Designing Knowledge Management System with Big Data for Data and Information Center Ministry of Health Indonesia

Adrian Suherman¹, Gunawan Wang²

Information Systems Management Department, BINUS Graduate Program – Master of Information Systems Management, Bina Nusantara University, Jakarta, Indonesia 11480

Abstract— Sharing and capture knowledge is one of the important indicators in the ministry of health. The role of staff's knowledge is a benchmark in determining service performance and quality, in this case the Knowledge Management System (KMS) is a solution in supporting the process of knowledge capture and knowledge sharing. However, the growth of innovation in knowledge management is also required in practice. The implementation of big data into the Knowledge Management System plays a role in extracting, transforming, loading, which can help the information system development division and this information technology and infrastructure management subdivision to collect, filter and combine data from various sources. The results of the KMS design are in the form of a site-based application that has a wiki module, discussion forums and document management to share medical experiences and there are search features needed by staff.

Keywords—Knowledge, Knowledge Management, KMS, Big Data

I. INTRODUCTION

The era of information technology is very fast, making competition in the business world to be tighter. Companies or organizations are competing to create a service that can sustain their business, especially in this dynamic business competition era. Therefore, both companies and organizations must have a good and sustainable strategy to be able to adapt to the changes that will occur. One of the strategies and special concerns of a company or organization in this dynamic business competition is to fully pay attention to the human resources that exist within the organization or company.

The rapid growth of data and technology at this time has led to the transformation of data into information and then this valuable information into knowledge [1]. The growth of data and technology is also matched by the increasing number of people who realize the value or value of knowledge and the ways to obtain, recognize, capture, store, and use it so that knowledge can be shared among individuals.

The amount of knowledge that is abundant in an organization or company makes the organization grow and develop from various business sectors.

The existence of information technology assistance in terms of sharing knowledge within organizations and companies is an easy thing to do. One of the technologies that organizations and companies often use in sharing knowledge is knowledge management (KM), where knowledge management can help disseminate knowledge more quickly and easily. The definition of knowledge management is a series of activities or processes that can help companies or organizations identify, organize, disseminate and transfer existing knowledge within the organization or company [2]. In existing companies and organizations, the knowledge management that is owned can only be accessed internally in the company itself so that the knowledge held is not leaked to parties outside the organization or company. Merali said that intranet and internet technology can help organizations to support knowledge management within the company [3].

The development of the times also makes the demand for public services higher, where this government institution must be able to adapt and overcome this dynamic environment so that this public service can finally meet its target, namely serving the community. The many and varied demands remind that the importance of information and knowledge in a government institution. In this study, the object to be studied is the Data and Information Center Ministry of Health. The Data and Information Center of the Ministry of Health has a helpdesk section where the helpdesk is part of the subdivision of infrastructure and information technology management and within the Data and Information Center itself there is an information system development division. The helpdesk here is tasked with solving a problem in services related to networks, video conferencing and data centers at the ministry of health. The staff at the helpdesk are also few but do so many services.

Figure 1: Incident Graph 2020

Table 1
Incident Table 2020

	Data Center	Network
January	47	25
February	67	9
March	29	6
April	43	15
May	6	13
June	6	31
July	41	15
August	59	9
September	50	26
October	50	10
November	39	9
December	46	6
Total	483	174

From incident graph 2020, helpdesk resolved 483 problems about data center and 174 problems about network so the total problems which handled by helpdesk is 657 problems.

From here the helpdesk staff must be able to quickly solve IT problems that occur in the ministry of health with limited staff. The staff in the subdivision of infrastructure and information technology management as well as staff in the information system development division already have knowledge of both tacit knowledge and explicit knowledge, but do not yet have a place or place to store knowledge about the helpdesk. In the information system development division, only a few employees are experts in the IT field and employees in the information system development division rarely document every stage in developing an information system, be it the requirements, design, coding and validation stages to users. These two divisions want a more structured knowledge storage container and the knowledge contained in these two divisions is also in various forms, be it PDF, Word, Excel, PPT, photos, Youtube, Social Media. Problems like this can be overcome by implementing a knowledge management system. With the availability of a container that stores various kinds of information and knowledge which will later be used by the subdivision of infrastructure management and information technology as well as the information system development division, it is hoped that the distribution of information to employees in these divisions and subdivisions will be able to overcome problems and facilitate the work of employees in solving problems. a problem. In this study, the framework used is a combination of the Tiwana framework and the KMSAIM framework along with the knowledge grouping based on Debowski. The use of big data, especially in the use of extract, transform, load can help these two divisions to collect, filter and combine data from various sources to be stored in the data warehouse. Then data warehouse can give recommendations.

II. LITERATURE REVIEW

A. Knowledge

Knowledge is something that is obtained through understanding, facts or from a thought [4]. Knowledge can also mean a collection of facts, opinions, perceptions and ideas as well as choices and beliefs and experiences [5]. According to Nonaka and Takeuchi, knowledge can be divided into 2, namely Tacit Knowledge and Explicit Knowledge [6]. Tacit knowledge is knowledge contained in the person's own mind is in accordance with the understanding and experience felt by the person.

Tacit knowledge is basically more personal in nature and developed with difficult experiences so that it is difficult to formulate and communicate. Explicit knowledge is knowledge that has been translated into the form of documentation or summaries so that it can be shared and easily understood by others. Explicit knowledge is knowledge that is formal and systematic to be shared and communicated to many people [7].

B. SECI Model

Nonaka and Takeuchi with tacit knowledge have provided an overview of how knowledge is viewed by people. Initially, tacit knowledge only became knowledge that was realized by individuals and could not be expressed, then Nonaka and Takeuchi's theory has opened the way to view tacit knowledge as a type of knowledge that has enormous potential and value in an organization. According to Nonaka and Takeuchi, knowledge is made explicit. This idea forms the basis of the knowledge conversion theory, namely the SECI model. This SECI model contains knowledge that is socialized (socialization), externalized (externalization), combined (combination) and internalized (internalization) in a continuous spiral process [6].

Figure 2: SECI Model

C. Knowledge Management

Knowledge management is a collaborative and integrated approach to the creation, retrieval, organization and use of assets within a company. Knowledge management is a set of processes for creating and sharing knowledge throughout the organization to achieve the mission and goals of an organization [8]. Knowledge management is a systematic coordination within an organization that manages human resources, technology, organizational structures and processes to increase value and innovation in an organization [9].

D. Knowledge Management System

Knowledge management system is a technology that supports knowledge management in regeneration and sharing knowledge in an organization [10]. Knowledge management system is an information system that helps the process of creating, storing, remembering and applying knowledge in a company/organization [11]. Knowledge management system is designed with the creation, sharing and storage of knowledge. Knowledge management system is an information system in the field of knowledge that supports the creation, management and dissemination of knowledge to people within an organization [12].

E. The 10 Step Knowledge Management Road Map

Figure 3: The 10 Step Knowledge Management Road Map

Tiwana made 10 step guides for creating and evaluating knowledge management which can be used as guidelines for creating a knowledge management system [13]. The 10 steps in creating a knowledge management system are divided into 4 phases, namely:

1) Infrastructure evaluation

Infrastructure evaluation is concerned with analyzing existing infrastructure and integrating knowledge management with business strategy.

2) Knowledge management system analysis, design, and development

This section deals with the design of knowledge management infrastructure, design of a knowledge management team, auditing and analyzing existing knowledge, making knowledge management blueprints and developing a knowledge management system.

3) System deployment

System deployment relates to testing a knowledge management system, managing change, culture and reward systems.

4) ROI and performance evaluation

This phase deals with evaluating the benefits of the knowledge management system and developing a knowledge management system on a regular basis.

Tiwana Framework that used for designing knowledge management system for Data and Information Center Ministry of Health Indonesia are align KM and business strategy, design the knowledge management blueprint and develop KMS. Align KM and business strategy for knowledge mapping or content management layer. Design the knowledge management blueprint for create KMS architecture. Develop KMS is relate to create user interface.

F. KMSAIM Framework

Figure 4: KMSAIM Framework

KMSAIM stands for Knowledge Management System Agile Implementation Methodology. The KMSAIM framework is built on agile methodologies [14]. The KMSAIM framework was proposed because the framework for designing the existing knowledge management system was deemed quite time-consuming, budgetary and resource-consuming so that it could pose a risk of failure to implement the existing knowledge management system and framework, which does not focus on client collaboration. In fact the KMSAIM framework requires very few resources and agile methods are well suited for cloud-based development. The KMSAIM framework places more emphasis on identification or initialization stages in depth in order to get details of business processes. These are the phases in the KMSAIM framework:

1) Initialization

In the initialization phase, an implementation team is formed and knows the conditions and requirements of the users. The implementation team also knows the business domain. This phase also has a goal, namely to get an overview of the organization, knowledge within the company, the flow of knowledge within the company and business concepts

2) Domain Mapping

This domain mapping phase handles the development of the concepts to be designed and the relationship between concepts in the business domain that are adapted to business processes and the main components of knowledge management, namely people, process and technology. This phase aims to determine what functions must be carried out based on the initialization phase, namely processes and business domains and what technology will be used.

3) Profiles and Policies

This phase contains users who can manage the knowledge management system along with access to a user. In this phase, a user must be determined who will manage the knowledge management system and determine access rights and the authority or scope of a user.

4) Implementation and Personalization

The implementation and personalization phase is related to the design of the knowledge management system that will be made starting from the infrastructure and architecture design and contains the knowledge management system blueprint.

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The implementation and personalization phase is also related to the transformation of requirements into a module that is built using the selected tools.

5) Validation

This validation phase contains the design of a knowledge management system that has been created and then tested in the form of an application that is in accordance with the knowledge management system blueprint.

KMSAIM Framework for designing knowledge management system for Data and Information Center Ministry of Health Indonesia are domain mapping and profiles and policies. Domain mapping for map the user's requirement. Profile and policies for create the scope for user.

G. Big Data

Big data contains exponentially increasing complex and unstructured data quickly and data accumulates with remote profiling options. Big data is a structure that analyzes conventional database management using an analysis system. Big data is a large variety of data with unstructured data with conceptual innovations that have been used in various fields [15]. Big data is data that has 4 characteristics, namely volume, veracity, variety and velocity.

H. KMS with Big Data

One strategy for managing sharing, capture and create new knowledge through KMS is use big data. Big data can extract information from structure data and unstructured data from many sources [16]. It can help staff to create knowledge from many resources to improve service for Ministry of Health Indonesia.

I. ETL

Extract, transform and load (ETL) is the core process of data integration and is often associated with data warehouses [16]. ETL functions to integrate data by involving extracting data from outside sources and then converting it according to business needs and finally entering it into the data warehouse. In the extract, transform and load (ETL) process, the role is to extract data, convert data and enter it into the data warehouse. Extraction is the process of retrieving relevant data sources. Transformation is related to the data cleaning process. Loading is the process of transferring data to a data warehouse [17].

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III. METHODOLOGY

The design model in this study begins by defining the domain mapping. Then, the second step is to define profile and policies. The third step is to create a knowledge management blueprint. The fourth step is to design the integration of big data with the knowledge management system and ends with the Design Knowledge Management System User Interface.

A. Domain Mapping

The first phase is to do a domain mapping. This phase contains what is needed by the organization based on the knowledge management architecture.

B. Knowledge Mapping

The second phase is knowledge mapping. Where in this phase, the existing knowledge grouping is carried out in the information system development division and the infrastructure and information technology management subdivision.

C. Profile and Policies

This profile and policies stage determines users and what users can do in a knowledge management system and also provides access according to users. Any scope restrictions will also be defined at this stage. In this third stage, a use case will also be made.

D. Design and Integrating Big Data

In this phase, we design a big data framework in the form of an architecture and how to map big data with knowledge management.

E. Design Knowledge Management System User Interface

At the stage of developing a knowledge management system in this research, create a user interface design for a knowledge management system. The prototype design made will be web-based on desktop and mobile. All paragraphs must be indented. All paragraphs must be justified, i.e. both left-justified and right-justified.

IV. RESULT AND DISCUSSION

The design model in this study begins by defining the domain mapping

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A. Domain Mapping

In Domain Mapping phase, it contains the requirements of Infrastructure and Information Technology Management Subdivision and Information System Development Division.

1) Requirement from Infrastructure and Information Technology Management Subdivision

Table 2:

Requirement from Infrastructure and Information Technology Management Subdivision

Requirement	Module
Existence of explicit knowledge documentation to make it easier to solve a problem case from the admin helpdesk	Wiki
Exchange of employee's explicit knowledge	Wiki
Documenting the results of one-way discussions between the staff of the infrastructure management and information technology division	Forum
There is a module in knowledge management that can replace Whatsapp as a place for previous discussions	Forum

2) Requirement from Information System Development Division

Table 3:

Requirement from Information System Development Division

Requirement	Module
There is documentation of the stages of a project work	Wiki
There is knowledge sharing among employees of the information system development division	Forum
There is document management, where the documents can also be downloaded (such as letters for projects)	Document Management

B. Knowledge Mapping

In the knowledge mapping phase, the authors classify existing knowledge. This grouped knowledge functions as a filter or advanced search.

1) For Infrastructure Management and Information Technology Subdivision

Table 4:

Knowledge Mapping for Infrastructure Management and Information Technology Subdivision

Topic	Subtopic
Backup	Cold Backup
	Hot Backup
	Warm Backup
Cloud Storage	Cloud Document
	Network Area Storage
	Upgrade Storage
Colocation	IP request
Hosting	Database access
	Backup database
	Operation system downgrade
	Web Framework Installation
	Web Service Installation
	Operation System Configuration
	Server Migration
	Server Request
	Remote Access
	Service Upgrade
	Information System Upgrade
Internal	IP Usage
	IP switch
Network	Dialup Tunnel Client
	IPSec Dialup Tunnel
	IPSec Site to Site unnel
	Load Balancing
	Cable Network Installation
	SSID Addition
Security	Web Application Firewall Activation
	Antivirus
	Create User Access
	Open Service (Port)
	SSL request
	Security Test
Customer Service	Other

2) For Information System Development Division

Table 5:

Knowledge Mapping for Information System Development

Topic	Sub-Topic
Technical knowledge	Programming
	Query
Tools Usage	Tools A Usage
	Tools B Usage
Information System Project	Project Case
	Document for Project
	Project Method

C. Profile and Policies

Figure 6 : Use Case Diagram

D. Design and Integrating Big Data

In the design and integrating big data phase, the author designs a framework for big data itself and maps big data to a knowledge management system. The big data framework designed here focuses on extract, transform, load (ETL).

1) Big Data Framework

Knowledge Database is data that comes from wiki and forum that have been created in KMS. Website, Office 365, File Sharing, Knowledge database included in ETL. The data sources transform to XML. Social Media and Youtube transferred via Apache Floop to Data Warehouse. Then after the ETL enters the data warehouse to be stored and later used as recommendations and queries. These recommendations can be wikis or frequently searched forums. This query is used to search on search engines.

Figure 7 : Big Data Framework

2) Mapping Big Data to KMS

Mapping big data is how to integrate the knowledge management system with big data so that it can be useful for sharing knowledge in the Information Technology and Infrastructure Management Subdivision and Information System Development Division. Big Data here is a file search engine in various forms and is built on Apache Hadoop. The search results are in the form of SQL queries that generate meta data and files contained in the Data and Information Center. Search results are collective, so there must be references to the results provided by search engines, be it wikis, forums or document management.

Figure 8 : Mapping Big Data to KMS

E. Design Knowledge Management System User Interface

1) Login Page

On login page, the user must enter a username and password.

Figure 9 : UI Login Page

2) Main Page

On front page there are menus, KMS search engine features, new wikis, popular wikis, forums and activity.

Figure 10 : UI Main Page

3) Search Engine Page

This search engine page appears after the user searches for a keyword in the KMS search engine feature on the front page.

On this search engine page there are advanced search, date modified, and an area to display what you are looking for.

Figure 11 : UI Search Engine Page

4) Wiki Page

Wiki page is similar to wikipedia in that it is a one-way article. On this wiki page there are advanced search, date modified, saved wiki, wiki area.

Figure 12 : UI Search Engine Page

5) View Wiki

This page shows more if we have clicked on one of the existing wiki articles.

Figure 13 : UI View Wiki

6) Forum Page

On forum page there are advanced search, date modified, forum area, saved wiki.

Figure 14 : UI Forum Page

7) View Forum

On this page more shows if we have clicked on one of the existing forums.

Figure 15 : View Forum

Figure 16 : UI Forum Page

The display of the forum view in the subdivision of infrastructure management and information technology because it only wants interaction between 1 staff and 1 other staff, then 1 staff who asks at the forum can choose which is the best answer from the staff who answers the question and then the best answer will be displayed.

8) Add Wiki

Figure 17 : UI Add Wiki and Fill Content

Figure 18 : UI Add Wiki and Upload Document

9) Add Forum

Figure 19 : UI Add Forum

10) Document Management

Figure 20 : UI Document Management

11) Add Document Management

Figure 21 : UI Add Document Management

V. CONCLUSION

The conclusions that can be drawn from the design of the knowledge management system at the Data and Information Center of the Ministry of Health are that the application of a good knowledge management system will help the Data and Information Center of the Ministry of Health to manage existing knowledge, increase knowledge sharing among employees and the creation of new knowledge by employees of the Data and Information Center of the Ministry of Health. The existence of a forum to accommodate and share existing knowledge at the Data and Information Center of the Ministry of Health creates productivity for the staff of the Data and Information Center of the Ministry of Health.

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The application of a big data-based knowledge management system will assist the Ministry of Health's Center for Data and Information in integrating data from data sources and entering it into the data warehouse.

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