of IS integration proposed by Wainwright and Waring (2004). This theoretical framework is followed to discuss issues surrounding IS integration.

### ***6.1 Overall Patterns of PHC Programs IS***

In this part, general features of IS functioning are discussed to explore weaknesses and strengths of PHC programs IS. Firstly, data collection and reporting in the settings of the programs is discussed, followed by discussion of data quality assurance and information use.

#### **6.1.1 Data Collection and Reporting**

As mentioned by many IS researchers, HIS of DC is highly constrained of performing its task of providing good quality information for the purpose of evidence-based decision making (5;22). In most cases, the impairment of function is attributed to scarcity of IS resources(5). This might have affected provision of data collection tool, data storage spaces, communication facilities and training of personnel. However, lack of resources is not always the only obstacle, since lack of proper IS integration is also a phenomenon been observed in many DC(5). Therefore, health information in the context of DC lacks quality to an extent that information is not utilized by managers to support decision making.

In this study, it was observed that there is variation in funding among PHC programs. In the settings of EPI, relatively good infrastructure was demonstrated. In such program, computers were found to be used at the state levels and internet was available. Accordingly, the IS of the program has demonstrated difference in resources and thence the performance. Overall, the IS was constrained of performing its task of providing timely and good quality information to support management in the context of PHC as a result of budget limitations. Although PHC programs have

shown reasonable availability of data collection tools, reports were entirely paper based at all levels and computers, if available, were used as data storage tools. Reporting of data was also tremendously encumbered by lack of resources. For example, reports were sometimes transported to the higher levels by means of public transport which poses the risk of delay in reporting or even loss of the reports. Completeness of data was similarly affected by lack of effective means to convey reports to higher levels, as well as, lack of incentives to health workers at community level activities to collect data.

Our study of PHC programs IS has revealed completely vertical and program-specific reporting without showing any degree of information sharing at all levels of the health system hierarchy. As described by AbouZahr and Borema (2005), the observation of fragmentation of HIS is widely occurring in the context of DC. The system is fragmented into subsystems to serve vertically run health programs. This kind of lack of coordination has implication related to wastage of time and resources through duplication of work, as well as, lack of good quality data and thence limited use of information as a result of data redundancy(30). The situation might even be more complicated in places, where there is already budget limitation, such as in Sudan. In all of the PHC programs studied, data were collected at different service delivery points and then reported to locality level where data were compiled in to a single report for each program. The reports were then sent to the state level where data compilation again takes place before it was further reported to the federal level. Although, HIC of the state was receiving a copy of all of the reports, the centre was amenable only for using the data to produce an annual report. Collection and reporting of data were taking place under no coordination between PHC programs.

However, the study of PHC programs has shown a degree of coordination at service delivery points. For example, Vitamin A and folic acid distribution service, as detailed in the previous chapter, was example of such coordination. Nevertheless, the coordination in service delivery was not accompanied with integration of information on these activities resulting in double reporting and redundancy of data.

### **6.1.2 Data Quality Assurance and Information Use**

Data quality is a core issue governing IS functioning. Use of information for decision making is directly linked to quality of information. Hence poor quality data hinders evidence-based decision making(5). Therefore, it is crucial to have measures that could be applied for errors check and quality assurance. In this regard, Heywood and Rohde (2001) state that control procedures should look at the areas of completeness, correctness, timeliness, consistency, relevancy and comparability of data. In our study, it was indentified that some of the measures were applied to assure data quality. Monthly meetings held at the locality and state levels for each of the PHC programs were the scene where reports were presented and discussed, as well as, errors were checked. The researcher attended one of EPI monthly meeting where the meeters were going through the reports. They were checking for data completeness as coming from all expected sources and for data consistency when reports were compared across months, years and relevant indicators.

Other measures to assure good quality data, as stated by Heywood and Rohde (2001), is to ensure use of user-friendly data collection tools. It implies simplicity and ease of use of data collection tools. Similarly, standardization of data elements definitions, training and supervision of health workers, as well as, feed backing to them, are all important measure to enhance data quality(23). For the PHC programs studied, participants of the study have mentioned their satisfaction about data collection tools as being user-friendly in terms of the layout of formats and the number of items included. However, Training and supervision of health workers were rarely happening. EPI was better performing in this regard too. The main reason for this, as mentioned by many of the participants, was shortage of budget to undertake such activities. As a consequence, neither health workers skill been scaled up nor IS performance errors been identified and corrected in order to assure good performance. When supervision was conducted, it was giving chances to cross check reports with register books as a measure for data quality assurance.

Although some of the above mentioned measures of quality assurance were taking place, many shortcomings were encountered on quality of reports. Completeness of data, as estimated by the State PHC manager, was around 70%. It was observed that some units were even missing in the IS or some data elements were not been



reported. This was especially demonstrated in the case of community midwives who were obtaining very low or no salaries and do not have other incentives to collect data. Likewise, correctness of PHC programs data was shown to be confutative. Emergences of data errors such as miscalculations were observed. Similarly, as mentioned by most of the study participant, there were considerable defects with regard to availability of data on time. The kind of problem was attributable to lack of effective means to transport reports and dependence on public transport system which is not reliable to convey the reports.

Our study also revealed that analysis of data to produce indicators was rarely performed. If happened at all, it was seen at the locality and state levels and not at the grass root level. However, data need to be analyzed and used at all level in the health sector this could be attributed to lack of skilled personnel in this regard. Our study revealed a better performance in the EPI settings where indicators were produced and used to prepare work plans. In the other PHC programs, there was no practice of data analysis. Therefore, it was not possible to evaluate important health indicators. Overall, information use to influence decision making was found to be hindered by, mainly, lack of good quality data and lack of trained personnel to analyze and process data.

## ***6.2 Health Information System Integration***

In this part, challenges and opportunities of HIS integration are discussed through three domains; technical domain, strategic domain and organizational domain. The three domains are identified by Wainwright and Waring (2004) as important to consider in IS integration. The organizational domain is discussed in more details, since it has shown more significant correlation with PHC program IS integration in Sudan.

### **6.2.1 The Technical Domain**

Technical domain of IS integration incorporates technical means to integrate data coming from different sources into a single store. As described by Mudie and Schafer (1985), it provides unified interconnected network that can be accessed by customers in organizations to enable information sharing(62). Standardization of data collection

procedures including data elements definitions and IS applications is seen as crucial for technical integration(34).

In this study of PHC programs IS, the concept of EDS was not applied. Therefore, huge amount of data were collected and reported to higher levels. In technical terms, the phenomena might be an obstacle to integrate all data that are diverse and enormous. Therefore, essential data that are needed to support management at each level should be defined. Another technical issue came across is lack of uniformity of data flowing in the IS. As mentioned under the previous sub-heading, data/information on PHC programs reach the state level as combination of processed data (indicators) and non processed data (raw data). This might have the implication of creating difficulties or less meaningfulness of integration of data.

Data collection formats were found to be standardized for each of the PHC programs across service delivery sites. From technical stand point, this might have positive contribution to the process of integration since duplicate data could easily be identified and removed.

Among others, DW is one of the technical methods to summarize and integrate data coming from different sources(40). In this regard, we looked at HIC as an appropriate home for building DW. The center located at the state level is entitled to receive health data from all parts of the state including PHC programs. Furthermore, it is reasonably equipped and staffed with personnel who have received basic training related to IS. Hence, HIC is considered a good hub for technical integration of HIS.

### **6.2.2 The Strategic and Organizational Domains**

We would like to consider the two domains together since the study findings to be discussed are overlapping over the elements of the domains and thence repetition could be avoided.

The strategic domain entails strategic thinking and planning in the process of implementing integrated IS(34). The authors described the need for aligning IS and organizational strategies in the kind of planning. They mentioned consideration of the organizational domain as an outstanding requirement for IS integration. The

organizational issues in this study are discussed in the order of; structure, social and historical, power and politics, and cultural components, as follows:

### ***Structure***

The studied PHC programs have demonstrated verticality in terms of IS where reports are sent separately directly to higher levels for specific programmatic management. Each program has its own IS infrastructure and procedures. In this regard, integration might bring up changes associated with emergence of new functions in the system. This could accompany efforts for procedural standardization and infrastructure sharing incorporated in the process of IS integration.

State PHC manager was found to be serving management coordination for PHC programs at the state level. This can be looked down upon it as a positive point that might support integration of IS of these programs since coordinated management bridges the structural gap among PHC programs and could thence mitigate unwanted impacts of structural integration.

### ***Social and historical***

Social context implies the manner of interaction of individuals within communities of organization(34). The social situation of an organization is to be analyzed in order to come up with understanding of the social context and how it could be improved alongside the process of IS integration. Udas (1998) proposed that a social theory could be built through participatory action research and working with the participant in implementation of integration(63).

In our study, a degree of sense of ownership was observed among the staff of PHC programs. On the other hand, cooperation in service delivery was noticed to some extent. In PHC programs with better resources, such as the EPI, study participants were expressing their satisfaction about their respective program IS functioning, as in case of EPI. Therefore, they wanted to maintain the existing systems and thence may not support implementation of new integrated IS. However, in the context of PHC programs a degree of social integration could be concluded from the coordination and collaboration between health workers at service delivery points. This could be

extended to involve coordination at the level of IS in terms of data collection, reporting and decision making which may have desirable impact on HIS integration.

### ***Power and Politics***

Power and political factors are highly embedded in the hierarchical health systems of DC and need to be carefully addressed when HIS integration is considered(40). As stated by Wainright and Waring (2004), introduction of integrated IS cuts horizontally through an organization and might hence necessitates redistribution of staff power and their inter-relationships. In this regard, studying PHC programs IS has revealed a degree of conflicting opinions among the participant. Most of the participants were showing optimism about HIC being the leading body in dealing with HIS in the state. On the other hand, only few of them were to mention disadvantages of integrating the HIS through HIC. They rather consider coordination of work vertically as better means to IS improvement.

In order to get all stakeholders on board committed to HIS integration, it is vital to develop mechanisms of demonstrating the advantages of IS integration early in the process of implementation. The interaction between the system and individuals will determine whether it will be adoption or abandonment of the system by stakeholders. The kind of interaction between participants, system and context is described by Markus (1983) as the interaction theory that facilitates understanding of motives, interests and power bases of individuals.

A demonstration for interaction theory is seen from the case of implementing integrated HIS in Serra Leone. Romain-Rolland et al (2010) described the successfulness of building single data repository as an early experimenting step in demonstrating improvement in data quality for the stakeholders and thence increasing their motivation and commitment to the new implementation.

Conflicting motives and interest among PHC programs personnel participating in this study was felt. Some of the study participants were reluctant to show their commitment to HIS integration. This was probably due to fear of losing power and responsibility they take when HIC is strengthened to be the leading body of the process of making an integrated HIS in the state. In this regard, Markus (1983) stated

that interests of IS user may sometimes be based on benefits of sub-units in an organization rather than benefits of the organization as a whole.

Besides, decentralization and empowerment of health workers at the grass root level in the health system has the advantage of promoting interdisciplinary collaboration at community level. A decentralized system also permits HIS integration at lower (for example district) level(44). The author described DHIS as being adopted by many DC to integrate HIS at district level. The degree of decentralization of HIS in the context of PHC programs in the Northern State was minimal. In these vertical programs, policies are set at national level and spelled to lower levels. However, as asserted by state PHC manager, there is a policy of decentralization of the HIC in the state but it seems that it has not been applied to the real context yet. Therefore, designing an integrated HIS to serve such context should mind the degree of decentralization.

### ***Culture***

The concept “organizational culture” was introduced by Pliskin et al (1993) to imply the shared beliefs and values in an organization. The elements impeding in organizational culture are described by the authors to include; how swift organizations respond to changes, the degree of taking risky practices, the extent of cooperation among individuals, the power relationships and the degree of autonomy. The authors also emphasize the role of considering cultural aspects in designing and implementing IS. Interviewing the participants of our study has explored the cultural elements embedded in the context PHC programs organization. The study participants showed diverse opinions about integration of HIS. However, the overall impression favors integration. Some of them considered the degree of coordination and relying on HIC to operate the integrated HIS as it may bring some kind of unfavorable effects. This might have been precipitated as a result of fear of health workers that shift of responsibility of HIS to the state HIC, which is considered by some of the study participants as not qualified for providing good quality information for management purposes. Therefore, they prefer to stick to their program specific IS. In order to overcome such kind of beliefs, it may be important to take reassuring steps that demonstrate on the ground the beneficial effects of integrated IS. This step may be useful to mitigate cultural resistance for introduction of integrated HIS since it is more convincing for stakeholders to watch than to listen.

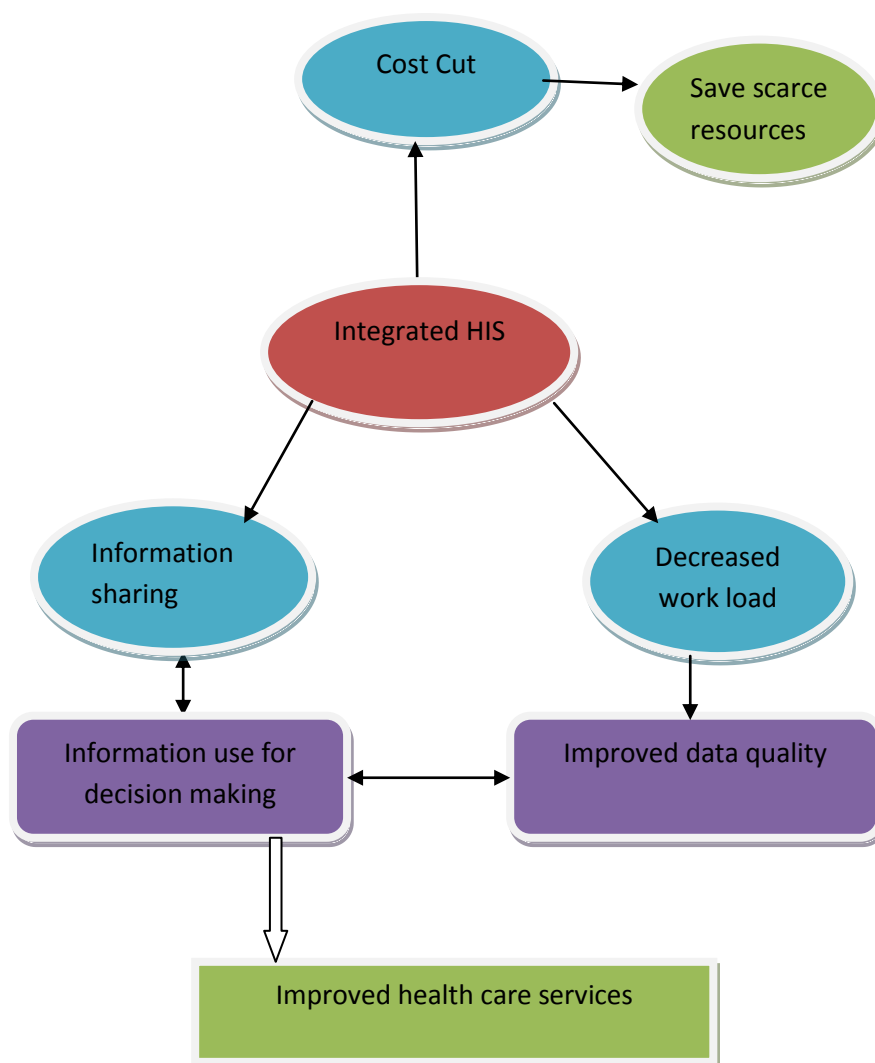
In the context of our study, it was found that health workers do not have enough skills for proper IS operation in relation to data processing and analysis. This was stated by most of the participants as they were not receiving regular trainings in this regard. This might challenge introduction of the new integrated system which carries potential obligations for standardization of data elements definition and for data processing and analysis. Therefore, health workers may find themselves faced with newly introduced techniques that go beyond their knowledge and skills. Of particular interest, in this regard, are health workers at the grass root level who have little time to work with data and the newly introduced techniques. Hence, it could be of an outstanding value to include health workers training as part of efforts to implement integrated HIS.

Another factor that might have cultural implications is adoption of EDS policy as part of HIS integration. Determination of EDS needed for each level, means cutting off data which are viewed as not very essential for management support. In this regard, PHC programs may be asked to nominate only fewer indicators in order to reduce the huge amount of data been collected and reported. Therefore, stakeholders of the programs might show some resistance to agree on applying the EDS policy to facilitate HIS integration. The kind of resistance has been emphasized by many authors as a true obstacle for IS integration in the context of the DC(32;40;45).

Overall, most of the study participants were optimistic at making an integrated IS that permits information sharing. Furthermore, the degree of standardization of data collection formats and coordination among PHC programs in service delivery, are all promising for making integrated HIS. However, lack of decentralization, potentials for resisting new techniques and application of the EDS policy may pose challenges in the face of adopting integrated system.

To sum up, implementing integrated HIS is critically demanded to augment evidence-based practices. Integrated HIS, as shown in figure (5), cuts off unnecessary time and money expenditure through coordination of work and sharing of infrastructure. Time is crucial resource, especially at grass root level where health workers are work-overloaded and data collection is considered as an additional task to do. Therefore, it is wise to consider HIS integration to minimize the amount of data they

collect and to save their time. Furthermore, integration has more favorable outcomes in terms of information quality, since it provides means for correlation of data coming from different sources. Therefore, the net result of HIS integration is improved information quality, use of information for action and hence overall health sector performance improvement, as summarized by the following figure;



*Figure: 5 Conceptual framework for HIS integration*

# Chapter 7

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## **7 CONCLUSION AND RECOMMENDATIONS**

This chapter presents conclusion of the study efforts, and draws recommendation and possible contributions of this thesis.

### **7.1 Conclusion**

The purpose of this study was to assess HIS of the Northern State, Sudan through study of PHC programs IS with particular attention to HIS integration. The issue of integration of HIS was the focus of this study as the objectives of the study was to document impacts of lack of integrated system and to explore challenges and opportunities for implementing integrated HIS.

Our study of PHC programs IS, revealed that there were many shortcomings affecting IS performance. Insufficiency of resources was a prominent feature constraining important measures such as training of health workers, supportive supervision and feedbacks. As a result data flowing in the IS were found to be of such poor quality that managers could not utilize it as a base for their decisions. Also shortage of skilled man power to process and analyze health data have added to hindrance of information use. The major obstacle disabling HIS, as identified by the findings of this study, was lack of integration. Primary health care programs IS was found to be completely vertical with no information sharing at any level. This has created redundancy in data, as well as, wasting of time and resources.

Looking at opportunities for integration of HIS, taking PHC programs as an example, has shown some promising outcomes. Green lights for integration come from the presence of HIC in the state with its policy of making integrated HIS. Currently, HIC receives health data on all activities and health programs held in the state. Therefore, considering the technical domain of IS integration, it could be easier to build integrated data repository at HIC. In addition, the degree of standardization of data collection tools encountered is in favor of integration. Besides, interests and motives of health workers about implementing integrated IS are mostly supportive of integration. PHC programs were also experiencing some of coordination at service



delivery, which, from social stand point, could help for further coordination that is in turn supportive to HIS integration.

On the other hand, some red flags were indicating potential challenges that would face implementation of integrated HIS. From technical point of view, lack of uniformity of data/information flowing in PHC programs IS might be an obstacle for integration. Integration is also challenged by the potential for power redistribution introduced by the process. Besides, PHC programs stakeholders might turn resistant to the need for decentralization and shift of the responsibility of IS to HIC. Likewise, new introductions called-for by IS integration, such as developing EDS, can also be challenged by the existing organizational cultural and political contexts. However, these challenges could be mitigated by undertaking some important initial steps in the process of integration. It could be of help, in this regard, to have an initial demonstration of the importance and benefits of HIS integration. Moreover, improving chances for health workers' training, supportive supervision and feedbacks are all equally important to enhance the process of HIS integration. Budgetary need for taking such important activities can be improved further, after unnecessary expenditure associated with fragmentation of HIS is cut off by integration of the system.

## ***7.2 Suggestions and Recommendations***

Concluding applicable suggestions from this study, I recommend the following for the health sector and other stakeholders to come up with integrated HIS:

### **1) Strengthening the HIC**

HIC could be empowered to take the lead of an integrated HIS. This is achievable by scaling up skills of the staff for information management so that they could take the responsibility of training health workers. The center may be further funded so that it could undertake other quality assurance measures such as supportive supervision of the health workers and feedbacks to improve performance.

### **2) Involvement of all stakeholders**

Efforts to integrate HIS should mind involvement of all stakeholders of health programs and activities. The process is crucial to get commitment of the

stakeholders and to mitigate possible resistance associated with adoption of a new system. Commitment of stakeholders may be enhanced through conducting workshops that address the need and benefits of HIS integration.

### **3) Gradual introduction of changes**

It is wise to introduce changes in a peace-meal fashion, starting from what exists, so that the new introductions are met with acceptance. As part of this, it could be of help to first demonstrate the benefits of integration by, for instance, building DW which will show a convincing level of data quality improvement. The step might make ease of introducing further changes. HIC located at the state level is an appropriate home for DW to be built. The center is now receiving all collected health data and its capacity for information management could be improved to serve integration of health data.

### **4) Technical considerations**

Technical aspects to consider may include application of EDS concept, standardization of data elements definitions and encouragement of data analysis and use at lower levels. Development of the steps should involve all stakeholders after achieving their commitment to the process of integration.

### **5) Reporting and transport**

Accessible transport service to handover reports to the next level was encountered as a main problem affecting HIS functioning. Therefore, I recommend computerization and electronic reporting where possible in the system. At the health facility level, shortage of budget might limit use of computers, since it demands training of health worker, as well as, provision of computers in all facilities. Therefore, I recommend facilitating deliver of reports by, for example, providing motor cycles to health worker at facilities.

Computerization is particularly facilitated by availability of power supply which is now adequately available in almost all of the Northern State. Internet service is also easy to make available since the technology is readily available in Sudan. However, such introductions must be accompanied by training of health workers in this regard.

## **6) Further research**

Further research is required to give more highlights on the issue of HIS integration in Sudan. It could prove of much help to study areas such as the other parts of routine HIS, as well as, the national level, which was not included in this study. The national level is important to consider especially in a hierarchal system such as in Sudan to explore interest and motives towards integration. Wider scope study of the health system might come up with results of further exploration of potential challenges and opportunities for system integration.

### ***7.3 Contribution to Knowledge***

This study documented a range of problems associated with functioning of IS of PHC programs in Sudan. The study also presented potential challenges and opportunities to implement integrated HIS in such context. The effort informs stakeholders in the health sector on the performance of PHC programs IS, and informs them on the green lights and opportunities to improve performance through HIS integration.

This thesis also contributes to understanding of the local context issued to be minded upon introduction of integrated IS. The structural, socio-cultural and political elements of the context have been mapped out. These aspects have been mentioned by different IS researchers as been overlooked on studying or implementing integrated IS. Thus, the findings of this study can enrich the existing researches and theories on the aspects to consider upon IS integration.

The study bridges the gap between IS profession and health sector. Therefore, audiences could conclude potential context sensitivity and particularities of the health sector in general and HIS in particular.

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## **Annex 1: Interview Guides and observation check list, for health workers at the facility level**

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1. What is your PHC program about?
2. How are data for these programs been collected?
3. What are the problems associated with data collection?
4. Do you have any written guideline (protocol) on data collection?
5. What tools do you use to collect data? Do you face shortage?
6. How do you send reports? To whom?
7. Do you sometimes need to report the same data element more than once?
8. Do you process and use the data at the facility level? If not, why?
9. Are the data you report been analyzed and used by the managers at higher levels?
10. Do you receive regular feedbacks and supervision?
11. What problems or difficulties you face due to presence of parallel reporting systems?
12. How do you look at integrating HIS in to a unified system?



## **Annex 2: Interview Guides and observation check list, for Program Managers**

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1. What is your PHC program about?
2. How much of resources are allocated for the program?
3. How is the PHC program been funded (governmental/non-governmental)?
4. How are data been collected in your health program?
5. What are the problems associated with data collection?
6. Do you receive data reported on time?
7. How do you describe the quality of data you receive?
8. Please can you describe how data flow in the IS starting from the facility level and up to the national level?
9. Are these data being analyzed, calculate indicators and used? If yes, who analyze/use it and for what? If no why?
10. Are there any training practices and/or supervision for health workers with regard to health information generation and use?
11. Are you satisfied with performance of programs information system? If yes why? If no, what do you suggest for improvement?
12. What do you think the reasons behind existence of program-specific, vertical reporting systems?
13. What are the effects of the fragmentation on the IS?
14. How do you look at integration of these independent IS?

### **Annex 3: Interview guides and observation checklist, for the HIC personnel**

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1. What is the role of HIC in the state? What is the policy of the center?
2. What do you say about the resources allocated for the center?
3. From where does the center receive health data?
4. How do you describe quality of data you receive?
5. What happens to these data at HIC? Do you analyze it? Do you report and to whom?
6. Are the data collected been used? Who use it and for what?
7. How do you look at program specific IS and parallel reporting?
8. What impacts does the phenomenon of fragmentation leave on IS functioning?
9. How do you perceive integration of HIS into unified system?
10. Does the center have any policy for integration?
11. What role could HIC play in HIC integration?

## Annex 4: Ethical Approval Letter

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**University of Dongola**  
**Faculty of Medicine and Health Sciences**  
**Jumeih Medical Research Centre**

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To whom it may concern

RE: Proposal No. JMRC-09/002

**Title: Challenges of integrating primary health care information system in the Northern State, Sudan**

**By: Sameir Kamal Sayyed Farah**

**Supervisors: Gunnar Bjune, Zufan Abera ( University of Oslo)**

Thank you for submitting the above mentioned proposal to the Ethical & Technical Approval Committee for ethical and scientific review.

We would like to inform you that we have reviewed and approved your application to conduct the above titled study in the Northern State, Sudan.

Approval Date: 2/8/2009

Expiry date: 2/8/2010

After the expiration date, this proposal may only continue upon renewal. For purposes of renewal, please fill in the special form obtainable from the .. secretariat and submit the form at least one month before the expiration date.

Please be reminded to send copies ( both hard & soft) of your submitted research for our records as well as for the research database

*Best regards*



Dr. Mohamed, Mohamed CAA (MBBS, MD)

Director, Jumeih Medical research Centre