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PROTOTYPE OF KNOWLEDGE MANAGEMENT SYSTEM (KMS) E-PROCUREMENT WEB-BASED: CASE STUDY AT PT.SIGMA PRO 77

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Abstract— Development of business and technology make knowledge become one the primary needs for a company to increase the effectiveness of business processes. Knowledge Management System (KMS)is applied with a web-based system into a solution of knowledge transfer needs for e-procurement activities. This study uses qualitative descriptive method, using the framework of Model Tiwana, knowledge mapping using Model Zack, for the formation of knowledge using SECI model. Prototype system development method using Evolutionary prototyping. Methods in analyzing and designing systems is Object Oriented Analysis and Design using the Unified Modeling Language. Software quality is tested based on four characteristics of software quality model of ISO 9126, namely: functionality, reliability, usability, and efficiency.
Keywords— Knowledge Management System; SECI Model; Evolutionary Prototype; ISO 9126 Model; E-Procurement;

I. INTRODUCTION

The development of business and technology is moving very quickly, knowledge become one the primary needs for a company to increase the effectiveness of business processes. Realising the tough competition, it needs to change the paradigm that was originally rely on resource-based into a knowledge-based. Most employees in the company are busy with their work and careless to document or share the knowledge that they gained while performing their responsibilities, so that whenever employees are facing a similar case, they do not have a reference about what solutions they ever applied first and consequently should analyze from the beginning. This is the function of a Knowledge Management (KM) to keep the knowledge that disappear because of those problems.In the business world, competition between companies is increasing, therefore every company is required to make changes to achieve a success in doing business[1]. *Knowledge management* is a new concept in the business world that has implemented various large companies.In principle, concept of *the knowledge management* aims to improve the quality of human resources in an organization to improve communication among all parts of the organization and improve the mastery of knowledge by *transferring* knowledge. Knowledge is divided into two types, they are *tacit* and *explicit* knowledge.

Tacit knowledge is knowledge stored in the human brain, such as thinking, memorization and personal experiences. *Explicit knowledge* is knowledge that is outside the human head, such as books, journals, documents and others. The role of *knowledge* in agency is important. But recently, the company is still a lot of knowledge and experience that has not been documented, and also still very minimal knowledge of sharing culture among staff. This is the background to research on PT.SIGMA PRO 77. The problems are : 1. How to make a prototype Knowledge Management System web-based can be applied to *e-procurement* activities? 2. How the results of this testing prototype Knowledge Management System web-based using ISO 9126 model? The purpose and benefits of the research are: 1. Provide the learning solutions that effectively and efficiently through the prototype KMS on e-procurement. 2. Make prototype of KMS on the activities of e-procurement in the form of a web application. 3. The results of this study are expected to contribute for ensuring the application of knowledge management within an organization and can be a material reference for further research. 4. The results of this study are expected to be a model application of knowledge management in the activities of e-procurement. In this writing, the authors presents in five parts, **I. Introduction**, in this section will be described about the formulation of the problem and the purpose of research benefits. **II. Platform Theory**, in this section will be described briefly the theory that supports the preparation and writing of this journal. **III. Methodology and Design Research**, in this section will be discussed about the exposure method used by the authors. **IV. Result Research,** in this section will be described about result of the prototype. **V. Conclusion**, in this section the author gives the conclusion of what has been discussed in previous chapters[2].

II. PLATFORM THEORY

A. Data, Information, and Knowledge

Organizations should have a good management system to produce quality and useful knowledge for the organization, because without data and information, we will not produce knowledge. Data are numbers, associated with numbers or attributes that are quantity, which is derived from observation, experiment, or calculation. Information is relating to the explanation, interpretation, and relationships with other material about objects, events or certain processes. Knowledge of information has been organized, synthesized, summarized to increase understanding, awareness or understanding. Knowledge is information that comes with understanding the relationship patterns of information with experience, both individuals and groups within the organization. Knowledge is information that is believed to direct to take a decision to act. According to Davidson and Voss, to understand the differences between data, information and knowledge, should be underlined value hierarchy. Information is data that is filtered and interpreted, as well as knowledge is information that is filtered and interpreted, according to Sang [3].

B. Knowledge

Probst argued that knowledge is the whole part of the existing knowledge and skills of individuals who are used to solve problems. Knowledge is divided into theory and practice are generally in the form of rules and instructions to make a decision. Knowledge depends on the data and information held by a personal which reflects on an opinion, according to Prob [4]. Knowledge is information that has been organized in the framework, model, worldview, concepts, principles, theories, hypotheses, or ground into action to improve the understanding of the situation of problem solving and decision making related to the situation and increase the likelihood of completion of a task. Knowledge is the domain of understanding of the actions of people, according to Beas [5]. Knowledge is information that comes with understanding the relationship patterns of information with experience, both individuals and groups within the company. Knowledge is the application of information believed to be directly used to take the decision to act, according to Wida [6].

C. Knowledge Management

President and Founding Chairman of Brinnt Institute states that "*knowledge is the potential for action based upon data*, *information*, *insights*, *intuition and experience*". Which means that knowledge is the potential for action based on the data, information, insight, intuition and experience, according to Malh [7]. Knowledge Management works to increase the organization's ability to learn from their environment and incorporate knowledge into business processes. Knowledge Management is a set of processes that are developed in an organization to create, collect, preserve organizational knowledge, according to Laud [8].

D. Knowledge Management (KM) Framework Tiwana

Amrit Tiwana modeling framework KM into 4 phases with 10 steps as follows: Step Evaluation Infrastructure Analysis of the existing infrastructure. In this step done things as follows :

a. Connecting networks, intranets that exist today in the knowledge management strategy.
b. Understanding knowledge management framework and its components.
c. Integrate existing intranets and extranets today with KMS.
d. The initial business needs analysis to evaluate the knowledge server.
e. Identify limitations and gaps in the existing infrastructure.
f. Take definite steps to invest and build the existing structure.

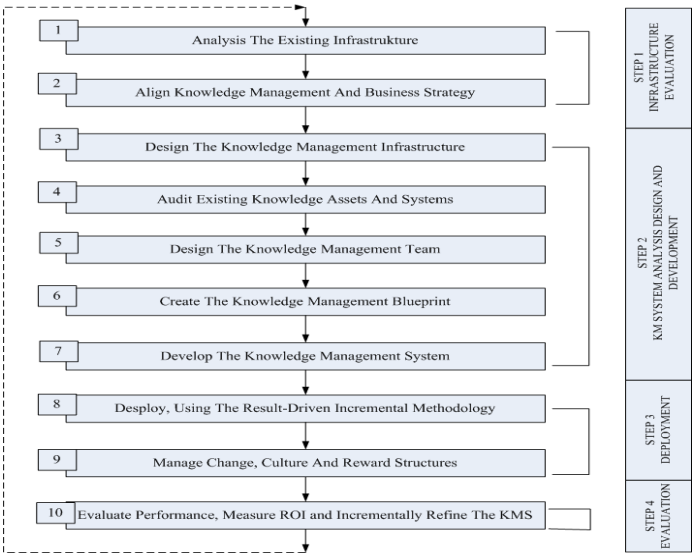

Fig. 1. Framework Tiwana

1. Step Analysis, Design and Development KMS :
   a. Step KM infrastructure design :
      1) Choosing IT components to create, find, integrate knowledge.
      2) Identify internal and external knowledge sources.
      3) Determining the collaboration platform.
   b. Audit and analysis of knowledge :
      1) Analysis of knowledge.
      2) Identification of grouping knowledge.
   c. Design the KM team:
      1) Identifying stakeholders.
      2) Specify the source for a particular field.
      3) Choosing an experienced project leader.
      4) Identifying things like end-user involvement and support from management.
      5) Balancing the management team and technology.
   d. Making KM blueprint. KMS overall designing both hardware, software, networks and design of the data.
   e. Develop KM. In this development phase, each layer of the seven layer architecture knowledge management began to study deeper.
2. Deployment Phase :
   a. RDI method. In conducting the deployment of a system, it is necessary methodology to help smooth the deployment phase of the system development project.
   b. Managing change, culture and appreciation. At this step, a CKO (Chief Knowledge Officer) which is tasked to monitor and oversee the course knowledge management system so that the system can run well.

4.Evaluation Phase.

At this step the results of the implementation of knowledge management started to be measured and evaluated.

E. Cycle Knowledge Management Framework Zack

Effective Knowledge Management should begin to look strategically about what knowledge is needed by the organization, according to Tiwa [9].

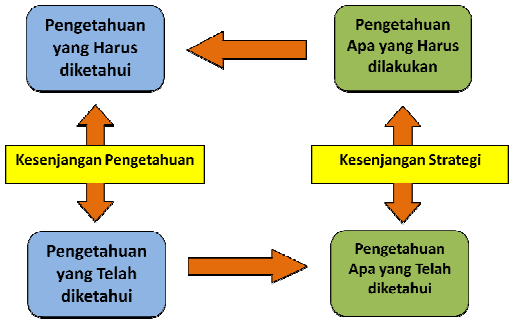

Fig. 2. Framework Zack

This is to ensure that the KMS is developed to what is necessary, as well as the organization's core competency. This alignment can be started by determining what strategy is being or will be executed and what has been run by the organization. Then do a study on the knowledge of what it takes to execute the strategy and what knowledge already owned by the organization. The relationship between strategy can be seen in the figure below:

F. Knowledge Spiral (SECI)

Ikujiro Nonaka makes formulations known as SECI or knowledge Spiral. That knowledge in a process that is described in a spiral, the process was called Socialization-Externalization-Combintion-Internalization, according to Nonaka [10].

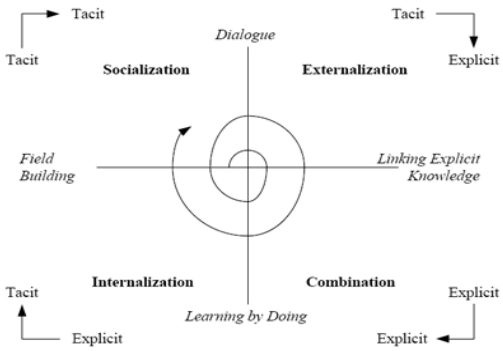

Fig. 3. SECI Knowledge

1. The process of externalization that is changing the tacit knowledge that we have become explicit knowledge. Able to write the know-how and experience we get in writing articles or books. And these writings will be very useful for other people who are in need.
2. Combination process, which utilizes the existing explicit knowledge to explicit knowledge so we implemented another. This process is very useful to improve skills and productivity of yourself.
3. Internalization process of transforming explicit knowledge as inspiration coming of tacit knowledge. From the previous process, maybe this is all we have done. It says learning by doing.
4. Socialization process of transforming tacit knowledge to tacit knowledge of others. This is sometimes forgotten. We did not take advantage of our presence on the job to learn from others, who may be more experienced.

G. Unified Modeling Language (UML)

According to Dennis, the Unified Modeling Language (UML) is a standard language for the visualization, specification, construction and pemdokumentasian of the artifacts of a software, and can be used for all step in the system development process from analysis, design to implementation, according to Denn [11]. UML provides several standard notation and diagrams that can be used as a communication tool for developers in the process of system analysis and system design. Diagrams in UML is defined as information in various forms that are used or generated in the process of software development. Based on the perspective in the process of object-oriented analysis and design with UML, there are several major UML diagram that can be used, namely:

1. Use Case Diagram.
   Describe the functionality expected of a system and describe the workflow[12].
2. Activity Diagram.
   An analysis model used or describe a process activity.
3. Sequence Diagram.
   Describe the objects that exist in the use case and the message that run in a use case.
4. *Class Diagram*.
   Describe a number of classes and the relationships between the classes in the system.

H. Evolutionary Prototype Model

In this study, using evolutionary prototype development.

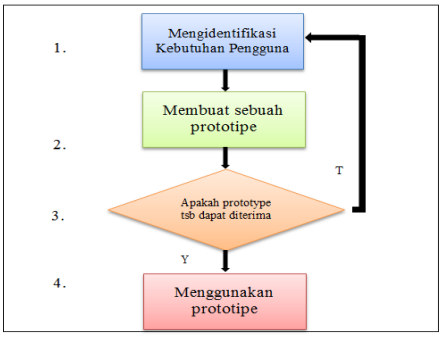

Fig. 4. Evolutionary Prototype Model

This method is a prototype model based on the idea of developing early implementations, then showing the initial system to users to comment on, and fix version to the version for the sake of a system that meets the requirements is obtained.

I. Application Testing Techniques

By knowing the predetermined function, so the test is done to look for errors in each function. Black Box Testing is designed to validate functional requirements without knowing the internal workings of a program.

Acunetix is one of the software used by the network security testing of web, this software works to find the weak points of a web-based application that can then be covered by improving the existing weak points. Acunetix is used by the IT consultant and Web Developer in testing web applications. Acunetix security holes can scan a website and displays it in a fairly complete report.

J. ISO 9126 Model

Software quality can be assessed through measurements and certain methods, as well as through software testing. One measure of the quality of the software is ISO 9126, established by the International Organization for Standardization (ISO). ISO 9126 memdefinisikan quality of software products, models, quality characteristics and related metrics used to evaluate and define the quality of a software product. ISO 9126 standards have been developed in an attempt to identify the key attributes for the quality of computer software. The quality factor according to ISO 9126 includes six quality characteristics as follows:

1. Functionality . The ability of the software to provide function according to user needs, when used in certain conditions.
2. Reliability. The software's ability to maintain a certain level of performance, when used in certain conditions.
3. Usability is the ability of software to be understood, learned, used and attractive to the user, when used under certain conditions.
4. Efficiency is the software's ability to provide appropriate performance and relative to the amount of resources used during these circumstances.
5. Maintainability namely the ability of the software to be modified. Modifications include corrections, improvements or adaptation to a changing environment, requirements and functional specifications.
6. Portability. The ability of the software to be transferred from one environment to another environment.

K. e-Procurement

E-procurement is a procurement process that using the Internet as a tool of information and communication. E-procurement has a huge of knowledge about the meaning of e-procurement, the terms in *e-procurement,* the methods in *e-procurement,* LPSE, applications that used to support the activities of *e-procurement,* the way of making the documents required, the stages are pre-qualification and post-qualification.

L. Related or Previous Research

In system information major, we found various kinds of journal that related to our current works. We can see it briefly in this following sentences:

1. The research that conducted by Agus Umar Hamdani, proposed Prototype Knowledge Management System for General Bureau and Human Resources Budi Luhur University using CMS and Joomla[13]. He did some research how prototype model that suitable for primary service at General Bureau and Human Resources Budi Luhur University.
2. The research that conducted by Abil Rio Baskoro was about Development Model of Knowledge Management System Web Based at Institutional Risk Monitoring Department[14]. This research used Fernandez's Framework and SECI Model.
3. The research that conducted by Budiono is titled Prototype Knowledge Management System for Supporting Inovation System Model using Open Source Technology Case Study at BPPT[15]. He concluded that this application not using CMS application open source, but built by independent as it needs.

M. Troubleshooting Mindset

The following design problem-solving mindset for this study:

Troubleshooting Mindset explanations above are used in this study can be explained as follows:

1. Researcher did a technology assessment review from aspects of the problems that occur at this time, as well as review of knowledge management concept and information technology aspects.
2. Using Evolutionary prototyping system development methods, researchers will conduct analysis and system design with UML, followed by coding the PHP programming language and MySQL database as well as conducted testing of the system that has been developed using FGD and Black Box Testing.
3. Display applications are built so that the user can input the data. The data is stored in a MySQL database and one time when the data is displayed as with more user friendly visual display.
4. Testing with several methods that have been done then be concluded whether the system is fit in ISO 9126

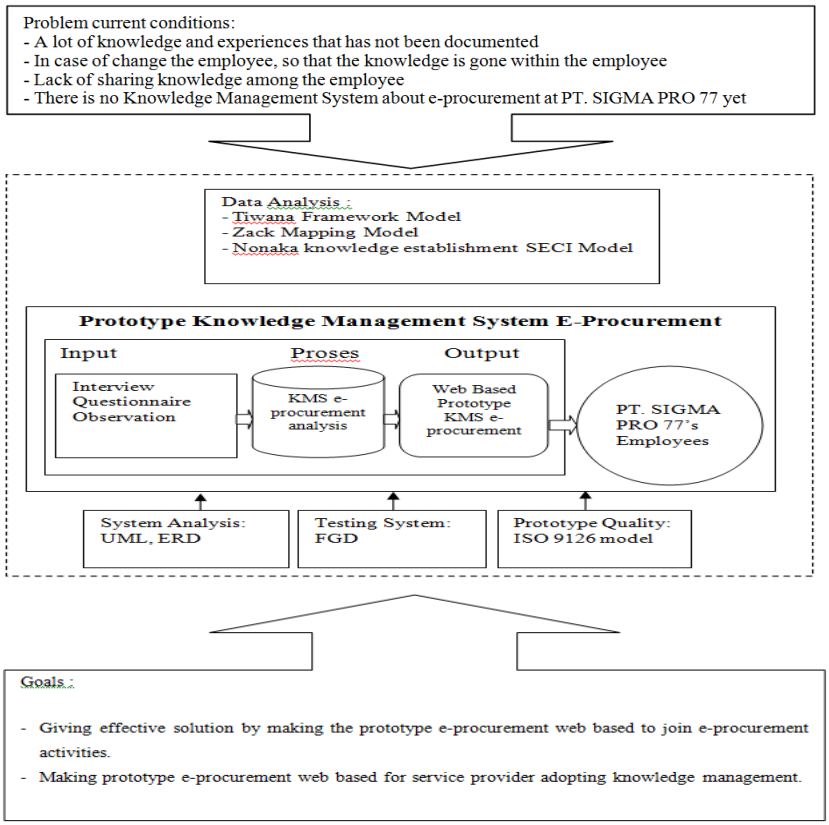

Fig. 5. Troubleshooting Mindset

N. Hypothesis

Based on the above framework, the researcher propose a hypothesis as the early conclusion of the problem formulated. The hypothesis is a temporary answer to the problems in research.

Based on the above, the researcher propose the following hypothesis :

1. Analysis model with Tiwana framework, design and implementation of software for web-based KMS prototype estimated using information system of evolutionary prototyping models can produce a KMS application that can be applied to e-procurement activities at PT. SIGMA PRO 77, so that increase knowledge sharing among the employees.
2. Level of quality prototype knowledge management system e-procurement at PT. SIGMA PRO 77 that produced based on four characteristics of ISO 9126 models, namely: functionality, reliability, usability, and efficiency can achieve very good criteria.

III. METHODOLOGY AND DESIGN RESEARCH

A. Research Method

Method of research is a qualitative descriptive method.

B. Sample Selected Method

The sample selection using Purposive Sampling technique, which is one of the sampling technique that is often used in research. Selection of samples based on employees who use e-procurement system.

C. Method of Collecting Data

Data collection can be done by:

1. Interview, we've done question and answer the employees of PT. SIGMA PRO 77.
2. The questionnaire is a technique of collecting data indirectly. Instrument or tool data collection is also called the questionnaire contains a number of questions that must be answered by the respondent. Respondents in the habit of giving answers in accordance with the perception.
3. Observation is a technique of data collection, where researchers make observations directly to the object of research to see closely the activities undertaken.

D. Data Analysis Technique

Data analysis techniques in this study using 4 phase roadmap for knowledge management from Amrit Tiwana, by making adjustments, namely the evaluation phase of infrastructure is supported by the interviews and questionnaires. Phase analysis and design with UML object-oriented approach, while the design of the system includes database design, system architecture and interface knowledge web-based management system.

4 phase roadmap for knowledge management of Amrit Tiwana used as follows:

1. The current infrastructure system
   Analysis of the current systems and infrastructure executed analysis of existing systems and infrastructure at this point in the object of research to find out the work process that related to the implementation of knowledge management.
2. Analysis of user needs and knowledge management systems
   Knowledge management strategies align with organizational strategy. Conducting user needs analysis of the questionnaire results to determine requirements and facilities desired knowledge of prototype knowledge management system to align with the organization's strategy.
3. Creating a knowledge management infrastructure design
   From the analysis of the systems and infrastructure that has been done later by designing knowledge management infrastructure for the implementation of knowledge management system prototype e-procurement.
4. Conduct an audit of the huge of knowledge
   A systematic examination of the activities of knowledge management in research objects. The components used in the audit of knowledge management is knowledge quality audit of learning knowledge management.
5. Develop design knowledge management team
   From the results of infrastructure design knowledge management and audit of the wealth of knowledge and then do the preparation of knowledge management team to describe levels of users in the use of knowledge management system prototype e-procurement.
6. Design knowledge management system
   Perform knowledge management system design such as architectural design, sitemap design, and interface design.

E. Steps Research

TABLE 1- STEPS RESEARCH

Phase	Input	Process	Output
1.Data analysis	Object of research, interview guides, questionnaires, and observation.	Analyzing data collected from interviews, questionnaires, and observations.	Data from interviews, questionnaires, and observation.
2.Analysis of the organization's activities.	From the observation.	Analyzing the organization's activities.	Data organizational activities.
3.Organizational knowledge needs analysis.	Organizational knowledge needs analysis.	Analyzing the knowledge needs of the organization.	Data needs organizational knowledge.
4.Analysis of the wealth of knowledge.	Data needs organizational knowledge.	Analyzing the wealth of knowledge.	Data organization with knowledge.
5.Analysis of organizational characteristics	Data relating to the organization.	Analyzing the characteristics of the organization.	The size of the organization, business strategies and the environment.
6.KMS scenario analysis On e-procurement.	Activity data, knowledge organization.	Analyzing the knowledge management process and create model of KMS.	The process of knowledge management and KMS models.
7.Analysis of the current systems and infrastructure	Data from observation.	Analysis of the current systems and infrastructure.	Data on infrastructure.
8.KMS needs analysis in e-procurement.	Data from interviews, questionnaires, and observation.	KMS needs analysis in e-procurement.	Functional and non-functional needs.
9.Infrastructure design and architecture.	Data on infrastructure.	Designing the infrastructure and architecture of KMS in e-procurement.	KMS infrastructure design and architecture in e-procurement.
10.Design knowledge management team.	The size of the organization, strategy business and uncertainly.	Develop knowledge management team.	Develop knowledge management team.

11.The system design e-procurement.	Functional and non-functional needs.	Designing a system of e-procurement.	Sitemap design, interfaces, databases.
12.Database creation.	Design database.	Create a database in MySQL.	Databases and tables.
13.Making an application.	Sitemap design, interfaces, databases.	Creating an application with the editorial dreamweaver.	KMS prototype learning web-based e-procurement.
14.Prototype evaluation.	KMS prototype learning web-based e-procurement.	To evaluate the pierce of the functional requirements of the system.	Evolutionary prototype evaluation results.
15.prototype testing.	KMS prototype learning web-based e-procurement.	Test scenarios, assessment questionnaires, interviews.	Evolutionary prototype test results.

IV. RESEARCH RESULT

A. Data Analysis

The initial steps were taken to identify the object of the study is to analyze the data collected from interviews, observations, questionnaires and documents. Results obtained from the collection of the data in this study as follows:

1. Interview

Data were collected from interviews grouped in the following table:

TABLE 2- INTERVIEWS RESULT

No	Kind	Description
1.	Data on PT. SIGMA PRO 77	From interviews obtained data about the history of the PT. SIGMA PRO 77 and Vision Mission.
2.	Knowledge sharing	From the interview data showed that the current knowledge sharing only happens in work environment.
3.	Facilities and infrastructure	From the interview data on infrastructure, IT infrastructure at PT. SIGMA PRO 77.
4.	system requirements	From the interview data showed no IT-based systems that can manage activities of knowledge management and knowledge sharing among employee.

2. Questionnaire

The data collected from the questionnaire grouped in the following table:

TABLE 3 - QUESTIONNAIRE RESULT

No	Kind	Description
1.	Knowledge owned	From the e-procurement questionnaire
2.	Knowledge not shared	From the questionnaire knowledge not possessed in e-procurement is a web-based learning.
3.	Knowledge required	Data obtained from questionnaires that are currently necessary knowledge e-procurement is the web and the internet.

3. Observation

Data were collected from the observation grouped in the following table :

TABLE 4 - OBSERVATIONS RESULT

No	Kind	Description
1.	Facilities and infrastructure	From the observation data showed that PT. SIGMA PRO 77 have one building consists of meeting room, administration, and staff room.
2.	means of support	From the observation data showed that PT. SIGMA PRO 77 have a field that is used by employees.
3.	IT infrastructure	From the observation data showed that PT. SIGMA PRO 77 already has the IT infrastructure.

B. Functional and Non-Functional Requirement User

After observation, interviews with the user, there are some feature requests from users for this prototype. Therefore, these researchers elicitation process to the functional and non-functional requirements in order to get some actual needs required by the user. These needs are as follows:

TABLE 5- ELICITATION FUNCTIONAL AND NON FUNCTIONAL PHASE 1

Functional	
1.	Admin can manage applications
2.	Admin can manage category knowledge
3.	Admin can manage knowledge
4.	Users can perform authentication
5.	Applications can display a menu category knowledge
6.	Applications can display knowledge in the form of text, image, and video
7.	Users can conduct a discussion on the topic thread
8.	Applications can display page summary discussion
9.	Users can give a rating on a knowledge
10.	Users can download the document

Non Functional	
1.	Displays a message if the wrong input
2.	Only need three minutes for the process action

TABLE 6 - ELICITATION FUNCTIONAL AND NON FUNCTIONAL PHASE 2

Functional				
Users want the system can :		M	D	I
1.	Admin can manage applications	√		
2.	Admin can manage category knowledge	√		
3.	Admin can manage knowledge	√		
4.	Users can perform authentication	√		
5.	Applications can display category knowledge menu	√		
6.	Applications can display knowledge in the form of text, image, and video	√		
7.	Users can conduct a discussion on the topic thread	√		
8.	Applications can display page summary discussion		√	
9.	Users can give a rating on a knowledge			√
10.	Users can download the document	√		

Non Functional				
The system is expected to :		M	D	I
1.	Displays a message if the input wrong	√		
2.	Only need three minutes for the process	√		

TABLE 7 -ELICITATION FUNCTIONAL AND NON FUNCTIONAL DRAFT

Functional	
Users want the system can:	
1.	Admin can manage applications
2.	Admin can manage category knowledge
3.	Admin can manage knowledge
4.	Users can perform authentication
5.	Applications can show category knowledge menu
6.	Applications can show knowledge in the form of text, image, and video.
7.	Users can conduct a discussion on the topic thread
8.	Applications can display page summary discussion
9.	Users can download

Non Functional	
I want the system that can:	
1.	Displays a message if the wrong input
2.	Only need three minutes for the process

C. Testing With ISO 9126

ISO 9126 quality testing consists of two parts, namely: the quality level of each aspect is based on four characteristics ISO 9126, and the overall quality level of the four characteristics of ISO 9126. Of the 10 respondents who filled out a questionnaire for quality testing of prototype software Knowledge Management System(KMS) e-procurement web-based.

Respondents to the quality level prototype Knowledge Management System(KMS) e-procurement based software quality indicators of the respondents' answers according to ISO 9126, can be measured by using the following formula:

$$\% \text{ Actual score} = \frac{Actual\ Score}{Ideal\ Score} \text{ x } 100\%$$

Explanation :

1. Actual Score is the answer to all respondents on the questionnaire that has been proposed.
2. Ideal score is the highest score or all respondents assumed to choose the answer with the highest score.

TABLE 8 - CRITERIA SCORE PERCENTAGE OF RESPONDENTS AGAINST IDEAL

% Total Points	Criteria
20.00% - 36.00%	Not good
36.01% - 52.00%	Minus good
52.01% - 68.00%	Enough
68.01% - 84.00%	Good
84.01% - 100%	Very good

Based on analysis of data obtained from the questionnaires, the following recapitulation of the quality testing based on four aspects of software quality according to ISO 9126, namely:

TABLE 9 - ISO 9126 TEST RESULT

Aspect	Actual score	Ideal score	% Actual score	Criteria
Functionality	404	450	89.78%	Very good
Reliability	215	250	86.00%	Very good
Usability	351	400	87.75%	Very good
Efficiency	139	150	92.67%	Very good
Total	520	630	89.05%	Very good

Based on the table above it can be concluded that the level of quality prototype Knowledge Management System(KMS) e-procurement web-based overall criteria Very Good, with a percentage of 89.05%. Aspects of the highest quality is based on aspects of Efficiency with a percentage of 92.67%, while the lowest quality aspect is the aspect Reliability with a percentage of 86.00%.

V. CONCLUSIONS

Based on the analysis and testing of this study is concluded to address the problems are:

1. Model Tiwana framework analysis, design and implementation software for KMS prototype that can be applied to the learning activities at PT. SIGMA PRO 77, so as to improve the mastery of knowledge and sharing knowledge among employees.
2. The level of quality prototype knowledge management system in PT. SIGMA PRO 77 produced by Black Box Testing and four characteristics ISO 9126 models, namely: functionality, reliability, usability, and efficiency can achieve the criteria Very Good.

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