DEVELOPING A WEB BASED KNOWLEDGE MANAGEMENT SYSTEM PROTOTYPE FOR KENYA TEA DEVELOPMENT AGENCY (KTDA) TEA PROCESSING FACTORIES

BY

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DECLARATION

DECLARATION BY THE STUDENT:

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To my lovely wife Flora, my children and the whole family. To my Mum and Dad, you really inspired me during hard times.

Thank you for being with me in this academic journey.

ABSTRACT

Knowledge is the currency of the current economy, a vital organizational asset and a key to creating a sustainable competitive advantage. Knowledge is increasingly being recognized as the new strategic imperative of organizations. The most established paradigm is that knowledge is power. Therefore, one has to hoard it, keep it to oneself to maintain an advantage. Managing knowledge is a major challenge that has impacted on how individuals cooperate to make sure the organization fulfills its objectives. In Kenya Tea Development Agency (KTDA) managed factories, expert in a given field are relied upon to provide necessary services based on what they know. These personnel are expected to consult minimally as they are the ones relied upon in tea production. In order to tie together the benefits of knowledge management in tea processing, there is need for adequate mechanisms for generating, capturing, and disseminating documented and undocumented knowledge to be developed. The aim of this study was to develop a web based system prototype for knowledge management at KTDA tea processing factories in Kericho County. The objectives were to: establish knowledge requirements of personnel in KTDA factories; determine methods used in knowledge management and sharing in KTDA factories; establish the challenges experienced by management in knowledge management and associated systems in KTDA factories; and model and build a prototype that facilitates knowledge, storage, processing and sharing among the KTDA factories. An iterative waterfall model was used during design and development of the system. Using qualitative design, this study sampled 50 employees of KTDA factories in Kericho County for face to face interviews. Data collected were analyzed through descriptive statistics in order to identify system requirements and challenges faced in the current system. The findings revealed that development and success of the knowledge management system is directly dependent on the level of commitment of the top management towards developing the system. A web based system prototype was then designed and developed for possible implementation by KTDA factories. The study makes a number of recommendations for effective and efficient web based management of knowledge in KTDA factories. It is recommended that these factories should find ways of adopting the current information technology methods other than the manual systems currently in use. In this study a system prototype was developed, it was recommended that a web based system for knowledge management can be extended other departments of the factory such as finance and human resource.

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ABBREVIATIONS

KTDA: Kenya Tea Development Agency

TRFK: Tea Research Foundation of Kenya

KM: Knowledge Management

KMS: Knowledge Management System

ICT: Information and Communication Technology

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CHAPTER ONE

INTRODUCTION AND BACKGROUND STUDY

1.1 Introduction

Tea industry in Kenya operates under Tea Act (Cap 343) and Agricultural Act (Cap 318) of Kenyan laws. Tea growing industry in Kenya is unique because it has two separate sectors; large scale sector (plantation) and the small scale sector (Kiarie, 2012). The plantation sector is owned by large scale tea producers and companies, mostly multinationals such as Unilever Tea while the small holder sector is owned by local small scale growers. The small holder sector has more than half a million tea growers scattered throughout Kenya, who sell their tea through small holder tea factories that are run by Kenya Tea Development Agency Ltd. Black and green teas are the two types of tea processed in Kenya. Currently, all Kenya Tea Development Agency factories are only processing black teas. Green tea is different from black tea because fermentation of green leaves is arrested in manufacturing green tea (Tea Board of Kenya, 2010). In tea industry, some employees lack significance knowledge to operate in their sections. Appropriate systems can be developed to help such personnel access missing knowledge.

1.1.1 Knowledge management

Knowledge management (KM) is a practice adopted by most companies seeking efficiency and effectiveness of their administrative processes. The formalization of knowledge allows the continuous improvement of processes that require the highest level of efficiency (Fabio, 2014). Knowledge management has been defined by different authors in different ways. Dalkir(2011: 3) observes that, a good definition of

knowledge management would incorporate both the capturing and storing of knowledge perspective, together with the valuing of intellectual assets. Dalkir further noted that, some typical knowledge management objectives would be to fascilitate a smooth transition from those retiring to their successors who are required to fill their positions, minimize loss of corporate memory due to attrition and retirement, and identify critical resources and critical areas of knowledge so that the corporation knows what it knows and does well and well. Knowledge management develops systems and processes to acquire and share intellectual assets.

When a company is skilful in its ability to acquire new information, and articulate the present information with new information or communicate the present information in a different way, the company would be in a better position to develop radical innovations, regardless of whether it is a product or process innovation (Leong et al, 2013).

As employees head for retirement, many knowledge-intensive organizations will be faced with a continuous loss of unrecoverable valuable knowledge if a process to capture that knowledge is not implemented (Calo, 2008). In order for knowledge sharing to occur, interactions between the knowledge provider and knowledge recipient are crucial (Maimuna et al, 2015). This indicates that knowledge sharing involves some sort of social relationships between the knowledge provider and knowledge recipient, and can be obtained via organizational socialization process. Storing of organizational knowledge is considered one of the most essential elements in the KM process as it helps in the prevention of losing important information.

Knowledge storage is referred to as a process of structuring and storing of knowledge. It formalizes knowledge and provides the possibility of utilizing it later (Massa and Testa, 2009). Knowledge management is necessary for continuous existence of a given organization. In most cases, most organizations build the human technical knowledge with an attempt to improving the performance of their organization. Moghimnejad et al (2014:1) noted that, the need for knowledge management originates from the fact that knowledge is an important element in organizational performance and having access to the stable competitive advantage. One of the current strategies that can assist firms to develop strategic capabilities dealing with uncertainty is knowledge management (KM). Through the systematic acquisition, creation, sharing, and use of knowledge, organizations develop, renew and exploit their knowledge based resources, thereby allowing them to typically adapt to ever changing business environment.

Security for knowledge management is critical as organizations have to protect their intellectual assets (Elisa,2006: 429). Therefore, only authorized individuals must be permitted to execute various operations and functions in an organization. Knowledge sharing and knowledge transfer operations must also enforce access control and security policies.

1.1.2 Web based systems

Worwa and Stanik (2010:2) observe that in recent years, the Internet and World Wide Web (www) have become ubiquitous, surpassing all other technological developments in our history. They've also grown rapidly in their scope and extent of use, significantly affecting all aspects of our lives. The commercial use of the Internet

and Web has grown explosively in the past five years. In that time, the Internet has evolved from primarily being a communications medium (email, files, newsgroups, and chat rooms) to a vehicle for distributing information to a full-fledged market channel for e-commerce.

Shahpasand and Rahimzadeh (2018:144) notes that, rapid changes in the knowledge management (KM) area are substantially dependent on the considerable progresses made by the mankind in the information technology (IT) during these years. In fact, Internet of Things (IoT), as part of the applied technologies in the IT world, has rendered feasible the fast growth and sharing of knowledge.

1.2 Background to the study

According to Kagira et al (2014:82), the KTDA as a management agency is faced by various challenges which include poor coordination of KTDA's operations, unreliable and inconsistent leaf collection and processing leading to significant losses and wastage in the supply chain and lack of transparency and accountability in the procurement system of inputs. Poor coordination of KTDA's operations can be tackled through investment in information technology to ensure accessibility of information by various parties in the supply chain. Kagira et al (2014:82), adds that, Kenya Tea Development Agency managed factories should improve their internal operations through automation of key processes. They should invest in computerization to ensure that tasks are conducted efficiently and effectively According to KTDA (2011:14) recent implementation of computerization at tea buying centers has started yielding fruits to farmers through greater production brought about by greater accountability and accurate records. This could further lead

to reduction of operational costs, enhancing information sharing among all stakeholders (such as factory managers, farmers, regulator, and other value chain partners), and stock reconciliations.

1.2 Tea processing

Black tea processing as a whole, consists of drying processes and a number of mechanical operations combined with or alternated by chemical and enzymatic reactions (Gupta et al, 2012). Gupta et al added that, Withering of the fresh leaf is the first and indispensable stage in black tea processing. The main objective of withering is to bring the mixed leaf material.

For processing of fresh tea leaves into black tea, the "crush, tear, curl" method (CTC) is used. At the factories, the tea is withered, sifted, CTC, fermented, and dried, then sorted into different grades and packaged for delivery to warehouses near the Port of Mombasa on Kenya's coast (Brian, 2013).

The research carried out has revealed that, flavourier and anti-oxidant rich teas can be produced by varying process conditions and type of raw leaf used. Further, research is required to develop systems that will stimulate adoption of quality improving technologies, as well as enhanced factory throughput and efficiency in tea manufacturing (TRFK,2011).

In view of these processes, quality tea depends wholly on how the processes are managed and the extent of expertise knowledge applied. Different tea processes require expertise to attend for best tea products (Kiarie et al, 2012). For example at fermentation stage, appropriate conditions must be provided. This dictates that a knowledgeable person must be in charge of this process of fermentation. Newly

employed persons who may be placed in such a level of processing must be briefed well if not conversant. Quality work must be done at every level of tea processing.

Kenya Tea Development Agency (KTDA) managed factories should aim at being market oriented by producing tea that consumers need. Kiarie et al (2012) added that the agency should conduct marketing research in order to understand market requirements. Therefore to compete in the global markets tea farmers need to improve the quality of their produce and the tea factories should modernize. The Tea Board of Kenya together with KTDA should set up a scheme for quality upgrading and product diversification. Low quality tea fetches low price especially where auction system is the mode of selling tea.

Expert knowledge is a major requirement in managing areas of risk such as inter-process linkages and exceptions, as with compliance-related events (Carmel, 2013).Knowledge considered as capital knowledge is a major factor of production that should be managed well to aid in manufacturing of quality products. Firms need to step back and carefully think about the "capabilities critical to sustaining their competitive advantages in their core businesses" (Law and Ngai, 2007:2344).

1.3 Knowledge management

Knowledge management is the conversion of tacit knowledge into explicit knowledge and sharing it within the organization (Uriarte, 2008). Uriarte adds that knowledge management is concerned with the process of identifying, acquiring, distributing and maintaining knowledge that is essential to the organization.

KM is divided into the following key processes: defining the goals of the knowledge, Identifying the knowledge, acquiring the knowledge, developing the knowledge,

distributing the knowledge, using the knowledge, retaining the knowledge, and Assessing the knowledge (Fabio,2014).

Knowledge management (KM) has attracted the interest of practitioners, consultants and researchers around the world. Knowledge management's attractiveness is based on the argument that intangible assets, such as knowledge, have replaced tangible assets as the principal driver of economic growth (Massingham, 2014). Through knowledge management, organizations can enjoy broad benefits. Knowledge management consists of various pillars.

There are four pillars in knowledge management (Uriate, 2008)

i) Management and organization

This is commitment at the highest levels of management. This commitment is absolutely essential to the success of any knowledge management initiative. Without such commitment, knowledge management initiatives are bound to fail. Sustained efforts to manage knowledge must permeate the entire organization, from the head of the organization down to the rank and file.

ii) Infrastructure

All knowledge management systems require a certain level of technology and infrastructure support to be effective. An adequate ICT infrastructure is needed in order to better create, organize, share and apply knowledge.

iii) People and culture

People are the bearers of tacit knowledge. And the sharing of tacit knowledge is crucial to the success of knowledge management. For this reason, perturbations in the composition of the workforce can have significant impact on the organization's performance. In order to ensure wide ranging participation of employees in knowledge creation and sharing, there is need to change traditional mindsets and culture from hoarding knowledge to sharing it. This can happen only when there exists a climate of trust within the organization and when employees feel secure about their employment.

iv) Content management systems

Content management systems include information assets both internal and external and systems that support the creation and administration of digital information. To ensure the proper functioning of the knowledge management system, programs for managing the content of web sites should be developed and implemented.

By combining these pillars, a management system for knowledge can be developed as a way of effectively storing and sharing knowledge. These systems are called knowledge management systems. In the next section, these systems are introduced and discussed further.

1.4 Use of Information Technology in Knowledge Management in Tea Processing

This section highlights on the use of information technology in knowledge management. Technology has provided a major stimulus to KM by implementation of KMS (Mital et al, 2013). Information technology that provides support to KM include databases decision support systems, enterprise resource planning systems, expert systems, management information systems, lesson learned systems and many others. Mital et al added that knowledge management system is an integration of information technologies for capturing, organizing, transferring and distributing knowledge.

In countries like Ethiopia where social networks are important factors in disseminating knowledge and information within the rural community, ICT kiosks plays a facilitating role and used by farmers to buy various goods and services(development brief report, 2012).

1.5 Knowledge management systems

Knowledge management system is a managerial, technical and organizational system structured to support the implementation of knowledge management within an organization (Massa and Testa, 2009). In this study increasingly, organizations see knowledge management (KM) as a valuable management initiative to enhance productivity and generate wealth (Campbell et al., 2012).

1.6 Tea industry in Kenya

The tea plant (Camelia sinensis) in Kenya can be traced back to 1903 when G.W.L, Caine, a European settler introduced the first seedlings from India and planted them in Limuru near Nairobi (Tea Board of Kenya, 2010). The cultivation of tea for

commercial purposes in Kenya commenced in 1924. The early settlers and colonial government restricted tea growing to large scale farmers and multinational companies because they wanted to maintain high quality. Africans were restricted from growing the crop. On the attainment of independence in 1963, the government passed various land reform bills that had far reaching implications on agriculture in the country. One of the implications was that Africans were allowed to grow tea.

1.7 Knowledge management in Tea industry and security

The following section will discuss the management of knowledge in tea industry.

1.7.1 Knowledge management in Tea industry

As companies search for ways to gain a competitive advantage, they are increasingly leveraging their knowledge capital. Most Kenyan tea is auctioned by factory name and grade at the public Mombasa Tea Auction Centre, resulting in direct feedback of market prices to factories and farmers (Brian, 2013). This indicates that, factories with best factory practices in tea processing will secure a wide market with best prices.

Knowledge management in agricultural sector is expected to focus on knowing what needs to be done to solve the problems in the sector or to exploit opportunities; how it can be done; the source of knowledge needed to succeed; and who can do it (ASARECA ,2009:10)).

There is need for tea industries to appreciate the essence of learning from new and experience technologies in order to gain competitive advantage. The definitions adopted by different academics that the “learning organization” is an organization which adopts specific strategies, mechanisms, and practices that encourage its

members to learn continuously so that they can adapt to the changing business environment" (Theriou and Chatzoglou ,2008).

The Kenya Tea Industry usually reflects the most challenging issues that face the tea industry in their meetings and conferences (Richard et al, 2014). Some of these challenges include a shortage of labor skills and retaining top performance employees. To counter these challenges, knowledge management can be one of the solutions.

1.7.2 Knowledge management and Security

Safeguarding of knowledge is key to in knowledge management. Trade secrets have to be kept highly confidential so that competitors do not have any access to it (Elisa et al, 2006). This means one needs to enforce access control in order to maintain confidentiality, availability of knowledge. Security for knowledge management is critical as organizations have to protect their intellectual assets. In order to safeguard this knowledge, appropriate security measures should be considered. Security methods for knowledge-management systems may include authentication or passwords, cryptography programs, intrusion-detection systems, or access control systems (Upadhyaya, 2006). Issues include insider threat (protecting from malicious insiders), infrastructure protection (securing against subversion attacks), and establishing correct policies, refinement, and enforcement.

Different methods can be applied in secure knowledge management. Upadhaya (2006:2) observes that secure knowledge-management (SKM) systems can be described in terms of the three Cs: communication, collaboration, and content. SKM systems act as a gateway to the repository of intellectual content that resides within an organization. SKM systems need to source and/ or provide access to knowledge that

resides in multiple machines across an organization or multiple organizations for collaborative efforts. Upadhaya (2006:5) adds that, secure languages are utilized to transfer information safely. At the same time, digital-rights management becomes critical in cross-organizational transfers of knowledge, while access control and identity management play an important role in securing the knowledge-management system.

1.8 Problem statement

In any organization, managing knowledge is a major challenge that has impacted on how individuals cooperate to make sure the organization fulfills its objectives. In KTDA managed factories, experts in a given field are relied upon to provide necessary services based on what they know. These personnel are expected to consult minimally as they are the ones relied upon in tea production. Also, it is important to note that their expertise cannot be consulted physically in case a problem comes up. Preliminary investigation by the researcher prior to formulation of the study problem indicated that most KTDA factories invest in their employees through trainings. Such trainings are usually funded by the respective factories to enable their employees attend in order to improve their expertise. An Inclusive Business Case Study (2014:1) carried out in KTDA indicates that these training programmes have been funded by KTDA in partnership with donors such as the Netherlands Ministry of Economic Affairs, Unilever, and the Sustainable Trade Initiative (IDH). KTDA is working toward developing a financially sustainable model for training provision. Within a factory set up, sometimes these expertise group that has been developed over time are not willing to be consulted or share expertise with other employees. In worst cases this expertise is lost through retirement, resignation, transfer to other factories, or

through natural attrition. This leads to permanent loss of such expertise due to lack of systems for retention and sharing of knowledge in KTDA factories. In order to minimize or eliminate knowledge loss, factories should have systems in place for knowledge storage and sharing. Dalkir (2014:1-5) observes that many organizations do not have knowledge management seamlessly woven within their fabric, and many organizations do not recognize or reward their employees for knowledge sharing activities. KTDA managed factories are no exception from this group of organization that offer no reward for knowledge sharing. In KTDA managed factories, the process of making knowledge on demand available to workers is challenging. Approaches for knowledge management are needed to keep expanding the knowledge base, retain knowledge when staff move on to new positions and to make it accessible by other employees. In order to tie together the benefits of knowledge management in tea processing, there is need for adequate ICT-based mechanisms for generating, capturing, and disseminating documented and undocumented knowledge to be developed in KTDA factories.

1.9 Aim and objectives of the study

1.9.1 Aim of study

The aim of this study was to develop web based knowledge management system prototype for Kenya Tea Development Agency factories.

1.9.2 Objectives of this study

The following were the research objectives of the study:

1. To determine the type of knowledge at KTDA factories.

2. To determine methods used in knowledge management and sharing in KTDA factories.

3. To establish the challenges experienced in knowledge management and associated systems in KTDA factories.

4. To model and build a system prototype that facilitates knowledge storage, processing, and sharing among the KTDA factories.

1.10 Research questions

This study was guided by the following the following research questions:

1. What types of knowledge are managed in KTDA factories?

2. How does KTDA factories manage and share knowledge?

3. What are the challenges faced by management during knowledge management in KTDA factories?

4. How best can an ICT based ststem be designed and developed to document and disseminate knowledge?

1.11 Assumption

In this study the following assumptions were made:

i) That the KTDA factories have expertise.

ii) That having knowledge repository in place will encourage knowledge sharing amongst employees of KTDA factories.

iii) That the KTDA factories were willing and able to adopt the system.

1.12 Significance of study

In this study a web based system prototype was developed for KTDA factories. This prototype could be developed in future into a complete system that can serve all sections in the factory. The system prototype may therefore provide a base for developing such a system.

This study may benefit different groups based on their interaction with the system. Users can create social group for knowledge sharing. It will help management to post new policy standard, new products and share their views with employees among others.

The system will act as a database for knowledge. As users interact with the system through sending questions, accessing response, and posting knowledge, these are stored permanently for future reference.

1.13 Scope and limitation

This study covers knowledge management in tea factories. The content of this study will therefore be limited to KTDA tea processing factories in Kericho County. The system prototype developed covers majorly tea processing. Other sections of the factory such as sales management, transport logistics, human resource, and accounts sections were not covered by this system. This was because the intent of this study was mainly to develop a system that can provide knowledge sharing related to tea processing. In this study, the knowledge of interest was that that touches directly on tea processing thus other sections were considered secondary to tea processing. Due to wide spread KTDA factories in Kenya; it was not possible to cover all factories due

to geographical distance. In that regard the study focused on the 6 KTDA factories in Kericho county.

1.14 Conclusion

In chapter one, a background to the study was described. The ownership and management of tea estates was highlighted. KTDA was noted as an agency that among other goals ensures that quality tea is processed by their factories. Management of knowledge tea industry was also described as that formed the major basis for this study. The problem statement of the study was also stated within which the objectives and questions of this study were developed. The following section gives a review of literature related to the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The intent of this study was to develop a knowledge management web based system prototype for the tea processing industry. This system is likely to provide a platform for knowledge sharing and interaction between users on knowledge related to tea processing. This chapter therefore reviews literature on knowledge, knowledge management, knowledge management in tea processing industry, and knowledge management systems. Based on the objectives of the study, this chapter is arranged into three major sections. The concept of knowledge including knowledge in tea processing industry is introduced in first section. Also theoretical framework is discussed in the first section of this chapter. The second section gives an overview of knowledge management, knowledge management processes and knowledge management techniques. The third section describes KMS, challenges and barriers in knowledge management, and design and development tools used in KMS development.

2.2 Theoretical framework

2.2.1 The Von Krogh and Roos model of Organizational Epistemology

Dalkir (2011:62) highlights that the Von Krogh and Roos KM model (1995) distinguishes between individual knowledge and social knowledge. Von Krogh and Roos takes an epistemological approach to managing organizational knowledge: the organizational epistemology KM model. In this model it considers that, the organization picks up information from its environment and processes it in a logical

way. The Von Krogh and Roos model also considers that, knowledge resides in both the individuals of an organization; and at the social level, in the relations between the individuals. The cognitive view of this model is that knowledge is viewed as an abstract entity while the connectionism view maintains that there cannot be knowledge without the knower. This fits nicely with the concept that tacit knowledge is very difficult to abstract out of someone. The connectionist approach of this model shows that individuals forms nodes in loosely connected organizational system and knowledge is an emergent phenomenon that stems from the social interactions of these individuals. Dalkir (2017:) stresses that, the connectionist approach appears to be more appropriate to underpin a theoretical of knowledge management especially due to the fact that the linkage between knowledge and those who absorb and make use of the knowledge is viewed as an unbreakable bond.

This model was adopted in this research because the web based KMS prototype that was developed provides a platform for interactions among individual users. The access points where the users will be accessing the system fits well with connectionist approach that considers individuals as nodes forming a network. In addition, this model considers that knowledge resides not only in the minds of individual, but also in the connection among these individuals. This underlines one of the reasons for knowledge sharing in the system developed.

The following are other competing models that may be applicable to similar studies.

2.2.2 Model of Knowledge Management Strategy

This model focuses on different factors such as knowledge management that is consistent with the overall philosophy of knowledge. This model is based on four

main elements of diffusion of knowledge, knowledge principles, application of knowledge, enhancing and revising knowledge (Debowski, 2006; 23). The following figure 2.1 shows an illustration of the knowledge management strategy model

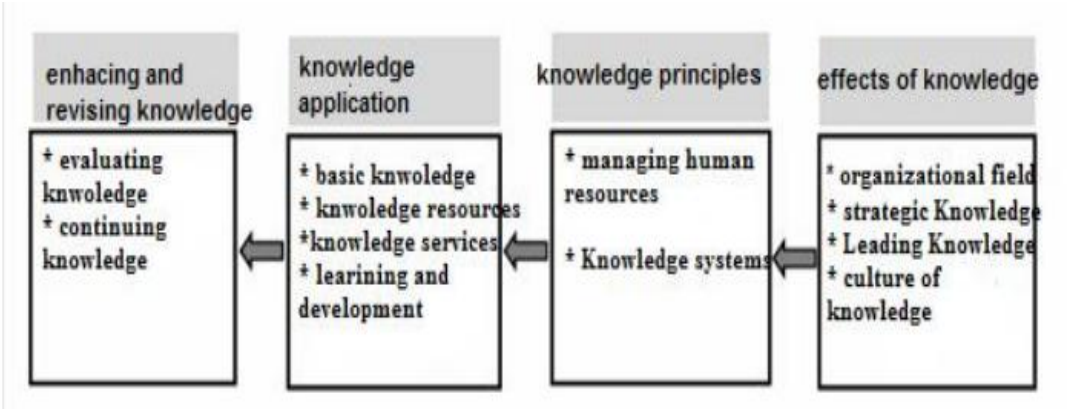


Figure 2.1: Knowledge management strategy model

Each of these stages is discussed below:

The effects of knowledge: In the above model, the issues related to organizational knowledge management model are shown. The effects of knowledge of the organization, both internal and external aspects of knowledge management will be examined in practice. In this regard, knowledge is the expression of strategic issues in which key principles and methods of knowledge management linked to the organization's strategic orientation are identified and explored.

Knowledge bases: Effective management of knowledge is based on entirely consistent robust systems, processes, structures, and policies and practices. Knowledge management must identify and create structures and systems that reasonably create, share and use knowledge effectively.

Application of knowledge: The way in which the implementation of organizational knowledge, support, and education is given is the main topics in the organizational knowledge management.

Enhancing and revision of knowledge: Knowledge management is a new topic that still needs both national and organizational development and evaluation. Evaluation and applying the knowledge in ways that enable the organization to maintain its growing trend , requires constant monitoring and permanently adapted to the circumstances under which it is used.

2.2.3 Wenger's Communities of Practice (CoP) Model

Wenger's Communities of Practice (CoP) is used to encourage interaction among the employees regardless of hierarchy, and availability of meeting rooms that are relevant to tacit KM. According to Wenger et. al. (2002:140) groups of people who have a shared concern or passion for something they do and learn how to do it better as they interact regularly in their domain of interest. To share knowledge members become actively engaged in a social learning environment in which they develop and spread new ideas in an attempt to improve professional practice.

2.2.4 The Inukshuk KM model

According to Girard (2005), the Inukshuk KM model was developed to help Canadian government department to better manage their knowledge. This model was developed by reviewing existing major models to extract five key enablers(technology, leadership, culture, measurement, and process).

2.3 Knowledge management

Cahyaningsih et al (2017:62), observes that knowledge management is one of organizational strategy to improve the organizational competitive value. Knowledge management is strategic issue in organization which believe can improve the organizational performance. Cahyaningsih et al added that, knowledge management (KM) can bridge the knowledge gap within people and organization . KM also can enhance the organizational learning to achieve their objectives with collaboration and cooperation among employee and institution align with their job and function in managing government human capital.

Tea handlers and their supervisors should be able know what must be done to achieve and maintained quality tea processing. According to Kenyan Constitution, provisions for protection of food in Kenya are found in a number of laws, but the bulk of provisions are contained in the Public Health Act Cap 242, and the Meat Control Act Cap 356 of the laws of Kenya. In Cap 242 subsection 4, food products must be processed, handled, packed, stored and transported or shipped hygienically and all necessary precautions taken to prevent recontamination. For any food processing industry, staffs must be well trained in relation to what they are handling. This will ensure that they produce quality products which are safe for consumption. In tea industry there, staffs should be equipped with sufficient knowledge required for tea processing. Due to knowledge dynamics and requirements in tea industry there is need to continually update and share such knowledge. The next section of this review describes knowledge and different types of knowledge.

2.4 Knowledge

Definition of knowledge may be traced back to the times of Aristotle when he tried to distinguish between “know-what” and “know-how” (Van (1991:23). The definitions of these constructs are as follows (Lundvall and Johnson, 1994)

- *Know-what* (sometimes replaced by know-that)- refers to knowledge about facts, for example knowing the ingredients of a recipe for a cake.
- *Know-how* – This equates to the capability of doing something.

The concept of knowledge has been debated since at least the time of the ancient Greeks (Jean et al, 2010).

Knowledge can be a result of what has been experienced through perception or generated through thinking and reasoning and which has been stored in memory (Brauner and Becker, 2006).

According to Uriarte (2008: 52) there are four types of knowledge

- Tacit
- Explicit

The above types of knowledge are described below.

i) Tacit knowledge

Uriarte describes tacit knowledge as personal and stored in the heads of people. This is accumulated through study and experience. It is developed through the process of interaction with other people. Tacit knowledge is part of a personal skill or capability

that individuals can rely on in their daily life without being aware of it, let alone understanding it (Kupers, 2005). Since tacit knowledge is highly individualized, the degree and facility by which it can be shared depends to a great extent on the ability and willingness of the person possessing it to convey it to others.

ii) **Explicit knowledge**

Uriarte describes this as knowledge that has been codified. It is stored in documents, databases, websites, emails and the like. It is knowledge that can be readily made available to others and transmitted or shared in the form of systematic and formal languages. They represent an accumulation of the organization's experience kept in a form that can readily be accessed by interested parties and replicated if desired. In many organizations these knowledge assets are stored with the help of computers and information technology. Explicit knowledge is not completely separate from tacit knowledge.

In view of these two types of knowledge, conversion of tacit knowledge into explicit depends wholly on the willingness and proper articulation of tacit knowledge from the owner. Uriarte (2008) noted that, the sharing of tacit knowledge is a great challenge to many organizations. It may be shared and communicated through various activities and mechanisms. These activities include conversations, workshops, and on-the-job training. Mechanisms include the use of information technology tools such as email, groupware, and instant messaging and related technologies.

Tacit knowledge should be properly managed to minimize its loss. The impacts of knowledge loss in an organization are the firm's credibility with the client (Carmel et al, 2013). Carmel et al added that, losing an expert's knowledge may mean the

company performs less well and is ‘‘at risk of producing low quality products. At times, special cases may happen where knowledge loss is inevitable such as retirement of employees. Old workers hold valuable knowledge of key industry players and resources, and tacit knowledge about company culture, politics and norms (Patel and Carmel, 2013). The range of experiences that this workforce builds up over time is another important component of organizational knowledge that older workers possess.

In conclusion, to minimize loss of knowledge, organizations should have a way of preserving knowledge. In tea factories, good performers and almost retiring employees may be requested to document their experience for future re-use. Such knowledge should be stored in a way that can be accessed and utilized in future.

There is need therefore to protect knowledge against loss and be treated like any other organizational asset. Knowledge is a valuable asset to an organization, be it an educational institution, a government organization, an industry, a corporate firm, non-government organization or any other organization (Biswanath et al, 2015). The obvious goal is to manage this knowledge in such way that it can be stored, shared, distributed and reused efficiently. It is therefore necessary to create quality relevant knowledge for dissemination.

In view of this, tea factories should be in a position to create new knowledge, store and disseminate such knowledge for sharing purposes. Knowledge may be developed from expertise group in a specific section of tea processing in order to maintain high quality products. For a tea factory to maintain its product in a competitive environment, appropriate knowledge already documented must be shared. For

effective use and sharing of this knowledge, there is need to have reliable systems that facilitates knowledge storage and sharing.

2.5 Knowledge management

KM envisages capturing, creating, using, reusing, sharing, disseminating and managing of knowledge, which comprises of three components as: i) people who create, share and use knowledge as part of their daily work and help shape a knowledge sharing organizational culture, ii) processes which include methods to acquire, create, organize, share and transfer knowledge to fit different situations, and iii) the technology including the mechanisms to store and provide access to data, information, and knowledge are created by people in various locations within a country or in different countries that must be integrated with the way people work, and address their real needs (Department of Health Research 2016).

Odor (2: 2018) notes that, It is no longer strange for individuals and organizations alike to appreciate that only organizations that are innovative will survive in very turbulent economic landscape. It is also a fact that innovations can only be achieved when an organization continuously learns and becomes a learning organ. A learning organization is characterized by the stock of both tacit and explicit knowledge which it has acquired over time and how the stock of knowledge is utilized. The stock of knowledge becomes useful only when it is shared and utilized for the overall improvement in all organizational processes and human capital enhancement.

Torabi (2017: 300) observes that, in order to boost organizational productivity, knowledge management should play a key role through the creation, sharing, dissemination and retention of knowledge and by offering the organization a superior

value proposition based on this knowledge. To create a knowledge sharing culture the organization needs to encourage people to work together more effectively, to collaborate and to share - ultimately to make organizational knowledge more productive. The purpose of knowledge sharing is to help an organization as a whole to meet its business objectives. Torabi (2017:301) adds that, accordingly, the knowledge anchored in employees' minds can get lost if they decide to leave the organization. The basis of Knowledge management is to find strategy that the right knowledge with the right shape are put in the right people. While highlighting on importance of knowledge Mohajan (2017:5) commented that through the application of successful KM, organizations can improve their effectiveness and can gain competitive advantage. KM helps in the decision making process for the benefit of a company. It leads to higher efficiency in terms of less duplication of work, followed by notably better performance, enhancing new staffs' capabilities and better quality decisions. Mohajan (2017:6) adds that KM is based on the thought that an organization's most valuable resource is the knowledge of its employees. Hence creation of new knowledge, sharing of knowledge in the organization and the best use of that knowledge effectively enhances the overall development of that organization both in short- and long- term period

Efficient management of knowledge would help the organizations to develop quality products and services, leverage the expertise and skills of workers across the organization, solve the intractable problems, increase network connectivity between internal and external experts, and improve the capacity of managing innovation and organizational learning (Biswanath, 2013). Organization theorists suggest that competitiveness can be reached when employees' collective knowledge is adequately

exploited (Syed, 2013). The ultimate aim of knowledge management is to achieve the organizational objectives, such as, competitive advantage, sharing the lessons learned, innovation and continuous growth of the organization (Gupta and Sharma, 2004).

For effective creation, management, distribution and sharing knowledge, appropriate tools should be used at every level. Tea factories can adopt some knowledge management tools and techniques to ensure that expert knowledge is shared effectively and efficiently. For tea factories to benefit from knowledge management, effectiveness of knowledge management depends on how knowledge management processes are aligned with an organization's infrastructure and processes, in a manner that supports the achievement of an organization's goals.

2.5.1 History of Knowledge Management

According to Uriarte (2008: 24), the early development of knowledge management came as a result of the work of a number of management theorists and practitioners such as Peter Drucker and Paul Strassman. In his article, Rhem (2013:6) notes that Peter Drucker and Paul Strassman stressed the importance of tacit knowledge as an organizational resource. Rhem added that, the work of Peter Senge, focused on the "learning organization" and emphasized the cultural dimension of managing knowledge This growing recognition of the importance of organizational knowledge led to an increasing concern over how to deal with exponential increases in the amount of available knowledge and the complexity of products and processes.

The following is an overview of the development process of KM (Gamble and Blackwell, 2001).

- The 1990s focused more strongly on releasing the competitive potential of human resources. Management was more concerned with the learning organization, reengineering, core competencies, market valuation and strategic information systems, intranets and extranets. Business process reengineering (BPR), therefore, led to a shift towards purpose, people, process (Ghoshal,1998),.

- The 2000s revealed that KM has emerged as a unifying corporate goal. The intention is to create enterprise integration through a knowledge-sharing culture, to recognize the value of intellectual capital and to understand that competition does not depend on the differential possession of physical assets, or even information, but depends on the ability to deploy and exploit knowledge.

This shows that knowledge management came into existence in 1990s.

2.5.2 Processes in Knowledge Management

Knowledge management is a practice adopted by most companies seeking efficiency and effectiveness of their administrative processes (Fabio, 2014). Knowledge management techniques may be important to formalize tacit knowledge through written procedures that should guide the sequence of repetitive activities. Formalization of knowledge allows the continuous improvement of processes that require the highest level of efficiency. Knowledge management may contribute to the improvement of organizational processes and projects by delaying the natural process of disorganization, and therefore, adopting knowledge management in organizations establishes a process of negative entropy.

Considering that the creation of knowledge is a process and knowledge is a strategic organizational asset, KM becomes one of the strategic pillars of organizations that seek to create value for its stakeholders (Al-Sudairy and Vasista, 2012:54). Structuring the process of managing this asset of organizations becomes essential for efficiency in cost reduction and better use of existing knowledge, and for the effectiveness in increasing revenue and creating new knowledge.

The following are processes of knowledge management (Fabio, 2014):

i) Knowledge creation

ii) Knowledge storing

iii) Knowledge sharing

iv) Knowledge application

Each of the above processes will be described briefly in the following sub section.

2.5.2.1 Knowledge creation

The processes of knowledge creation involves finding ways to convert documents, models, human insights and other artifacts into forms that make retrieval and transfer easy without losing the "true meaning" of the knowledge (Staples, 2001).

Researchers advocate for a shift away from the view that knowledge resides in individuals alone (Tywoniak, 2007). Considering that the creation of knowledge is a process and knowledge is a strategic organizational asset, KM becomes one of the strategic pillars of organizations that seek to create value for its stakeholders (Al-Sudairy and Vasista, 2012).

2.5.2.2 Knowledge storing

It is important for the organization to store created knowledge for future retrieval and reuse (Gevorgyan and Ivanovski, 2009). There is a need to find effective ways to store and organize knowledge that has been found (Grant, 2005). Tacit knowledge cannot be codified and stored in physical resources but has to be transformed into explicit knowledge (Boniface et al, 2006). Explicit knowledge which is stored in physical resources is more permanent than knowledge which is stored in the minds of individuals.

2.5.2.3 Knowledge sharing

Knowledge sharing is one of the building blocks for organization's success and acts as a survival strategy in this knowledge era (Witherspoon et al, 2013). Among the many processes of knowledge management cycle, knowledge sharing has been identified as the most significant process as well as the cornerstone for effective knowledge management (Yesil et al , 2013). Knowledge transfer requires the willingness of a group or individual to work with others and share knowledge to their mutual benefit (Syed et al, 2004). Without sharing knowledge, it is almost impossible to transfer knowledge to another person or group (Goh, 2002).

In view of challenges in knowledge transfer, the main reason for missing knowledge perception and knowledge transfer is often related to an unstructured approach (Keller and Kastrup, 2009). Keller and Kastrup developed a model for knowledge perception and knowledge transfer as presented in the following figure 2.2.

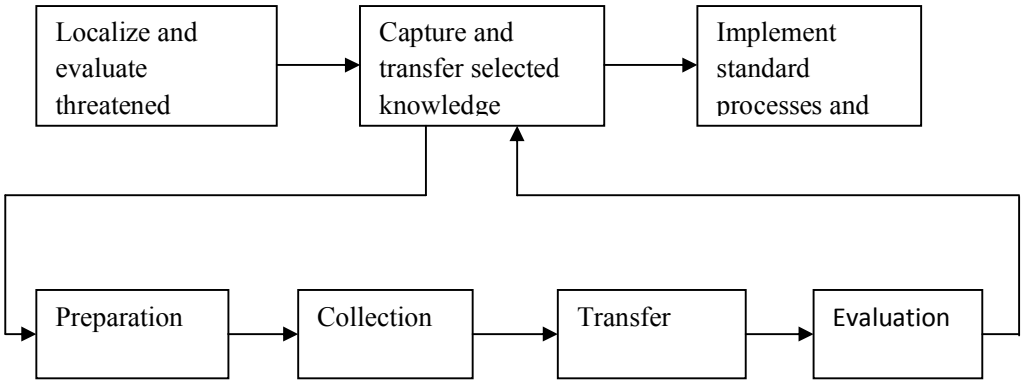


Figure 2.2: Model for knowledge perception and knowledge transfer (Keller and Kastrup, 2009:74)

According to the above model, the first step in the structured perception of knowledge in the organization is the localizing of the possible loss of knowledge. The areas and the involved employees need to be found and the projects need to be prioritized. The goal should be the identification of knowledge areas for transferring the knowledge and to embrace it in the organization as standard defined processes and actions.

The next step in the model of Keller and Kastrup is capturing and transferring of selected knowledge, which includes the subtasks of preparation, collection, transfer and evaluation. Projects need to be established in each of the steps with the knowledge holders to identify the acute need for action on the one hand and to get the support of the overall organization on the other hand.

The final step is the implementation of standard processes and activities that follow the first hand-over projects and are intended to be driven by the management. The handling of changes in the staff (managers or specialists) should become an accepted and lived process that is evaluated regularly to implement improvements as they become necessary. In the above figure, the capturing and sharing is of great

importance. This is a stage where relevant and useful knowledge can be captured and codified for efficient sharing. There are two knowledge sharing approaches that are commonly used (King, 2006):

i) **Codification perspective**: this presumes that knowledge can be disconnected from its source. It deals with the capture and storage of knowledge representations in electronic repositories independent of the individual who generated it. Electronic repositories which contain organizational knowledge facilitate knowledge transfer among the organizational members.

ii) **Personalization perspective**: this presumes that knowledge cannot be disconnected from its source. It implies that knowledge can be shared through person to person interactions. The interactions can be face to face with a shared context or mediated by technology as in email, instant messaging, and text messaging, video conferencing among others.

While highlighting the significance of sharing knowledge, Tywoniak (2007: 45) notes that sharing of knowledge reduces uncertainty, turns individual learning into organization learning, and prevents reinventing the wheel.

2.5.2.4 Knowledge Application

The individual sharing knowledge should be in a position to utilize knowledge by applying it in relevant sections. Ooi (2013: 853) notes that, knowledge application, which can also be termed as knowledge responsiveness, simply means a firm responding to the different types of information it has access to. Knowledge

application is a strategic competitive asset for the modern businesses. It is useful for promoting organizational innovation and supporting new forms of co-operation by applying the relevant knowledge acquired.

2.5.3 Knowledge Management Techniques

This subsection will present various techniques that may be applied in knowledge management. Knowledge management can be seen as an activity concerned with initiatives and strategies to manage knowledge in an organization's context (Syed, 2013). In this section knowledge management techniques have been categorized into information technology based and non-information technology based techniques.

The following are information technology based KM techniques (Gupta and Sharma, 2004)

i) **Groupware systems:** Groupware is a term that refers to technology designed to help people collaborate and includes a wide range of applications. These include communication tools, conferencing tools, and collaborative management tools.
ii) **The intranet and extranet:** The intranet is essentially a small-scale version of the internet, operating with similar functionality, but existing solely within the firm
iii) **Data warehousing and data mining:** Warehousing data is based on the premise that the quality of a manager's decisions is based, at least in part, on the quality of his information.
iv) **Content management systems:** They are responsible for the creation, management, and distribution of content on the intranet, extranet, or a website.

v) **Document management systems:** systems that aid in the publishing, storage, indexing, and retrieval of documents.

Gupta (2005: 6) identified the following non-Information technology based techniques used in knowledge management:

i) **Mentorship programs**: This program allows experienced senior employees to share their knowledge and experience with junior employees.

ii) **After action review**: This is a discussion of a project or an activity that enables the individuals involved to learn for themselves what happened, why it happened, what went well, what needs improvement and what lessons can be learned from the experience. Lessons learned are not only tacitly shared on the spot by the individuals involved, but can be explicitly documented and shared with a wider audience.

iii) **Project summaries**: This entail having that project team write a synopsis of their project work upon completion.

iv) **Centers of excellence**: These are knowledge centers which are formally centralized to synthesize and distribute the firm's knowledge.

v) **Regular intra-office or intra division meeting**: the purpose of these meetings is to bring together employees from different offices or different areas of the firm. Such interaction between desperate areas of the firm allows employees to exchange ideas and experiences and thus transfer knowledge between areas of the firm.

vi) **Communities of practice**: these are groups of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis.

2.5.4 Knowledge Management in Tea Processing Industry

In the Halal food industry context, the knowledge required by stakeholders are the knowledge that is related to the Halal status of the product which includes most of the supply chain knowledge(Siti et al, 2013). Tacit knowledge such as experience, intelligence and the experience of the staff that handle the production process is also depicted in the Halal process. The staffs that handle production processes must be aware and has a certain level of understanding about Halal requirements so that all the processes are complied with the Halal requirements. Organizational memory is found in an organization's physical artifacts, i.e., knowledge is externalized into documents, reports, intranets, and information systems (Beljic et al, 2013). This form of organizational memory is noted in the three companies: A (bakery), B (bakery), and C (beer and soft drinks). For example, company B (bakery) especially prefers this form of organizational memory, emphasizing availability and sharing opportunities for their policies, documents and plans. However, successful knowledge retention cannot be guaranteed since the companies need to apply a suitable strategy or method to manage their organizational memory. Tacit knowledge management approach is dominant in the companies due to craftsman skills, a need for social interaction since most employees do not have computers, and face-to-face meetings or training sessions with customers and suppliers. The only way to manage employees' knowledge is to directly observe or discuss with them how they maintain the equipment, how they prevent waste, and how they use raw materials and energy.

2.6 Challenges and Barriers in knowledge management

Most important competitive assets for most enterprises are the skills, expertise, and experience of their people, and it is incumbent upon them to offer people the facilities they need to better gain, retain, use, and convey their knowledge (Murphy and Verma, 2008). If the human is not considered enough in the strategy of knowledge management barriers will come up and the success of every knowledge management initiative is in risk (Richter, 2008). One of the barriers to knowledge management was inadequate motivation among others. The quality and the quantity of work of an employee are influenced mainly by two important factors: the individual skills and willingness to use them. Therefore it should be in interest of each organization to encourage development of both of these skills especially through motivation by rewarding positively those who share knowledge.

Weak and unsupportive management affects knowledge management in any organization (Keller and Kastrup, 2009). In their view, leadership was the essential success factor of good knowledge management.

The fear of losing power is also another challenge in knowledge management as observed by (Richter, 2008). “Head monopoly” and the related attitude to work with knowledge brings fear of losing power. The view on this term is explained by the opportunity of someone, who has a specific knowledge and is able to use it to influence something in the organization.

The axiom “knowledge is power” has been a major resistance point to knowledge sharing and therefore, it must always be kept in mind that overcoming these barriers can only be created by establishing a mutual understanding (Menken, 2009). One of

the approaches to resolve this challenge is to go into greater detail and clarity of the plan, the solution, and the intended outcomes. Personal reactions are simple anxiety for the future, which are related to the loss of job, loss of influence, resentment on any implied criticism over performance, or resistance to authority. Dealing with such kind of resistance requires a personal path of discussion assuring the individual of the positive benefits of the program.

2.7 Knowledge Management Systems (KMS)

This section gives a description of knowledge management systems in reference to design and development from a general perspective, modeling of a knowledge management system, and tools for knowledge management systems development.

Knowledge Management Systems (KMS) are systems that manage or provide access to knowledge artifacts (Crowsto, 2005). Knowledge can come from various sources, internal and external to the organization. KMS process knowledge originating from members of the organization, regardless of the knowledge seekers; examples are customer self-service applications like online help services, frequently asked questions sites, and simple information provision about a company. These systems might provide a service that external users can access though it may not be open to external contribution of knowledge artifacts.

2.7.1 Components of a Knowledge Management System

According to Liebowtz (2012), knowledge management is combined by three components: people, process and technology.

- People are about how to create and nurture a knowledge sharing environment and culture in the company.
- Process is about managing the knowledge management processes and aligning knowledge sharing with the daily work of the employees.
- Technology is about creating a unified platform for the employees to communicate and share knowledge.

2.7.2 Modeling Knowledge Management System

Knowledge modeling is a cross disciplinary area that deals with approaches to acquire, refine, analyze, capture, model and describe knowledge in a way that facilitate its preservation and to ensure that it can be aggregated, substituted, improved, shared and reapplied (Biswanath et al, 2015). Modeling approaches aim at a formal description or prediction of the human-computer interaction. Models are produced to represent both the current system and data structure and the required system and data structure (Donald, 2004). They enable detailed investigation to be made of the requirements and the design before money is spent in actually producing the system. Knowledge management system comes to existence as a flexible network of interdependencies between elements generating business environment, knowledge sharing and KM processes, and ICT media, which contribute to the enhancement of the company performance (Agnieszka, 2009). Agnieszka modeled knowledge management system as shown in Figure 2.3 below:

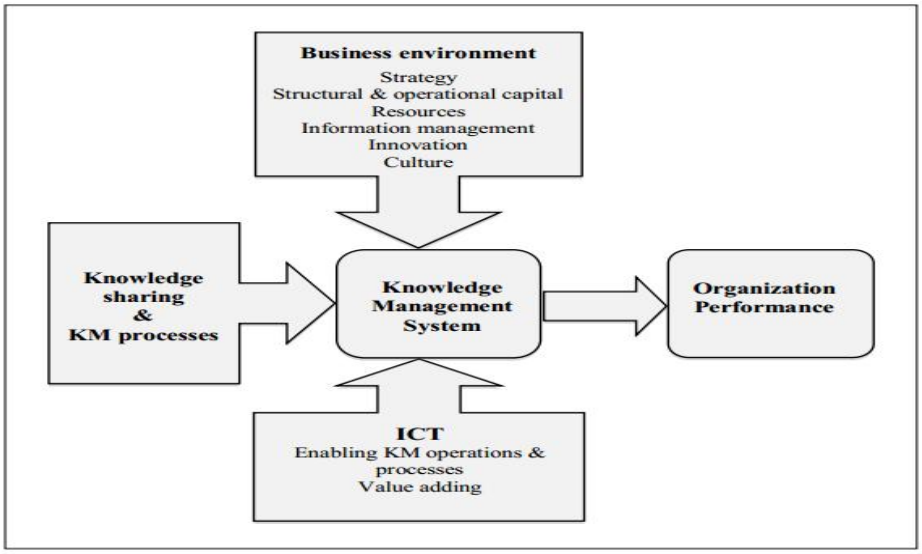


Figure 2.3: Agnieszka Comprehensive knowledge management system model (2009, 75)

The above model shows the main contributing factors during knowledge management system development and the impacts of the system. Agnieszka (2009) argues that the created knowledge management system should be able to face the complexity of company's business environment through incorporating all KM processes into the organization's strategy, operations and activities.

A new group of web-based information management tools has emerged based on freeform social software that enhances individual knowledge work, group communication, and collaboration (Syed, 2009). These tools include:

i. **Blog:** Blogs are most commonly used as an online version of a personal journal. Essentially, a blog is a web page that contains periodic, chronological ordered posts, additionally grouped by categories.

ii. **Tags:** Tagging is essentially a form of social book marking. It allows users to tag or categorize web pages with words they create. When tagging a particular page, one can see words others have used to categorize the page, thereby synchronizing our own categories with others to create an overall order.

iii. **Wiki:** A wiki is fundamentally a web of interlinked pages where each page typically contains a concept (a name) and a description of that concept (an article). Users are allowed to edit any part of the article, modify the description, add new names, add external links and add links to names (and their corresponding articles) that do not exist yet. The most well known example of a successful wiki is Wikipedia.org, a free online encyclopedia composed of articles written by the general public.

These tools may be applied to develop a knowledge management system.

2.7.3 Developing Knowledge management system

In system development, we are mainly concerned with the actors that interact directly with the system-to-be, including end users and other systems (Marsic, 2012). However, all stakeholders have certain goals for the system-to-be and occasionally it may be appropriate to list those goals. Knowledge management system is integration between the technologies and mechanisms that are developed to support the processes in the Knowledge Management (Achmad et al, 2010). To design an effective knowledge management system, there is need to identify key stakeholders both within and outside the company; identify sources of expertise that are needed to design, build, and deploy the system successfully while balancing the technical and managerial requirements.

All software, especially large pieces of software produced by many people, should be produced using some kind of methodology. Even small pieces of software developed by one person can be improved by keeping a methodology in mind (Mike, 2005). There are a number of phases common to every development, regardless of methodology, starting with requirements capture and ending with maintenance. The following system development phases may be followed during system development:

- **Requirements:** This is about discovering what were to be achieved in the new piece of software.
- **Analysis:** This refers to understanding the current system and the system to be developed.
- **Design:** This is working out how to solve the problem.
- **Specification**: It describes the expected behavior of the programming components.
- **Implementation:** Writing pieces of code that work together to form subsystems, which in turn collaborate to form the whole system.
- **Testing:** Software must be tested against the system requirements to check if it fits the original goals.
- **Deployment:** This getting the hardware and software to the end users, along with manuals and training materials.
- **Maintenance:** This deal with faults (bugs) and removing them.

The features of knowledge management system architecture are grouped into six principal feature sets where each set contains specific tools (Staniszkis, 2004). Figure 2.4 below illustrates the architecture.

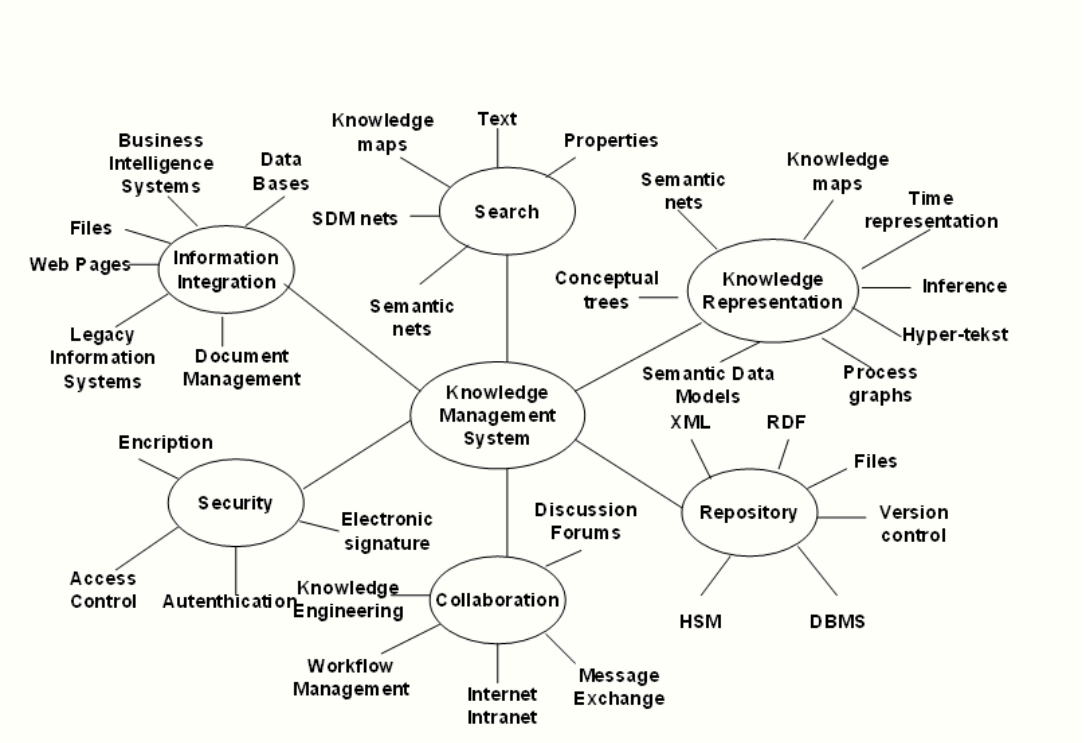


Figure 2.4: Knowledge management system architecture, Staniszkis (2004:4)

The figure above shows the building blocks of a knowledge management system.

2.7.4 Knowledge management system development Tools

There are three kinds of physical systems that are necessary for a KM to be a core capability (Tiwana, 2002). These are capture tools, communication tools, and collaboration tools. Each of these tools is briefly described below.

2.7.4.1 Capture Tools

These tools help in acquiring, codifying and storing structured and explicit knowledge. Examples of such technologies are intelligent databases, note-capture tools, electronic whiteboards, and the associated DBMS.

2.7.4.2 Communication Tools

One of the major responsibilities of communication tools is to enable viewing of documents irrespective of their formats, operating systems, or protocols. This is why intranets, which are platform independent, are extremely valuable for communicating knowledge an organization.

2.7.4.3 Collaboration Tools

Collaboration is the formal sharing of ideas, thoughts, and opinions centered on arriving to agreement (Menken, 2009). The agreement does not have to be formal, such as a contract, nor does the environment hosting the collaboration have to be formal.

2.7.5 Studies on KMS development

In Zimbabwe, Tarambiwa and Mafini (2017:88) observes that there is a general acceptance that Knowledge Management Systems (KMS) are a primary source of

value and have taken a center stage in the definition, operation and performance of most business organizations. However, their use within the manufacturing sector in developing countries remains inconsistent. A study that was done in Zimbabwe by Tarambiwa and Mafini(2017:88) indicated that the availability of both information technology centered and social centered KMS influences export performance by improving the firm's export strategy, export commitment, export orientation, export growth, export sales, export profits and export market share.

In Poland, Kłos(2017: 15) notes that, while managing knowledge, product and process innovations determine the competitiveness of manufacturing enterprises. The evaluation of a prototype of a new product or technology is a very-important process which sets the strategy of manufacturing or service enterprise development. Research-and-development-processes are expensive and time-consuming. But the most important for a manufacturing or service enterprise is the effectiveness of these processes (as measured by the market success of a product or innovative technology)

In Bangladesh, Mohajan (2017: 1), notes that through the application of successful KMS, organizations can improve their effectiveness and can gain competitive advantage. KM helps in the decision making process for the benefit of a company. It leads to higher efficiency in terms of less duplication of work, followed by notably better performance, enhancing new staffs' capabilities and better quality decisions.

According to Soniewicki (2017:78), there is a number of problematic issues related to KMS. Firstly, it is difficult to support actions in the area of tacit knowledge with their help, as they rather concentrate on its explicit elements. here are exceptions, such as various, modern communication tools or those supporting group work like the

example of British Petroleum (BP), which uses videoconferences to share experience of their best specialists. Problems or lack of positive effects in the sphere of KMS are often caused not directly by these tools, but by lack of processes that those could support.

In his study Nevo (2012: 5), highlighted the following shortcomings in most of the KMS.

1. Content management tools: tools that offer abilities to integrate, classify, and codify knowledge from various sources.

2. Knowledge sharing tools: tools that support sharing between people or other agents.

3. Knowledge search and retrieval systems: systems that enable search and retrieval of knowledge discovery abilities.

These three problems should be resolved in order to attain more effective use of KMS. However, in his study Nevo (2012) focused only on identifying required meta-knowledge. Nevo associated meta-knowledge with organizational memory. Therefore, to identify required meta-knowledge he adopted the theoretical basis of another collective memory called transactive memory. Transactive memory is based on the distinction between internal and external memory encoding.

British Petroleum's knowledge management approach is encompassed by a simple framework, which describes a learning cycle before, during and after any event which is supported by simple process tools (Chowdhury and Ahmed, 2005). The

following figure 2.5 shows architecture for British Petroleum knowledge management.

Figure 2.5: Architecture for British Petroleum knowledge management, Chowdhury and Ahmed (2005, 67)

The above figure shows that systems can learn based on inputs and feedback which finally affects its outputs.

Chowdhury and Ahmed (2005) add that goals of the organization affects the results of the system.

2.8 Developing secure KMS

Information security is a nonfunctional property of the system; it is an emergent property (Marsic, 2012). One of the challenges in knowledge management is maintaining security (Zhou, 2010). Zhou (2010) argues that Security for knowledge management is critical as organizations have to protect their intellectual assets. Knowledge sharing and knowledge transfer operations must also enforce access

control and security policies. To safeguard knowledge against theft, secure knowledge management is a necessity (Upadhyaya, 2006). Upadhyaya(2006) adds that when organization fails to protect its externalized organizational knowledge from theft, the organization will lose its competitive advantage. Although all data and information systems in organizations must be protected using authentication, cryptography, intrusion detection or prevention, and access control mechanism, particular attention must be paid to protecting strategic knowledge resources. A model for ensuring secure knowledge management in health care is shown in the figure 2.6 below (Chadwick and Mundy, 2007).

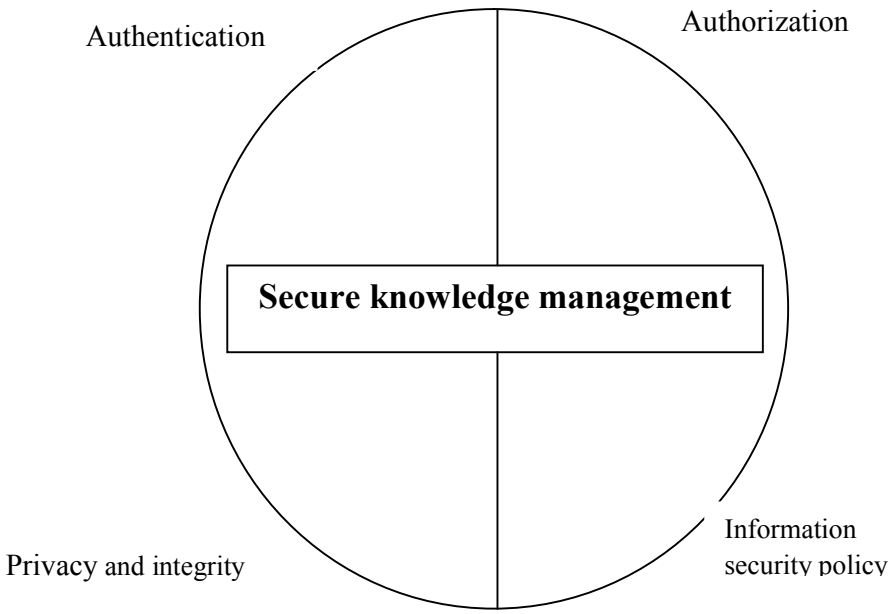


***Figure 2.6: Model for a secure knowledge management (D.Mundy, D.W.Chadwick, 2007*)**

Chadwick specifies the following components of secure knowledge.

Authentication: Security measure designed to establish the validity of a transmission, message, or originator, or a means of verifying an individual's eligibility to receive specific categories of information.

Authorization: The rights granted to a user to access, read, modify, insert, or delete certain data, or to execute certain programs.

Data security (privacy): protection of data from unauthorized (accidental or intentional) modification, destruction, or disclosure.

Data integrity: Condition that exists when data is unchanged from its source and has not been accidentally or maliciously modified, altered, or destroyed

Information security policy: organizational guidelines, rules, regulations, and procedures that are used to protect an organization's information.

The above components may be adopted during design and development of a secure knowledge management system. Similar objectives have also been developed by other authors, for example;

The main objectives of information security are (Marsic, 2012):

- Confidentiality: ensuring that information is not disclosed or revealed to unauthorized persons.
- Integrity: ensuring consistency of data, in particular, preventing unauthorized creation, modification, or destruction of data.
- Availability: ensuring that legitimate users are not unduly denied access to resources, including information resources, computing resources, and communication resources.
- Authorized use: ensuring that resources are not used by unauthorized persons or in unauthorized ways.

2.9 Developing a web based knowledge management system prototype for KTDA

2.9.1 Web based systems

Worwa and Stanik (2010:2) observe that in recent years, the Internet and World Wide Web (www) have become ubiquitous, surpassing all other technological developments in our history. In that time, the Internet has evolved from primarily

being a communications medium (email, files, newsgroups, and chat rooms) to a vehicle for distributing information to a full-fledged market channel for e-commerce. Shahpasand and Rahimzadeh (2018:144) notes that, rapid changes in the knowledge management (KM) area are substantially dependent on the considerable progresses made by the mankind in the information technology (IT) during these years. In fact, Internet of Things (IoT), as part of the applied technologies in the IT world, has rendered feasible the fast growth and sharing of knowledge.

- In their study, Gillman and Hagmann (2017:9) developed an integrated KM system model geared towards improving performance of its users. The model is described to constitute five inter-connected functions that form the foundations of the system: information management, monitoring and evaluation, communication and innovation, which together support rapid learning and adaptation. Gillman and Hagmann adds that, It provides for a continuous improvement process involving all members of project teams, who learn, try out new ways of doing things, reflect, share their wisdom, and then change and adapt their projects to become more effective and successful. It is geared primarily to the needs of project managers and teams and their counterparts in development organizations and government bodies. The following figure 4.8 shows an illustration on how the system works.

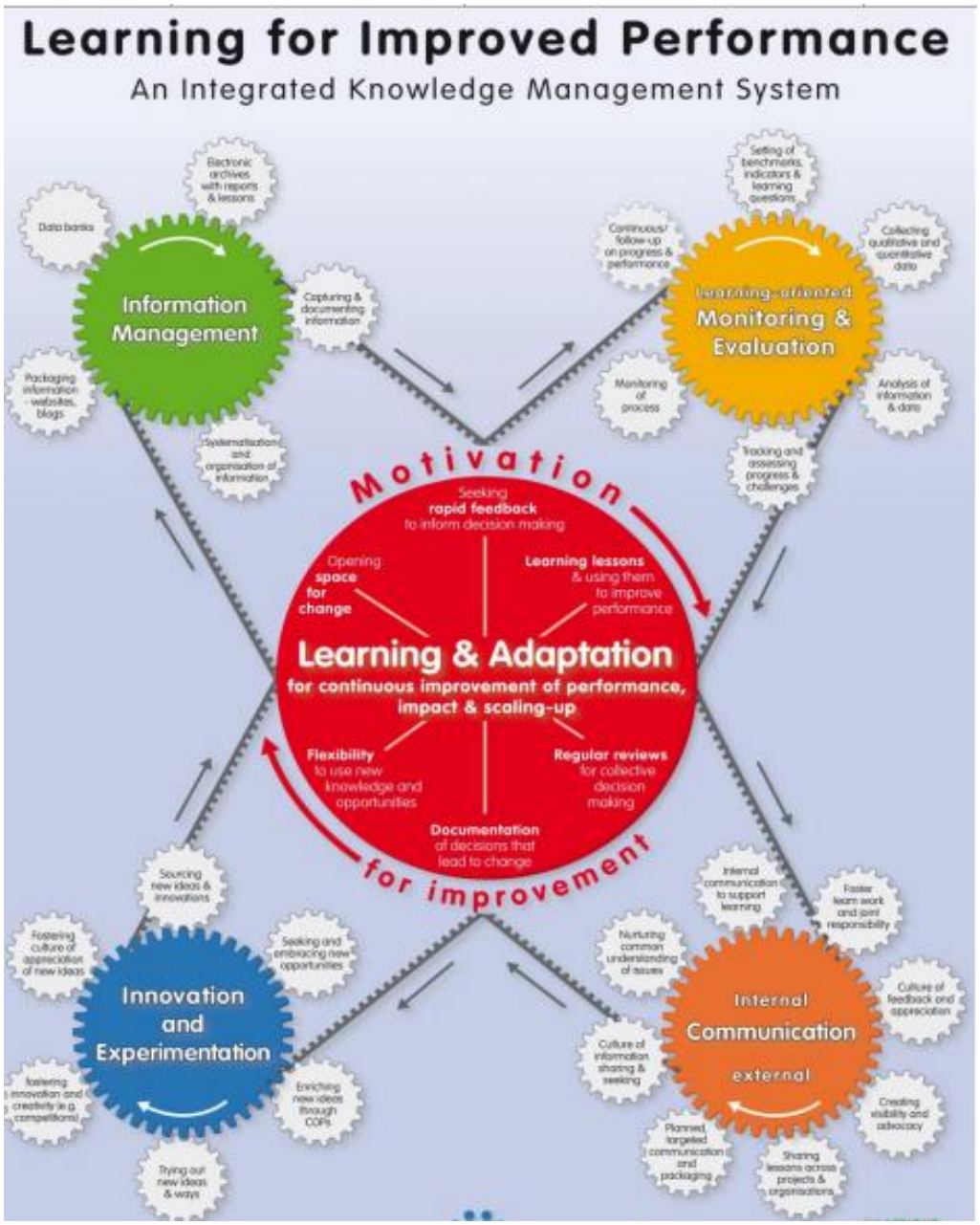


Figure 2.7: Model for an integrated KM system

While developing the knowledge management web based system prototype for KTDA, the above model was considered for incorporation of major components such as information technology, learning process, and improvement of performance. In this

system, factory employees from different sections are expected to benefit from the system.

2.10 Knowledge Gap

From the literature reviewed, it was revealed that there are KMS in some food industries but specifically none has been developed for KTDA tea factories.

2.11 Conclusion

Knowledge management in industries is of importance in knowledge documentation, storage, retrieval, and sharing. In tea industries where variables have to be controlled for quality processed tea, professionals should be in place to oversee the whole process. This shows the need for proper documentation of knowledge. While developing KMS appropriate models should be used in order to develop useable system. The system interaction with users should be made user friendly. The following chapter will describe the methodology that was used in this study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methodology that was adopted in carrying out the study. It details the research design, the target population as well as the sampling design that was used to get the required number of participants. During data collection process, semi- structured interviews and documented records were used. This chapter also highlights how piloting was done before the actual data collection was carried out. Before concluding, the chapter describes how data analysis was done and the system prototype was developed.

3.2 Research Design

The target population in this study was composed of tea factories operating within the Kenyan tea processing sector. These factories were managed by Kenya Tea Development Agency. To select the sample, a combination of the cluster and a purposive techniques were used. Firms were clustered according to their respective counties. Thereafter, tea factories were selected using the purposive sampling technique. The sample consisted of 6 tea factories from Kericho County. From the sampled factories, a random sample of employees from different sections of tea processing was picked. The final sample was composed of 50 respondents from 6 tea factories and were sampled from both production and management team.

3.3 Instrumentation and Data Collection Procedures

Data were collected by means of a questionnaire. The questionnaire was divided into two sections: one section for management and other section for production staffs.

During the process of data collection, ethical considerations were enhanced, namely participant's rights to anonymity, voluntary participation, confidentiality, right to answer or not to answer question, and protection from victimization were followed.

3.4 Study population and sampling

At the time of this study there were 66 registered KTDA tea factories in Kenya. In view of this, the population consisted of 66 KTDA factories. While sampling tea factories, purposive sampling was adopted. During sampling process, 6 factories were picked that were located in Kericho County. These factories were chosen due to high production and quality tea products from this county. Also, due to expansive coverage of KTDA factories in Kenya, cost and time could not allow a complete coverage of the 66 factories.

The KTDA managed factories were chosen because of the following characteristics:

a) They are among first tea processing factories to be established in Kenya. In this study, these factories provided wealth of data which has been build for a long time contrary to recently established factories.

b) KTDA factories have consistent quality management in tea processing.

c) KTDA factories have the same mission statement. These factories were guided by one mission and thus there was homogeneity in their production policies.

Respondents were chosen from each factory that were from different sections in their respective factories. A total of 50 employees were taken through interview schedule. The respondents were expected to reduce as the interview progressed depending on the answers they give during interview.

In the case of employees from sampled factories, random sampling was adopted where employees were asked to pick papers labeled YES or NO. For each group, YES labeled papers represented 75% and 25% represented the NO labels. In this case, 75% was chosen so as to have a good representative number for data collection. The 75% was also guided by the fact that some sections in the factory had fewer employees. For example, if in Factory A, there were 13 employees in the production unit. In view of this:

Expected YES labels = 75/100 x13

=10 employees to be interviewed

Expected NO labels = 13-10

= 3 employees not to be interviewed

In this study, those who picked YES papers were interviewed while others with NO papers were not interviewed for any given section of a factory. Finally a total of 50 employees from all the 6 factories were interviewed. In this case, all sections of tea processing were considered.

3.5 Data collection methods

This study adopted qualitative research approach in which semi structured interviews and document review were used as data collection methods. The following is a description on how these tools were used during data collection process.

3.5.1 Semi structured interviews

In this case the researcher used an interview schedule (see appendix) with a set of questions on some specific areas and processes to be covered. During the interviews, the researcher asked the interviewee semi structured questions. In instances where answers given by interviewees necessitated clarification then the researcher could ask another related or extension of the original question. For example a question like "*How do you acquire knowledge in case of new job allocation in tea factory*?" could be asked. Then depending on the response, this question could be extended by asking interviewees to mention those concerns in ensuring that new employees get inducted into new jobs.

In this study, semi structured interview was preferred over structured interview because interviewer gains a broader understanding of the interviewees world view. While using semi structured interview, it was easy to get in depth understanding of specific fields of tea processing due to ability to such clarifications when necessary. Before the start of each interview, an introduction to the background and purpose of the research project was highlighted, it also included a description of how the answers would be used and that the answers would be anonymous, which hopefully made participants confident to contribute more of their views. Different interview schedules (see Appendix I) were used with different individuals as they had different roles and were interviewed on different topics. For the purposes of comparability and validity of conclusions, the same questions were used in different interviews when asking on the same topic.

The interview schedule was developed to ensure quality and consistency of the discussion. The schedule followed the sequence below.

i. Thanking the interviewee for taking his/her time to participate in the interview.

ii. Explaining the purpose of the research study and the interview

iii. Conducting the interview based on the semi-structured interview schedule.

iv. Ensuring the interviewee had the opportunity to ask questions

v. Closing the interview by thanking the participants and asking if it would be possible to contact him/her again in case any further questions.

The above sequence of events gave the interviewee confidence to participate during the interview process

In order to supplement interview data, in depth-document research was also done as described in the following sub section.

3.5.2 Document Review

The interview data were supplemented by document review. The different types of documents that were used as sources of data were publications, letters, diaries, newspapers, journals, and factory statistics. Most KTDA factories produced pamphlets and reports annually detailing on the quality tea produced by different factories. The pamphlets also explain conditions and processes that favors quality tea. Before these documents were used, they were sorted according to titles. After sorting those documents, specific documents were then picked for review based on the

objectives of the study. In this case, those documents that covered on tea production requirements, tea products and factory policy for quality tea, and knowledge sharing techniques were studied. Before the documents were reviewed, documents were first grouped based on topics they cover. By doing this, some documents were left out that did not touch on issues on tea, tea processing, knowledge, and KTDA factories. For example, on quality tea standards, a document for review was picked then a topic covering quality tea standard was studied. Through studying these documents, relevant data were recorded for analysis.

3.5.3 Piloting the Instruments

During piloting, the interview schedule was tested in order to determine if results required were obtained. Before this was done, five people who were not involved in its construction were requested to read through and see if there were any ambiguities. The five people were to ensure clarity and also that the desired data could be collected through the interview. By way of confirmation, questions were altered accordingly and then administered in two factories which were not part of the 6 sampled for the study. Interviewees were then taken through the interview and their responses recorded. These responses were analyzed critically to discover whether there were still ambiguities and whether responses were as expected. After piloting, it was observed that the pilot interview obtained data required though with some minor ambiguities. The interview questions affected were altered before the actual interview was carried. The following shortcoming were identified and corrected:

Interview structure- the original interview structure was in a continuous prose. Questions were then corrected and re-structured according to the objectives of the

study. Also questions were reorganized based on objectives already identified. The original and corrected copy of interview guide for management appears in the appendix II.

3.6 Analysis of data

The intent of this study was to develop a Web based system prototype for knowledge management in KTDA tea processing factories. In view of this, 6-KTDA managed factories were sampled for data collection in relation to knowledge management. Gall et al (1996) suggests the following approach for analyzing qualitative data:

i. Interpretational analysis: This examines data for constructs, themes and patterns that explain the phenomena;

ii. Structural analysis: This searches for patterns in the data with little or no interference as to the meaning of the pattern;

iii. Reflective analysis: This uses intuition and judgment to evaluate the phenomena.

Following these suggestions, the data collected were analyzed through interpretational analysis. After every interview schedule, a summary of each interviewee response was done. This was entered into a pre design table in order to capture main issues highlighted by the interviewee and any emerging issues if any. Through this method, results were tabulated in order to identify themes and patterns that may explain a certain objective of the study. Based on patterns derived from tables appropriate interpretations and conclusions were made.

3.7 System development

In this study, iterative development methodology was used. This methodology was adopted because it allows us to iterate over the phases, moving backwards and forwards, or round and round, as the need arises (Mike, 2005). The development phases of this methodology were then divided into manageable phases as follows:

3.7.1 Features of knowledge management system

The knowledge management system developed was to provide storage and sharing of knowledge platform among others. The system should therefore allow users to register as new users, log in and interacts with other users. The system that was developed has the following features:

i. The system provides users a interface where they can share knowledge, search knowledge and view contributions from other users;

ii. Allow users to communications through e-mail, instant messaging, and chatting. This ncludes posting questions and providing solutions to already posted questions;

iii. File transfer or file swapping; and

iv. Remote login that is the ability for a user, administrator and other interested parties to login remotely and their requests processed remotely. This includes the use of mobile phones for login and processing of requests by administrators.

The above features of KMS were basically considered while identifying the system requirements.

3.7.2 Functional Requirements

In this system, the stored and shared knowledge is mainly on tea production. It is therefore the intent of this study to benefit people in tea factory by providing a way on how they can interact and have a chance to view what others have been doing for best tea production. In view of the objectives of this study and the desired features of the KMS, the following are functional requirements of the knowledge management system: register system users, login users, search for knowledge, share knowledge, upload knowledge, and display a summary of registered users. These functional requirements were then used later in this study to model the system by using use case diagram. This model describes the system from user perspective, that is, what users can do with the system and how the system response the users

3.7.3 System Analysis

This stage involved proper understanding of the existing KMS; their strengths and weaknesses with intent to understand how a web based KMS will be designed and developed. This included understanding the needs and nature of users from management team to production. During system analysis, employees were interviewed in order to have an understanding on how existing systems were used. Also at this level, it was possible to determine system requirements from the possible challenges faced by users while interacting with existing systems.

3.7.4 System Design

Design is essentially the process of taking the documented requirements and translating them into an implementable computer system. In this phase, how to solve the problem (design and development of a web based KMS) at hand was worked out.

While working out on how to solve the problem, major decisions were made based on experience, estimation and insight, about how the system was developed and how it was deployed. The system was broken down into smaller subsystem to ease problem solving. Breaking down of the system into subsystems was based on the system requirements. Each sub systems solved a specific problem. For example system *log in, interface design* and *knowledge search* were considered as subsystems that were coded independently before they were integrated into bigger unit system. It was at this level where technologies to be used were considered. The following table 3.1 show the major subsystems and technologies that were used to develop.

Table 3.1: Subsystems and Technologies

Subsystems	**Technology used**
System log in	PHP
Database	My SQL wamp and PHP
Knowledge search	PHP
Posting/Uploading/Downloading	PHP and HTML
User registrations and approval by administrator	PHP and Html
Users and new knowledge summary	PHP

The system design was divided into two parts:

i. Logical design and,

ii. Physical design

In this study, these design levels were done as follows:

i) Logical design

This was to represent the various forms for data entry and web interfaces for user-system interaction. During logical design, forms used for user registration, knowledge entry, and user login were designed. This design level was necessary in order to ascertain and confirm the extent of information necessary to be captured by a given form. Logical design was mainly done by use of diagrams.

ii) Physical design

This was the stage where the logical design was transformed into physical system requirements specification. The already designed forms in the logical design were then transformed into computer designs by using tables and forms. The physical design forms are programmed in a way that they can accept user input. For example the logical database was structure was transformed physical database design as described below:

3.7.4.1 Database design

In this study, relational database is composed of different related tables. These tables contain information such as registered users, tea processes, and factory best practices among others. While designing these tables, primary key was identified for the purposes of relationships. The following are major tables that were designed for this system:

i) User registration

ii) Knowledge posting

iii) User login

iv) Registered users

v) Posted knowledge

The above tables were contained in a common database for easy access and centralized management.

3.7.4.2 User interface design

Interface forms point of interaction between the user and the system. The user friendliness of the interfaces was considered in depth in order to provide users a way of entering information into the database with eased. This interface was first drawn on a paper and critically checked for any missing attributes that may have been erroneously left out. This also assisted much in identifying the logical order of data entry.

3.7.5 Implementation

This is the stage where writing pieces of code that work together to form subsystems was done. These subsystems in turn collaborate to form the whole system. This coding was done in accordance to system design using the languages below.

3.7.5.1 MySQL Database Server

This is a structured query language. It is a relational database management system (RDBMS) that runs as a server providing multi-user access to a number of databases. MySQL was used in coding and developing database in order to support storage and sharing of knowledge. This code was written in a way that supports user requests such as searching of specific knowledge, uploading of knowledge and keeping a list of users. MySQL was therefore applied to hold information on tea processing, knowledge requirements for processing different quality tea products, conditions for

quality tea processing, emerging issues on tea processing, and suggestions from other users. MySQL was used because it can store knowledge effectively. Provide statistical data for stored data, and knowledge can be retrieved easily. Also MySQL enables users to query the system.

3.7.5.2 PHP

This was used in developing the back end of the system. This was used to write codes that assists users to connect to database so as to post requests, upload and download knowledge. It was also used developing searching tools. PHP was used mainly to write programs that enabled users to connect to the database.

3.8 Modeling tools

According to Mike O'Docherty (2005: 116), the need to amend project artifacts iteratively is a strong justification for the use of a software tool. Such a tool should allow members of the project team to produce the artifacts and then to store them. Development tools in this study were used mainly to support traceability, change history, multi user access control, and networked operations. UML has 13 diagrams but in this study the following diagrams have been used:

i) **Use case**: This was used to describe how the system was used its users or by other systems.

ii) **Communication diagram**: This shows collaborations between objects. This was used to describe the process of accessing specific knowledge over the intranet. It involves a user log on, goes to menu and specifies knowledge reference. Feedback is given based on search.

3.9 Conclusion

This chapter provided an overview of methodology that was used in developing the KMS. The methodology ranges from data collection techniques to system development. This chapter also highlighted technologies that were used in developing the system. Over the years, tea manufacturing industry has realized new industries coming up with different tea processing techniques but producing a common product with varied quality attributes. Development of KMS will enhance knowledge sharing amongst the old expertise and new employees. The following chapter presents and analyzes data that was collected using data collection and analysis techniques already described in this chapter.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, AND INTERPRETATION

4.1 Introduction

This chapter presents analysis and interpretation of data collected from employees of different tea factories as explained in chapter three. During data collection, there was need to explore the current systems, and technological and organizational mechanisms for capturing and sharing of knowledge. In this chapter, the presentation of data is done according to the objectives of the study. The first part of the chapter captures the respondents' profile then followed by a presentation, analysis and interpretation of data under the thematic areas derived from the objectives.

4.2 Respondents' profile

As observed in chapter three, the interview schedule targeted two groups: management and production teams. Other than participating in face to face interviews, the management team was targeted in order to a provide access to documentations such as journals. The production team provided information in relation to knowledge acquired in the sections where they work in. In addition, production team also highlighted on knowledge management techniques, knowledge sharing and knowledge requirements in tea factories. Employees in the other sections of productions gave general overview on how knowledge was transferred within the factory. Their responses revealed that most employees posted to new sections were expected to observe and emulate other workers. It was in this way that learning took place continuously throughout the tea production process until each employee had sufficient knowledge in their various fields of operation. Employees contacted in the

lower level of production, indicated that they had no specialized knowledge in tea production when they were first employed. They added that they gained required knowledge through induction, seminars and taking instructions from their supervisors.

4.3 Type of knowledge at KTDA factories

The first objective of this study was to establish the type of knowledge at KTDA factories in KTDA factories. In order to achieve this objective, the respondents were first asked whether it was necessary for them to have specific knowledge to work in the sections in which they worked at the time of data collection. The following chart gives a visualization of percentage response.

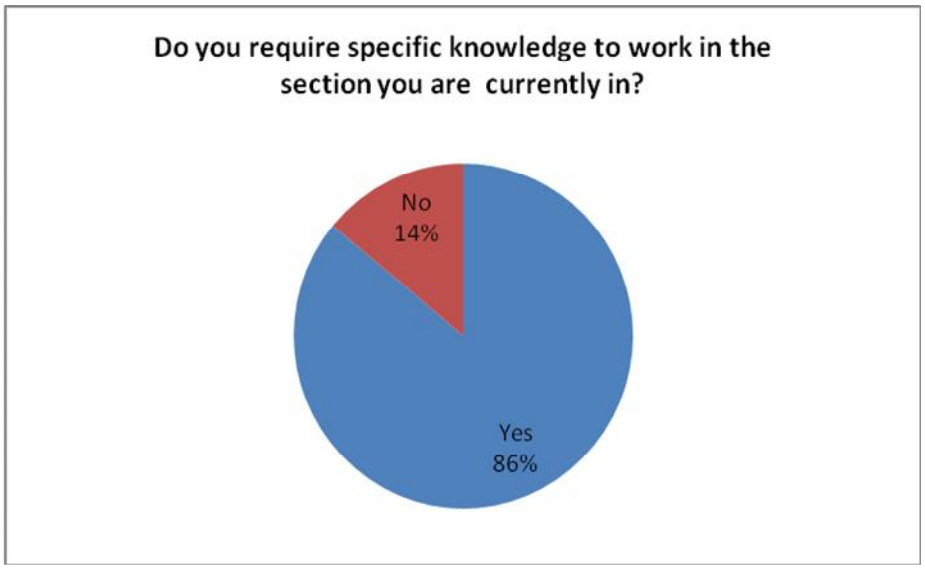


Figure 4.1: Do you require specific knowledge to work in the section you are currently in?

The results show that 86% of respondents require knowledge to work in specific sections. This response shows that employees should have knowledge in order to work in specific areas of the factory. These results shows that the respondents opinion was that they required knowledge to work in specific areas of the factory. As

highlighted in chapter two (section 2.3), the construct of *know-what;* which refers to knowledge about facts is quite necessary for employees. For example controls on quality tea. Fourteen percent of the respondents indicated that they did not require knowledge. This shows that, not all employees required knowledge to do what they do. Respondents, which were 43 out of 50, who revealed that knowledge was a requirement, were further asked to specify the type of knowledge

Respondents were then asked to specify knowledge they required. The following table 4.1 gives a summary of the interviewees' response.

Table 4.1 knowledge requirement (N=43)

Knowledge	**Section**	**No. of Respondents**	**Percentage response**
Green leaf colour and texture	**Withering**	**11**	**26**
Frequency of turning green leaf.	**Withering**	**9**	**21**
Van operations	**Withering**	**7**	**16**
Grading of tea based on quality and size.	**Sorting**	**6**	**14**
Boiler operations	**Boiler**	**4**	**9**
Fermentation temperature and tea color	**Fermentation**	**3**	**7**
Tea quality	**Quality control**	**3**	**7**

Table 4.1 above, reveals that different sections in the factory required specific knowledge. In this study, 26% of the respondents in withering section indicated that knowledge of green leaf and its texture was a requirement. This means that knowledge on green leaf and its texture is a requirement in withering section. Also 21% of the respondents added that frequency of turning green leaf during withering is part of required knowledge. This means that employees working in withering section should know how frequent they should turn green tea. Fan control was also knowledge required in withering as revealed by 16% of the respondents. The withering section marks the start of processing in the factory and should be done in accordance to set standards for best quality tea. In sorting section, it was also revealed by 14% of the respondents that grading of tea based on quality and size was required knowledge. This meant that employees working in sorting section should know how to grade tea according quality and size. In addition to above knowledge, boiler operation, fermentation temperature, tea quality was cited by respondents as knowledge required in tea processing factory. As noted in chapter one (section 1.2.3), tea processing undergoes different process before a final product is obtained. The response in table 2 above is therefore closely related to those processes already highlighted in chapter one. In tea production, sorting section requires that individuals should have knowledge on quality attributes that aid in sorting such as size of tea granules and taste. One of the respondents noted that: "some *sections in this factory like boiler and fermentation require people who have good understanding to operate we are few here"*.

In pursuit of the first objective of this study, there was need to find out from respondents whether there was anybody in charge of ascertaining that employees have specific knowledge requirement. The following chart gives a summary of responses.

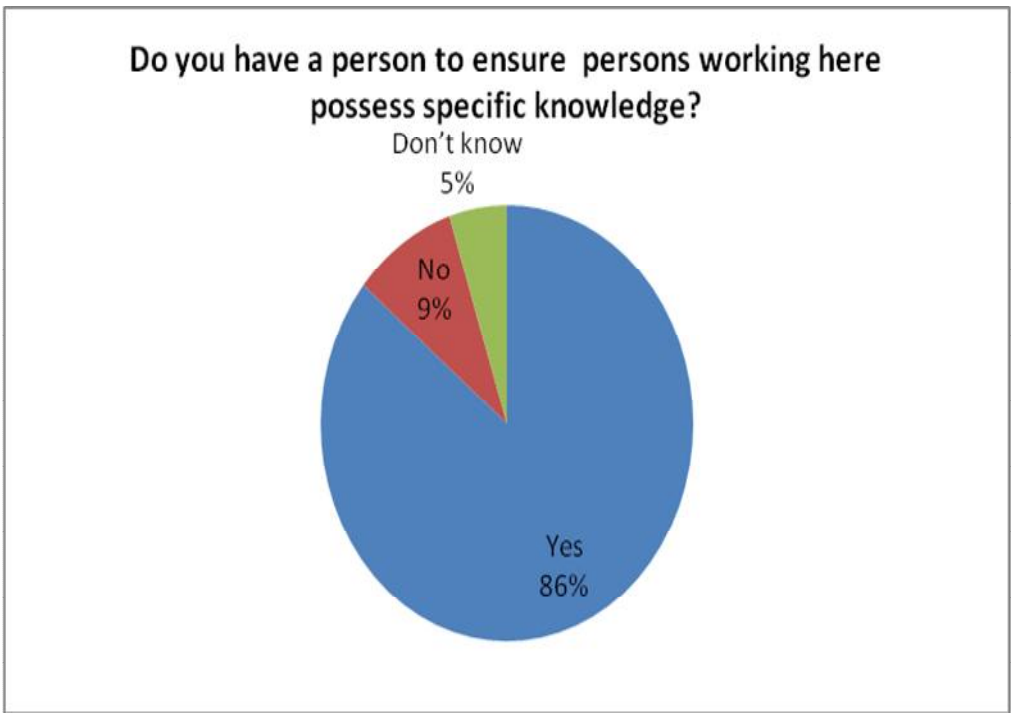


Figure 4.2: Do you have a person to ensure persons working here possess specific knowlwedge?

From above chart, it is clear that 86% of the respondents agreed that there were personnel in the factory who ensured that employees working in specific sections possessed relevant knowledge necessary for them to work in their sections. The 86% response was aligning to the need of quality products in the food factories by ensuring that employees possess specific knowledge. As indicated by literature in section 2.4.4: In the Halal food industry context, the knowledge required by stakeholders was the knowledge related to the Halal status of the product. Also 9% of the respondents indicated that there was no one in charge of sections to ensure that employees

possessed specific knowledge. Additionally, respondents were asked give examples and elaborate on sections that did not have persons in charge. Respondents mentioned sections such those placed on job targets such as packaging. Respondents highlighted that anyone could work in such sections as long as a person was willing to learn.

4.4 Methods used in Knowledge management and sharing among KTDA employees

The second objective of this study was to determine methods that were used in knowledge management and sharing in KTDA factories. In order to achieve this objective, various questions were asked. The first question asked whether there were employees who were experts in a certain section of tea production. The following bar graph shows a visualized summary of results.

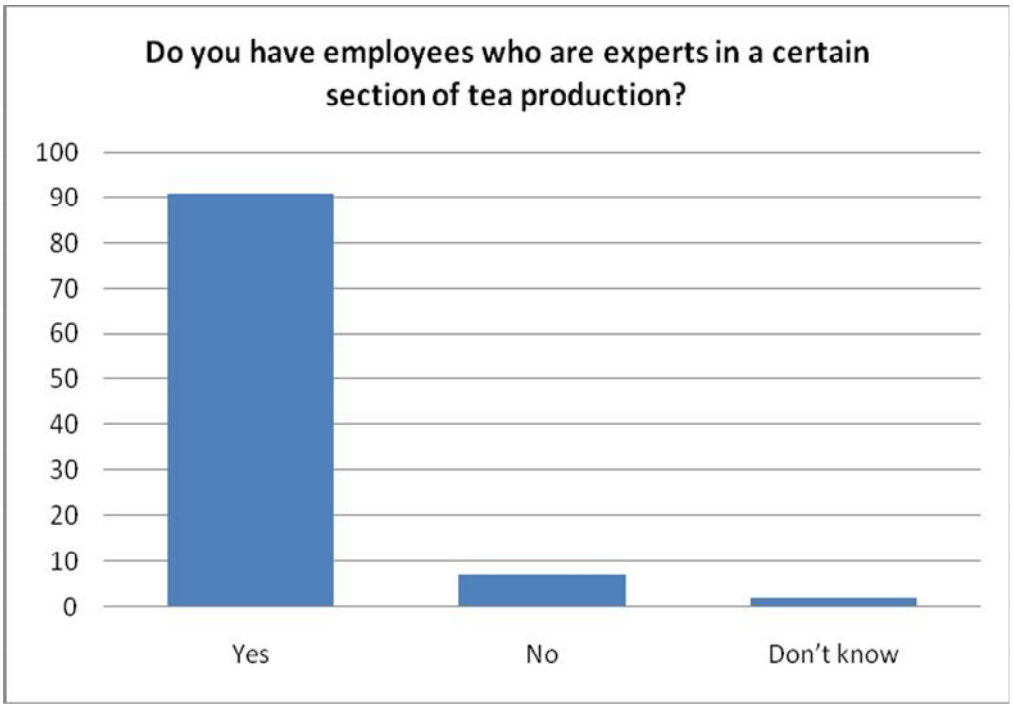


Figure 4.3: Do you have employees who are experts in a certain section of tea production?

From figure 4.3 above, most of the respondents (91%) revealed that there were experts in certain sections of tea production. Since the respondents were from different sections of the factory, it implies the experts were widespread in different sections of the factory. In this study, this was interpreted to mean that most sections in the factories have experts who could be consulted incase other employees are faced with challenges during factory processes. As noted in literature (section 2.4), organization theorist suggest that competitiveness can be reached when employees collective knowledge is adequately exploited. Other 7% of respondents indicated that there were no experts in their sections. Also the absence of these experts in some sections, may not necessarily guarantee knowledge sharing. In view of this scenario, a question was posed to respondents to establish the willingness of employees to share knowledge.

In order to determine whether employees in tea factories shared knowledge, the second question asked whether employees were sharing knowledge in their factories. The following figure 4.4 gives a summary of response.

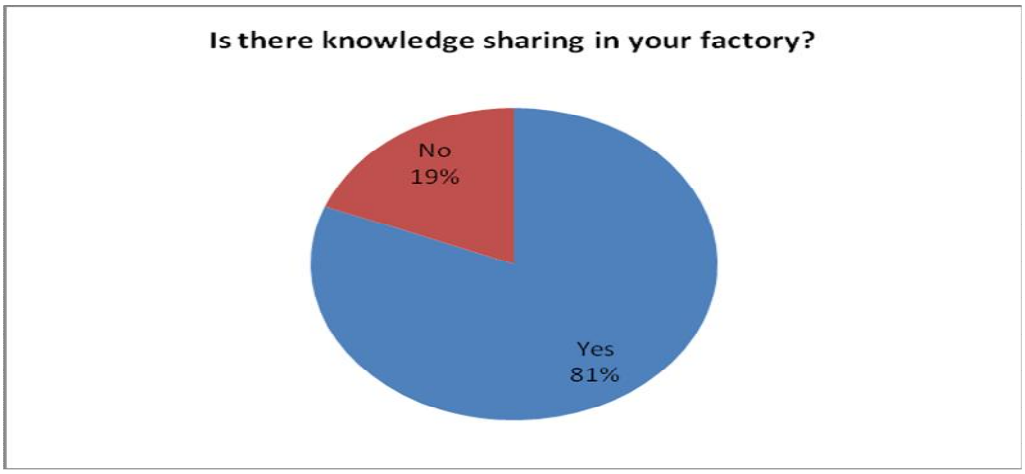


Figure 4.4: Is there knowledge sharing in your factory?

Figure 4.4 above shows that most respondents indicated that there was knowledge sharing within their factories. In view of this response, there is a possibility that a framework for knowledge sharing exists. The response of 81% also indicates that there was knowledge transfer in those factories. As discussed in section 2.4.2.3 of literature review, Goh (2002:27) notes that without knowledge sharing, it is almost impossible to transfer knowledge to another person or group. Since knowledge existed in those factories that should be done in an efficient and reliable way in order to maximize its benefits. After establishing that there was knowledge sharing in factories, there was need to determine how knowledge was shared by employees. The respondents were asked to give an overview on how knowledge was shared in their factories. The responses are summarized below.

Figure 4.5: How do you share knowledge in your factories?

The results as visualized from figure 4.5 above shows that there are methods used to share knowledge in the factories. The existence of this methods and that employees are aware about, provides a ground for developing improved ways of sharing knowledge. Reports and mentorship was cited by most respondents. These by the look seem to be important ways currently used in factories to share knowledge. These results also hint a gap that exists in terms of usage between the different methods of knowledge sharing. For example reports were cited by 86% while journals were cited by 26%. In view of these results, a system that integrates these methods may be developed.

In addition to what was presented in figure 4.5 above, respondents were asked whether they have witnessed employees leaving the factory and if that was the case, respondents were asked to elaborate on how expert knowledge remains within the factory.

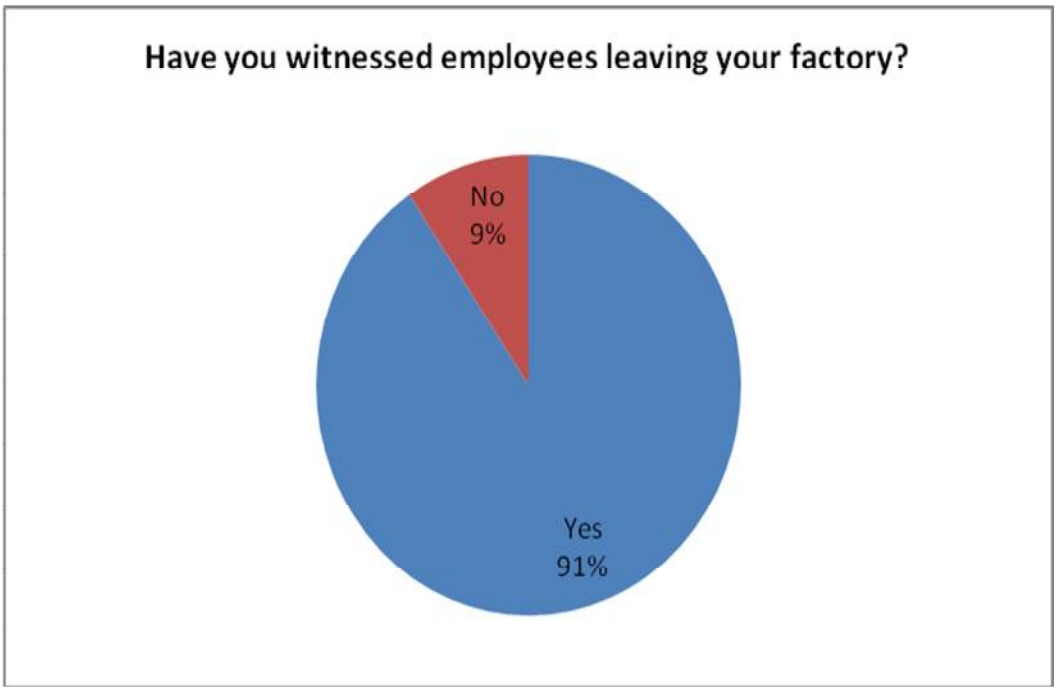


Figure 4.6: Have you witnessed employees leaving your factory?

It is clear from 4.6 above that most of the respondents have witnessed employees leaving the factory. Many responses acknowledge the fact that there are employees leaving the factory. These results confirms what was highlighted in section 1.1 of this study, that is, Calo (2008:412) comments that as employees head for retirement, many knowledge-intensive organizations will be faced with a continuous loss of unrecoverable valuable knowledge if a process to capture that knowledge is not implemented. In view of this results, there is need to develop a methodology to curb knowledge loss due to employees leaving the factory.

After establishing that employees exit factories, it became necessary to ascertain through interviews how a factory ensured that the knowledge remained in the factory. In order to achieve this, employees were asked to explain how their factory

management ensured that knowledge remained within the factory when they left. Table2 below gives a summary of responses.

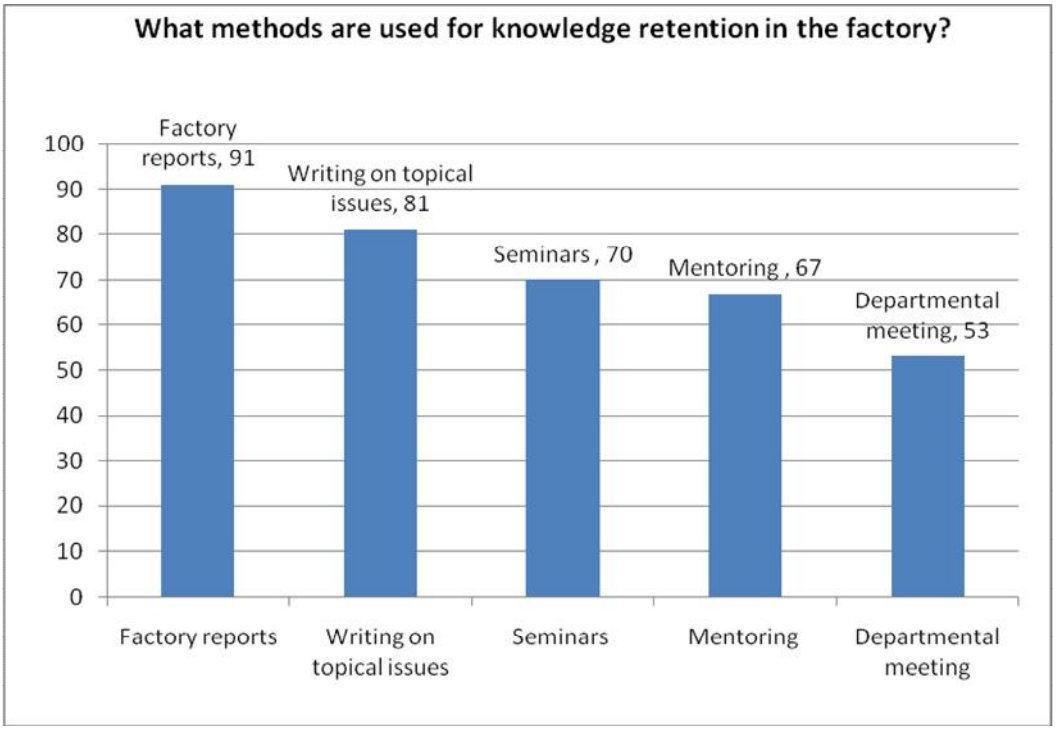


Figure 4.7: What methods are used for knowledge retention in the factory?

Results as visualized from figure 4.6 above indicate that factories have methods used for knowledge retention. This shows that there is already existing framework for knowledge retention within the factory. This provides a foundation for developing an efficient integrated system that accommodates the already existing methods of knowledge retention. To improve on storage, access, and availability of knowledge retained using the above methods, electronic database can be used in such a way that it can be accessed by employees. Such databases can be accessed through a stand alone, online or in a distributed system.

As a way of enhancing knowledge sharing, it was necessary to ascertain from respondents if there were challenges faced during knowledge sharing. The following section will highlight challenges faced knowledge management.

4.5 Challenges faced during knowledge sharing and knowledge management at KTDA

4.5.1 Challenges faced by respondents

The third objective of this study was to establish the challenges experienced in knowledge management in KTDA factories. In order to achieve this objective, questions were posed to respondents to determine whether they faced challenges during knowledge sharing and entire knowledge management process. The following chart gives a summary of the responses:

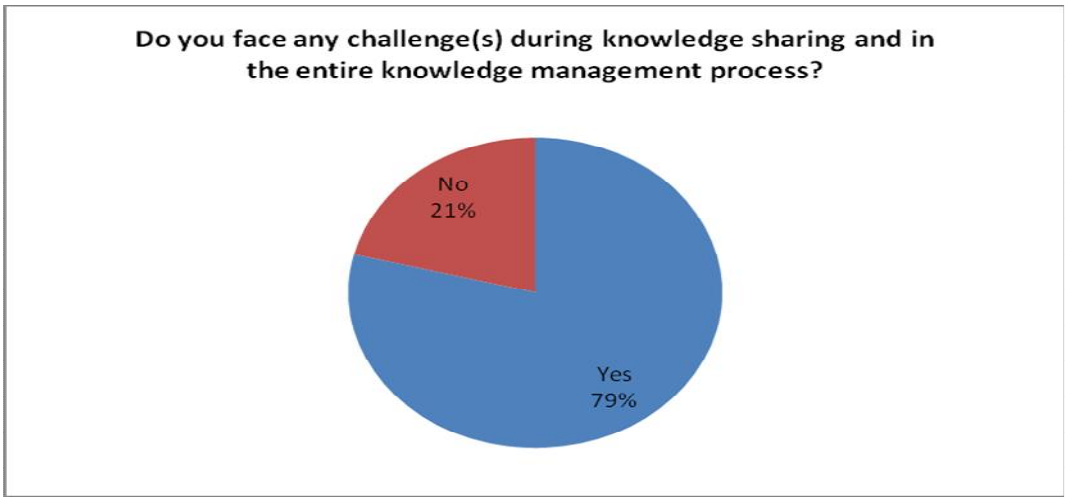


Figure 4.8: Do you face any challenge(s) during knowledge sharing and in the entire knowledge management process?

From figure 4.7 above, 79% of the respondents said that they faced challenges in knowledge sharing and the entire knowledge management process. This shows that, from the current framework of sharing knowledge, there is room for improvement or even developing a new system that minimizes or eliminates the challenges. From this response, the researcher asked the respondents further to highlight the challenges that they faced during knowledge management. The following challenges were cited by the respondents:

- There was limited time to exchange ideas and experiences in there working areas due to nature and intensity of work within the factory. On completion, they might not have a chance to share or review the day's work. They added that workshops, seminars, meeting, and mentorship programs are occasionally organized and not all employees attend. In order to benefit all employees, they recommended that notes should be availed through a central point where everybody can access,
- Communication barrier; some employees have communication related challenges. While employees are attempting to share knowledge, they noted that language was limiting factor.
- Some employees took knowledge as a personal tool that sustains them in a given job. Knowledge workers did not want to give up their autonomy and anonymity, and lose control over personal assets they had developed.
- The top management's lack of support and commitment to knowledge sharing also restrains employees from implementing new ideas into their work.
- Computer illiteracy: this limited employees from typing their work for the purposes of printing.

Respondents noted that, the above views posed challenges during knowledge sharing and management.

From the current system, a number of system requirements were revealed including:

i) Manual systems were used for knowledge management in the tea processing factories. The manual system integrated the of journals, reports, notices, face-to-face interactions, and seminars. Journals and reports were usually printouts that were either produced quarterly or annually. Factory employees from different sections could borrow those printouts and later return them.

ii) There was minimal addition or sharing of knowledge due to:

- Lack of a common platform: As indicated above in section 5.1, those employees willing to share their knowledge could do so by sketching on a paper. This was then transferred to be printed before they were physically filed.

- Fear of losing job: Employees believed that it was the tacit knowledge that made them remain relevant within the factory.

The above points posed a major challenge to knowledge sharing in KTDA factories.

iii) Minimal sharing of documented knowledge: This was due to bottlenecks encountered during knowledge request and search.

In view of the above challenges in the current manual system, a web based system prototype for knowledge management system was designed and developed. The following section describes the requirement analysis of the web based system prototype for knowledge management.

4.5.2 Suggestions for solving the challenges

Respondents were further asked to suggest ways that could be used to counter or minimize the challenges they experienced in sharing of knowledge. The following were proposed by respondents:

- Providing knowledge sharing platform: Respondents suggested that there was need to have a common point where employees could interact freely for the purposes of sharing knowledge. Some respondents suggested that factory management should make use of social media, create website, or provide computers connected to internet for chatting.
- Encouraging employees to participate in knowledge sharing: Employees needed assurance on job security. Employees were concern that some of them were not given opportunities to participate in seminars, topical writing and works. They suggested that management should provide free Wi-Fi services for online communication using smart phones.
- Accepting employee's raw formats of sharing knowledge: Respondents suggested that someone to be identified to ensure that knowledge shared were refined for reuse. They added that knowledge should be stored safely in a central point for easy access.
- Buying mobile phone airtime for employees: This was suggested mainly to assist employees to discuss issues online. One of the respondents commented that: "some of we have smart phones but cannot chat online concerning sections we works .management should buy us airtime to access internet "

- Providing internet services: Respondents claimed that provision of internet would ease knowledge sharing. Some respondents were of the view that, if knowledge could be stored centrally in an electronic database, online access could help in sharing such useful knowledge. Others were of the view that factory website could be develop for knowledge storage.
- Provide guide notes for new employees.

The proposed solution by the respondents will be considered during system design and development.

4.6 Conclusion

In this chapter the respondent's views were analyzed and interpreted. The respondents brought out issues related to how they manage knowledge in their factories. The respondents highlighted the challenges they face while sharing and managing knowledge. Based on challenges that were raised by respondent, the following section of chapter five will discuss an harmonized solution to the problem. The following chapter will discuss the design and development of a web based knowledge management system.

CHAPTER FIVE

SYSTEM DESIGN AND DEVELOPMENT

5.1 Introduction

The aim of this study was to develop a web based system prototype for knowledge management in KTDA tea processing factories. This chapter presents the design of the system based on the requirements already discussed in chapter four of this study. After designing the system, the actual coding will follow in order to have a functional system. The following section will describe the requirements of this system.

5.2 Current system

From the data presented in chapter four, it was found that KTDA factories sampled used manual systems to document and share knowledge. In the manual systems, employees first prepared drafts of knowledge on a paper. This knowledge was then typeset and edited before a final copy was printed. The hardcopy output was then filed in a specific physical filing system for future use. In this case, the filing systems were categorized depending on knowledge they stored. Different files with different amount of knowledge were securely kept in filing cabinets. The cabinets were manned by a person who ensured availability and integrity of knowledge. Employees shared this knowledge by requesting the person in charge for access. Before access was permitted, employees were supposed to identify themselves by name and section they work in. The employee attributes were then verified for appropriate action, that is, deny or allow access. Upon allowing access, employee picked knowledge of interest for a specific period and later took back source document for storage. At that

level, employees had two options; either to request knowledge or terminate the requisition.

In view of the current system, the following were challenges encountered during knowledge sharing:

- There was limited sharing of similar knowledge at a given time due to insufficient printouts.
- It was not easy to manage the system; knowledge creation and update were challenging.
- The system sometimes erroneously authenticates the user.
- It expensive to maintain the system due high rate of wear and tear of knowledge materials was high.

These points gave an indication of system requirements that were used for design and development of the new system.

The figure below illustrates a conceptual overview of the current system.

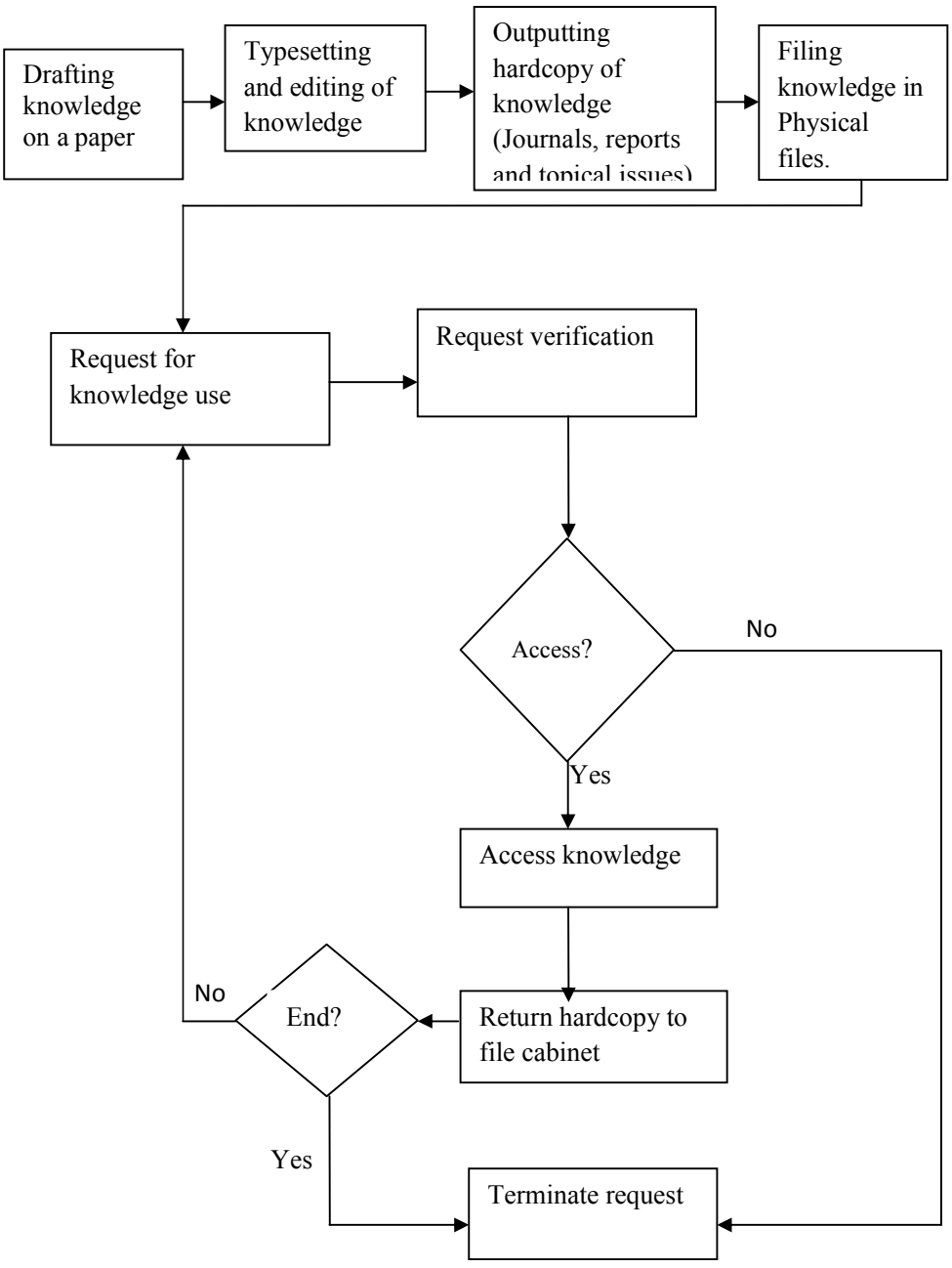


Figure 5.1: Overview of the current system

The above diagram shows an overview of the current manual system in the KTDA factories.

5.3 Analysis of the current system

This section provides the analysis of the existing system. The system was analyzed using unified modeling language tools. The following are the events in the current system:

- Register user
- Identify user
- Create knowledge
- Request for knowledge
- Return printouts
- Terminate request

In order to describe what the system does, the following use case diagram was used:

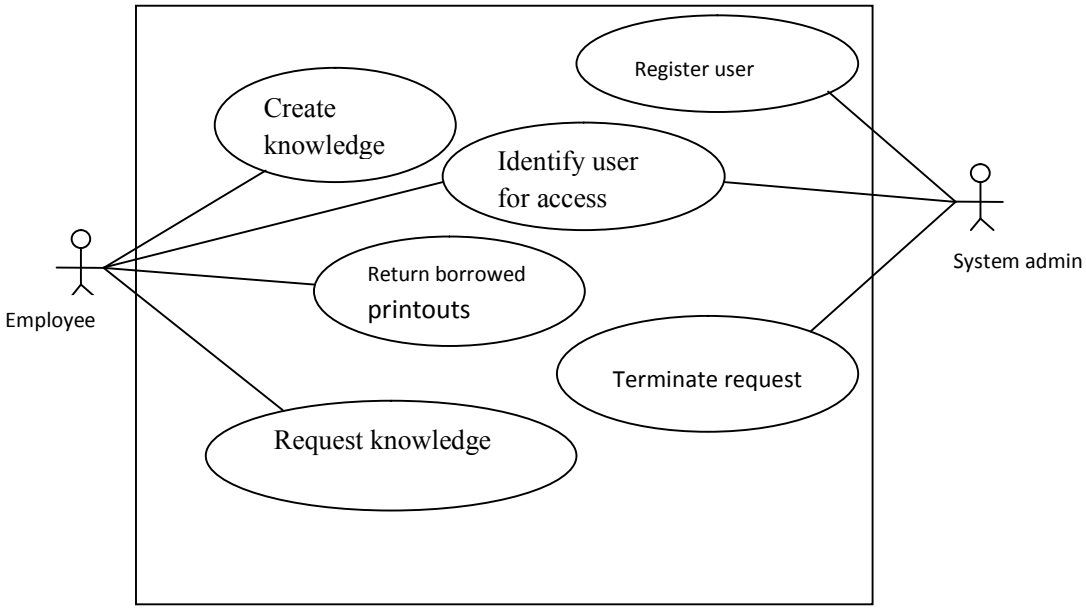


Figure 5.2: Use Case diagram for the current system

Above diagram shows the use case diagram for the current system.

5.3 Proposed system

This section highlights what the web based knowledge management system will do. From chapter two (section 2.6.3), this study adopted system management architecture model as shown in figure 2.3. From that model, the study picked key components. The components were: search, knowledge presentation, security, and collaboration. From the data presented in chapter four (section 4.5.1), there were challenges faced in the manual system and respondents proposed ways of minimizing them. In the proposed system, searching would be fast compared to manual system. In view of this, the response time would be much shorter. Also the knowledge database would be updated online. In the proposed system there would be 200 simultaneous users, and it would be available 24/7, with the exception of scheduled occasional maintenance

down times. In addition to security, all files uploaded will be scanned and saved in the system, and the common platform will provide a common point where knowledge can be accessed and shared. Interested persons will be required to register as users and log in for knowledge access.

5.3.1 Functional requirements of the system

The following are functional requirements of the system:

- Create user account
- Register user
- Authenticate user
- View personal information
- Edit user records
- Create knowledge
- Add knowledge
- Store knowledge
- Request knowledge
- Search knowledge
- View knowledge
- Download knowledge
- Notify users of new knowledge

The above requirements form what the system should do for the users. The following figure shows the modeling of the above functional requirements of the system.

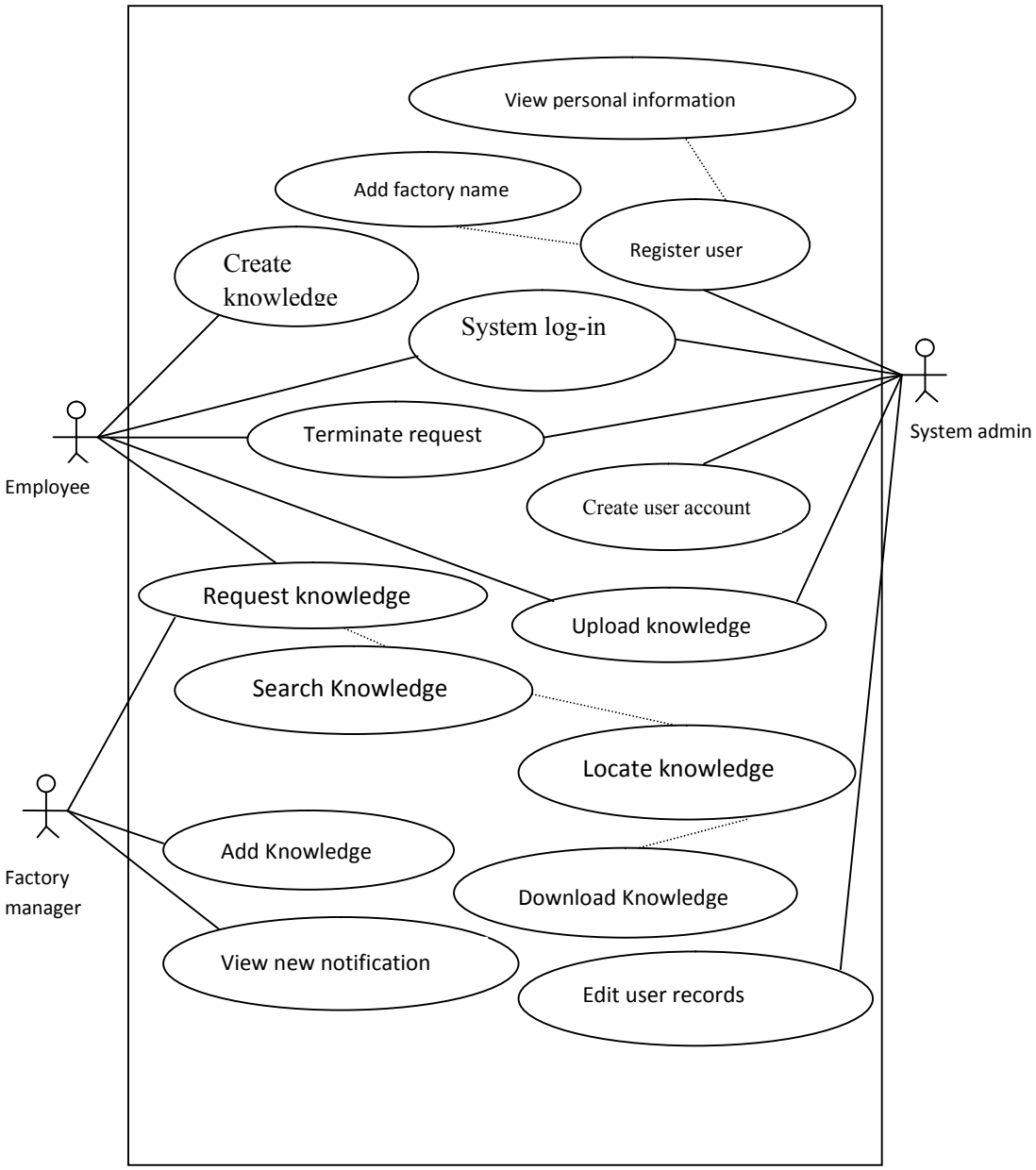


Figure 5.3: Use case diagram for the proposed system

5.3.2 Non functional requirements of the system

The following are non functional requirements of the system:

- User register once
- Users have only one account
- Knowledge access is based on privileges
- Only registered users to access knowledge

The above non functional requirements are like constraints for the functional requirements.

5.4 System Design

From the requirements analyzed above, the system was then. The design of the system was achieved by different sub systems as described below.

5.4.1 Input design

The following factors were considered during input design:

- Input volume- Only data that forms part of knowledge should be entered. Amount of data volume entered at a given instance should be minimized in order to reduce error generation.
- Data entry screens- descriptive icons were used for users to learn and input right data. The screens provide users with an opportunity to confirm the accuracy of input data before entering it

- Input format- while a user is inputting data, appropriate data format should be chosen. Data formats supported by this system are .db, .doc, .pdf, .jpeg, .mp3, and .mp4. The input design was design in way that allows users to choose appropriate extension. This will determine how data will be organized, stored, maintained, updated, accessed and used.

In view of the above discussion, a user input was designed using controls, labels, scroll bars, and radio buttons.

5.4.2 User registration design

Users were expected to register in order to access the system resources. During registration process, users give the following personal details to system administrator:

i. User name.

ii. User password.

iii. Department.

These details will then be used to create user account which will be tied to user privileges. The user accounts created for users will be used to access the system. All registered users are expected to keep personal details for system login. The following is user registration form design.

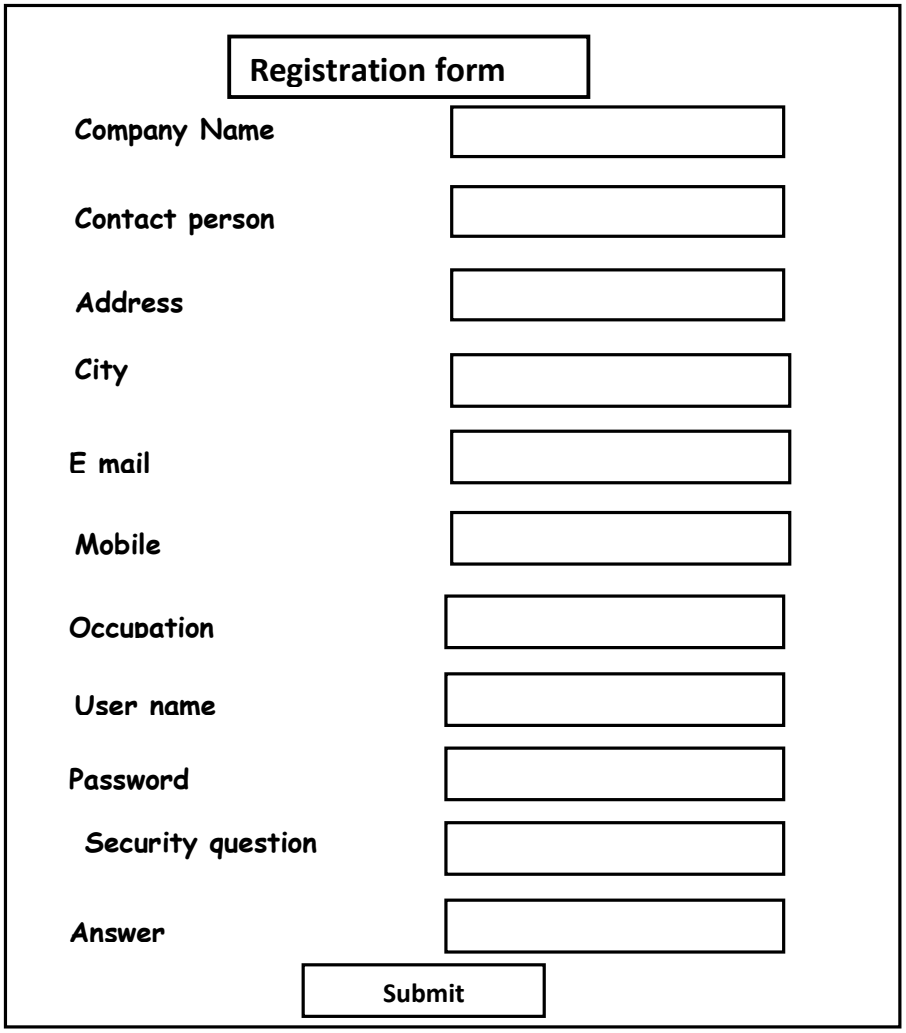


Figure 5.4: Form design for user registration

The above form design enables interested users to register in order to access the system

5.4.3 System login design

For users to access the system, they were expected to use personal details that were used during registration. Users log into their accounts through user names and passwords. After entering user name and password, users will be authenticated based

on these details. Upon successful system login user can create knowledge, search knowledge, and post questions based on user privileges. Privileges attached to user accounts include searching for knowledge, viewing files, uploading files, and posting of questions. The following sequence diagram illustrates the logging in process:

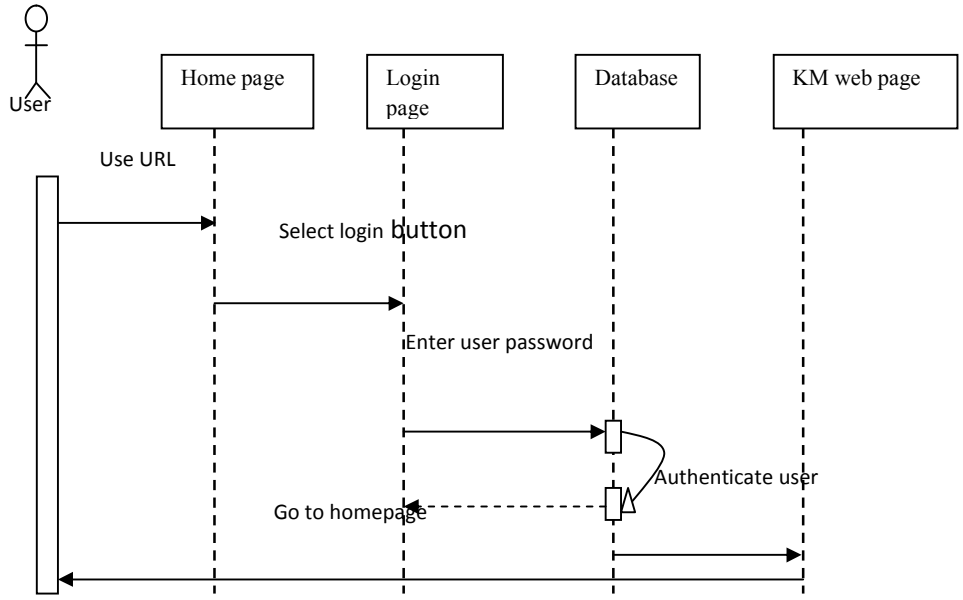


Figure 5.5: Sequence diagram for logging in

The following form design allows registered users to Login

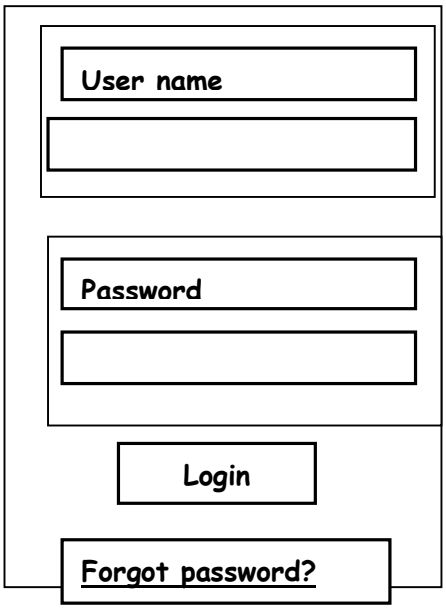


Figure 5.6: Form design for system log in

The above logical design allows users to access the system.

5.5 User interface for Knowledge creation

In chapter two of literature review, Staples et at (2001:11) notes that, the processes of knowledge storage involves finding ways to convert documents, models, human insights and other artifacts into forms that make retrieval and transfer easy without losing the "true meaning" of the knowledge.

The proposed system allows for creation of knowledge using a computer system. During conversion, tacit knowledge and explicit are converted into digital form by respective resource persons. Upon conversion, knowledge could be posted into knowledge database for the purposes of storing, retrieval, and sharing with other

system users. The figure below illustrates how knowledge would be created in the proposed web based system prototype for knowledge management.

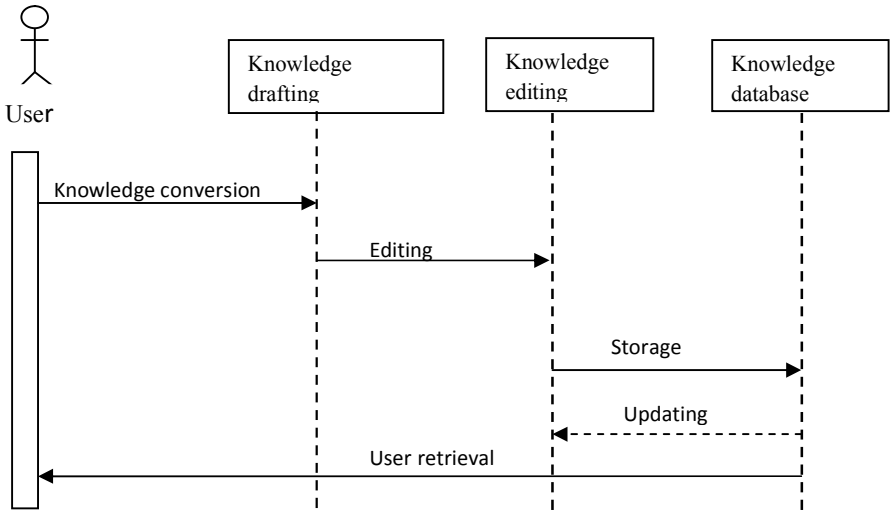


Figure 5.7: Sequence diagram for knowledge creation

After completing the process of knowledge creation, users could search for knowledge of their interest. The following section describes how searching takes place.

5.6 Posting Knowledge

For users to post knowledge, an interface was designed. The following figure shows user interface design.

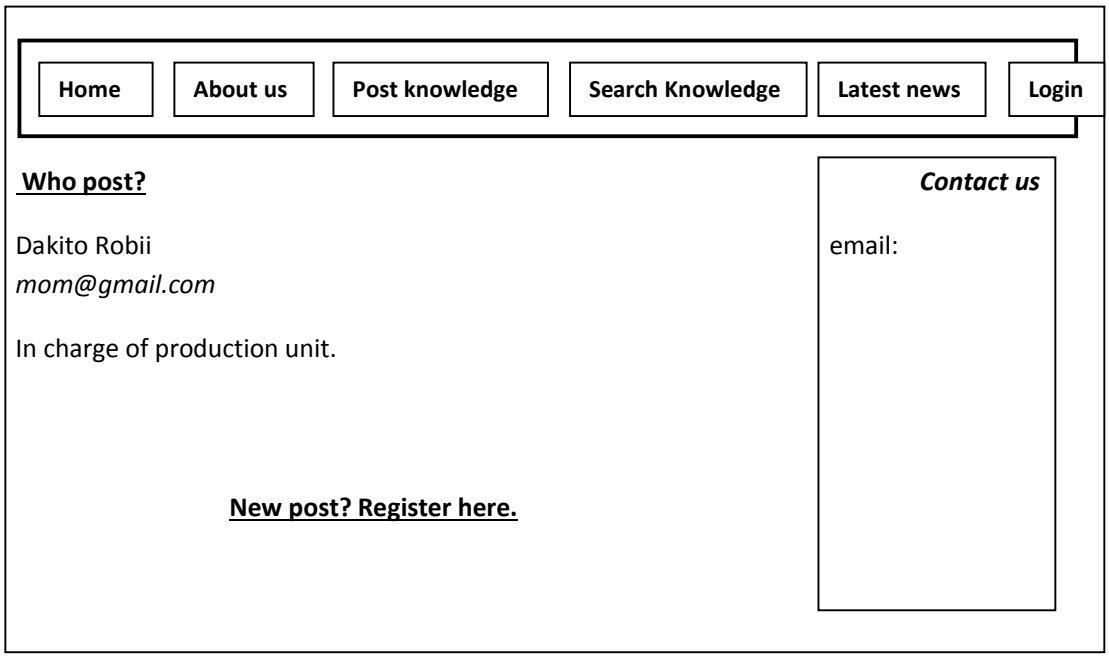


Figure 5.8: Form design for posting knowledge

Users can post knowledge from different areas of specialization using the above form

5.6.1 Knowledge search

This allows users to search for and locate knowledge within a knowledge database. The system will have a keyword search function for searching documented knowledge. The keywords will be based on knowledge field, process level, policy, and general keywords unique to tea concepts. For instances where keywords were merging the stored knowledge, then search results are output to be viewed by users.

The figure below shows activity diagram for searching knowledge.

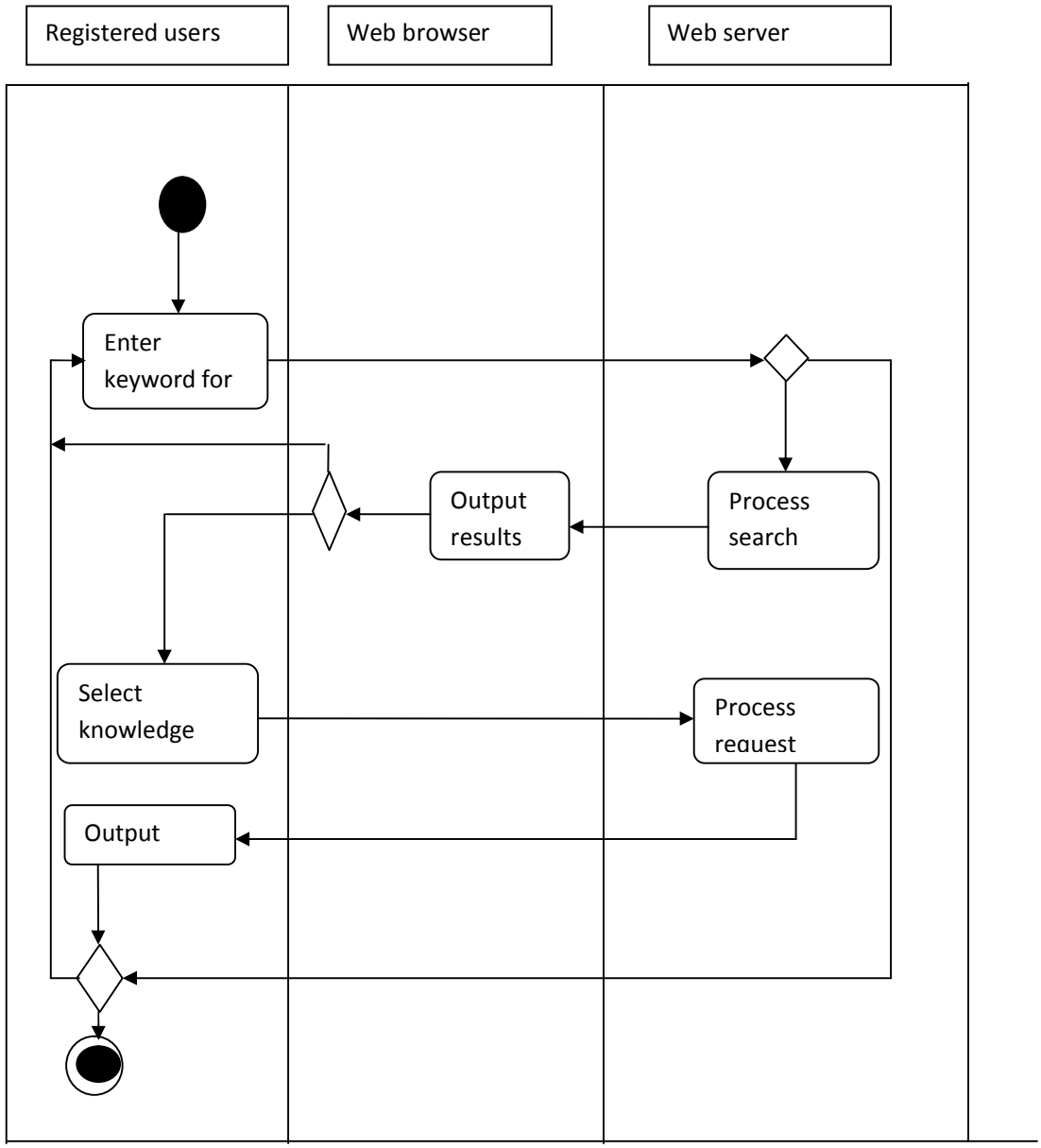


Figure 5.9: Activity diagram for searching knowledge

The following logical design gives the output of the searched knowledge.

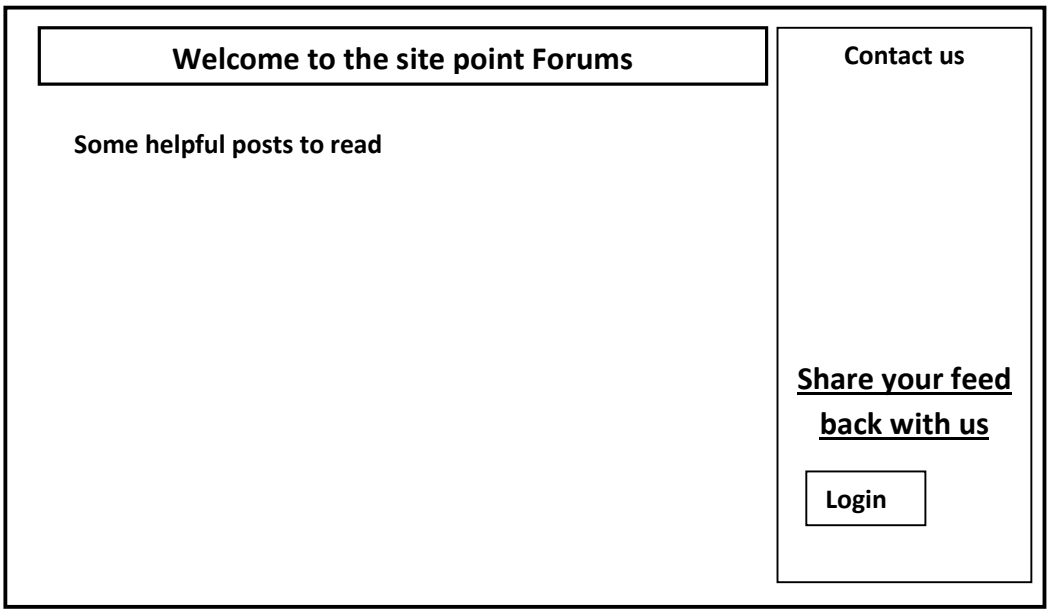


Figure 5.10: Form design for output knowledge

The form above in figure 5.14 will be used by users to post and share knowledge with others.

The following diagram shows a general conceptual design of the web based system prototype for knowledge management.

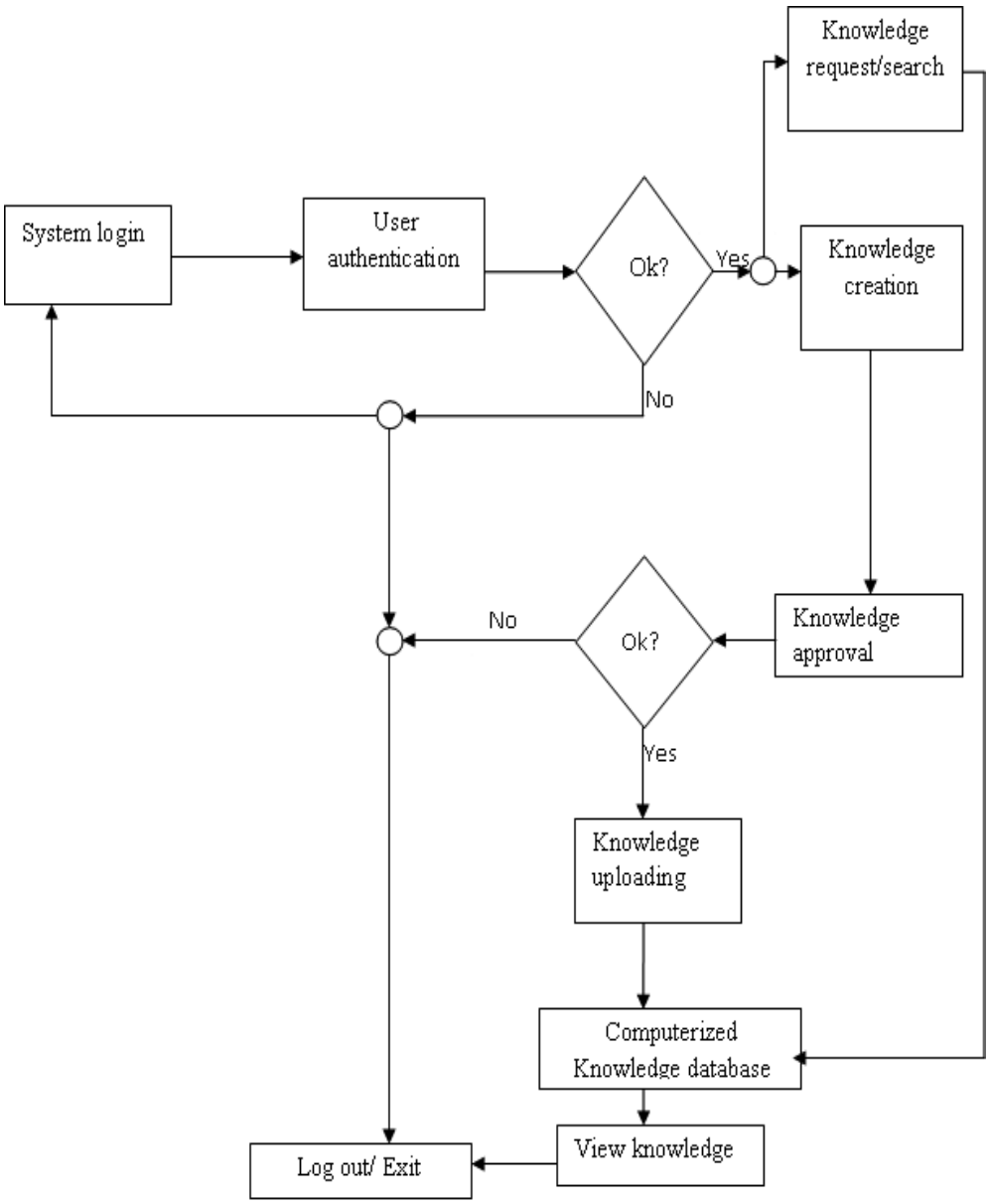


Figure 5.11: Conceptual model of the proposed system

The above figure gives a summary of data processing in proposed system

5.6.2 Sequence diagram for the System

The figure below is a sequence diagram for the proposed web based knowledge management system prototype.

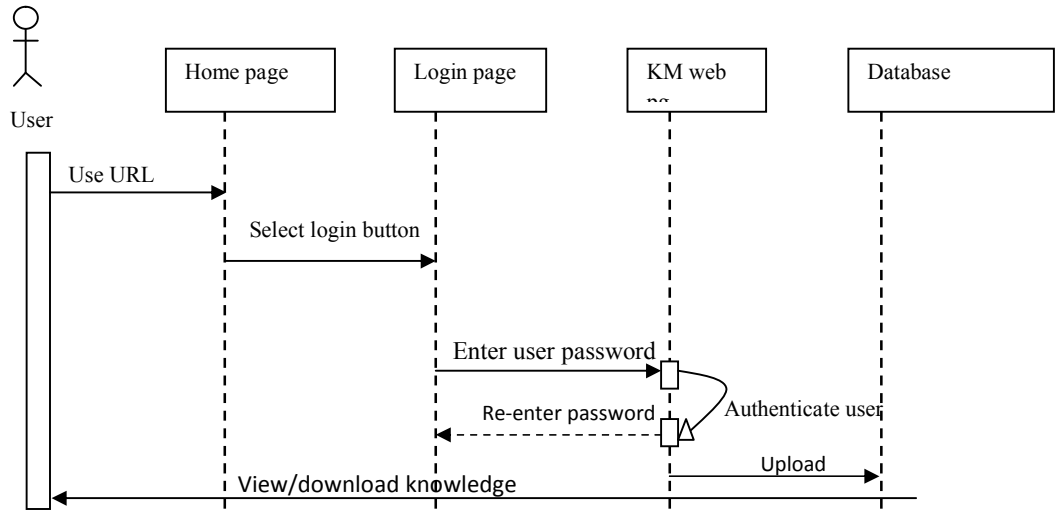


Figure 5.12: Sequence diagram for the proposed system

From the sequence diagram above, users can access the system online by using uniform resource locator (URL). Once the system is online, users can access the home page where they can login. Before any user logs into the system, they must undergo registration process. All users have to be registered by system administrator in order to access system. These users authenticated by the system administrator before they are allowed to access knowledge database. Users from different divisions will have different privileges though all users will have common basic privileges such as uploading documents, viewing documents online, and posting questions.

Figure 5.13 below shows class diagram for the proposed system prototype:

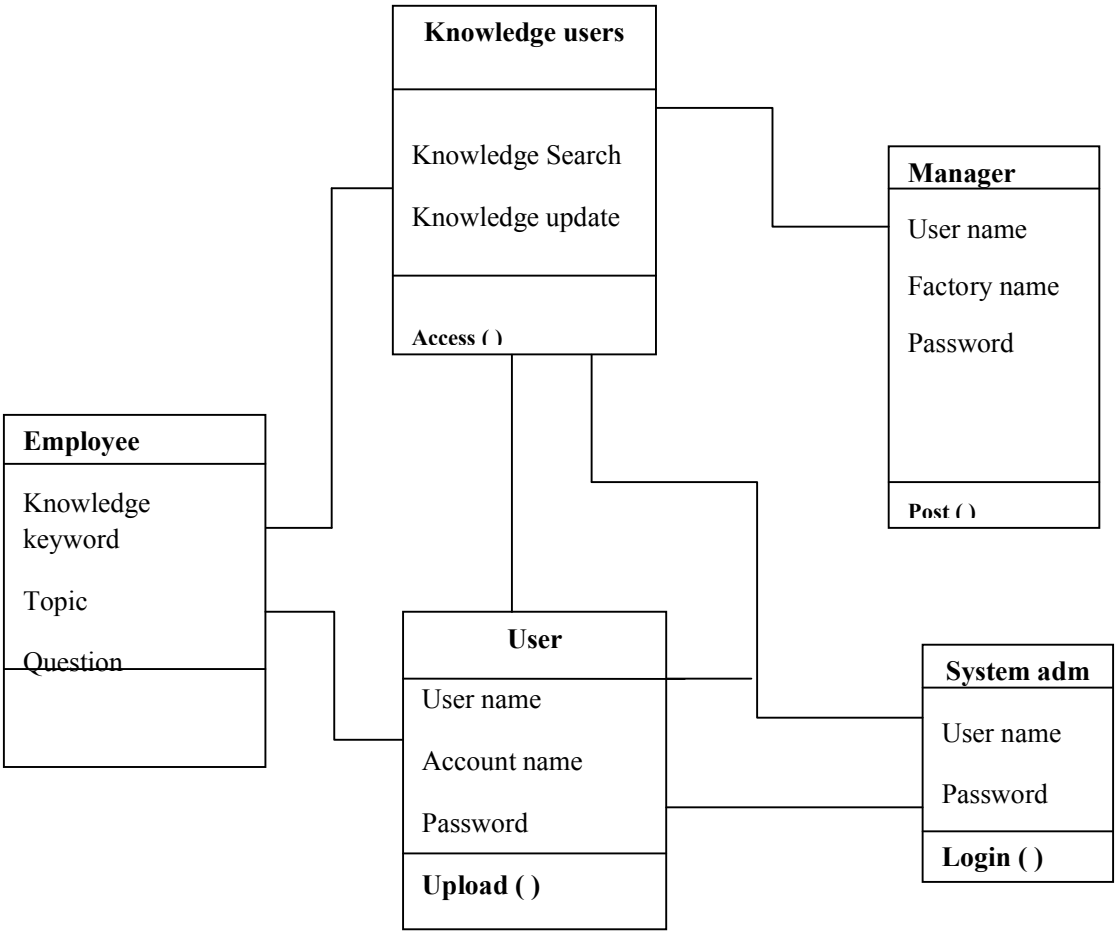


Figure 5.13: Class diagram for the proposed system

The figure above shows a class diagram for the web based system prototype.

Output design

System output gives the desired or expected knowledge based on input requests. In the web based system, the output design was done in way that allows the user to view various outputs.

In view of this, the following were used to assist users to choose of access expected output:

i) Information box- this was used to give a prompt alert to the user based on requested knowledge. This box gives alert in form of error messages or options (i.e. Continue/ Exit).

ii) Selection screen- This was designed to enable users to select the appropriate knowledge based on search key words.

The following are screen shots showing outputs of the system.

The expected system outputs are in the following forms:

- Knowledge searched.
- Error messages
- Warnings
- Help

The above output can be viewed from screen and appropriate action taken.

5.8 User Interface Design

While designing the interface, the type of user was priorities for better usability of the system. In order to achieve the usability of the interface, the interface was built in a way that:

i) The menus and graphics were integrated to enhance user friendliness of the system.

ii) Simple language was used in menus. For example, for users interested in searching knowledge would select "**search knowledge**" menu.

iii) The System home page was not congested.

The system was then designed by including the necessary menus and icons.

5.9 Database design

In this study, database was designed by use of PHP and MySQL commands. As noted in chapter three (Section 3.7.5.1), MySQL was used in coding and developing database in order to support storage and sharing of knowledge. By use of PHP and My SQL commands, management of user details was efficient. Database access was managed by use of passwords which were also coded during design and development stage.

5.10 System Development

Based on the system requirements already identified, the system was developed on the basis of the system design. During system development, the actual coding of the system was done in which the designs above provided a road map for coding. A sample of codes that were used during system coding is available in appendices IV and V.

5.10.1 Development of user interface

The user interface was developed using PHP. For users to successfully interact with user interface, users are required to register. The registration form was design using PHP. The following is part a code that was used to develop user registration form.

```
<div class="article">

    <h2><span><a href="#">Knowledge Searcher Registration Form</a></span></h2>
```

```
<div class="login">
<form action="JobSeekerInsert.php" method="post" onSubmit="return validateForm(this,arrFormValidation);" enctype="multipart/form-data" id="form2">
<table width="100%" border="0" cellspacing="0" cellpadding="0">
<tr>
<td>User Name:</td>
<td><span id="sprytextfield3">
<label>
<input type="text" name="txtName" id="txtName" />
</label>
<span class="textfieldRequiredMsg">Enter Name</span></span></td>
</tr>
<tr>
<td>Address:</td>
<td><span id="sprytextarea1">
<label>
<textarea name="txtAddress" id="txtAddress" cols="45" rows="5"></textarea>
</label>
<span class="textareaRequiredMsg">Enter Address</span></span></td>
</tr>
```

```
<tr>
 <td>City:</td>
 <td><span id="sprytextfield4">
  <label>
  <input type="text" name="txtCity" id="txtCity" />
  </label>
 <span class="textfieldRequiredMsg">Enter City</span></span></td>
</tr>
<tr>
 <td>Email:</td>
 <td><span id="sprytextfield5">
  <label>
  <input type="text" name="txtEmail" id="txtEmail" />
  </label>
 <span class="textfieldRequiredMsg">Enter Email Id</span></span></td>
</tr>
<tr>
 <td>Mobile:</td>
 <td><span id="sprytextfield6">
  <label>
```

```
 <input type="text" name="txtMobile" id="txtMobile" />
 </label>
<span class="textfieldRequiredMsg">Enter Mobile</span></span></td>
</tr>
<tr>
</tr>
<tr>
 <td>Other:</td>
  <input type="text" name="txtOther" id="txtOther" />
 </label></td>
</tr>
<tr>
 <td>Gender:</td>
 <td><label>
  <select name="cmbGender" id="cmbGender">
   <option value="Male">Male</option>
   <option value="Female">Female</option>
  </select>
 </label></td>
</tr>
```

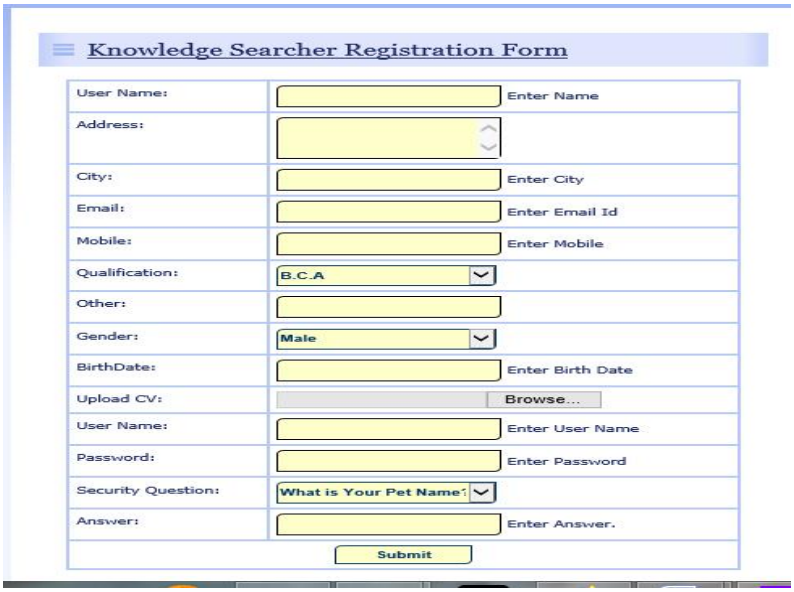
```
<tr>
 <td>BirthDate:</td>
 <td><span id="sprytextfield7">
  <label>
  <input type="text" name="txtBirthDate" onclick="ds_sh(this);"
id="txtBirthDate" />
  </label>
 <span class="textfieldRequiredMsg">Enter Birth Date</span></span></td>
</tr>
<tr>
 <td>Upload CV:</td>
 <td><label>
  <input type="file" name="txtFile" id="txtFile" />
 </label></td>
</tr>
<tr>
 <td>User Name:</td>
<td><span id="sprytextfield8">
  <label>
  <input type="text" name="txtUserName" id="txtUserName" />
```

```
 </label>
 <span class="textfieldRequiredMsg">Enter User Name</span></span></td>
</tr>
<tr>
 <td>Password:</td>
 <td><label><span id="sprytextfield9">
  <input type="password" name="txtPassword" id="txtPassword" />
 <span                                          class="textfieldRequiredMsg">Enter
Password</span></span></label></td>
</tr>
<tr>
 <td>Security Question:</td>
 <td><label>
  <select name="cmbQue" id="cmbQue">
   <option selected="selected">What is Your Pet Name?</option>
   <option>Who is Your Favourite Person?</option>
   <option>What is the Name of Your First School?</option>
  </select>
 </label></td>
</tr>
```

```
<tr>
 <td>Answer:</td>
 <td><span id="sprytextfield10">
  <label>
  <input type="text" name="txtAnswer" id="txtAnswer" />
  </label>
 <span class="textfieldRequiredMsg">Enter Answer.</span></span></td>
</tr>
<tr>
 <td colspan="2"><label>
  <label></label>
  <div align="center">
   <input type="submit" name="button2" id="button2" value="Submit" />
  </div>
 </label></td>
</tr>
</table>
</form>
</div>
```

From the above code, the resulting registration form was:

Screenshot 1: Registration Form



Similarly, the home page of the proposed system was coded and developed using PHP. The PHP codes used are in the appendices IV. The screenshot 2 below shows the resulting homepage from the PHP code used.

5.10.2 Development of input and output screens

The input screens were developed to provide an interactive interface between the user and the proposed system. The output screens were developed using PHP. One of the input screens is login screen which was developed using both PHP and MySQL codes. The following is part of the code used in developing the Login screen:

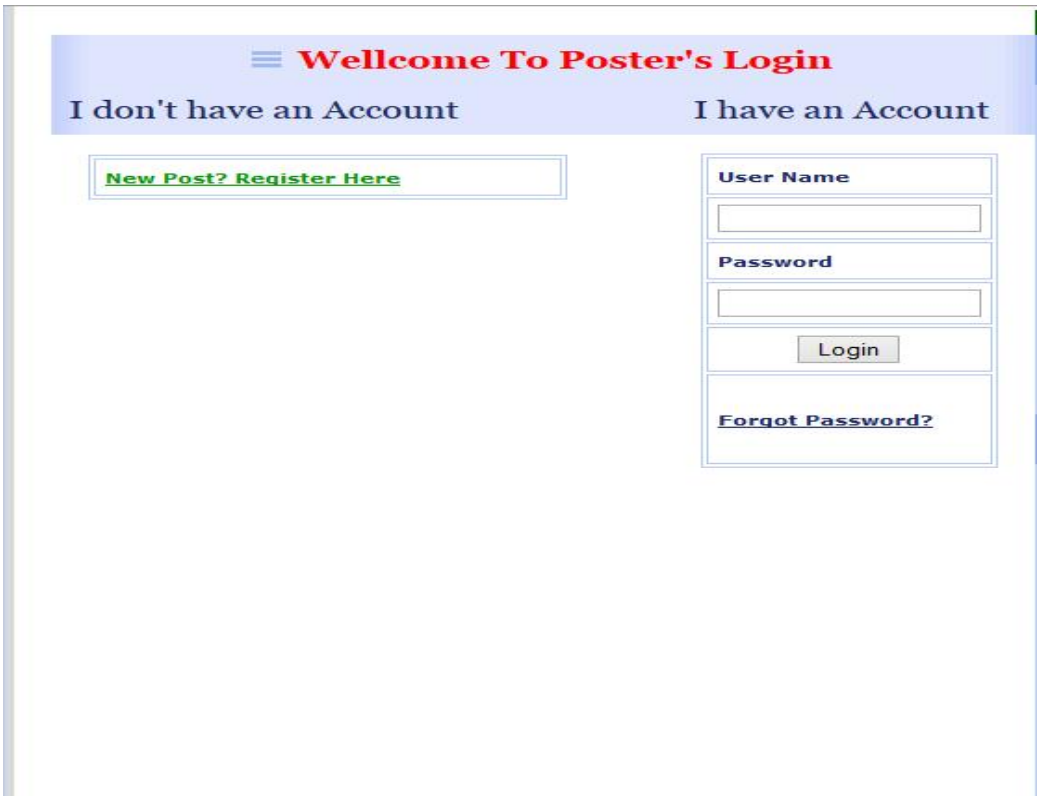
```
<body>

<?php

session_start();

$UserName=$_POST['txtUser'];

$Password=$_POST['txtPass'];

$UserType=$_POST['cmbUser'];
```

```
if($UserType=="Administrator")
{
$con = mysql_connect("localhost","root");
mysql_select_db("knowledge", $con);
$sql = "select * from user_master where UserName='".$UserName."' and Password='".$Password."'";
$result = mysql_query($sql,$con);
$records = mysql_num_rows($result);
$row = mysql_fetch_array($result);
if ($records==0)
{
echo '<script type="text/javascript">alert("Wrong UserName or Password");window.location=\'index.php\';</script>';
}
else
{
header("location:Admin/index.php");
}
mysql_close($con);
}
```

```
else if($UserType=="JobSeeker")

{

$con = mysql_connect("localhost","root");

mysql_select_db("knowledge", $con);

$sql = "select * from jobseeker_reg where UserName='".$UserName."' and Password='".$Password."' and Status='Confirm'";

$result = mysql_query($sql,$con);

$records = mysql_num_rows($result);

$row = mysql_fetch_array($result);
```

From the above code, the following input Login screen was developed as shown in the screenshot 3 below:

Screenshot 2: Login Screen



5.10.3 Database development

In the proposed system, the database was developed using MySQL. This was mainly to provide storage services. Also PHP was used in developing the database interface. The following sample code was used to develop a table for viewing **latest news** posted.

```
<tr>
 <td class="style3"><div align="left" class="style9 style5"><strong><?php echo
$Name;?></strong></div></td>
```

```
        <td class="style3"><div align="left" class="style9 style5"><strong><?php echo
$JournalTitle;?></strong></div></td>

        <td><a href="#" title="Login to view" target="_self">View</a></td>

        <td class="style3"><div align="left" class="style9 style5"><strong><?php echo
$Description;?></strong></div></td>



<?php

}

// Retrieve Number of records returned

$records = mysql_num_rows($result);

?>

      <tr>

        <td colspan="5" class="style3"><div align="left" class="style12"><?php echo "Total
".$records." Records"; ?> </div></td>

      </tr>

<?php

// Close the connection

mysql_close($con);

?>

</table>

     <p align="center" class="style6">

      <center>

       <span class="style7"><strong>Seminar       </strong></span>

      </center>

     </p>

     <table width="100%" border="1" cellpadding="1" cellspacing="2"
bordercolor="#006699" >
```

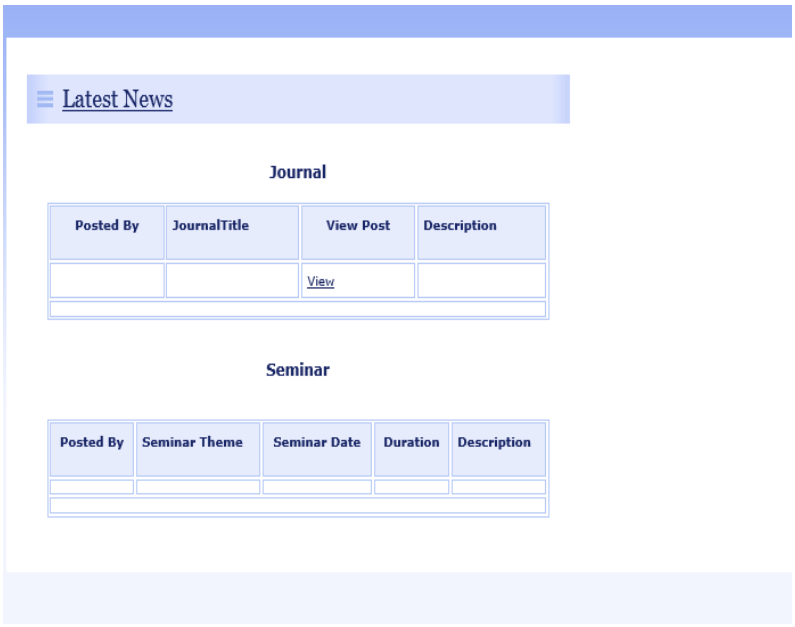
```
<tr>

 <th height="32" bgcolor="#1CB5F1" class="style3">Posted By </th>

        <th bgcolor="#1CB5F1" class="style3"><div align="left" class="style9
style5"><strong>Seminar Theme </strong></div></th>

        <th bgcolor="#1CB5F1" class="style3">Seminar Date</th>

        <th bgcolor="#1CB5F1" class="style3">Duration</th>

        <th bgcolor="#1CB5F1" class="style3"><div align="left" class="style9
style5"><strong>Description</strong></div></th>

</tr>

<?php

// Establish Connection with Database

$con = mysql_connect("localhost","root");

// Select Database

mysql_select_db("knowledge", $con);

// Specify the query to execute

$sql = "select * from walkin_master";

// Execute query

$result = mysql_query($sql,$con);

// Loop through each records

while($row = mysql_fetch_array($result))

{

$Name=$row['CompanyName'];

$txtTitle=$row['JobTitle'];

          $txtDate=$row['InterviewDate'];

          $txtTime=$row['InterviewTime'];

$Description =$row['Description'];
```

```
?>

<tr>

 <td class="style3"><div align="left" class="style9 style5"><strong><?php echo
$Name;?></strong></div></td>

        <td class="style3"><div align="left" class="style9 style5"><strong><?php echo
$txtTitle;?></strong></div></td>

                                                    <td class="style3"><div align="left"
class="style9 style5"><strong><?php echo $txtDate;?></strong></div></td>

                                                    <td class="style3"><div align="left"
class="style9 style5"><strong><?php echo $txtTime;?></strong></div></td>

        <td class="style3"><div align="left" class="style9 style5"><strong><?php echo
$Description;?></strong></div></td>




<?php

}

// Retrieve Number of records returned

$records = mysql_num_rows($result);

?>

    <tr>

        <td colspan="6" class="style3"><div align="left" class="style12"><?php echo "Total
".$records." Records"; ?> </div></td>

    </tr>

<?php

// Close the connection

mysql_close($con);

?>

</table>

 </div>
```

```
    <!-- /article -->

    <hr class="noscreen" />

  </div> <!-- /content -->
```

From the above code the resulting screen is shown in the screenshot 4 below:

Screenshot 3: Latest News



5.11 System testing and documentation

Upon completion of the system, testing was performed for the purposes of ensuring that the goal of the study was achieved. Major sections of the system were tested. These are**:**

- Login process for users, administrators, and management
- Search, uploading, and downloads of documents
- Viewing posted knowledge
- Viewing notices, posters, and questions.

System testing was mainly guided by system requirements and specifications.

Documentation of the system was made in form of a user manual (Appendix V).

5.12 Conclusion

In this section, a web based system prototype was successfully designed and implemented. During the design process, the attributes of the system, that is, log in, searching, and posting of knowledge were considered. These systems attributes were then tested in order to confirm whether system requirements and specifications were met. The following chapter will therefore give a summary of major findings, conclusion and recommendations based on this study.

CHAPTER SIX
SUMMARY OF MAJOR FINDINGS, CONCLUSION, AND RECOMMENDATIONS

6.1 Introduction

In the previous chapter, design and development of the web based system prototype for knowledge management was explained. This chapter presents a summary of key findings, conclusion, and recommendations of the study. It will also highlight the challenges encountered during the study.

6.2 Major Findings of the study

The following were the major findings of this study:

As noted in chapter one, this study aimed to develop a web based system prototype for knowledge management in KTDA factories. The first objective of this study was to establish knowledge requirements of personnel in KTDA factories. Data analysis and interpretation (chapter 4, section 4.3) revealed that specific knowledge was required for personnel working in factory. Examples of knowledge required were van operation, green leaf colour and texture, tea grading, and quality control. This meant that employees in various sections should have specific knowledge for smooth tea processing in tea factories.

The second objective was to determine methods used in knowledge management and sharing in KTDA factories. Data interpretation (chapter 4, section 4.4) revealed that KTDA factories were using manual systems to manage knowledge. The manual systems in place had personnel in charge of knowledge stored in form of printouts for employees to borrow. Data analysis and interpretation further revealed that, there

were methods used in the KTDA factories for knowledge management and sharing. From the study, these methods were: reports, mentorship, workshops, and communities of practice, internet, and use of internet. Though reports were found to be commonly used, different methods of knowledge sharing were used to target different groups. For example mentorship programs targeted new employees. During knowledge sharing, some employees were hesitant to share knowledge for fear of job loss. Most employees took tacit knowledge as private asset that cannot be shared. Most employees believed that sharing knowledge can render an individual to be irrelevant and of no use to the organization. It was the responsibility of the top management to give assurance of job security during knowledge sharing. This meant KTDA management should design and develop a platform that motivates employees to share knowledge without fear of losing their current jobs.

The third objective of this study was to establish the challenges experienced by management in knowledge management and associated systems in KTDA factories. Data analysis and interpretation (chapter 4, section 4.5) revealed that there were challenges experienced by KTDA during knowledge management. These included communication barriers, employees hesitant to share knowledge, limited time for knowledge sharing, and lack of support by management. This meant that there was need for KTDA to find out ways of minimizing such challenges for improved employee performance.

The fourth objective of this study was to model and build a system prototype that facilitates knowledge storage, processing, and sharing among the KTDA factories. It was found that, development and success of the system prototype for knowledge

management system was directly dependent on the level of commitment of the top management towards developing the system. This is because the process involves a complex process of developing the knowledge-friendly culture and knowledge-sharing facilitating environment throughout the whole organization. Lack of this commitment from management can jeopardize the whole process of knowledge management. In conclusion a web based system prototype for knowledge management was developed.

6.3 Contributions

The main contributions of this work are as follows:

- A web based system prototype for knowledge management was developed that can be used in future research.
- The system prototype developed that can facilitate knowledge management in KTDA factories upon its implementation. Users can benefit from the system through posting knowledge, checking what others have posted, and search for specific information from the system.

6.4 Conclusion

The first research question of this study was to find out whether there were technologies developed to support knowledge management in KTDA factories. It was found out that KTDA had no technologies in place to support knowledge management.

The second research question was to find out techniques that were used in knowledge management in KTDA factories. It was found that KTDA factories were using the manual techniques to manage knowledge.

The third question of this study was to find out challenges that were faced by KTDA management in knowledge management. It was found that KTDA factories faced different challenges during knowledge management process. The challenges included employees not willing to share knowledge, limited time for knowledge sharing, communication barrier, and lack of support from management.

The main objective of this study was to develop a web based system prototype for knowledge management system in KTDA tea processing factories. The system prototype was successfully built and upon its full implementation, it will facilitate the process of knowledge management in KTDA factories.

6.5 Recommendation

This study recommends the following:

1. Adopt ICT-based systems

There is need for the management of KTDA factories to find better and improved methods of managing knowledge for effective knowledge creation, storage, and sharing. These factories should find ways of adopting the current information technology methods other than the manual systems currently in use. One way of doing this is by improving the internet connection within their factories in order access internet based services for example in knowledge management.

2. Implement web-based knowledge management systems

Secondly, in order to minimize the challenges in the manual system, it is recommended that the management of KTDA factories adopt the web based system for knowledge management. The web based system upon its full implementation will facilitate the knowledge management process. Some employees were hesitant to share

knowledge. It was the management's role to communicate the importance of common knowledge generation and utilization for the organization and individual knowledge-workers. Through participatory system development, the system developed will be appreciated and more resourceful to its users.

In this study a system prototype was developed, it is recommended that a web based system for knowledge management can be developed in future by researchers or system developers.

6.6 Further Research

This study found out that there was need to carry out further research on how tacit knowledge can be captured accurately to form implicit. There was also need to find out other factors that discourages employees from sharing knowledge.

6.6.1 Implementation of system

In this study, a system prototype was developed and implemented. There is need to develop a complete system for implementation in future.

6.6.2 Explore ways of capturing tacit knowledge

In this study, it was noted that there was a need to explore ways of capturing tacit knowledge without necessarily affecting the working standards and confidents of employees. This will go a long way in enriching the explicit knowledge in tea processing factories.

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APPENDICES

Appendix I: Letter of Introduction

Cheruiyot Too Wesley
Box 9 Kabianga
Telno. 0721843911

The Manager

Dear Sir/Madam,

RE: DEVELOPING WEB BASED KNOWLEDGE MANAGEMENT SYSTEM FOR TEA PROCESSING FACTORIES.

I am a student in the School of Information Sciences, Moi University (Main Campus) pursuing Master of Science in Information Technology (Msc. IT). I am undertaking a study based on the topic above in partial fulfillment of the requirements for the Masters degree at Moi University.

I therefore request for your permission to conduct the research in your factory. The study aims to examine knowledge sharing techniques, knowledge requirements, and challenges faced during knowledge processes in your tea factory with a view to developing a web based knowledge management system for tea processing factories.

In this study, confidentiality and anonymity will be ensured for all the participants. Kindly note that the information provided will be treated with utmost confidentiality and will only be used for the purpose of the study. Upon completion, a copy of the final research document will be brought to the factory and a demonstration of the system will done.

Your assistance and participation in this study is greatly appreciated.

Yours sincerely,

Cheruiyot Too Wesley
IS/MPHIL/09/08

Appendix II: Interview Guide for Management

Interview date…… interview time……..

Section A: Background information

1. When did you report to this factory?
2. When you report first, which section of the factory were you posted to?
3. Were you given orientation on the first day of reporting about your section? If no, how did you manage to learn about your operation in that section?
4. In this section you are currently working, what are your responsibilities?

Section B: Communication

5. Do you organize for seminars and meeting in your organization? If no why? If yes, for what reasons.
6. In case there is information to be passed to other employees in other sections, what mode of communication do you use?
7. Do you face some challenges while trying to communicate to others in the organization? If yes, what are the challenges?
8. Do you sometime have changes in the way things are to be done in certain sections in your organization? If yes, how do you ensure that such changes are implemented well?

Section C: Knowledge documentation and sharing

9. Do you have employees who are experts in a certain section of tea production? If yes. How do they share their expertise knowledge with others?

10. Do you have employees leaving your organization? If yes. How do you ensure that their expertise knowledge remains in your organization?

11. Do have ways of managing knowledge in your organization? If yes, which ones?

12. In your organization do you promote sharing of knowledge? If yes how is it normally done?

13. Do you have methods that you use to share knowledge in your organization? If yes which one?

Section C: Knowledge Management

14. Is there any one in charge of knowledge management in this factory? If yes, who? If No why?

iii) Do you manage knowledge management aspect such as sharing of knowledge, codifying of knowledge and effective communication between partners? If yes, How effectively do you think your organization manages the following aspects of knowledge management i) Sharing information on production difficulties or problems ii) Ensuring effective communication between partners within the value chain iii) Sharing process innovation across extended enterprise iv) Documenting and making available tacit knowledge from within external partners

15. Do you face challenges during knowledge management process? If yes what are the challenges.

16. What do you propose as a way of countering challenges faced during knowledge management process?

17. Does your organization have methods of acquiring knowledge? If yes which ones?

18. Do you extract knowledge from those expertise employees? If yes, how effectively do you document and making this knowledge available to others?

19. Do you think by developing a web based knowledge management system can overcome challenges of the current systems of sharing knowledge? If yes, how? If No why?

I hope in future you are willing to be conducted incase anything comes up during this study. If you have any questions about this study or comments/suggestions about your participation in this research, please contact Wesley Too on 0721843911

Appendix III Interview Guide for Production Staff

Interview Date……. Interview time……

Section A: Background information

1. Which section do you work in?
2. When were you posted to this section?
3. Were you given orientation on the first day of reporting about your section? If no, how did you manage to learn about your operation in that section?
4. Kindly tell me what activities you normally carry out in this section.

Section B: Knowledge requirement

5. Is it necessary for you to have specific knowledge to work in this section? If yes, what specific knowledge required?
6. Do have any one in charge of ensuring that persons working in a section posses specific knowledge? If yes, who? If no why?
7. Do you sometimes given a new job that requires different knowledge from your former section, if yes, how do you acquire the required knowledge?

Section C: Knowledge Sharing and its challenges

8. In your factory, do you share knowledge and experience? If yes, how do you share knowledge or experience in your factory?

9. Do you sometimes face challenges in an attempt to share knowledge? If yes, what obstacles or challenges do you normally encounter in the process of sharing knowledge or experience?

Section C: Knowledge management and knowledge management techniques

10. Have ever come across knowledge management? If yes, what is your general understanding on knowledge management?
11. Do you have knowledge management techniques (that is methods of creating, documenting, storing and sharing knowledge) in your factory? If yes what techniques are used?
12. Do you recommend for specific knowledge management techniques to be developed in your organization? If yes, which ones? If no, why?
13. Do you have communities of practice in this factory? If yes, What is the role of Communities of Practice (workers with common problem or issue coming together to discuss or look for a solution) in this tea factory
14. Is there a website for the knowledge management initiative in the factory? If yes describe how this website has assisted in sharing or looking for specific knowledge in your line of operation.
15. Do you consider the efficient flow of information and knowledge to be beneficial to you? If yes, What do you consider to be the main benefits that could be derived from the improved flow of information and knowledge within your company?
16. In your organization, do you have anybody responsible for promoting the sharing and capture of knowledge in your organization? If yes, who?

17. Do your organizations use seminar notes, meeting notes and journals to capture knowledge? If yes, how successfully do you think your company captures and exploits the following sources of information?

    i) seminar notes

    ii) Meeting notes

    iii) Journals

18. Are you contented with the type of knowledge creation provided by the factory? If yes why? If no what can be done to improve knowledge creation process?

19. Would a web based knowledge management system play a role in overcoming the challenges of the current systems of sharing knowledge? If yes, how? If no why?

I hope in future you are willing to be conducted incase anything comes up during this study. If you have any questions about this study or comments/suggestions about your participation in this research, please contact Wesley Too on 0721843911

Appendix IV: Interface Code

```
<!DOCTYPE html PUBLIC >


<html >


<head>

  <meta   http-equiv="content-type"   content="text/html;
charset=utf-8" />

  <meta http-equiv="content-language" content="cs" />



  <title>KNOWLEDGE MANAGEMENT SYSTEM</title>

  <meta name="description" content="..." />

  <meta name="keywords" content="..." />



  <link rel="index" href="./" title="Home" />

  <link     rel="stylesheet"     media="screen,projection"
type="text/css" href="./css/main.css" />

  <link  rel="stylesheet"  media="print"  type="text/css"
href="./css/print.css" />

  <link  rel="stylesheet"  media="aural"  type="text/css"
href="./css/aural.css" />

  <style type="text/css">

<!--

.style2 {

     font-size: medium;

     font-weight: bold;
```

```
}
.style3 {
     font-weight: bold;
     color: #009900;
}
.style4 {color: #009900}
.style5 {color: #00CC00}
.style6 {
     color: #FF0000;
     font-weight: bold;
}
-->
  </style>
</head>

<body id="www-url-cz">
<!-- Main -->
<div id="main" class="box">
<?php
include "Header.php"
?>

<!-- Page (3 columns) -->
  <div id="page" class="box">
```

```
  <div id="page-in" class="box">

      <!-- /strip -->

    <!-- Content -->

    <div id="content">


      <!-- /article -->


      <hr class="noscreen" />


      <!-- /article -->

      <hr class="noscreen" />

            <!-- Article -->

            <!-- /article -->

      <hr class="noscreen" />

      <!-- Article -->

     <div class="article">

        <h2    align="center"><span><marquee>Welcome    To
KNOWLEDGE    MANAGEMENT    SYSTEM    FOR    QUALITY    TEA
PRODUCTION</marquee> </span></h2>

        <h4 align="center"><strong>

         Knowledge is power!!! Inquiring Minds:

          Transforming  Tea  industry  Transfer  from  one
user to another </strong></h4>

      <p                              align="center"><span
class="style2">W</span>elcome    to    online    knowledge
management system for quality tea production. It provides
facility to the user to search for various tea production
knowledge. Here user can registered himself on the web
```

```
portal and create his profile along with his educational
information. </p>

        <p>This Portal is also designed for the various
persons who wish to <a href="#" title="Share your
knowledge" target="_parent">share</a> their knowledge of
tea production. these persons can registered himself on
the web portal and then he can upload information of
various knowledge. </p>



        <h2><img      src="design/banner2.png"      alt=""
width="431" height="117" /></h2>

        <p><marquee><?php
```

Appendix V: Login Code

```
<span class="style6">Wellcome To Poster's Login </span>

       </center> </h2>

       <h2>I don't have an Account                                      I have an Account </h2>

       <form          name="form1"          method="post" action="login.php">

        <table width="10%" border="0" align="right">

          <tr>

           <td><strong>User Name</strong></td>

          </tr>

          <tr>

    <td><span id="sprytextfield1">

            <label>

             <input       type="text"       name="txtUser" id="txtUser">

            </label>

           <span class="textfieldRequiredMsg">*</span></span>

     <label></label></td>

          </tr>

          <tr>

           <td><strong>Password</strong></td>

          </tr>  <tr>

        <td><span id="sprytextfield2">

            <label>

            <input     type="password"     name="txtPass" id="txtPass">
```

```
            </label>
           <span
class="textfieldRequiredMsg">*</span></span></td>
          </tr>
          <tr>
           <td><label>
            <div align="center">
             <input      type="submit"      name="button"
id="button" value="Login">
            </div>
           </label></td>
          </tr>
          <tr>
           <td><div align="center">
            <p><a         href="Forget.php"><strong>Forgot
Password? </strong></a></p>
            </div></td>
          </tr>
                </table> </form>
       <div align="justify">
        <table width="258" border="1">
         <tr>
          <td><a   href="PostReg.php"   class="style5">New
Post? Register Here</a> </td>
         </tr>
        </table>
      </div>
      </div> <!-- /article -->
```

Appendix VI: Database design

```
- phpMyAdmin SQL Dump

-- version 3.4.10.1

-- http://www.phpmyadmin.net

---- Host: localhost

-- Generation Time: Jul 25, 2015 at 09:39 AM

-- Server version: 5.5.20

-- PHP Version: 5.3.10


SET SQL_MODE="NO_AUTO_VALUE_ON_ZERO";

SET time_zone = "+00:00";

-- Database: `knowledge management`

-- --------------------------------------------------------

-- Table structure for table `Knowledge management`

CREATE TABLE IF NOT EXISTS `Knowledge management` (

 `Title` varchar(11) NOT NULL AUTO_INCREMENT,

`Idno` int(11) NOT NULL,

 `Name` varchar(11) NOT NULL,

  `Status` varchar(30) NOT NULL,

 `Description` varchar(200) NOT NULL,

 PRIMARY KEY (`idno`)

-- Table structure for table `employer_reg`

-


CREATE TABLE IF NOT EXISTS `employer_reg` (

 `EmployerId` int(11) NOT NULL AUTO_INCREMENT,
```

```
`PostName` varchar(20) NOT NULL,
`PostTitle` varchar(20) NOT NULL,
`CompanyName` varchar(20) NOT NULL,
`ContactPerson` varchar(20) NOT NULL,
`Address` varchar(100) NOT NULL,
`City` varchar(20) NOT NULL,
`Email` varchar(40) NOT NULL,
`Mobile` bigint(20) NOT NULL,
`Area_Work` varchar(40) NOT NULL,
`Status` varchar(10) NOT NULL,
`UserName` varchar(20) NOT NULL,
`Password` varchar(20) NOT NULL,
`Question` varchar(100) NOT NULL,
`Answer` varchar(50) NOT NULL,
PRIMARY KEY (`EmployerId`)
) ENGINE=InnoDB DEFAULT CHARSET=latin1 AUTO_INCREMENT=6 ;
```

Appendix VII: User Manual

1.0 Introduction

The web based system prototype for knowledge management in KTDA is a system that enables users to share knowledge. This system is web based and for users to share knowledge successfully, they must register or create accounts for easy access. This manual describes the system purposely to aid users on how to use the system.

The first part of this manual describes the front end of the system which details on what the public can view when they visit this system. The manual also describes other sections that are accessed by logging in. the system log in will entirely depend on the privileges assigned to users.

1.1 About Web based knowledge management system prototype for KTDA factories

Web based knowledge management system prototype is designed for KTDA factories for knowledge sharing. It was designed and developed in order to provide a platform for knowledge sharing and in a way overcomes the challenges of the former manual system.

The following are functions performed by the system:

i. It provides a platform for users to post their expertise.
ii. It provides users an environment for interactive discussions
iii. Enables users to search for knowledge and post questions if need be.

iv. It provides management a platform to post information such as meetings, quality alerts among other.

This web based system allows its users to access information online from a knowledge database. The system provides a friendly graphical user interface where users can access the system easily. It is therefore the responsibility of respective KTDA management to ensure that authorized users make use of the system constructively. All users must be registered for the purposes of information security.

1.2 Design features

The system has user friendly interface for use. It was designed such that users can access various components of the system easily. The system was designed to be used online

The home for this system is shown below

From the above homepage, users can link to various sites for interaction. The user communicates with the program via the keyboard and mouse.

1.3 Description of links

The links on the front end are linked to other pages in the system that have different information as given below:

- Home: These links lead to the homepage of the system where users can select from different menus.
- About us: This opens a page that gives information about KTDA factories
- Post knowledge: This link leads to a page where users can post knowledge.
- Search knowledge: this link leads to a page where users can search for knowledge.
- Latest news: This link leads to a page where users can access recently posted items.
- Contact us: this link leads to a page that give contacts
- Log in: this link opens a log in form where registered users can login to the system.

2.0 Authorized use and permission

The system was developed purposely for use by the KTDA factories; any unauthorized use by non KTDA factories is highly prohibited. KTDA management is therefore free to improve the system in future if need be.

2.1 Points of contacts

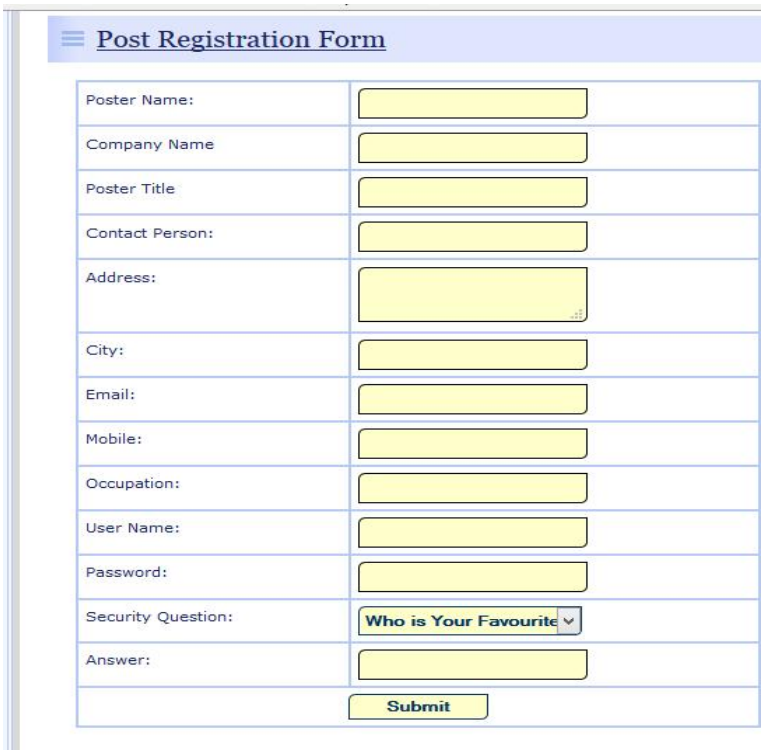
In case of proposed modification or question concerning the system, the system developer may be contacted on email: cheruiyottoo@yahoo.com or telephone number +254721843911

2.2 User Access Levels

System users are categorized into different levels depending on their privileges. The following are two categories of system user:

- Production staff- This category includes all factory employees in the field of production. This includes employees in green leave, withering, CTC, Fermentation, Sorting, and packing. Supervisors on those sections are also included in this category. Employees in this section can post their expertise into knowledge database subject to approval. At this level, employees are not allowed to post advertisement, notices for meetings, and issues touching on tea quality.
- Management staff- This category includes factory manager and other unit managers if they exist. At these level issues touching on management are posted. Users in this category have additional privileges compared to those in production level.

In order to access the system, you must register and have your accounts saved. The following figure shows *user registration form.*



All users interested in sharing knowledge must register using the above form. Upon registration, subsequent access will require users to log in. To log in to the system, you are required to enter your user name and password in the following form.

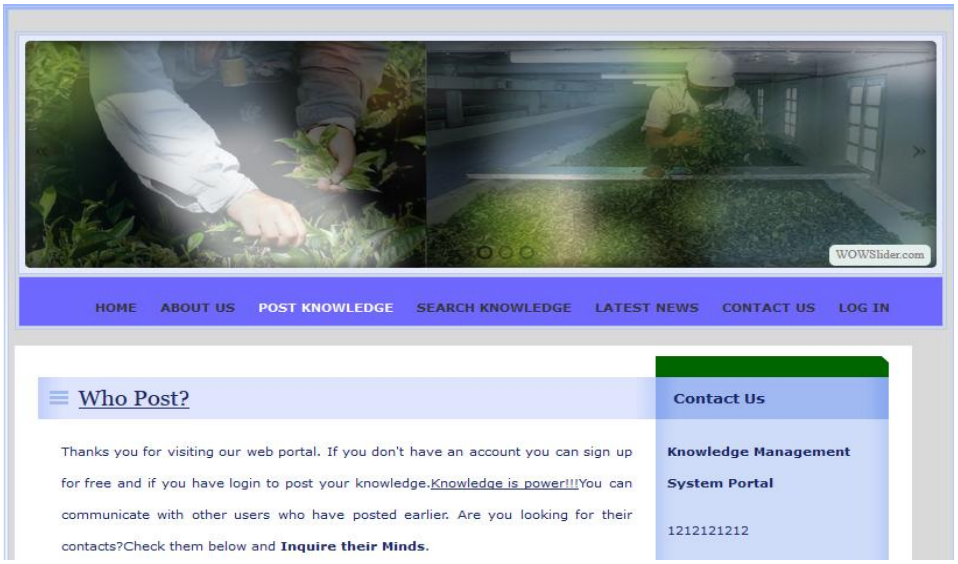
After entering your *user name*, you need to select user type and click the button for *log in*. The user type is found by clicking the drop down button. The form will appear as shown below.

Upon logging in successfully, the system takes you to home page where you can select what you want to do with the system. When you are at the home page, you can choose from the menus below what you want to do.

When you point at a menu, for example Home, it will give you other sub menus to choose from. Those submenus have different function; the sub menu name implies its function.

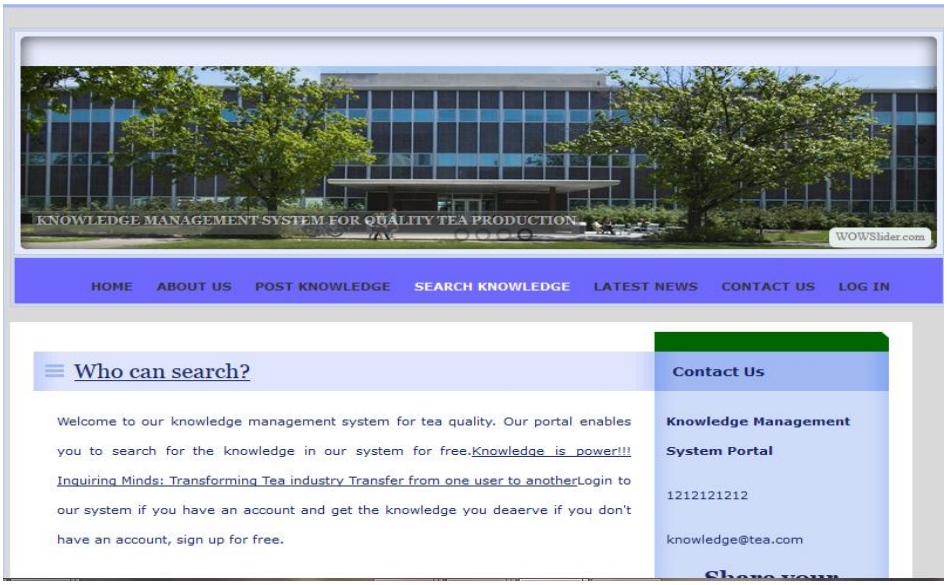
2.3 Post Knowledge menu

In order to post knowledge, select *post knowledge menu.* This will take a window where you can post knowledge and even check those who posted earlier. Similarly, search knowledge menu can be followed in the same way. The following figure shows post knowledge environment.



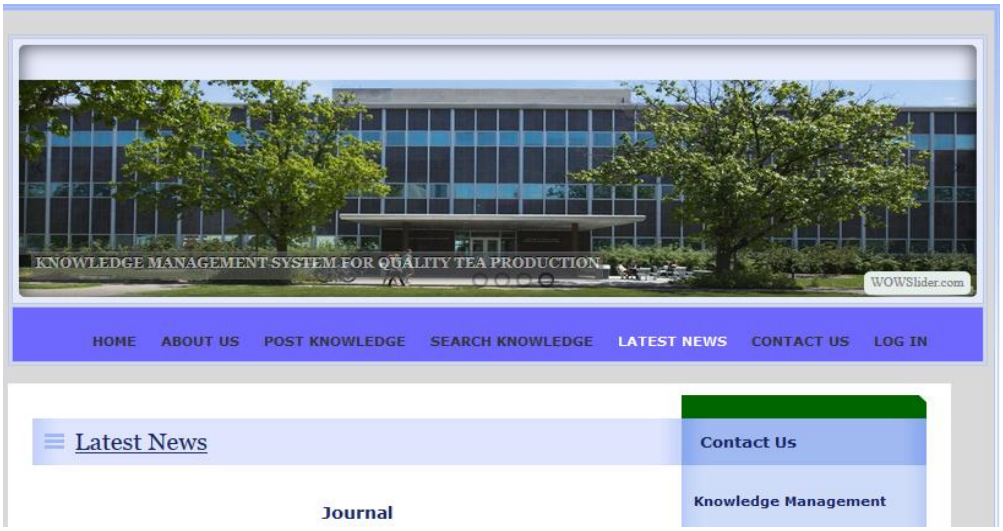
To search knowledge, click on search knowledge menu then

The following screen will appear.



Click on the "*who can search"*. On clicking, it will take to an environment where you are required to login into the system before searching knowledge. Upon logging in successfully, you can then search knowledge using key words.

In order to view latest information such as advertisement, notices and others, click on *latest news* menu. The following screen will appear.



To view the item, click on the item itself to view its contents, for example, to view the journal posted, click on the journal.

Conclusion

This manual is designed to help users of the web based system prototype for knowledge in KTDA factories. It will help users to interact easily with the system.