

## Proposed Knowledge Management Systems (KMS) for public sector organizations in Bahrain

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### ABSTRACT

Developing a Knowledge Management System for the public sector organizations in Bahrain is a serious need and it can be achieved easily upon establishing the Amazon Web Services (AWS) in Bahrain in 2017. The aim is to create this system to manage and organize knowledge in the public sector organizations. All of the knowledge in people's minds are put into this system to have it viewed by others in the public sector organizations and by sharing it all of them will benefit. This way the knowledge is stored and never lost even if employees retire.

Furthermore, the theoretical background is retrieved from a number of sources like articles and other researches of the same topic. By looking and taking in the idea of the Knowledge Management System the analysis and limitation was done and after that the need for a new system is confirmed for the public sector organizations.

Moreover, planning the development of the project is clarified with the feasibility study of technical, economical, operational and scheduling and including the Gantt Chart for the work breakdown structure. Also, a methodology was chosen to implement the SDLC which is the agile approach. The requirements such as functional and nonfunctional requirements are represented and illustrated in a use case diagram with an interpretation of each part of it. Bahrain currently hosting an AWS regional office which is a center for cloud technology and services, this can be the way that the data is going to be stored in which is the cloud with the presentation of tables and attributes. In addition to the implementation of the system illustrating the interfaces of the developed system. Eventually, the research is concluded in the final chapter with recommendations and suggestions for the future of the system.

**Keywords:** Knowledge, Knowledge Management, Knowledge Management Systems, Cloud Computing, Bahrain

### 1. Introduction

In present days, the economy depends mainly on knowledge, and for that reason today's economy is known as the knowledge economy or "k-economy" (Abu-ALSondos, Pangil & Othman, 2015; Halawi,

Aronson, & McCarthy, 2005). K-economy is characterized by rapid development, does not depend on traditional capital assets, and it is dynamic. Knowledge economy is shared worldwide (Civi, 2000).

Knowledge Management (KM), defined as the creation and application of new knowledge, is becoming a good source of competitive advantage. Employee innovation is increased by the development and sharing of knowledge (Abu-AlSondos, Pangil & Othman, 2012). Some people might wonder what knowledge is and to understand that first they need to distinguish between two things which are data and information. First, data is objects, names or raw numbers that on their own they have no meaning. Second, information is data processed, manipulated, and organized into context to have a purpose. Knowledge is living of information and have it processed in order to get experience, capabilities.

Now that knowledge became clear, then knowledge management (KM) will be easier to comprehend. Knowledge management is retrieving what is required from the sources of knowledge to have it organized and at hand at all times. Moving on to knowledge management systems (KMS), it is KM in an advanced way by having the support of technology. KMS smooth out the process of sharing and enlarging size knowledge. It is also having both technology and mechanisms integrated to support KM process (Abu-AlSondos et al., 2012).

Amazon Web Services (AWS) was used by Bahrain's government to have the infrastructure of IT and that was their goal for the ministries. When converting to the cloud, Bahrain used AWS as it brings innovation to the Middle East. Almoayyed Computers aided the public sector organizations in websites of a mission-critical and customer-facing to have them on AWS no more than 2 weeks and smoothly. The public sector organizations hold the public relations of Bahrain, the media and even Bahrain News Agency (BNA). Now Almoayyed Computers is one of the Summit sponsors of Amazon and the public sector organizations chose them to move the BNA websites to AWS, Almoayyed has experience in applying solutions and architecture of AWS for the sectors and especially the public one. In addition, Almoayyed is an AWS Partner Network (APN) Standard Consulting Partner, the first in Bahrain, joined in 2017 in the Public Partner Sector Program of AWS with Authorized Government Reseller. (<https://aws.amazon.com>)

A number of companies have old systems that are used and survived because of the maintenance. When the company wants to integrate another system or application it gets complicated and difficult and may carry risks (Ali, Omar, & Bakar, 2016). Information age has changed the way in which traditional systems work (Ali, Bakar, & Omar, 2016). Most of them before taking in the cloud convert the applications to SOA as it is adaptable to service composition with encapsulation through web services. These applications of SOA is made up from 3 layers which are the Presentation Layer, it is the interface, the Business Layer, it is the business logic, software components or WSs, and finally the Data Layer which is the application data and storage. Through these layers the applications will be migrated like the legacy system migrated with the cloud (Zalazar, Gonnet, & Leone, 2015).

### 1.1 Research Problem

Sharing of knowledge is not without its own challenges. It is proposed here that in order to encourage knowledge sharing (Pangil, Abu-AlSondos, & Othman, 2018). Not having a knowledge base (KB) to

manage and store all the knowledge in the minds of employees is an issue. Without it mistakes will be repeated, lack of utilization of knowledge, and loss of knowledge and its protection (Hajric, 2018). There will be a negative effect on the performance like the scale of economies, scope of economies and the competitive advantage.

Moreover, when the knowledge in possession of employees is not shared it results in absence of innovation as the ideas stays within them. Consequently, poor and slow decisions will be made since employees can't reach the expertise in the whole organization. Not only that, but also there will be less interaction between employees affecting the way they solve problems as it is going to be slow and inefficient then the work wouldn't be completed on time. Now the public sector organizations in Bahrain doesn't have a KMS and this is a big issue knowing that they have a huge amount of information to be sorted and stored.

Bahrain's Crown Prince Salman bin Hamad Al Khalifa stressed in 2017 that the Government Action Plan for 2015-2018 had three priorities: to transform the role of the public sector from a primary employer to a regulator of the market, to support entrepreneurship and innovation, and to invest in human capital, particularly the capacity, productivity, and competitiveness of Bahraini citizens. (Government Action Plan, 2015) (Bahrain TV, 2017) ( Almajdoub, 2018) Due to that, the public sector organization need to use this privilege to maximize their productivity and adapt with near future changes.

## **1.2 Research Objectives**

These are the objectives that will be achieved by this research:

- To create Knowledge Management System for public sector organizations in Bahrain.
- To organize, store and share knowledge by employees.
- To solve problems and make decisions in an efficient and effective manner.

## **1.3 Research Scope**

This research will be about the KMS developed for the public sector organizations in Bahrain.

## **1.4 Research Significance**

KMS is noteworthy and very important for any organization especially the ones with big amounts of information. First, that it helps leveraging the competencies of the business, second is empowering employees, with access to the KB they can make decisions effectively and efficiently. Not only that, but of the precious and important assets of organization is the intellectual capital won't be lost. It is significant because investing in KM is like investing with a capital which generates benefits for a long term. Moreover, KM has a positive impact on four levels which are people, process, products and overall performance.

By storing knowledge of experts in the organization, the effort of training and teaching the new employees will be reduced. With this in mind it is clear how significant KMS is to organizations seeing its benefits it in many different areas and KMS can strengthen the commitment to the organization too.

## **2. Literature Review**

## **2.1 Theoretical Background**

Based on statistics from various researches, knowledge management plays a crucial role in organizations. For instance, Robinson (2018) documented that inadequate knowledge-sharing approaches by big companies cost them over \$31 billion annually because KMS helps to increase their productivity by up to 40%.

### **2.1.1 Knowledge**

The most critical role of knowledge management is to ensure that data and information are systematically collected and stored by members of an organization. As explained previously, Knowledge management is critical in it makes data available to be accessed by staff. Now for knowledge, as Hajric (2018) explained, is related to performing and indicating know-how and comprehending. Once employees are knowledgeable, their output can increase in the organization gaining experience can improve the employees' level of confidence.

### **2.1.2 Types of Knowledge**

knowledge is crucial for organizational competitiveness and this fact has been highlighted by many scholars (Abu-AlSondos et al., 2018; Chen & Mohamed, 2010). Knowledge can be categorized into various categories, depending on the targeted users. Starting, tacit vs. explicit knowledge is the first and most apparent category. Since tacit knowledge solves the puzzle of 'knowing-how,' individuals often gain them through experience. In another research, it was defined almost the same but Igbinoia and Iknwe (2018) added that it is uncodified. On the other hand, explicit knowledge explained by the same authors that it is codified and easy to share because they are stored in books, documents and databases. The personal factors which influence work performance are knowledge, capabilities, skills, motivation and attitudes (Ali, Omar, & Bakar, 2016).

Procedural or declarative knowledge is another category of knowledge, which Hong & Yang (2018) defines as operations relevant for performing a task. Procedural knowledge is essential for organizations since it helps in problem-solving.

### **2.1.3 Knowledge Management**

Geisler and Wickramasinghe (2015) define knowledge management as an integrated approach by organizations to identify, capture, store, and evaluate data for use by the organizations. A study by the same source indicates that knowledge management is a critical tool in any organization because it allows employees to retrieve and share information effectively. In knowledge management, there are a variety of forms that exists, and they include document sharing, secure file sharing, business intelligence, data capturing, social analysis, and automatic data integration.

### **2.1.4 Knowledge Management Process**

Knowledge and its effective management are important organizational resource and they are crucial for success. The process of knowledge management and its necessity for leveraging organizational knowledge has been studied by the researcher. Their view has been changing regarding the definition and level of technology support for the knowledge management (Abu-AlSondos et al., 2012).

KM is technical and takes a systematic process, which includes data discovery, data capture, data sharing, data application by members of an organization. The most appropriate framework of knowledge management was documented by Massaro, Dumay, & Garlatti (2015), who crafted six necessary processes of KM.

### **2.1.5 Knowledge Management Infrastructure**

Knowledge management infrastructure refers to the enablers of KM. the first is organizational culture, is organizational structure, communities of practice, IT infrastructure and common knowledge

### **2.2 Analysis and Limitation of the Existing System**

The most critical flaw of the knowledge management system, according to Mao et al. (2016), is that organizations find it difficult to make information easier to access. This challenge has hindered the efficiency of the knowledge management system. From the same study, KMS has inefficiencies in capturing and recording knowledge, which makes it challenging to integrate knowledge to the staff. Another challenge in the knowledge management system is that it can be difficult to motivate or encourage staff to adopt the knowledge management system. However, Mao et al. (2016) also examined ways to overcome these challenges.

### **2.3 Need for a New System**

The first need for a new system in knowledge management is that it reduces the costs of inefficiencies. According to a report by Omotayo (2015), the knowledge management system reduces inefficiencies in organizations by making an organization develop appropriate strategies for collecting data, storing the data, and making it available to the members. An organization that has an outstanding knowledge management structure implies that the current data will be stored accurately and readily accessible to be found quickly. According to Ali, Omar, & Bakar, (2016) knowledge management, employee motivation and innovation can have a positive effect on firm performance.

Author study by Hislop, Bosua, & Helms (2018) found that there is a need for a new system in knowledge management since it makes access to information quicker and sooner to use multiple data and analyze the existing knowledge to make ideal decisions from different viewpoint.

## **3. Research Methodology**

### **3.1 Project Planning**

Project planning is knowing and deciding what to do in each step of the project with a timeframe that is determined and it has a major effect on the success of the project.

#### **3.1.1 Feasibility Study**

Feasibility study is the evaluation and assessment of a project planned to forecast the result. It dedicates if the project can be done and how to do it in the most feasible way possible. In, addition, it includes technical, economic, operational, legal and scheduling feasibility (Mukherjee and Roy, 2017).

### **Technical feasibility**

This will be done by a technical team and the experts to examine the technical points of view. In addition, the team will transform the plan into actuality (Mukherjee and Roy, 2017).

### **Software**

Moreover, the user interface is for the search, navigation, help and news. The interface must be clear for everyone to enter knowledge and search for certain topics which brings us to that search engine, this helps reduce time to find needed documents.

### **Hardware**

As for the hardware, the requirements are the personal computers of each employee and a local area network (LAN) to interconnect employees.

### **Economic feasibility**

Cost-benefit analysis is done to estimate the benefits and least cost (Mukherjee and Roy, 2017). This system wouldn't cost a lot because the operating system won't change and the benefits exceeds the cost where it will save all knowledge from people and manage it.

### **Operational feasibility**

According to Easterbrook (2005) it is what the users and managers think of the project and how it will solve the problems. This system will be used by employees from the same organization and culture so it will be easier for them to accept it and it's in both English and Arabic.

## **3.1 Software Development Methodology**

To create a system or a software there are steps to be followed and a method chosen to do it (Rajeswari, 2017). The approach that is going to be used in this project is agile, where steps are also followed like planning, analysis, design, implementation, testing and maintenance. It is flexible where any step can be revisited for modification (Zima, 2015).

### **Phases of Software Development Methodology**

#### **Plan:**

When a software is being planned the managers will gather all the requirements to have them analyzed. This step is very important to collect as many information as possible. If this step wasn't taken care of then the poor planning will risks (Softwaretestinghelp, 2019).

#### **Design:**

An architecture is designed using the requirements as input. This step makes everything clear by providing a picture of what was expected to give feedback (Softwaretestinghelp, 2019).

**Implement:**

Here the design from the previous step is converted into source code. This is where the system is created and actually implemented Software testing help (2019).

**Test:**

Developers must test the system by running it. However, if errors were to be found then the coding must be fixed and do the test again to check the changes Software testing help (2019).

**Deploy:**

Now that the system works perfectly with no error and goals are achieved the system can go live as long as there's acceptance from the users Software testing help (2019).

**Maintain:**

Eventually, when the system goes live and it is actually used, more changes might come up with time. This is why maintenance exists, to make up for what wasn't expected to have better performance with the updates Software testing help (2019).

### 3.2 Analysis of the New System

**User Requirement (functional and Non-functional Requirements)**

User requirements for the system defines the needs of the users. In this project techniques used are observation of other researches and their explanation of the system makes clear what the requirements of KMS is. In addition, ready systems of KM that are used by others are also helpful to gather more information.

**Functional Requirements**

The functional requirements are the major needs and activities done by users while running the system (Sotelo, Baron, 2018). These must be cleared out to developers and end users as well. These behaviors are important and significant because without them the system wouldn't operate as desired. Here are some:

- User can login to the system
- Users can view and search for all types of documents
- Users can add and share any type of document
- Users can contact any other users
- Only managers can create users and teams
- Only manager can view reports, no. of views and interactions of certain documents
- Users can add designs to documents however they like before uploading it
- Only admins can reset password
- Users can select desired language
- Users can logout

### **Non-Functional Requirements**

Non-functional requirements are not the behavior rather they are the way that the system operates and aids in the performance of the system. (Guru, 2020). Here are some:

- Performance: Time taken for each task to be done
- Scalability: Ability to cope with the increasing size of data and work
- Responsiveness: The time taken to respond to the user or an intrusion
- Reliability Operating without failure
- Security: Data and system are defended and encrypted against all types of attacks

### **System Requirements**

System requirements is about the hardware components and software resources that help in performing tasks. System requirements:

- Operating System: Windows 7 or later
- CPU: Intel Core i5, i7 recommended
- Storage: Cloud computing
- Internet Connection: Yes

### **Domain Requirements**

The people in the public sector organizations in Bahrain will be using this system and as employees they'll of course come from different departments. Therefore, this system will be a simple one with clear interface for employees to accept and adapt to it quickly. It will also be fast, organized and comfortable.

## **4. Software Design and Implementation**

### **4.1 Use Case diagram**



Use Case in software development is converting requirements that are set for a certain system into a diagram illustrating the functionality of the system by actors. The Unified Modeling Language (UML) Use Case assists in understanding the roles of each e helping in reaching goals (Waykar, 2016). The use case diagram for the proposed system is shown in figure 1.

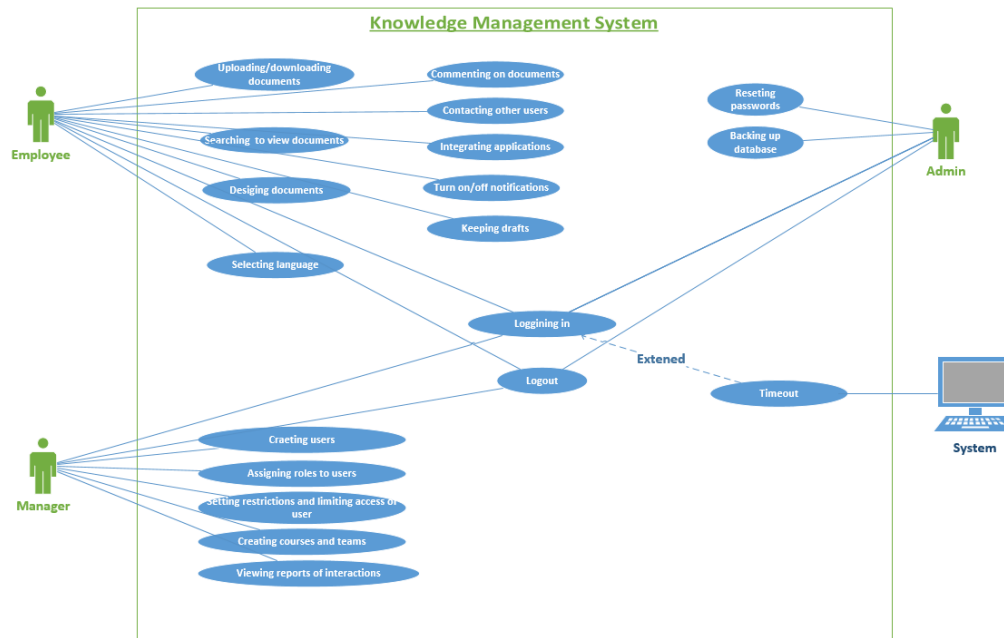


Figure 1. Proposed KMS Use Case Diagram

#### 4.1.1 Employee

The employee here is a primary actor, this actor can do many functions and the major two use cases are logging in and logging out of course. Moreover, employee can design, upload and download any document. Furthermore, employees can use this system to contact other employees by sending messages to the users, this use case encourages interaction. Also, they can always keep drafts for later and even more functionalities.

#### 4.1.2 Manager

The manager is also a primary actor that can do exactly what an employee can do as clarified above but the manager has more privileges. What is more to managers, that they are the only ones who creates the users in this system for employees for new comers. Another use case enables them to set restrictions to limit access of users based on their position in the public sector organizations. In addition, managers can create courses for employees, these are training courses.

#### 4.1.3 Admin

The admin is the third primary actor in the system. When employees forget their password, they go back to the admins because they have the use case that enables them to reset passwords in such cases. Also, admins

are the only ones having the authority to back up the system if needed because the cloud database does it regularly.

#### **4.1.4 System**

The system is a secondary actor and here there's only one-use case that have dependency relationship with logging in use case which is timeout. The dependency is extending because if the user responds then the timeout won't take place, however, if the user doesn't respond with time specified then the timeout will take place

## **4.2 Cloud computing**

### **4.2.1 Definition and Benefits**

For this system all data is going to be stored on the cloud as it provides better storage that having a database. Cloud storage is storing data and it is a cloud computing model which is having resources of systems available on demand, it provides services such as storage, databases, networking, analytics and software from a provider. All of the services provided are online over the Internet, instead of having servers physically in the workplace it is hosted in data center using the Internet (Ranger, 2018).

Cloud computing is very beneficial and most organizations have started using the cloud. According to Microsoft (2020) cloud reduces costs and also it automatically backs up the data with a disaster recovery plan. In addition, the cloud improves the performance and efficiency as they operate on datacenters that are protected and always upgraded. Which brings us to the protection of the data stored, the cloud has policies set and high technologies that ensure that data is secure.

The public sector organizations can benefit from the cloud and there will be efficiency in doing the work by having the public sector organizations' employees' focus on their work and doing it in high rate with the collaboration that the cloud provides. For all of the reasons explained above, cloud computing is perfect for the public sector organizations to store data as it has many important and useful features.

### **4.2.2 Deployment Model**

There are three deployment models for the cloud which are public, private or hybrid. Now the deployment model for the public sector organizations is going to be the hybrid model, this is because this provides the combination of the public and private. Since the public sector organizations is going to store both regular and sensitive data then the hybrid is suitable.

### **4.2.3 Service Model**

There are a number of service models for the cloud computing that serves businesses and provides benefits based on their need. The major service models are Software-as-a-Service (SaaS), Platform-as-a-Service (PaaS), Infrastructure-as-a-Service (IaaS) and Database-as-a-Service (DBaaS).

There's a fourth service that come within the PaaS which Database-as-a-Service (DBaaS). Techopedia (2017) defined it as service model in cloud computing that is paid for to provide a database for users without a hardware or installation. This provider performs all the tasks, management and maintenance of the database.

#### 4.2.4 IBM Db2

For the KMS that we developed for the public sector organizations, the researchers chose a cloud database by IBM. IBM Db2 provides a high standard database with easy deployment of tables and has the ability to integrate with multiple platforms. In addition, IBM Db2 supports many operating systems such as Windows, Linux and Unix. This database is great for storing and analyzing data efficiently where it also includes Structured Query Language (SQL).

Now for the in the Schema –collection of tables- there'll be tables included such as Employees, Documents, Training Courses and Reports.

To continue with the relational tables, for each table there must be data entered based on the attributes chosen. As for the Employee the attributes are: Employee ID, First Name, Last Name, Phone No., Address, Date Hired, and Position as shown in table 1.

*Table 1 Employee Table attributes*

	EMPLOYEE ID	FIRST NAME	LAST NAME	PHONE NO.	ADDRESS	DATE HIRED	E-MAIL	POSITION
1	1029	Mariam	Fahad	34353698	Manama	26/9/2011	<a href="mailto:mfahad@gmail.com">mfahad@gmail.com</a>	HR Assistant
2								

Documents: Document ID, Document Title, Employee ID. The Employee ID here is to link which employee wrote this document to have the table Normalized which reduces redundancy by referring the ID of the Employee to the Employee table for further information.

Training Courses: Course ID, Course Title, Course Date/Time, Employee ID. The Employee ID here is to choose the employee participating in this course and this is normalized as well.

Reports: Report ID, Report Title, Results, Document ID, Employee ID. Documents and Employees are linked here too to show the reports of which document and employee.

When the database is ready with all of the details all what is left to do is integrate the database created with the system developed. IBM Db2 will manage everything from now on as previously.

### 4.3 Implementation

Implementation here means the execution of the plan set to develop a system where the process of building the physical system is defined. This makes sure that the system is running with no errors for all users and meets the quality standards.

#### 4.3.1 Login Page

All users can view and must view the login page to access the system using the email and password given and then click login.

### 4.3.2 Home Page

After logging in the first page that appears for all users is the home page. As shown in the figure 2, the home page with the major title of this system which is public sector organizations Knowledge Management System, on the left is a list to choose from that can be hidden or shown by a small arrow. In this list the first is the home page, second is the notifications where it can collapse and expand to show what has been received. In addition, to the uncompleted documents in drafts and archive too, finally is log out.

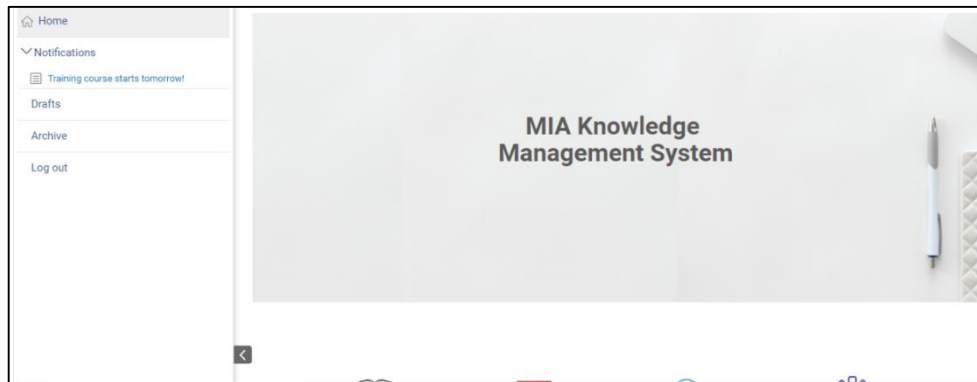


Figure 2. Home Page

### 4.3.3 Employees

On the same page when scrolling down all of the functions on the system are displayed for the employees. Each function specified for employees is represented by an icon and labeled as well with a brief explanation of each as shown in in figure3.

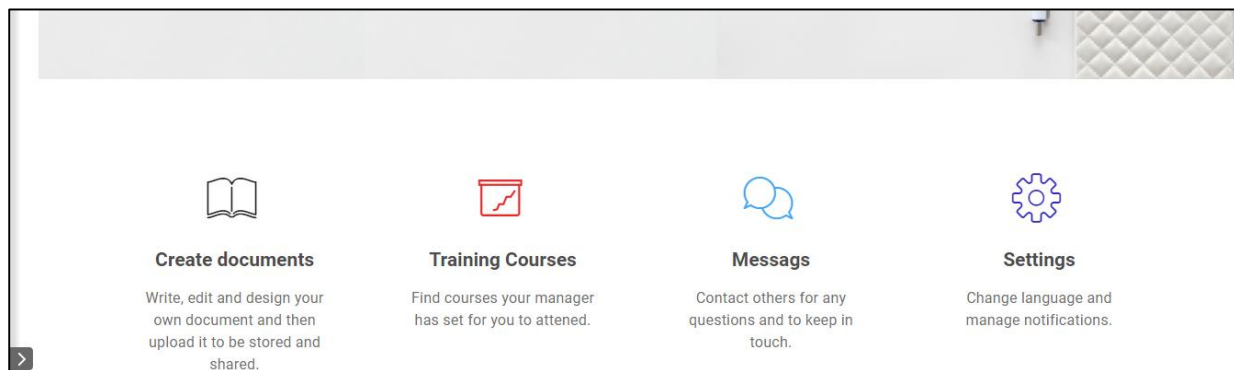


Figure 3. Employee Home Page

When employees create documents the screen shown in figure 4 will appear where they can compose their documents easily with all tools available.

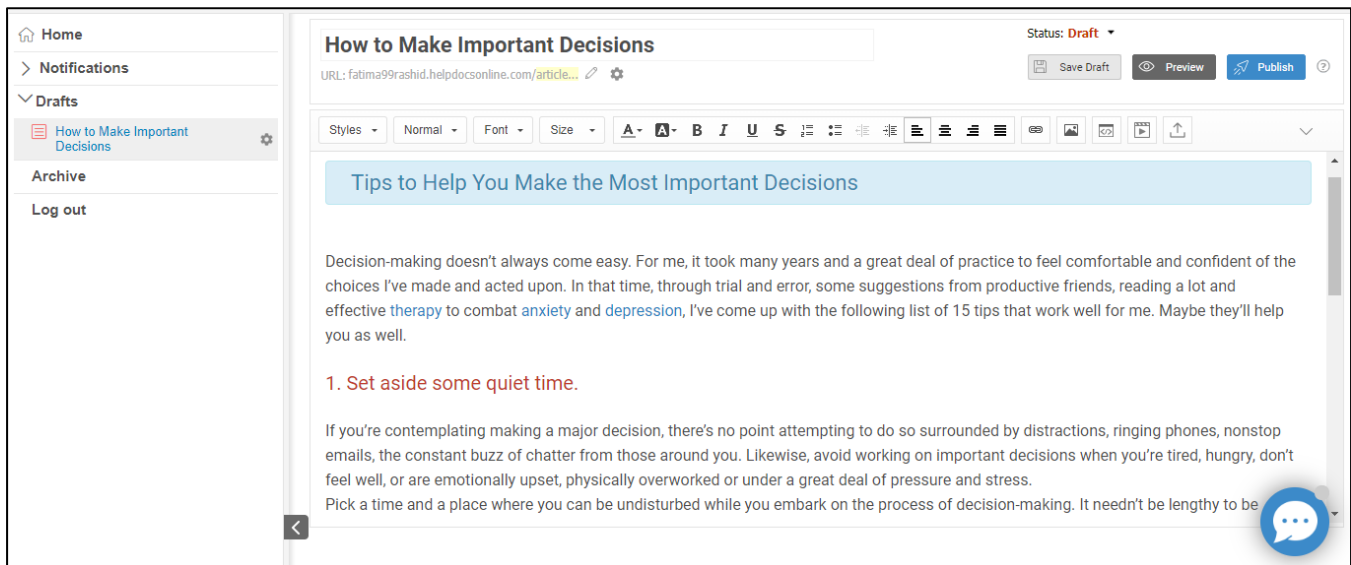
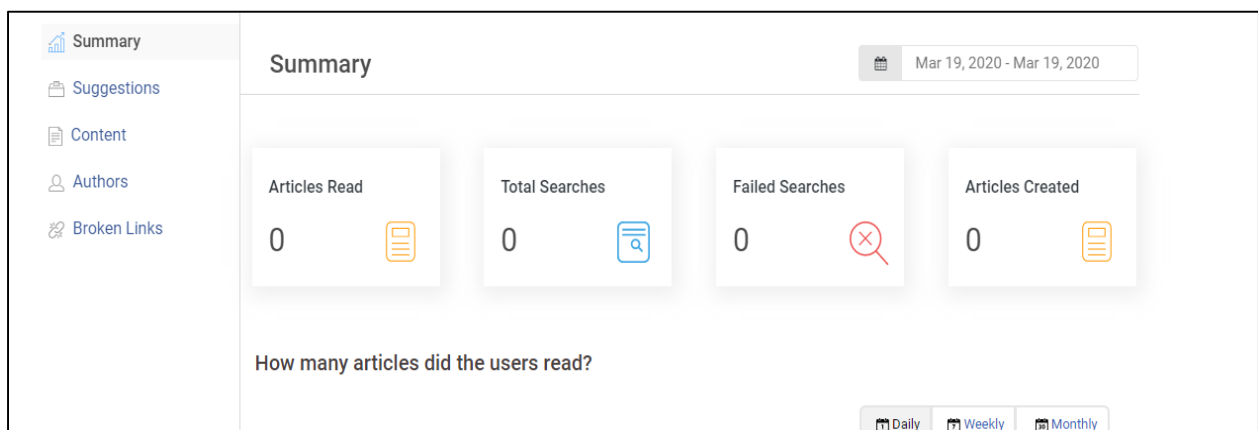


Figure 4. Creating Documents

#### 4.3.4 Managers

In the home page of managers where there's two more icons, that other employees don't have, which is add users and reports because these can be accessed only by managers as shown in figure 5. Managers can add new users and they'll be listed with all of their details such as the emails, roles and more. Also, groups can be created to add users and edited for later when training courses are made. Managers can also set restrictions on certain documents to limit users who can edit the document and limits the views as well. Moreover, managers can view reports, as shown with numbers represented in bar charts to have the reports and also dates can be selected to view a certain period of time.

Figure 5. Documents Report



#### 4.3.5 Admin

When the user clicks “forgot your password?” they’ll have to enter their email and send it. The admin will receive that this user forgot their password and the admin will contact this user as soon as possible to reset the password.

## 5. Conclusion, Recommendations, and Future work

### 5.1 Conclusion

To have KMS is the best way to manage the knowledge in an organization and that’s what public sector organizations needed. MIA lacked not only KM but the whole system that’s why this project was done. Every organization that holds a huge amount of knowledge must get it to be discovered, collected, shared and applied. Through this process it improves in performance, solving problems quickly, making better decisions and aids innovation as well. KMS stores data and have it kept through the years for all employees to retrieve helpful information and to never lose the knowledge in people’s minds even if they retired. The whole research consisted the development of this system from the beginning until it was implemented.

### 5.2 Recommendations

This system will be available for all employees and it is recommended for all employees to use as it offers many tools that is in advantage not for the employee only but the whole organization too. Furthermore, it is recommended for managers to use this system to have a good look on the employees who are using the system through the reports provided from the system itself and to encourage using it.

### 5.3 Future work

Technology is very important for KM as it will form the future of the KM and these technologies also come combined and makes big and amazing changes in organizations like cognitive technology, robotics, artificial Intelligence and 3D printing.

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