

Prototype Knowledge Management Framework to Facilitate Knowledge Sharing Practices among Health Professionals and Patients in Hiwot Fana Specialized University Hospital in Ethiopia

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Abstract

The objective of this study was to determine the existence of knowledge management framework, develop and design knowledge management framework to facilitate knowledge sharing practices among health professionals and patients at Hiwot Fana Specialized University Hospital in Ethiopia. Design science research method with a sample size of 152 health professionals and 21 patients was used. A stratified simple random sampling technique was used for the selection of health professionals and a purposive sampling for the volunteered patients in the hospital. Questionnaire, and semi-structured interview instruments were used for data collection. Results revealed that knowledge management framework was not available in the hospital for

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use by all categories of health professionals that included - nurses, doctors, radiologists, laboratory technologists, health officers and pharmacists; all categories of health professionals variously had mixed opinions on individual, organizational and technological factors that influence their knowledge sharing practices. The levels of opinions were: strongly disagreed, disagreed; undecided and agreed. Patients also agreed that knowledge sharing practices among health professionals and patients' existence was paramount. However, researchers proposed, designed, developed an information technology based prototype knowledge management framework for the hospital. The prototype system was evaluated and user acceptance test by respondents showed that 80.20 % of the participants had positive attitude towards the developed and designed prototype Knowledge management framework for the hospital. Researchers concluded that the collaborative and innovative framework will motivate and facilitate knowledge sharing practices among health professionals and patients in order to create a good knowledge flow environment.

Keywords: Health professionals, Patients, Healthcare, Hospital, Knowledge, Knowledge management framework, Knowledge sharing practices, prototype, design science and research method.

1. INTRODUCTION

In the twenty first century, the world economy is being reshaped in a fundamental manner than any other time in human history; through the application of information technology, which according to Tai-Ning et al. (2011:10); Demirkan (2013, 41) and Ghosh & Mahanti (2014) will facilitate, organizational structures, knowledge acquisition and knowledge sharing among employees in organizations.

However, knowledge according to the authors is human expertise that is found in people's mind and obtained by employing new expertise through networking with different firms, organizations and even competitors. Knowledge, as considered by Temtim (2014:52) and Nonaka et al. (1996, 836) are either tacit or explicit resources, which employees should possess; to effectively execute their tasks in work

environment. Tacit knowledge, which resides within individuals' heads in the form of personal experiences, know-how, insights, mental modes and personal beliefs; allows the individuals to articulate and write down or document it into explicit knowledge. Hosseini et al. (2019, 16) opined that knowledge is used as source of economy, where knowledge management is popular with the main objective of improving the systematic management of knowledge within an organization for performance and gaining competitive advantage among their competitors (Wakuma et al. 2017).

Knowledge management (KM) plays effective roles in many organizations, such as in healthcare organizations, industries, educational institutions, governmental and business organizations and many more (Ghosh & Mahanti 2014, 15 and Alawneh & Aouf 2016, 3). The healthcare sector is increasingly becoming a knowledge-based community that depends critically on KM activities, to improve the quality of healthcare systems. In this knowledge-based community the important activity of KM is knowledge sharing practice.

Knowledge sharing (KS) is defined as a deliberate act that makes knowledge reusable by other people through knowledge exchange. It has been identified as the key component of KM and performance improvement system. So, having a KS culture enables the healthcare sector workers to implement their best practices and generate new ideas and better quality healthcare services and their deliveries (Dessie 2017:151). Moreover, knowledge sharing practice is based on some factors in a given organization that can be categorized as: individual, organizational and technological factors that can influence, support and use information and communication technological (ICT) infrastructures on how to share knowledge to make or produce best benefits to the organization (Riege 2005:18; Noor & Salim 2011:106; Cepeda-Carrión 2011:89; Chun-zhou et al. 2011:781; Alhalhouli et al. 2013:1089; Hejase et al. 2014:1549; Lee 2017:29 and Mulate & Gojeh 2020:161).

But Zaher (2016:47) asserted that to facilitate KS practices in healthcare sector, needs/requires designing and developing a proper knowledge management framework (KMF), which can ensure that knowledge is manifested into readable form rather than hidden as tacit knowledge in professionals' minds. KMF is a structured and

information technology (IT) based application that is developed and designed to enhance and bring effectiveness in organizational processes of knowledge creation, storage, sharing and managing knowledge (Al-Madi 2017 and Jabar et al. 2014). Information technology (IT) is an important enabler of many KM initiatives. It can support and enable KM in two main ways: (1) it can provide the means for people to organize, store and access explicit knowledge and information, as it is in its best practices and in databases and (2) it can help to connect people with people; so that they can share tacit knowledge, through groupware or video conferencing (Allahawiah et al. 2013).

According to Zaher (2016:47) the key measurements of organizational performance are mainly assessed in the IT. Information technology also manages the knowledge itself in the organization in terms of accessibility, the extent of accumulation, utilization, how people share this knowledge and how ownership is accorded to individuals is based on the premise that hoarding of knowledge can be reduced, which the IT platforms and tools can facilitate knowledge exchange, knowledge storage and accessibility (Mkhize 2015; Mathew et al. 2012 and Alhalhouli et al. 2014).

The healthcare sector is characterized by a collection of diverse specialists working in specific environments towards a collaborative goal of quality patients' care. The poor access to knowledge is detrimental to the goals of the healthcare sector to provide quality care using innovation to reduce costs and improve patients care. In healthcare sectors, KMF for KS is networking system that is helpful to solve different KS problems. Its main importance is increasing service facility/organizations efficiency and competitiveness by improving the way organization manages its explicit and tacit knowledge assets in and outside the organization and at the same time facilitating KS to the health professionals and patients on every activity they undertake in relation to healthcare issues. Hence, using KMF can improve performance by helping knowledge workers who deal with the fragmented knowledge that exists in medical environments.

Knowledge in healthcare sector is derived from patients, clinicians as well as external sources. Medical knowledge is highly dynamic, while healthcare sector depend on evidence based medical practice. The inability to share knowledge can be detrimental to the

achievement of the goals; through effectively using the abundant knowledge in the healthcare sector.

The ultimate goal of the healthcare sector professionals is to improve patient care by accessing the knowledge about the patients and then using the right knowledge and equipment to manage the patients. Using technology is essential in this case to facilitate the diagnosis and treatment; as well as ensuring that the flow of information is sustainable and traceable so that other practitioners can also be able to follow through. In this way, knowledge is shared in an open space.

Patients centered healthcare is a healthcare paradigm in which patients are actively involved in making decisions about their health. In patient-centered healthcare centers, patients are seen as experts with respect to their own conditions. Patients collaborate and share knowledge with care providers. Care providers provide the clinical care based on both the best and most relevant medical and scientific knowledge and on the knowledge they gain from the patients (Beveren 2003). In addition, the need for health practitioners to access up to date medical knowledge about patients and to share local, contextualized knowledge with each other. Patients need access to general medical knowledge and need to exchange the knowledge with health practitioners and possibly with each other (Van-Beveren 2003).

Moreover, the success of KS depends on the organizational KMF. Therefore, identifying the enabling technologies for KS with all the essential components and integrating it to organizational KMF is important to address knowledge share limitations of organizations. Such as: narrow the physical gap that exists between individuals; provide a framework for individuals to improve social relations and develop trust and provides a common interface and easy navigations to share valuable knowledge resources. A capable framework with all essential functionalities is important for functioning in a broad work environment. The integration of technological solutions is important to support KMF activities by providing a single point, easy and timely access to information/knowledge as well as facilitating the necessary tools and techniques to ease interaction of communities of knowledge workers. It can also help to efficiently share the vast volume of information or knowledge generated in different activities daily.

Arshad et al. (2016) revealed that a lot of research work has been accomplished regarding KMF in various fields of studies but the healthcare sector is still lacking a considerable amount of research and literature with respect to effective knowledge management framework. However, healthcare is a knowledge driven process, which requires knowledge and a Knowledge management framework that can assist healthcare organizations to become viable in giving healthcare information context (Nicolini et al. 2008). While knowledge management framework for Knowledge sharing practices in healthcare sector is expected to enhance two ways communication process that takes place among health practitioners and between patients and health practitioners (Dwivedi et al. 2003; Mahmood et al. 2012; Alhalhoul et al. 2013 and Shehira 2015).

2. OBJECTIVE

The objective of this study was to determine the existence of Knowledge Management Framework, to develop and design a prototype knowledge management framework that will facilitate knowledge sharing practices among health professionals and patients in Hiwot Fana Specialized University Hospital (HFSUH) in Ethiopia.

HFSUH was founded in Harar city in 1955. It has a bed capacity of 157 with 294 rooms to offer different services in the hospital. It has been serving as a referral Hospital to the people of Harari Region and also for the nearby Eastern Oromiya and Ethiopian Somali Region. On July 14, 2017, the Harari Regional Health Bureau handed over the administration and service provision of the hospital to Haramaya University College of Health and Medical Sciences and has since been named as Hiwot Fana Specialized University Hospital in Ethiopia.

3. METHODOLOGY

The method used for this study was Design science research method, which focuses on the creation of innovative, collaborative and purposeful information technology artifacts for the problem domain that typically include: algorithms, human/computer interfaces, design process models and languages (Peppers et al. 2007:58). Using the

method, researchers aimed at assessing, developing and designing a prototype KMF to facilitate KS practices between and /or among health professionals and patients in HFSUH in Ethiopia. To achieve this, the researchers adopted the research procedures/guidelines from (Peffers et al. 2007:61) six guidelines that focused on the building of artifacts as presented in figure 1 below:

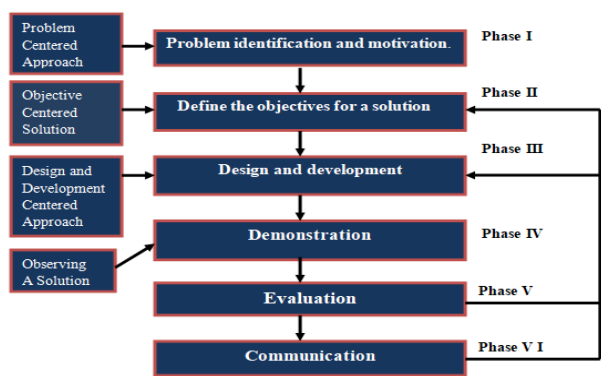


Figure 1: Design science research procedures/guidelines. Source: Peffers et al.2007:61

Peffers et al Design science research method has six research procedures that are in phases as presented in figure 1 above. Phase I: Problem Identification and Motivation; Phase II: Objectives and Solutions; Phase III: Design and Development; Phase IV: Demonstration; Phase V: Evaluation; and Phase VI: Communication.

3.1 Phase I: Problem Identification and Motivation

Phase one was carried out to identify problems and motivation through understanding the current status or presence of KMF for KS practices, current KS practices and factors that enable/hinder KS practices in HFSUH, Ethiopia. A Cross-sectional research survey method was applied using a structured questionnaire items comprising only closed ended questions and covered the problem identification and motivation items on: presence of knowledge management framework (KMF); knowledge sharing practices (KSPs) and availability of tools for designing and developing KMF in the HFSUTH and structured interview instruments were used for data collection from participants

that included categories of health professionals (i.e. nurses, doctors, radiologists, laboratory technologists, health officers and pharmacists); as well as patients, drawn from HFSUH in Ethiopia.

The sample size of 173 categories of health professionals (comprising of 46 nurses, 18 doctors, 15 radiologists, 26 laboratory technologists, 22 health officers and 26 pharmacists) with 21 patients taken from a target population of 304 health professionals and patients in the hospital.

The sampling technique used for the selection of the 152 categories of health professionals was stratified simple random sampling technique and purposive sampling technique for the 21 patients. As for the health professionals, the population was heterogeneous and working in the HFSUH. The target population was first divided into uniform strata and then using a simple random sampling technique, the proportional sample of health professionals were selected into their categories (Sekaran & Bougie 2016). Also, a purposive sampling of the 21 sampled patients was chosen based on the patients volunteering to participate in the study. They were also on admission in the hospital.

3.2 Phase II: Definition of objectives for the solutions.

Here, attempt was made to creatively solve the problems identified by taking into consideration the existing problems and the existing knowledge in HFSUH. Based on the results of phase I, the study proposed solutions through creating ways to integrate services from different applications, to create a homogenous environment and facilitate KS among the categories of health professionals and patients. The major challenges to accomplish this objective were (a) finding the document protocol used for KS and finding out the key KS practices in HFSUH. This gave room to study how and what knowledge was needed to meet the proposed objectives. In this phase also, the researchers proposed the KMF implementation model. The goals attained were used to address the current KS practice problems and user requirements or solution to the problems identified in phase I.

3.3 Phase III: Design and Development.

The main goal of the phase was to develop KMF and design a prototype system to facilitate KS practices in HFSUH. In this phase again relevant KMF design options for HFSUH were identified based on the KMF development goals in Phase II. The main artifact of KMF was created based on Phase I and Phase II. In the third phase, KMF and prototype was developed to facilitate KS practices and to solve the identified problems in phase I.

3.4 Phase IV: Demonstration.

In this phase, various development tools were used in phase III, among which was Xampp, which is a software that was used to develop the KS prototype. Xampp contains MySQL database and apache software that is compatible with PHP language for system development process. PHP is easy to work with, easy to build database and produce fast access website. PHP is easy to learn and adaptable scripting language which makes it attractive for development. Other programming languages used to develop the prototype system were HTML, CSS and JavaScript for attractiveness, decorativeness, interest and suitability for users' interface.

3.5 Phase V: Evaluation.

After designing the KS practice prototype system, its system performance was evaluated to see the functionalities of the system, which was followed by user acceptance test so as to evaluate the usability of the system. Phase V focused on the evaluation of the prototype KS practice perspectives; to assess and measure how well the artifact supports the KMF. Evaluation requires the identification of the evaluation method and criteria/ technique that can address all evaluation metrics. From the three approaches (i.e. comparing the model to a golden standard established benchmark, review the model using human experts and applying the model to the target domain using domain data) for evaluating developed and designed prototype models, the researchers in this study used the user acceptance test checklist. The usability evaluation checklist for KS practice prototype system, is the degree to which a given software can be used by specific users to achieve quantified objectives with efficiency and effectiveness.

3.6 Phase VI: Communication.

The researchers in phase VI, communicated the relevant audiences, such as: all the categories of health professionals, researchers and management of HFSUH.

All the phases were used in this study for assessing, developing and designing a prototype Knowledge Management Framework to facilitate Knowledge Sharing practices among health professionals and patients in HFSUH in Ethiopia.

4. RESULTS AND DISCUSSIONS

The response rate of returned questionnaire to the categories of health professionals was 147 (88%); comprising of 46 nurses, 18 doctors, 15 radiologists, 26 laboratory technologists, 22 health officers and 26 pharmacists, while the patients involved in the structured interview was 20 (12%).

4.1 PROBLEM IDENTIFICATION AND MOTIVATION

4.1(a): Cross-sectional research analysis of categories of health professionals

In this phase, a Cross-sectional research analysis of categories of health professionals was conducted. The SPSS version 20 computer programme was used for the statistical analysis of the data collected from the perceived categories of health professionals and is depicted in Table 1(a) below. The items on the table were measured on a five point scale, using an equal interval of 0.80 and the guideline below was used for interpreting the attitude scores of respondents or health professionals on the items description of the questionnaire.

However, a mean score of the respondents was considered strongly disagreed (SD), if it falls within the range of 1.00 - 1.80; a mean score within the range 1.80 - 2.60 was taken as Disagreed (D); a mean within the range 2.60 - 3.40 was considered undecided (UD), while a mean score within the range 3.40 - 4.20 was taken as Agreed (A); and a mean score within the range 4.20 - 5.00 was considered strongly Agreed (SA) for positive items.

The table therefore, reflects the decisions taken on the mean perception difference on each of the items 1 – 27 that influence

knowledge management framework to facilitate Knowledge Sharing practices among categories of health professionals and patients in HFSUH in Ethiopia. The opinions of categories of health professionals on the items were specifically categorized under the following headings:

1. Items 1&2 (2 items) were opinions on availability of knowledge management framework in HFSUTH that include:
 - i. Availability of organized knowledge management framework in the hospital for knowledge sharing and;
 - ii. Do you think that knowledge management framework support the hospital?

2. Items 3-13 (11 items) were opinions on individual Knowledge sharing factors in HFSUTH that include:
 - i. In my hospital knowledge sharing is highly valued;
 - ii. Health Professionals share knowledge in their daily work process;
 - iii. In the hospital there are formal opportunities like training program and workshop within the hospital that allow employee to share knowledge;
 - iv. It is my pleasure to share my know-how, information, working experience & Knowledge to my colleagues voluntarily;
 - v. It is my pleasure to share freely information and knowledge that improves the Hospital performance;
 - vi. My colleagues are willing to share information with other colleagues at all the time;
 - vii. I believe I would gain new ideas, technologies, skills or techniques by sharing knowledge;
 - viii. If I share knowledge with in my organization my colleagues will believe that I am very concerned about their welfare (wellbeing);
 - ix. I believe my experience can improve work efficiency and increase productivity by sharing my knowledge;
 - x. Sharing knowledge would waste my time or increase my work load;
 - xi. Sharing knowledge would reduce my personal competitiveness.

3. Items 14-18 (5 items) were opinions on availability of organizational knowledge sharing factors in HFSUTH that include:

- i. In our organization there is knowledge sharing culture;
- ii. In our organization there is knowledge sharing culture;
- iii. Managers in our organization encourage knowledge sharing with colleagues or staffs;
- iv. Our organization encourage group interaction (team work) regarding knowledge sharing and;
- v. In my organization individuals who share their knowledge gets recognition and acknowledgement.

4. Items 19-27 (9 items) were opinions on Availability of Technological Knowledge sharing factors in HFSUTH that include:

- i. Staffs have computer or mobile literacy skills;
- ii. ICT infrastructure (internet, intranet) is available in the hospital;
- iii. There is technical support and maintenance of integrated Information Technology system;
- iv. In the hospital, employees use knowledge networks such as (email, intranet, internet) to communicate with colleagues;
- v. Employees make extensive use of electronic storage (such as databases) to access knowledge;
- vi. In my organization there is technical support or immediate maintenance of integrated IT system to enhance work routines and communication flows;
- vii. In my organization there is training regarding employee familiarization of new IT systems and processes;
- viii. In our organization there is ICT technology that is compatible to the hospital working process and;
- ix. In our organization ICT tools are easily used by employees of the organization.

Table 1(a): Problem identification and motivation for designing and developing a prototype knowledge management framework at HFSUTH in Ethiopia

S/N.	IPI&M	CHP	N	Mean	Decision
AVAILABILITY OF KNOWLEDGE MANAGEMENT FRAMEWORK IN HFSUTH					
Availability of organized knowledge management framework in the hospital for knowledge sharing		Doctor	15	1.73	SD
		Nurse	46	1.65	SD
		Laboratory technologist	25	1.72	SD
		Radiologist	14	1.64	SD
		Health officers	21	1.67	SD
		Pharmacist	26	1.77	SD
		Total	147	1.69	SD
Do you think that knowledge management framework support the hospital?		Doctor	15	1.27	SD
		Nurse	46	1.37	SD
		Laboratory technologist	25	1.48	SD
		Radiologist	14	1.14	SD
		Health officers	21	1.33	SD
		Pharmacist	26	1.27	SD
		Total	147	1.33	SD
AVAILABILITY OF INDIVIDUAL KNOWLEDGE SHARING BY HEALTH PROFESSIONALS IN HFSUTH					
In my hospital knowledge sharing is highly valued.		Doctor	15	3.67	A
		Nurse	46	3.07	UD
		Laboratory technologist	25	3.16	UD
		Radiologist	14	2.71	UD
		Health officers	21	2.95	UD
		Pharmacist	26	2.96	UD
		Total	147	3.07	UD
Health Professionals share knowledge in their daily work process.		Doctor	15	2.27	UD
		Nurse	46	2.91	UD
		Laboratory technologist	25	2.20	UD
		Radiologist	14	1.86	D
		Health officers	21	2.10	UD
		Pharmacist	26	2.54	UD
		Total	147	2.44	UD
In the hospital there are formal opportunities like training program and workshop within the hospital that allow employee to share knowledge		Doctor	15	4.07	A
		Nurse	46	3.20	UD
		Laboratory technologist	25	3.36	UD
		Radiologist	14	3.50	A
		Health officers	21	3.43	A
		Pharmacist	26	3.50	A
		Total	147	3.43	A
It is my pleasure to share my know-how, information, working experience & Knowledge to my colleagues voluntarily		Doctor	15	3.67	A
		Nurse	46	3.72	A
		Laboratory technologist	24	3.83	A
		Radiologist	14	4.14	A
		Health officers	20	4.15	A
		Pharmacist	26	3.58	A
		Total	145	3.81	A
It is my pleasure to share freely information and knowledge that improves the Hospital performance		Doctor	15	3.73	A
		Nurse	45	3.84	A
		Laboratory technologist	25	3.96	A
		Radiologist	14	4.57	SA
		Health officers	21	3.95	A
		Pharmacist	26	4.19	A
		Total	146	4.00	A
My colleagues are willing to share information with other colleagues at all the time.		Doctor	15	4.07	A
		Nurse	46	3.43	A
		Laboratory technologist	24	3.50	A
		Radiologist	14	3.14	UD

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	Health officers	21	3.33	UD
	Pharmacist	26	3.27	UD
	Total	146	3.44	A
I believe I would gain new ideas, technologies, skills or techniques by sharing knowledge	Doctor	15	2.73	UD
	Nurse	46	3.52	A
	Laboratory technologist	25	3.92	A
	Radiologist	14	4.00	A
	Health officers	21	3.52	A
	Pharmacist	25	3.60	A
	Total	146	3.57	A
If I share knowledge with in my organization my colleagues will believe that I am very concerned about their welfare (wellbeing)	Doctor	15	2.33	D
	Nurse	45	2.62	UD
	Laboratory technologist	25	2.00	D
	Radiologist	14	2.07	D
	Health officers	21	2.48	D
	Pharmacist	26	2.04	D
	Total	146	2.31	D
I believe my experience can improve work efficiency and increase productivity by sharing my knowledge	Doctor	15	3.07	UD
	Nurse	46	3.13	UD
	Laboratory technologist	25	2.92	UD
	Radiologist	14	2.50	D
	Health officers	20	3.75	A
	Pharmacist	26	3.23	UD
	Total	146	3.13	UD
Sharing knowledge would waste my time or increase my work load.	Doctor	15	2.27	D
	Nurse	46	2.39	D
	Laboratory technologist	25	1.88	D
	Radiologist	14	1.50	SD
	Health officers	21	2.00	D
	Pharmacist	26	1.81	D
	Total	147	2.05	D
Sharing knowledge would reduce my personal competitiveness.	Doctor	15	2.67	UD
	Nurse	46	2.09	D
	Laboratory technologist	25	2.24	D
	Radiologist	14	1.57	SD
	Health officers	21	2.57	SD
	Pharmacist	26	2.27	D
	Total	147	2.22	D
AVAILABILITY OF ORGANIZATIONAL KNOWLEDGE SHARING IN HFSUTH				
In our organization there is knowledge sharing culture	Doctor	15	2.60	D
	Nurse	46	2.72	UD
	Laboratory technologist	25	2.12	D
	Radiologist	14	2.64	UD
	Health officers	20	2.25	D
	Pharmacist	26	2.23	D
	Total	146	2.45	D
In our organization there is knowledge sharing culture	Doctor	15	2.73	UD
	Nurse	46	2.85	UD
	Laboratory technologist	25	2.16	D
	Radiologist	14	1.71	SD
	Health officers	21	3.05	UD
	Pharmacist	26	2.08	D
	Total	147	2.50	D
Managers in our organization encourage knowledge sharing with colleagues or staffs	Doctor	15	2.40	D
	Nurse	46	2.65	UD
	Laboratory technologist	25	2.48	D
	Radiologist	14	2.14	D
	Health officers	21	2.71	UD
	Pharmacist	26	2.58	D
	Total	147	2.54	D
	Doctor	15	3.27	UD

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Our organization encourage group interaction (team work) regarding knowledge sharing	Nurse	46	3.35	UD
	Laboratory technologist	25	2.56	D
	Radiologist	14	2.64	UD
	Health officers	21	3.38	UD
	Pharmacist	26	2.54	D
	Total	147	3.00	UD
In my organization individuals who share their knowledge gets recognition and acknowledgement	Doctor	15	2.47	D
	Nurse	46	3.09	UD
	Laboratory technologist	25	2.64	UD
	Radiologist	14	2.50	D
	Health officers	21	2.24	D
	Pharmacist	25	2.68	UD
	Total	146	2.70	UD
AVAILABILITY OF TECHNOLOGICAL KNOWLEDGE SHARING IN HFSUTH				
Staff have computer or mobile literacy skills	Doctor	15	2.40	D
	Nurse	46	2.35	D
	Laboratory technologist	25	2.60	D
	Radiologist	14	2.71	UD
	Health officers	21	2.00	D
	Pharmacist	26	2.08	D
	Total	147	2.33	D
ICT infrastructure (internet, intranet) is available in the hospital	Doctor	15	3.13	UD
	Nurse	46	3.13	UD
	Laboratory technologist	25	2.88	UD
	Radiologist	14	2.07	D
	Health officers	20	3.50	A
	Pharmacist	26	3.08	UD
	Total	146	3.03	UD
There is technical support and maintenance of integrated Information Technology system	Doctor	15	2.73	UD
	Nurse	45	3.58	A
	Laboratory technologist	25	2.84	UD
	Radiologist	14	2.07	D
	Health officers	21	2.90	UD
	Pharmacist	26	2.81	UD
	Total	146	2.99	UD
In the hospital, employees use knowledge networks such as (email, intranet, internet) to communicate with colleagues	Doctor	14	2.21	D
	Nurse	46	2.63	UD
	Laboratory technologist	25	2.04	D
	Radiologist	14	2.36	D
	Health officers	21	2.57	D
	Pharmacist	26	2.19	D
	Total	146	2.38	D
Employees make extensive use of electronic storage (such as databases) to access knowledge	Doctor	14	3.07	UD
	Nurse	46	2.87	UD
	Laboratory technologist	25	1.88	D
	Radiologist	14	1.93	D
	Health officers	21	3.10	UD
	Pharmacist	26	1.81	D
	Total	146	2.47	D
In my organization there is technical support or immediate maintenance of integrated IT system to enhance work routines and communication flows.	Doctor	14	2.07	D
	Nurse	46	2.70	UD
	Laboratory technologist	25	2.12	D
	Radiologist	14	2.00	D
	Health officers	21	2.38	D
	Pharmacist	26	2.38	D
	Total	146	2.37	D
In my organization there is training regarding employee familiarization of new IT systems and processes	Doctor	15	2.60	D
	Nurse	45	2.22	D
	Laboratory technologist	25	2.12	D
	Radiologist	14	2.71	UD
	Health officers	21	2.33	D

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In our organization there is ICT technology that is compatible to the hospital working process	Pharmacist	26	1.73	UD
	Total	146	2.22	D
	Doctor	14	2.57	D
	Nurse	46	3.07	UD
	Laboratory technologist	25	2.08	D
	Radiologist	14	2.43	D
	Health officers	21	2.38	D
	Pharmacist	26	1.69	SD
	Total	146	2.45	D
	Doctor	15	2.60	D
In our organization ICT tools are easily used by employees of the organization	Nurse	45	2.80	UD
	Laboratory technologist	25	2.00	D
	Radiologist	14	2.57	D
	Health officers	21	2.86	UD
	Pharmacist	26	2.58	D
	Total	146	2.59	D

KEY

- S/N = Serial numbers
IPIM = Items on Problem Identification and Motivation
CHP = Categories of Health Professionals
N = Number of responses
SD = Strongly Agreed
A = Agreed
UD = Undecided
D = Disagreed
SD = Strongly Disagreed

From items analysis on table 1 above, researchers found that all categories of health professionals (i.e. nurses, doctors, radiologists, laboratory technologists, health officers and pharmacists) strongly disagreed on items 1&2 (i.e. Availability of organized knowledge management framework in the hospital for knowledge sharing and knowledge management framework support the hospital). All categories of health professionals strongly disagreed with the total mean difference of 1.69 and 1.33 respectively. This implies that there was no KMF in HFSUH at time of the study.

Also, all categories of health professionals variously had mixed opinions on items analysis on the factors that influences their knowledge sharing practices in the HFSUH in Ethiopia. The levels of opinions were: disagreed (D); undecided (UD) and agreed (A). The factors cut across individual; organizational and technological factors

The disagreed items were eleven (11). They include: Items 10; 12; 13; 14; 15; 16; 19; 22; 23; 24; 25; 26 and 27 (i.e. items 10: If I share knowledge with in my organization my colleagues will believe that I am very concerned about their welfare (wellbeing); items 12: Sharing

knowledge would waste my time or increase my work load; items 13: Sharing knowledge would reduce my personal competitiveness (three (3) items on Individual factors); items 14: In our organization there is knowledge sharing culture; items 15: In our organization there is knowledge sharing culture; items 16: Managers in our organization encourage knowledge sharing with colleagues or staffs (three (3) on Organizational factors); items 19: Staff have computer or mobile literacy skills; items 22: In the hospital, employees use knowledge networks such as (email, intranet, internet) to communicate with colleagues; items 23: Employees make extensive use of electronic storage (such as databases) to access knowledge; items 24: In my organization there is technical support or immediate maintenance of integrated IT system to enhance work routines and communication flows; items 25: In my organization there is training regarding employee familiarization of new IT systems and processes; items 26: In our organization there is ICT technology that is compatible to the hospital working process and items 27: In our organization ICT tools are easily used by employees of the organization (Seven (7) on Technological factors) were disagreed upon by the respondents. The mean difference was from 2.05 to 2.59 on the eleven items.

The undecided items were seven (7) and they include items 3; 4; 11; 17; 18; 20 and 21. They items cut across individual; organizational and technological factors (i.e. items 3: In my hospital knowledge sharing is highly valued; items 4: Health Professionals share knowledge in their daily work process; item 11: I believe my experience can improve work efficiency and increase productivity by sharing my knowledge; item 17: Our organization encourage group interaction (team work) regarding knowledge sharing; item 18: In my organization individuals who share their knowledge gets recognition and acknowledgement; item 20: ICT infrastructure (internet, intranet) is available in the hospital; There is technical support and item 21 maintenance of integrated Information Technology system. The mean difference was from 2.44 to 3.13 on the eleven items.

The agreed items were five (5) and they include items 5; 6; 7; 8 and 9. All the items were on individual factors (i.e. item 5: In the hospital there are formal opportunities like training program and workshop within the hospital that allow employee to share knowledge;

item 6: It is my pleasure to share my know-how, information, working experience & Knowledge to my colleagues voluntarily; item 7: It is my pleasure to share freely information and knowledge that improves the Hospital performance; item 8: My colleagues are willing to share information with other colleagues at all the time and item 9: I believe I would gain new ideas, technologies, skills or techniques by sharing knowledge).

But a cursory look at individual opinions of each category of health professionals (i.e. nurses, doctors, radiologists, laboratory technologists, health officers and pharmacists) on the table 1 showed that there were also several opinions by each category of health professionals on the items. However, only the category of Radiologists that strongly agreed on one (1) of the twenty-seven (27) items, which was item 7; being individual factor (i.e. it is my pleasure to share freely information and knowledge that improves the Hospital performance). The same category of Radiologists strongly disagreed on three (3) of the twenty-seven (27) items, which were items 12; 13 and 15 being individual and organizational factors (i.e. item 12: Sharing knowledge would waste my time or increase my work load; item 13: Sharing knowledge would reduce my personal competitiveness and item 14: In our organization there is knowledge sharing culture).

The researchers observed and described the opinions of the Radiologists as a typical of the other five (5) categories of the health professionals of the HFSUH. Although, the categories of the Health officers and Pharmacists was strongly disagreed on items 13 and 26 (i.e. item 13: Sharing knowledge would reduce my personal competitiveness and items 26: In our organization there is ICT technology that is compatible to the hospital working process) respectively. Both opinions of the Health officers and Pharmacists could be viewed from the professional point of view of health professionals that are at the treatment end after diagnosis. But Radiologists are medical doctors who are trained in executing and interpreting images such as X-rays, CT scans, Ultrasounds, and MRIs and using them to aid in the diagnosis and treatment of patients; although they do not normally handle the general medical needs of patients.

4.1(b) Patients perception on knowledge sharing in Hiwot Fana specialized university hospital

A structured interview items were used by the researchers to interview the volunteered 20 patients from the HFSUH in Ethiopia. The researchers sort answers from patients as ‘Yes’ or ‘No’ as responses to the items 1-7 interviewed questions. The results of the Patients’ perception on knowledge sharing in Hiwot Fana Specialized University Hospital were recorded in percentages and are presented in Table 1(b) below.

Table 1(b): Patient’s perception on knowledge sharing in Hiwot Fana Specialized University Hospital

S/N	Items	Yes	
		F	%
1.	Do the health professionals share knowledge with you?	11	55
2.	Does the knowledge you get improves your health?	12	60
3.	There is openness to share knowledge between health professionals and patients?	13	65
4.	There is opportunity to share knowledge between health professionals and patients?	3	15
5.	Does the shared knowledge increase accuracy of patient treatments?	18	90
6.	Do yo trust to share knoelwdge with health professional?	16	80
7.	Do you have willingness to share knoelwdge with health professional?	15	75

F=Frequency, % =Percentages

As presented in table 1(b) above, 18(90%) patients perceived shared knowledge increase accuracy of patients treatments but does not believe that there was an opportunity to share knowledge between health professionals and patients 3 (15%). From the table, we can say that patients in HFSUH perceived KS practices between and or among health professionals and patients in HFSUH in Ethiopia.

4.2. Discussion

The objective of this study was to determine the existence of Knowledge Management Framework, develop and design a prototype knowledge management framework that will facilitate knowledge sharing practices between and/or among health professionals and patients at Hiwot Fana Specialized University Hospital (HFSUH) in Ethiopia. The following findings were made at the analysis; interpretations and results section of the problem identification and motivation phase one of this study and are discussed as follows:

The findings revealed that KMF was not available at the HFSUH for use by all categories of health professionals (i.e. nurses, doctors, radiologists, laboratory technologists, health officers and pharmacists) at the time of the study. It was also found that, all categories of health professionals variously had mixed opinions on factors that influence their knowledge sharing practices in the HFSUH. The levels of opinions were: disagreed (D); undecided (UD) and agreed (A). The factors cut across individual; organizational and technological factors.

In addition to the findings, it was found that individual opinions of each category of health professionals were also several; with only the category of Radiologists that strongly agreed on the pleasure to share freely information and knowledge that improves the Hospital performance but strongly disagreed on individual and organizational factors that sharing knowledge would waste their time or increase work load; reduce personal competitiveness and lastly strongly disagreed that in their organization there was knowledge sharing culture. Patients on the other hand agreed in this study that KS practices among health professionals and patients existence is paramount.

The findings above, supports (Al-Madi 2017; Zaher 2016:47; Jabar et al. 2014 and Allahawiah et al. 2013) on the facilitation of KS practices in healthcare sector that needs/requires designing and developing a proper knowledge management framework, which in this study was absent at HFSUH. KMF is a structured and information technology (IT) based application that is developed and designed to enhance and bring effectiveness in organizational processes of knowledge creation, storage, sharing and managing knowledge. It can ensure that knowledge is manifested into readable form rather than hidden as tacit knowledge in professionals' minds. Hence, the researchers' proposed prototype KMF design and development to facilitate KS practices at HFSUH, Ethiopia that based on the findings of phase one problem identification and motivation.

4.3 Definition of objectives for the solution

Based on the results of phase I and discussion section, the study proposed solutions to the problems through designing and developing a prototype KMF to integrate services from different applications,

creating a homogenous environment and facilitate KS among the health professionals and patients in the HFSUH. The major challenges to accomplish this objective are (a) finding the document protocol used for KS and finding out the key KS practices in HFSUH. This gave room for the researchers to study how and what knowledge is needed to meet the proposed objectives. In this phase the researchers proposed the KMF implementation model, whose goals are attainable to address the absence of KMF the current KS practices problems and user requirements or solutions as identified in phase one of this study.

4.4 Design and Development

The main goal of this study was to design and develop a prototype KMF to facilitate KS practice in HFSUH. In this phase relevant KMF design options for HFSUH were identified based on the KMF development goals in the Phase II. The main artifact of KMF was created based on a series of findings and recommendations in Phase I and Phase II, which this phase III sets out to design and develop a prototype KMF to facilitate KS practices in HFSUH.

The researchers used a collaborative technology to build the framework; as a means of enabling capabilities for KS with advantages of requiring only: basic knowledge of computer usage, it will minimize cost, requires internet to be available and computers, to have timely updated and rich content and interactivity and user openness. This collaborative technology based framework was an initial point to design an effective healthcare professional's KS system that needed additional functionalities that were customized for healthcare setting; with controlled and secured environment as well as quality of the knowledge that should be shared to be evaluated continually.

Whereas, there are various types of KS platforms in the world like Share Practice and Doximity, which allows connecting with doctors from all kinds of fields. But this designed and developed prototype KMF allows not only the sharing of knowledge among health professionals but it also supports the sharing and accessing images of patients' ailments within the network and pave the way in order to discuss them. The researchers proposed this framework to serve as an essential gateway to support interaction between individuals, which is composed

of seven layers for which each layer have separate application and this makes it easier to implement re-usable components for KS in HFSUH. The front layer runs on the client side, which include first layer which is user layer, second layer which is security layer, third layer which is presentation layer and fourth layer which is process layer, the back end layer runs on the system, which include the fifth layer and is the application layer. The sixth layer is the knowledge layer and the seventh layer is the storage layer. Figure 2 shows the layers in the proposed KMF and their functions.

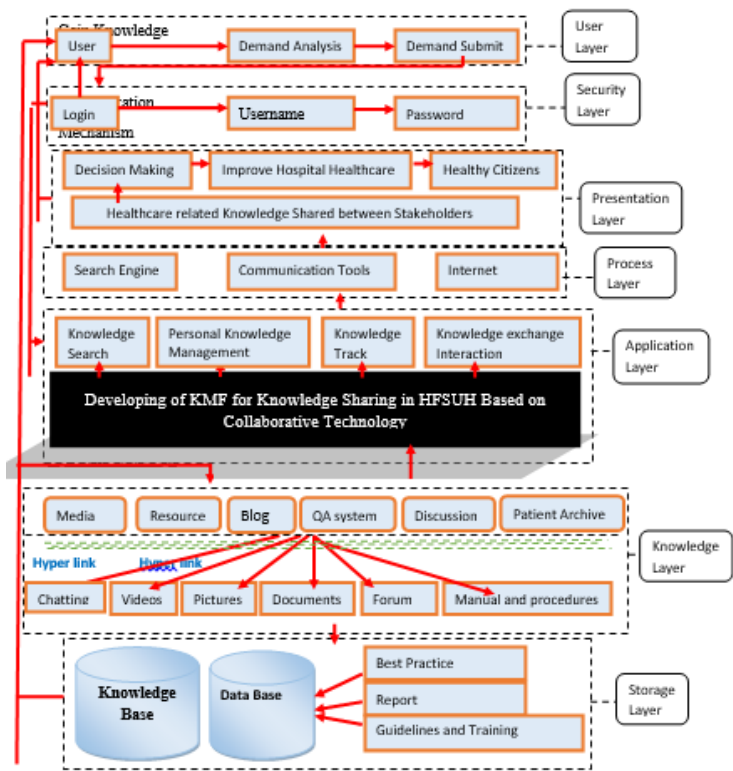


Figure 2: Proposed prototype knowledge management framework for knowledge sharing between and/or among health professionals and patients in Hiwot Fana Specialized University Hospital in Ethiopia

Description of the seven layers in the proposed prototype knowledge management framework:

i. User layer is the layer that facilitates interaction with external application or services. The developed KS framework has user interfaces mentioned on figure 2 above, which interacts with the users of the framework.

ii. Security layer is any framework that facilitate KS must be secure to fulfill the three main components of framework security which are confidentiality, integrity and availability, therefore to make the developed framework secure, the researcher was used authentication mechanism which is giving the user username and password so that no one access the framework until registered and get conformation to access the framework, but the authenticated or privileged user can get access to the framework.

iii. Presentation layer is a layer that the accessed knowledge presented using user interface. The user access the integrated knowledge through interface which offers direct and unified access to relevant features. As presented in qualitative study, there is no structured and integrated ways that facilitate KS. So, considering this the framework interconnects the departments to have an integrated knowledge among the health professionals and between health professionals and patients. The accessed knowledge in presentation layer support decision making this leads improve the hospital healthcare and as final all this make up healthy citizens.

iv. Process layer is the mechanism emphasizes techniques and processes that are able to users to create interaction with the framework. The process layer communicates between the application layer and the presentation layer. At this layer most of applications translates clients processing needs from the application layer to presentation layer and brings database responses with respect to the knowledge and data need of the user. The system processes using Internet, communication tools and search engine.

v. Application layer has all the main functionalities of the KS framework, which were mentioned on figure 2 above are processed. This layer is used as intermediate between knowledge layer and process layer. This layer accepts the user need after the framework is checked for security, process the user need and obtain knowledge from

knowledge layer by help of collaborative technology and send the knowledge to presentation layer, lastly in presentation layer KS take place between stakeholders/users need knowledge.

vi. Knowledge layer is the collaborative technology based framework layer proposed by the researchers. It is an initial point to design an effective KS among health professionals and between health professionals and patients. In addition, this layer also stores all the knowledge to the data base and knowledge based which is linked on the blog, media, resource, question answering system, discussion forum and patient archive page and uploaded knowledge from knowledgebase and database to those listed page.

vii. Storage layer serves as storage for the knowledge collected in the past stages. Therefore, storage layer is viewed as organization memory and retention of knowledge assets. Storage layer must have sufficient storage media to accumulate knowledge and prevent valuable expertise from disappearing. Also, storage layer importance relies on the viscosity of knowledge to store. Storage layer in the above framework helps to store all hospital activity in knowledge base and database. In addition, to storing it also helps as input to upload knowledge for blog, media, resource, question answering system, discussion forum and archive page

The KMF system prototype is designed based on the requirements gathered from the cross sectional survey research conducted by the researchers and the contents incorporated into the KMF suggested by health professionals and patients. As mentioned in demonstration section, the researchers used Xampp software to develop the prototype design. The goal of designing this prototype KMF system is to facilitate the KS activities of the health professionals and patients, increase efficiency and effectiveness of the health professionals and patients' healthcare services within HFSUH.

The designed prototype KMF system consists of components like: Home page; Contact us page; media page; resource page; discussion forum page; blog page; question and answering page; user registration page and login page. In addition, there is the patient page and health professional's page that are also included as part of the KS between health professionals and patients. Each page and its

components are discussed below for ease of understanding and usage of the prototype by the users anywhere inside or outside the compound of the hospital as follows:

i. Home Page:

This page is the first page of KS prototype that anyone (user) can login and easily access the content whenever he/she opens the website. Home Page includes widgets to contact us, resource page, media page, blog page, question and answering page, discussion forum page, registration page, login page and calendar of the year and KS quote. On this page, visitors may find the above components / elements of knowledge area that facilitate KS among health professionals and between health professionals and patients. The login widget allows each user to get into the page (once they are given privilege), while the registration page allows them to register into the system. The following figure 3 below, illustrates the main home page of KS prototype of health professionals and patients of HFSUH.



Figure 3: Main home page illustration of KS prototype of health professionals and patients of HFSUH

ii. Contact Us Page

As its name indicates, the main reason this page is created is to give an alternative address for those people who are interested in knowing the real address of the hospital and the departments in particular. The address in addition, for those who visit the hospital in person, the telephone, email, postal and fax address are provided on the page. Figure 4 below, illustrates the main contact us page of KS prototype of health professionals and patients of HFSUH.

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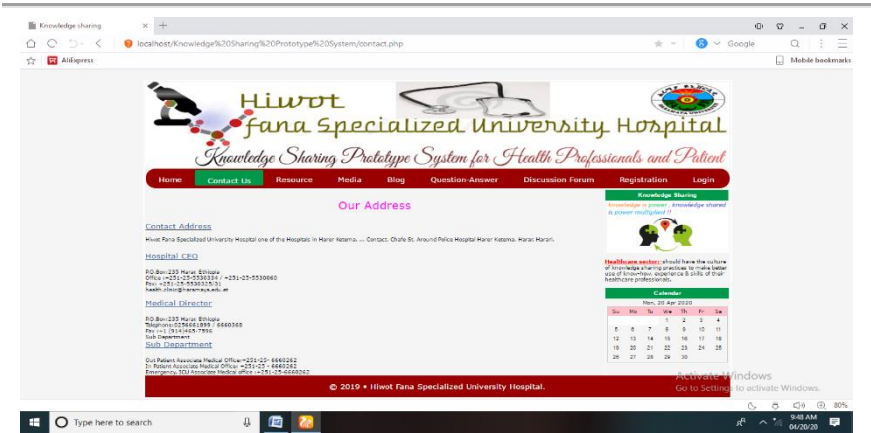


Figure 4: Contact us page of knowledge sharing prototype system

iii. **Registration Page/Form**

A registration page/form is a list of fields that a user will input data and submit to the hospital or individual. There are many reasons why you would want a person to fill out the registration page/form. Hospitals use registration page/forms to sign up customers for subscriptions, services or other programs or plans. However, Figure 5 is registration page/form or User sign up page of knowledge sharing prototype system. In this page the user can create account or register, once registered, the user will not have login privileged; until the site administrator confirm the registration. Once the site admin confirmed the user can access any content that are given privileged in the site.

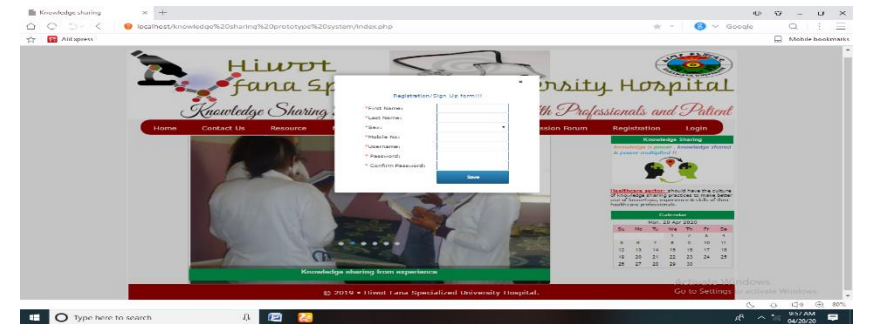


Figure 5: User sign up/ registration page of knowledge sharing prototype system

iv. Login Page

The login page authenticates the authorized health professionals, administrator and patients who have account for the designed KS prototype system of HFSHU. See figure 6 on login page. This page requires username and password.

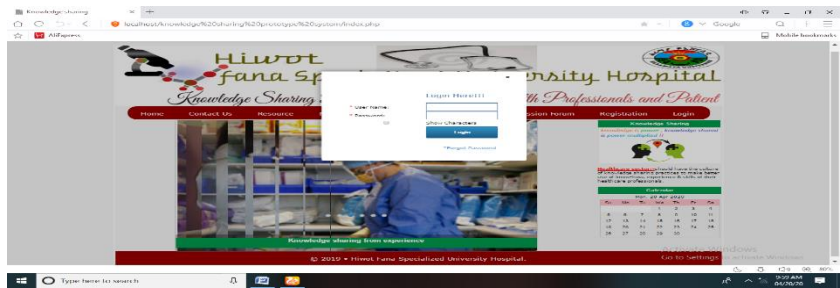


Figure 6: User login page of knowledge sharing prototype system

v. Patients Archive Page

Once patients are registered and get confirmation, the patients have the privilege to share their knowledge about their health. All patients' information are shared with their health practitioners are recorded in this page. See figure 7. The patients do not have privilege to access other pages like: blog, media, resource, discussion and question and answering page. One of the important components and features of the page is allowing professionals to access patients archive/record that may help them not only to engage in the discussion and KS with their colleagues on each of the patients history/record, but also in the follow up of the clients visiting the department. The patients' records can only be accessed by the administrator and health professionals who have a legitimate right to access patients' data.

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Figure 7: Patients archive page of knowledge sharing prototype system

vi. Resource Page

This page or widget is accessible only for health professionals working in HFSUH. To access this page the users first registered and get confirmation from site administrator. See figure 8. Once confirmation is gotten in this page; any document published or uploaded on this site/page by the site administrator and/or user (those people who have privileges of accessing the page) in soft copy can easily accessed by professionals working in the hospital; regardless of the department they are working in. The resources page is designed in a way that it can help users' access topic specific resources including, family planning, research, seminar and others. Resources are materials like different modules, guidelines, manuals and others. However, resources published by users can be deleted by site administrator if they are not needed for the hospital.

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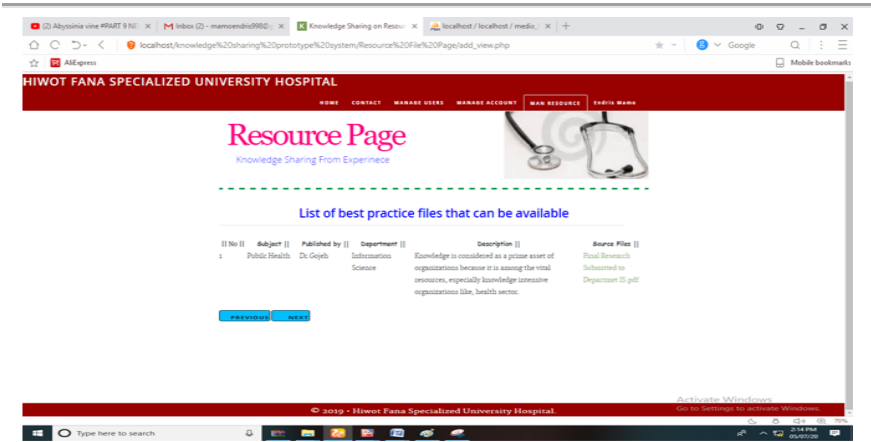


Figure 8: Resource page of knowledge sharing prototype system

vii. Media Page

This page or widget is accessible only for health professionals working in HFSUH. This page is created in a way that the users of the page should access different audios and/or videos uploaded on the page in relation to hospital need. See figure 9. Users with account can upload, download, view materials from this specific site page.



Figure 9: Media page of knowledge sharing prototype system

viii. Blog Page

This page or widget is accessible only for health professionals working in HFSUH. The blog page allows authorized users to maintain a blog. See figure 10. Blogs are series of posts that are time stamped and are

typically viewed by the date as similar to view a journal. Blog entries can be made public or private to the site members, depending on which roles have access to view content. The blog is usually used when there is a need for a number of blogs, written by different users, running on one site. In this page any user can access the content on this site /page blogged by site administrator and /or user; i.e. those people who have privilege of accessing the page can easily have access; regardless of the department they are working. This page is designed in a way that specific topics of resources and any other hospital related materials can be blogged.



Figure 10: Blog page of knowledge sharing prototype system

ix. Discussion Forum Page

This page or widget is accessible only for health professionals working in HFSUH. Sharing knowledge among health professionals is key in quality healthcare services. One means of sharing tacit knowledge among employees of a given organization is engaging in discussion forum face to face or using different platforms like this page. See figure 11. Therefore, this specific discussion forum page, plays a role in the KS activity among health professionals working in the hospital. Users/professionals with account on this page will easily discuss with other colleagues either on the topic they created or titles created by other individuals and replay on other people’s post.

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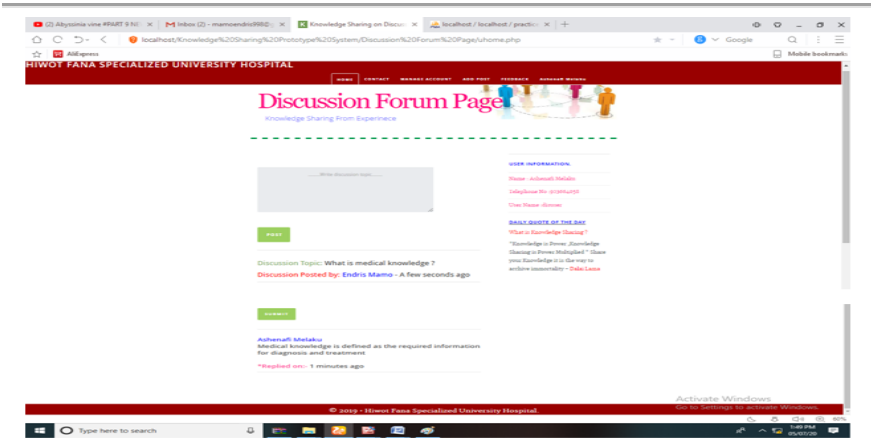


Figure 11: Discussion forum page of knowledge sharing prototype system

x. Question Answering Page

This page or widget is accessible only for health professionals working in HFSUH. This page is created in a way that the users of the page can ask any question related to healthcare issues. See figure 12. This page allows authorized users to ask the system and get answers for the question (s) given by the administrator of the system.

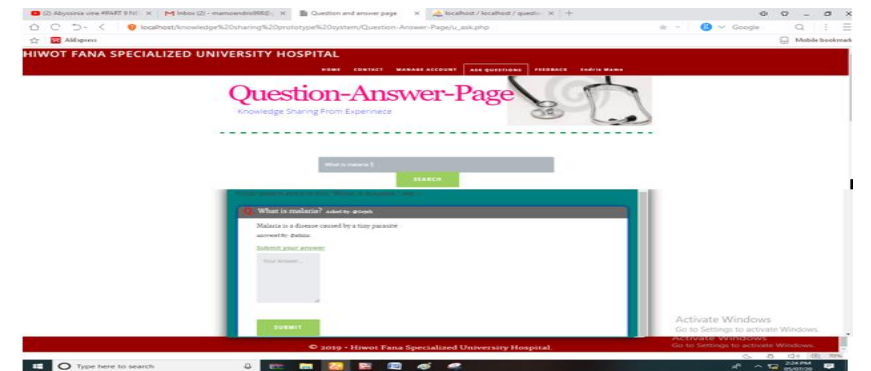


Figure 12: Question answering page of knowledge sharing prototype system

4.5 Demonstration

Various development tools were used in this study, among them were:

- a. Xampp** is software that was used to develop the KS prototype. Xampp contains MYSQL database and apache software that is compatible with PHP language for system development process. PHP is easy to work with, easy to build database and produce fast access website. PHP is easy to learn and it is an adaptable scripting language, which makes it attractive for development.
- b. HTML, CSS and JavaScript** are other programing language used to develop the prototype system was HTML, CSS and JavaScript to make attractive, decorative, interesting and suitable user interface.

4.6 Evaluation

For evaluation of the KS practice prototype system, the user acceptance testing was conducted. User testing is a technique for confirming that the intended users of the KS prototype system can carry out the intended tasks efficiently, effectively and satisfactorily. For this particular prototype KMF system to facilitate KS practice the user test was performed to address any significant issues identified and the results are presented below in Table 3. In the table, seven users participated in the testing process. They were presented with eight different questions that the researchers believed as addressing the users’ requirements using a five point Likert scale evaluation matrix of: Strongly Agreed (SA), Agreed (A), Neutral (N), Disagreed (DA) and Strongly Disagreed (SD).

Table 3: User test result for knowledge sharing prototype system

No	Test Questions	SA	A	N	DA	SD
1	The system is easy to open and access.	3	3		1	
2	I like the font and the color of the interfaces.	3	2	1	1	
3	There is consistency in the prototype interface.	3	3	1		
4	The system is easy on using different functionality in the given privilege.	3	4			
5	All important content addressed well in the interface.	3	3	1		
6	There is no unnecessary content available in the interface.	2	3	2		
7	The system response time while saving searching is acceptable.	1	3	2	1	
8	After logging out the system do not allow to access unprivileged pages.	3	3			1
Average result		2.63	3.0	0.88	0.38	0.13
Average result in percentage		37.46%	42.74%	12.54%	5.41%	1.85%

SA=Strongly Agreed, A=Agreed, N=Neutral, D=Disagreed, SD=Strongly Disagreed

As shown in table 3 above, the value of the responses was taken based on the Likert scale. According to the result of KS prototype system user interface evaluation, most of the respondents that is 80.20 % strongly agreed and agreed that the KS prototype system was easy to use, secure, all important contents were addressed well, fast access, attractive, clear information and functional explanation regarding the major functionalities of the system.

4.7 Communication

The researchers in this phase communicate to relevant audiences, such as: the health professionals and its management at HFSUH in Ethiopia on the problem and importance of the artifact to solve the problem, its utilization, novelty and effectiveness of the artifact. Furthermore, the findings are now being recommended for publication as a journal article for further research endeavor in the area.

4.8 ACKNOWLEDGEMENTS

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