A Framework for Enhancing e-Health Data Integration and Sharing in Distributed Environments

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ABSTRACT

This paper describes a proposed conceptual framework for integrating e-Health records for health research institutions. The framework is based on a cross-sectional study at Ifakara Health Institute in Tanzania. It is developed by identifying both social and technical aspects associated with intra-organization data integration and sharing. The two major questions answered in this research are: i) what are the principal socio-technical factors in a value chain of intra-organization data integration? and ii) what is the intensity and strength of these factors in influencing the effectiveness of health data integration and sharing between and across a network of collaborators? The specific objective of the study focuses on the impact of socio-technical factors on intra-organization data integration and sharing. Technical and social factors were analyzed as service requirements to enhance data integration in health research institutions. The significance of each domain in respect to *data integration was identified. Finally, a conceptual framework was proposed to address the gap* in the process of intra-organization data integration.

Keywords: Integration, health information framework, socio-technical domain, e-Health, data sharing

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1. INTRODUCTION

The world has progressively become interconnected and complex, and therefore, human health is increasingly perceived as the integrated outcome of many factors including institutional determinants (Huynen, Martens, and Hilderink, 2005). Electronic data collection, integration and sharing contribute significantly in improving collaborative research in human health. Collaborative research is perceived as the way to achieve world health for life. It is a strategy for choice when needs are many, resources are scarce, and individual effort has proved unsuccessful in addressing serious health issues (Haithcox-Dennis, DeWeese, and Goodman, 2014). Through collaboration, health for life is an expected outcome of e-Health records integration and sharing. Collaboration in health research like in any other form of collaboration is not always easy to achieve. This is due to the fact that its success depends much on adhering to some core principles such as: stakeholders with a vested interest in the issue, trust among and between the partners, a shared vision and common goals, expertise among partners to solve community problems, teamwork strategies, open communication, motivated partners, sufficient means to implement and sustain the collaborative effort, and an action plan (Rinehart, 2001). As collaboration develops and matures, partners should continually revisit each component to assess the status of the collaboration and determine what actions are needed to enhance collaboration. All these are linked to social aspects and stakeholders' relationships. It is pointed out in (Blobel, 2002) that the basic conditions of health and welfare in both developed and underdeveloped countries are changing and caused by social, economic, technological, political and environment drivers. Under such challenges, the society are modifying their health management systems structure to decentralized and specialization, share caring concept, extending communication and co-cooperation as well as increasing means of data sharing between and among the collaborators. A loosely couple framework is therefore important to health research institutions to provide a road map to competitiveness in the global environment.

Even though many frameworks for health systems exist, there is no one addressing the issues of social aspects in information integration and sharing. The WHO conceptual framework for health systems focuses on improving efficiency and responsiveness (Siddigi, 2008; WHO, 2014). Globalization conceptual framework for health also focuses on contextual and disaster determinants whereas conceptual framework for health analysis and action focuses on economic of health (Huynen, et al., 2005). Furthermore, the conceptual framework introduced in the previous study (Podolak, Harrison, and Vetter, 2012) focuses on data access and protection of an individual privacy as well as health data inequalities. The information framework suggested in the literature (Pardo, Cresswell, Dawes, and Burke, 2004) lacks the justification of significance of items with respect to data integration. Also, the conceptual framework discussed in (Smith, Madon, Anifalaje, Lazarro-Malecela, and Michael, 2007) spotlight on health policy-makers. We argued that socio-technical domain is the determinant in the intra-organization data integration and sharing. The coefficient contribution of each domain in the framework is interrelated in such a way that holistic approach is required to harmonize the process of intra-organization data integration. It is argued in the work (Irene, 2010) that health data has critical roles to play in improving the quality, accessibility and efficiency of health service. In addition, health data has important role in ensuring that health systems can continue to improve affordability. In addition to technical and standardization challenges in data integration, one must also take into consideration leadership, political, organizational legal, psychosocial and commercial issues as well as emerging technologies.

This paper describes a proposed conceptual framework for integrating e-Health records for health research institutions. The framework is based on a cross-section, multicenter study, and one time data collection occurred at several branches of Ifakara Health Institute (IHI) in Tanzania. The framework is developed by identifying both social and technical aspects associated with intra-organization data integration and sharing. The two major questions answered in this paper are: i) what are the principal socio-technical factors in a value chain of intra-organization data integration? ii) What is the intensity and strength of these factors in influencing the effectiveness of health data integration and sharing between and across a network of collaborators? It is therefore, significant that a statistical

analysis be performed to seek evidence on how socio-technical factors associate with intra-organization data integration. Technical and social factors are analyzed as service requirements to enhance data integration in health research institutions and point out the significance of each domain in respect to data integration. Finally, a conceptual framework is proposed to address the gap in the process of data integration.

Organization: This paper is organized as follows: - Section 2 explains the methodology adopted in this study. It describes the ethical clearance and data analysis method. Section 3 presents the finding where the main contribution is on Technical and Social factors as well as a proposed framework for data integrating and sharing health data. Critical discussion is presented in section 4. Finally, section 5 gives the conclusion.

2. METHODOLOGY

A cross-sectional study was deployed in seven branches of the IHI and one branch of the National Institute Medical Research (NIMR). Primary data was collected in order to identify factors associated with electronic data collection (EDC) and Intra-organization data integration (IDI) and sharing. Guided questionnaires were used to measure intensity and strength of the factors associated with IDI. The questionnaires were divided into two groups: the first targeted research scientists and principal investigators. This group is responsible for research coordination and management. The second targeted software developers, data managers and system administrators. This group is responsible for innovation on the design of research tools. Descriptive analysis and bivariate correlation were conducted using STATA to determine association between outcome variables and independent variables. Fisher's exact test was used as a statistical proof to determine the significance between the variables whereas Spearman's test was used to determine correlation coefficient of each of the factors. The significance was tested at confidence interval (CI) of 95% that is using a p-value of $p \leq 0.05$.

2.1. Ethical Considerations

The protocol of this study was approved by the scientific board of the Nelson Mandela African Institute of Science and Technology (NM-AIST) and granted an institutional ethical clearance number IHI/IRB/NO.03-2014 by the Institutional Review Board of IHI. All participants in the study were asked for their written informed consent before collecting data and they had complete right to withdraw from the study at any time without any disadvantage.

2.2. Data Analysiss

Descriptive results are presented for devices used for electronic data collection and means of data sharing as well as the procedure used to process data. Probabilistic value (ρ) and correlation coefficient (r) for the domain score are determined to describe variation in different factors in relation to IDI. The IDI score was used as the dependent variable in the regression analyses. Several items were grouped to form a single domain. A mean score of each domain was obtained by taking the average of responses of the items that form a domain.

3. RESEARCH FINDINGS

3.1 Demographical Characteristics

A total of 121 respondents were administered through questionnaires. Among them, 96 were males, and 25 were females. Responses by job grade indicate that 13.2% were principal research investigators, 62.8% were research scientists, whereas 24% were system administrators and software developers. The respondents' working experience was that 2.5% had less than one year, 43.0% had 1-3 years and 54.5% had more than 3 years working experience.

3.2 Outcome Variable

The outcome variable "Intra-Organization Data Integration and Sharing" was defined from three groups of information as shown in Table 1. The first was the measure of devices used to collect electronic data. The second

information was about the measure of data sharing among the research groups and the last was the measure of the procedure for collecting and processing data.

Table 1. Devices used for electronic data collection, sharing and means of data collection (N=121)

Item	Number	%
Devices		
Personal Digital Assistance	48	40.0
Tablet PCs	36	30.0
Notebook (Laptop)	67	55.0
iPad	5	4.1
Phone (iPhone / Mobile)	34	28.1
Sound File / Voice Recorder	26	21.5
Manually (by Paper)	23	19.0
Used Electronic Devices (either of Electronic Devices)	**107**	**88.4**
Means of Data Sharing		
CD / DVD / Flash	68	56.2
Centralized Database	52	43.0
Website (Network)	46	38.0
Email	93	76.9
Tape	3	2.5
Data Sharing	**75**	**62.0**
Procedure for Data Collection		
Data collected annually and entered in database for processing	83	68.6
Data collected online using web application	7	5.8
Data collected manually then processed electronically	71	58.7
Data collected electronically using both mobile and computer	57	47.1
Either of the Above	**119**	**98.4**
Outcome Variable (Use of Electronic Device + Data Sharing + Recommended Procedures for Data Collection)	67	55.4

3.3 Associated Technical Factors

The determinants for IDI are grouped into two major categories. The first category is those which are brought about by technical and technology setting and the second are those which arise from social settings. The first category includes technical, security, technology, and human domain. The technical factors associated with IDI are presented in Table 2 below. The findings indicate that the security (ρ =0.024) and technology domain (ρ =0.043) were significantly associated with IDI while technical and human domain were not significantly associated with IDI.

Table 2. Technical Factors associated with data sharing (N=121)

Factor	Number of Respondents	Data Sharing		Fishers Exact P-value
		Yes (%)	No (%)	
Security Domain				
Agree	89 (73.5)	59 (66.3)	30 (33.7)	
Moderate	25 (20.7)	10 (40.0)	15 (60.0)	0.024
Disagree	7 (5.8)	6 (85.7)	1 (14.3)	
Technology Domain				
Agree	97 (80.2)	55 (56.7)	42 (43.3)	
Moderate	20 (16.5)	17 (85.0)	3 (15)	0.043
Disagree	4 (3.3)	3 (75.0)	1 (25.0)	
Technical Domain				
Agree	94 (77.7)	56 (59.6)	38 (40.4)	
Moderate	22 (18.2)	14 (63.6)	8 (36.4)	0.258
Disagree	5 (4.1)	5 (100)	0	
Human Domain				
Agree	96 (79.3)	62 (64.5)	34 (35.4)	
Moderate	19 (15.7)	9 (47.2)	10 (52.6)	0.379
Disagree	6 (5)	4 (66.7)	2 (33.3)	

3.3.1 Technical Domain

The findings indicate that the technical domain has strength in contribution to the process of IDI. The responses show that 77.7% agree that the technical domain is important for supporting data integration, 4.1% disagree whereas 18.2% find it moderate. Out of those who agree, 59.6% collect data electronically while 40.4% do not. Despite the fact that technical domain is important factor in IDI, Fisher's exact test shows that there is no significance difference between the technical domain and data sharing ($p = 0.258$). Intuitively, Spearman correlation shows positive association between technical domain and data sharing. The coefficient is found to be $r = 0.105$.

3.3.2 Security Domain

There is a higher strength and intensity of security domain on data integration and sharing (Ndume, Nkansah-Gyekye, and Ko, 2014). From table 3, at the responses indicate that 73.5% agree that security impends electronic data sharing, 5.8% disagree while 20.7% find it moderate. Out of those who agreed, 66.3% have the possibility of data sharing and 33.3% have no data sharing. The result of Fisher's exact test shows that security domain and data sharing is significant ($p = 0.024$). There is negative correlation between IDI and security domain and the coefficient $r = -0.121$. The negative correlation can be explained that the three important aspects of security i.e. confidentiality, integrity and availability should be balanced in the cause of data sharing.

3.3.3 Technology Domain

The technology spillover on electronic data collection increases the chance of data integration. Nonetheless, implementation and practice require technical knowhow and sometimes expensive resources. Responses in Table 2

show that 80.2% agree that technology has a positive effect on data sharing, 3.3% disagree while 16.5% find it moderate. Of those who agree; 56.7% are in a position of engaging in data sharing while 43.3% are not. Fisher's exact test found that there is significant difference between technology domain and data sharing ($p = 0.043$). The correlation between data sharing and technology is positive and the coefficient is $r = 0.215$.

3.3.4 Human Domain

It is observed in Table 2 that 79.3% of respondents agree that the human factors hamper electronic data collection, integration and sharing, 4.9% disagree and 41.1% find it moderate. Of those who agree, 64.6% collect data electronically, whereas 35.4% do not. Even though responses indicate that the human domain is an important aspect in data sharing but Fisher's exact test indicate that there is no significant difference between the human domain and data sharing ($p = 0.379$). The Spearman correlation between data sharing and human domain is negative and the coefficient is $r = -0.096$.

3.4 Associated Social Factors

The social determinant of Intra-organization data integration and sharing include organization setting, finance, skill sharpening, innovation as well as Information Technology (IT) policy and procedure. The description of these determinants and their association and significance with data integration are given in Table 3.

Table 3. Social factors associated with data integration and sharing (N=121)

Factor		Number	Sharing Data: Yes (%)	Sharing Data: No (%)	Fishers Exact P-value
Organization Setting					
	Agree	104 (86.0)	65 (62.5)	39 (37.5)	
	Undecided	16 (13.2)	10 (62.5)	6 (37.5)	0.633
	Disagree	1 (0.8)	0	1 (100)	
Innovation					
	Agree	94 (77.7)	60 (63.8)	34 (36.2)	
	Undecided	12 (9.9)	11 (91.7)	1 (8.3)	0.002
	Disagree	15 (12.4)	4 (26.7)	11 (75.3)	
IT Policy and Procedure					
	Agree	83 (68.6)	52 (61.5)	32 (38.5)	
	Undecided	22 (18.2)	13 (59.1)	9 (40.9)	0.882
	Disagree	16 (13.2)	11 (68.8)	5 (31.2)	
Finance for IT					
	Agree	83 (68.6)	57 (68.7)	26 (31.3)	
	Undecided	16 (13.2)	12 (75.0)	4 (35.0)	0.001
	Disagree	22 (18.2)	6 (27.3)	16 (72.7)	

Skill Sharpening					
	Agree	85 (70.3)	59 (69.4)	26 (30.6)	
	Undecided	20 (16.5)	9 (45.0)	11 (55.00)	0.034
	Disagree	16 (13.2)	7 (43.8)	9 (36.3)	

3.4.1 Organization Setting

The results in table 3 show that 86.0% agree that the organization setting is very important for the success of IDI, 13.2% were undecided, whereas 0.8% disagree. Of those who agree, 62.5% collect and process data electronically while 37.5 % do not. Although respondents found organization setting a critical factor, statistical tests find negative correlation with data integration and Fisher's test found a p-value of $\rho = 0.633$ indicating that it is not significant. The negative correlation can be explained that implementing IDI in a tightly coupled organization may be difficult.

3.4.2 Research Innovation

The research findings indicate that research innovation is significant in the process of IDI. The p-value is found to be $\rho = 0.003$ and the correlation coefficient is $r = -0.174$. Responses confirm that 77.7% accept an innovation as an important aspect in data integration, 9.9% were undecided and 12.4 disagree. Out of those who agree, 63.8% collect and process data electronically, whereas 36.2 % do not.

3.4.3 IT Policy and Procedures

The IT Policy and procedures provide users with systematic protocol on how to use health records. The findings indicate a positive correlation between IT policy and data integration. The descriptive analysis show that 68.6% agree that IT Policy and procedure are important in data integration and sharing, 18.6% were undecided while 13.2% disagree. Of those who agree, 61.5% are in the process of data integration, where 38.5% do not. Despite the higher acceptance of IT policy in data sharing, statistical tests found a p-value of $\rho = 0.503$ indicating that is it is not significant. Nevertheless, there is positive correlation and coefficient is $r = 0.036$.

3.4.4 Finance for IT

Research findings indicate that there is a positive correlation between the financing for IT and data integration. The correlation coefficient is found to be $r = 0.287$ and p-value is $\rho = 0.040$ indicating that it is significant. Descriptive analysis indicates that 68.6% agree that finance for IT is a requisite for data integration; 13.2% are undecided and 18.2% disagree. Out of those who agree 68.7% collect and process data electronically whereas 31.3 % do not.

3.4.5 Skillful Level

The findings show that skillful human resource is an important aspect in the process of data integration. Descriptive analysis indicates clearly that 70.3% agree that skillful human resource is remarkable in the process of data integration, 16.5% were undecided while 13.2% disagree. The statistical test found significant difference between skillful human resource and data integration and sharing. However, there is a negative correlation and the correlation coefficient is $r = -0.220$. The negative correlation demonstrates that unskilled human resource may degrade the process of data integration.

3.5 Proposed Framework

As depicted in Figure 1, a conceptual framework for enhancing e-Health data integration was developed by including both social and technical factors that associate with IDI. The principal socio-technical factors in a value chain of IDI are presented on the framework. The framework is built on the theoretical proposition of data integration and empirical research on e-Health records management and sharing among collaborators. Modeling of the framework for data integration is taken holistically. The framework includes multiple factors representation encompassing the business process of the organization such as technology, security, IT policy and procedure and technical know-how on IT problems which arise spontaneously in the organization. An assessment must use a simple tool like a survey in order to understand organization strength. The analyses include determination of the strength and intensity of social aspect of the organization such as finance, innovation strategy, skillful human resource, policy and procedure as well as leadership aspect of an organization setting. The benefit of IDI can be realized by the health community only if there is coherence between both social and technical aspects of the organization. Responses concerning the importance of data integration and sharing indicate that 90.9% agree that data sharing is important for information and knowledge sharing which can result into innovation. 93.4% indicate that data sharing is important for collaboration in work process for better results and decision making. Furthermore, responses show that 81.8% found data sharing is important in building trust among researchers, nevertheless 85.1% found data sharing important for enhancing decision making.

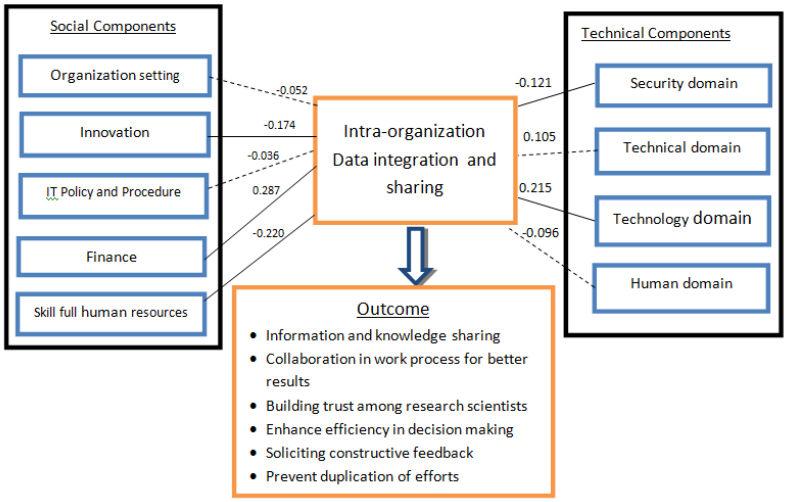

Figure 1: Proposed conceptual framework for data integration and sharing in e-Health

4 DISCUSSION

4.3 Technical Implications

The security domain is an important factor which scientists face when implementing data integration and sharing of research results. There is little willingness of research scientists to share data especially when they are not certain about the security of their data and the backup procedure of the centralized data set. Dealing with personal medical information that is highly sensitive in a shared care information system require appropriate services and mechanism for guaranteeing security and privacy by legal, organization and technological means according to the policy agreed. It is important to note that security and privacy contain political, legal, social organizational and technical and

technological issues. Therefore many organizations and institution deal with different orientation, competence, efficiency and efficacy with this security challenges.

If there is no guarantee of the security, scientists will not attempt to upload data to a centralized health repository for sharing. They are worried of research data to be used or published without prior approval of the owner. Another key issue within the context of security on data sharing is the type of collaboration kit used. Despite the availability of a number of collaboration kits such as Ning (aimed for network expansion), public library of science (knowledge expansion), Epic surveyors (remote functionality), Scribed (research promotion) as well as Skype, Wiser, Twitter and Facebook, some of the kits don't give researchers peace of mind with respect to security, intact and credibility of their work. Considering the legal framework, it is necessary to have a number of laws concerning data protection and data security whether directly or indirectly. Technically and mechanically, authentication, integrity, confidentiality, accountability, authorization, and security infrastructure services must be considered to support shared care paradigm. However, the security framework highly depends on the concrete application scenario. For that reason, often the consideration and interpretation are referred to the specific situation of distributed e-Health system.

On technology domain, internet connectivity enables research scientists to have data in hand. With physical network real time data collection is possible through web-based application. The system architecture and interoperability of hardware and software impose challenge in electronic data collection and integration. On the other hand, ontology, data definition tool, semantic, as well as the tools for accessing integrated database is among the factors that contribute to difficulties of sharing integrated data. The complexity of technology domain therefore arises due to interaction of large numbers of systems such as clinical trials, laboratory systems, use of various district health information systems, pharmacy systems as well as business management systems (Bertolini, Schäf, and Stolz, 2012). The information application used by the provider to support their e-Health process information–related, have to support also their communication and co-operation. For that reasons, application system must be capable of supplying each other with information and function, i.e. of sending and receiving requests as well as providing and using services.

In the technical domain, it is noted that the dynamism of technology affects some longitudinal research which has to be carried for a long period. Investigators may be required to change the means of data collection from time to time in order to meet technology needs. Re-engineering of the process also obstruct data sharing. In addition, the lack of standardized tools to collect electronic data and data integrity adds complexity in data integration. The implementation of advanced technology requires skill sharpening to meet the demand of new technology. Likewise, querying multiple data sets with different format requires mediated schema. For example, some research data might be stored in MYSQL while others are stored in excel or SQL server. Matching data from different schema requires scientists to have knowledge on query syntax. In that context, building a complex e-Health system for research scientists require technical investigation by look for definition of terms. Also, it is important to use class diagram to define database schemas, and providing use-case for specification as well as modeling of the interaction of the system using sequence diagram.

The human domain implies that manually collected data result into double work when it comes to electronic data sharing. For instance, manually collected data needs to be scanned so that they are accessible electronically or they may require creation of new metadata. Old data may be incompatible with technology if stored for a long period. Moreover, the harmonization and operation plan to share manually processed data is difficult. It is argued that each work item needs a certain amount of resources including staff or facilities (Bertolini, et al., 2012). Even though, the harmonization of the work flow management becomes increasingly complex, but it is crucial to the health research institutions with geographically distributed offices. In addition, it is noted that, poor programmed software may induce errors hence affect the whole project. Similarly, the delays of procurement of devices for data collection do affect the time schedule of the project.

4.4 Social Implications

In theory, data integration is perceived as a simple technique that needs only technical knowhow. However, in practice it is a complex process that combines various factors including organization setting. In fact, the success of data integration process can be achieved by combining efforts from both technical knowhow and social issues. Organization setting that support collaboration always has mutual benefits in improving population-level health outcome by creating an environment change in the different community sectors where health-related behavior occurs (Roussos and Fawcett, 2000). In this research, it is observed that collaborative health research yields coherent global strategy. This argument is supported in (Duff et al., 2009) that collaborative project is useful for achieving health outcomes than an integrative project where participants merely join their separate contribution. Diversity of team members in health projects ensures that the team can draw on different perspectives and bases of expertise. It is argued that the rapid changes in technology have special impact in data management of the organization (Halevy et al., 2005), for this reason, modern management pattern is required to deal with technology management and innovation (Karimi, Somers, and Gupta, 2001; Magdalena and Munteanu, 2009). Integrating information of different collaborators may require change of the organization structure, philosophy and procedures. From the result of this research it is argued that managers needs to know how to organize team spirit and leadership and realize the ambition of group leaders, in order to align with political willingness and create structures that support collaboration and innovation. The framework for building Africa's health workface observatory concurs with this view that workforce leadership and governance capacity need to be strengthened in order to get quality service in health systems (WHO, 2012a).

The strategy for organizing human resource should include human resource planning, education strategy, workforce management and utilization, as well as the use of partnership among key stakeholders (Mtasiwa, 2008). Integrating data from different branches of the organization requires not only the control over traditional human resource but also the need to have skillful human resources. Data integration goes beyond financing; it also requires end user perception and view (WHO, 2012b). This is due to the fact that utilizing the data integration system may be accompanies by the pain of system failure or delight of system success. If this happen it affects the whole organization. Concern in human resource includes the need to address the issues of work force planning, education, recruitment, retention and performance as well as defining regulatory options to improve quality. For IT services, it is not enough to recruit people but to recruit skillful persons who are self confident on decision making and who can do IT troubleshooting with confidence. It is noted in this research that software developers normally invest more time during developing the research tool and therefore, become annoyed with administrative regulation of signing in and out while their work requires more than eight hours a day. This deters their self planning which can increase chances for innovation.

In some instances, contract enforcement and employment rules are violated. Software developers might be tasked to develop software for a new project without legal agreement and justification on how the person will benefit the project financially or through publication. In addition, employment contract build confidence, trust and willingness of the staff in the process of IDI. A transparent training schedule and continuous skill sharpening should catch the attention of people working in software developments. Furthermore, better resource allocation and utilization increase people perception and attitude towards organization.

Finance is an aspect that makes many projects fail or succeed. Constraints with schedule and costs are always inherent in application development. Staying within budget is an obvious concern because over expenditure always deters project completion. In this research, it is argued that the amount invested in IT facilities reflect the extent to which IT services is delivered. The finance aspect must address the issues of resource committed to innovation-related activities, training, rewards as well as revenues. This argument is in support of the WHO health system conceptual framework (Siddigi, 2008). Even though research findings indicate that there is a positive correlation between the finance for IT and the process of data integration but the observed relation does not necessarily imply a causal relationship. The question of whether IT department relatively needs more finance depends on the

organizational mission in improving the quality of IT service aiming at efficiency and productivity. Further findings reveal that poor services in IT are associated with existing IT Infrastructure and organizational commitment on IT. Many branches have IT infrastructure which has non-uniformity of devices with connectivity like D-Links, Cisco or ZyXEL, such connection may reduce data speed in the network and results into poor IT services to users.

Since collaboration across organizations on data sharing implies joint responsibility and shared procedures, it follows that any legitimacy damage and los of integrity on data should adhere to policy frameworks. Any dispute arising cannot be cordially settled between parties in the collaboration without an arbitrator. The absence of a clear policy in the framework may lead to loss of rights for one party as far as information integration and sharing is concerned. It is therefore, argued in this research that IT policy, or e-Government policies is the determinant of the smooth running of data integration and sharing. If there are no guidelines in data sharing, access and retrieval of scientific findings may lead to misunderstanding among the parties and cause legal action for the side against proper use of the data.

The goal of innovation is to improve technology and achieve the business requirement of the organization. Innovation can be of many forms including product, process, organizational method, research or workplace organization, stakeholder's relations, communication, dissemination process, and others. Cultivating innovation creates more opportunities for an organization to excel. Innovation is an excellent way to create innovation mindset. Materials for innovation provide a variety of experience and unconventional skills not only for expanding the hemispheres of the brain, but also stimulating the mind and spirit of scientists to think globally. However, a successful innovation methodology must incorporate inspiration of both leadership and employees to generate an outcome of higher value. Innovation in design, engineering and research methodology results into outcomes that attract more funding for further research. Likewise, any success in innovation should takes into consideration established standards for fairer practice and protection of the rights of the innovators. Training is required on mentoring research scientists in order to impact innovation, skill and knowledge to young scientists. It is noted in (Gupta, 2009) that in an early stage people may think on the innovative idea as good, crazy, stupid or funny idea, it takes longer but then ideas becomes more innovative. It is advised in (Halevy, et al., 2005) that any idea is worth a try. The evidence suggests that adoption and diffusion of innovation in health systems is influenced by the nature of complexity of the innovation (Atun, de Jongh, Secci, Ohiri, and Adeyi, 2010). Therefore, an organization attempting to institutionalize innovation must determine its methodology of choice.

5 CONCLUSION

In this paper we have proposed a conceptual frame work for intra-organization data integration and sharing. The conceptual framework is intended to guide scientists in harmonizing and creating health data repository for centralized information access and sharing. The model comprises of two major components. Each component is set of domain associated with intra organization data integration and sharing. The framework can be used as a cornerstone in developing regression model for intra-organization data integration and sharing.

Statistically, the security domain and technology domain were significant with data integration and sharing. Furthermore, the results provide support to the view that innovation, finance for IT, and skillful human resources were significant to the IDI and sharing. Nevertheless, descriptive analyzes demonstrate that all nine factors have strength and strong intensity of association with the process of data integration. These observations highlight the danger of using statistical inference on the determination of intra-organization data integration and sharing.

Also, it is observed that the health research data stored in a distributed health information system and which deal with sensitive personal information requires sensitive services guaranteeing both communication and application security in order to support intra-organization data integration and sharing paradigm. However, due to the enhancement of people mobility, mobile computing and technology such as high internet access, distributed collaboration still remain as an enabler of sharing research results among research scientists. The way forward is to

address the issues of technology by developing techniques of exchanging data in a low bandwidth distributed environment using web services.

6 REFERENCES

ATUN, R., DE JONGH, T., SECCI, F., OHIRI, K., AND ADEYI, O. (2010). Integration of targeted health interventions into health systems: a conceptual framework for analysis. *Health Policy and Planning, 25*(2), 104-111.

BERTOLINI, C., SCHÄF, M., AND STOLZ, V. (2012). Towards a formal integrated model of collaborative healthcare workflows. *Foundations of Health Informatics Engineering and Systems*, 57-74.

BLOBEL, B. (2002). *Analysis, Design, and Implementation of Secure and Interoperable Distributed Health Information Systems* (Vol. 89): IOS Press.

DUFF, G. et al. (2009). A collaborative design to adaptively manage for landscape sustainability in north Australia: lessons from a decade of cooperative research. *Landscape ecology, 24*(8), 1135-1143.

GUPTA, P. (2009). *Businness Innovation in the 21st century: A Comprehensive aproach to Institutional Business Innovation* (1st ed.): S.Chand and Company.

HAITHCOX-DENNIS, M., DEWEESE, A., AND GOODMAN, J. (2014). Rethinking the Factors of Success: Social Support and Community Coalitions. *American Journal of Health Education, 44*(2), 110-118.

HALEVY, A. *et al.* (2005). *Enterprise information integration: successes, challenges and controversies*.

HUYNEN, M. M., MARTENS, P., AND HILDERINK, H. B. (2005). The health impacts of globalisation: a conceptual framework. *Globalization and Health, 1*(1), 14.

IRENE, P. (2010). A Review of the Health Data Landscape: Trends, Successes and Gaps. *World Economic Forum: 2010*,http://www.eabis.org/fileadmin/eabis_uploads/Projects/Rutgers_J_J/Podolak_Health_Data_Research_Study.pdf

KARIMI, J., SOMERS, T. M., AND GUPTA, Y. P. (2001). Impact of information technology management practices on customer service. *Journal of Management Information Systems, 17*(4), 125-158.

MAGDALENA, D. *et al* (2009). Transforming Organisational Culture through the Impact of Information Integration. *Communications of the IBIMA, 8*(4), 137-141.

MTASIWA, D., M. (2008). *Human Resource For health strategy planing*. Dar Es Salaam: Ministry of Health and Social welfare.

NDUME, V., NKANSAH-GYEKYE, Y., AND KO, J. (2014). Improving Data Collection and Integration on e-Health Records: A case Study Approach. *ARPN Journal of Systems and Software, 4* (2), 20-27.

PARDO, T. A., *et al* (2004). *Modeling the social and technical processes of interorganizational information integration*.

PODOLAK, I., HARRISON, O., AND VETTER, P. (2012). Measuring health data management maturity in Abu Dhabi. *Health Policy and Technology, 1*(3), 127-136.

RINEHART, T. L., AND BRISCOE G. (2001). Collaboration Tool kit: How to Build, Fix and Sustaina productive Partnerships. Retrieved from http://www.cops.usdoj.gov/html/cd_rom/collaboration_toolkit/pubs/collaborationtoolkit.pdf

ROUSSOS, S. T., AND FAWCETT, S. B. (2000). A review of collaborative partnerships as a strategy for improving community health. *Annual review of public health*, Vol.21 No.1,pg. 369-402.

SIDDIGI, S. (2008). *Governance of the health system: Moving a head*: Regional Capacity Building Workshop working on Health system Development.World Health organization Regional office for European Document No.WHO-EMP/PHP/043/E. Retrived from http://www.euro.who.int.

SMITH, M. *et al* (2008). Integrated health information systems in Tanzania: experience and challenges. *The Electronic journal of information systems in developing countries,Vol.* 33 No.1,pg.1-21.

WHO. (2012a). Health System and Service Cluster, 2012*: Regional office for Africa*. Retrived from http://www.afro.who.int/en/clusters-a-programmes/hss/cluster.html

WHO. (2012b). Health System in africa: Community Perception and Perspective, *World Health Organization, Regional Office for Africa, The Report of a Multi-Country Study*. ISBN 978-929- 023-2018, Brazzavile, 2012, pg.10-61:Retrived from http://www.afro.who.int/index.php?option=com_docmanandtask=doc_downloadandgid=8329andItemid=2593

WHO. (2014). Health statistics and Health information system: "World Health organization". (May 1st, 2014). Retrieved from www.who.int/healthinfo/