Implementation of e-Learning based on Knowledge Management System for Indonesian Academic Institution

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***Abstract*—As per May 2016, in the second semester of 2015-2016 there are 5.144.659 active students served by all academic institutions in Indonesia. This number is large compared to the number of academic document indexed by Google Scholar, which only reaches about 1.150.000 documents. The main purpose of this research is to propose a design of information system solution that has the capability on acquiring knowledge, manage the knowledge, and empowering the knowledge in the form of academic document, which in return can improve the number of documents indexed by Google Scholar. We use TM Forum Application Map or TAM from Frameworx 13.5 as a framework to design the solution as Knowledge Management System. Empowerment of well-documented explicit knowledge to create eLearning will focus on Data Presentation and Distribution functionality, which means both explain how eLearning presents the knowledge to create courses and how eLearning distribute the courses. There are several advantages offered by an eLearning based on Knowledge Management System, include creation of a course freely by using cross knowledge study, updating the reference whenever a newer edition is available, and creation of unlimited number of courses by using abundant explicit knowledge. This will gives further benefit in knowledge sharing and reuse. The novelty of this research is by implementing eLearning based on Knowledge Management System for Indonesia academic Institution.**

Keywords—Knowledge Management System; eLearning; online courses; Indonesia academic institution

I. INTRODUCTION

As per May 2016, Indonesia has 4447 educational institutions, which mostly is in Higher School (54%), Academy (25%) and University type (12%). Those institutions serve 5.144.659 active students in the second semester of 2015-2016 [1]. However, despite of the large number of students, Indonesia penetration in academic documents indexed by Google Scholar is far less, which only reaches 1.150.000 documents (http://scholar.google.com/scholar?q=site:ac.id). This is comparable to five students only create one document, but in reality, every student must have creates lots of document, for example courses assignment like paper review. If for any undergraduate student create 1 document for every course taken, then 1 student will create at least 30 documents (an undergraduate student must take at least 144 credits to pass, and if 1 course averagely comparable to 3 credits then 1 student will take 48 courses). For every student creates 30 documents it will create 154.339.770 documents. The problem is where should they store all of these documents?

One of possible answer to this question is to establish a Knowledge Management System (KMS), where students and faculties can store all type of explicit knowledge, manage the knowledge, and use the knowledge in the form of readable document [2-3]. One of the benefit in establishing Knowledge Management System is we can use all the knowledge contained to create another layer on top of KMS for eLearning purposes [4-6]. This model of eLearning can be flexible when creating course for longer purposes because it does not have to follow the curriculum and students can enroll to any courses wherever and whenever they are available [7].

Purpose of this research is to create eLearning layer on top of KMS, starts from design to implementation. ELearning on top of KMS means that we will use and empowering knowledge stored in KMS to create open and online courses. The design starts with the functionality requirement base on TMForum Application Map in Frameworx 13.5 [8]. Based on this functionality requirement, the design will discuss on how eLearning can benefit from all the knowledge stored in KMS. Elaboration on what opportunities open when applying this model of eLearning closes this research.

II. SYSTEM DESIGN

A. Requirements

The main requirement for this research is to establish a KMS platform that has the capabilities on acquiring knowledge, manage the knowledge, and empowering the knowledge, where knowledge in this research refers to explicit document, accessible and readable by a specific type of users. One of possible application in empowering knowledge is eLearning creation, which will utilize any knowledge available and use them to create course(s). This design will focus on empowering knowledge stored in KMS for eLearning purposes. To provide a good platform, the eLearning itself must provide flexibility, where:

Any type of member can create any type of course and use any type of knowledge (1)

Any type of member includes all types of lecturer each with their background, all types of students, all types of staff, and invited guests. Any type of course includes courses that related with the curriculum and courses that have no relation with the curriculum. Any type of knowledge includes books, teaching materials, case studies, reports, thesis, etc. These kinds of flexibility ensure user creativity to empower the knowledge and create a knowledge sharing with specific purposes.

Figure 1 explains the process of submission, editorial, and approval using configurable process and catalogue. All processes are based on master data, which includes user profile, curriculum, questionnaire, and academic processes. Once a submission is approved, it will become a knowledge resource.

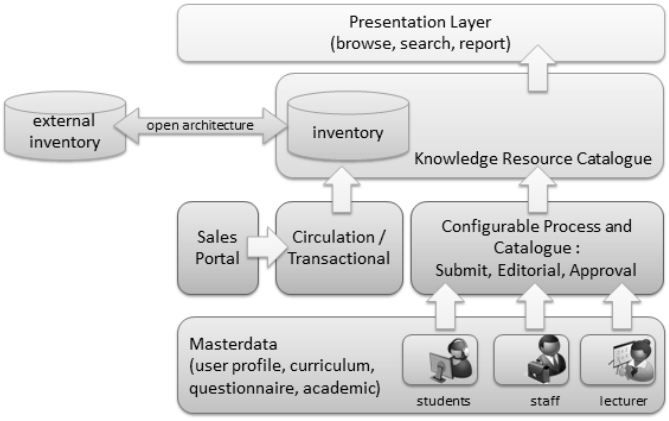


Fig. 1. Knowledge Management System internal business processes

For the design, we use Frameworx 13.5 as the reference, especially for the TM Forum Application Map or TAM for short [8]. This is to ensure our KMS provides all functionalities described in the application map. Figure 2 describes TAM with all the seven layers.

Based on Figure 2, in TAM there are seven layers, from top to bottom including Marketing and Sales, Product Management, Customer Management, Service Management, Resource Management, Partner Management and Enterprise Management. In Enterprise Management layer (described in Figure 2), there are 10 modules including Revenue Assurance Management, Administrative Services, HR Management, Fraud Management, Financial Management, Regulatory and Compliance Management, Asset Management, Security Management, Knowledge Management and Supply Chain Management.

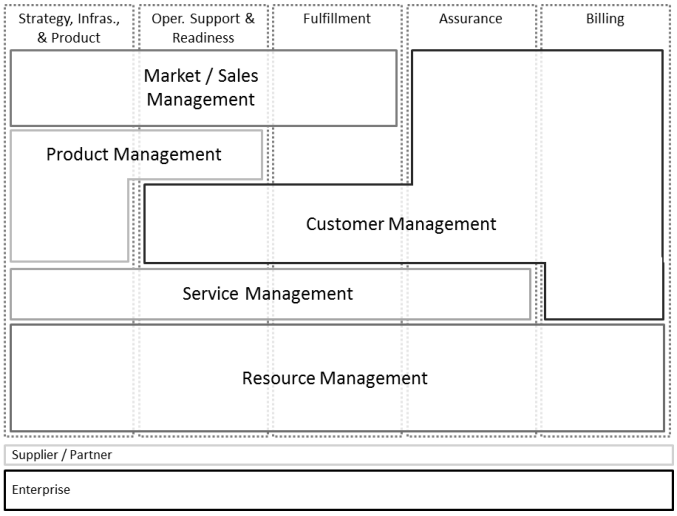


Fig. 2. TM Forum Application Map [8]

In Knowledge Management module (described in fig. 3), there are several functionalities provided:

1. Business Intelligence
2. Data Management
    a. Data Storage and Archival
    b. Access and Transformation
    c. Data Integration and Context
    d. Data Presentation and Distribution
3. Patent, Invention and Trademark Management
4. Content Management
    a. Repository and Archival
    b. Authoring and Compilation
    c. Distribution and Acquisition
    d. Portal and Discovery
5. Enterprise Web Sites and Portals Business

Fig. 3. Knowledge Management in TM Forum Application Map [8]

Empowerment of knowledge to create eLearning will focus on Data Presentation and Distribution functionality, which explains how eLearning presents the knowledge to create courses and how eLearning distribute the courses.

B. Design

From above requirements, we design the architecture to include master data as the foundation and collaboration to

accommodate interaction between modules. KMS uses master data as a reference to create member profile, since the KMS itself is part of academic module in the high-level architectural design, depicted in fig. 4 [9]. In fig. 4, KMS resides in academic suite, along with suite for academic operational.

Fig. 4. High Level Architectural Design [9]

To support KMS functionalities, there are several data groups in our master data system, including:

1. Master data organization
2. Master data customer (ex. student, staff, and lecturer)
3. Master data resource (ex. room, peripheral)
4. Master data product (ex. course, service)

Master data organization defines the organization structure along with each of its job specification (competency needed to fulfill the job description) to ensure a perfect match between employee and his/her competency. Master data customer defines each of the customer type's profile and their personal achievement. Master data resource defines and manages all resources needed for product delivery fulfillment and to assure that its utilization is in optimum level. Master data product defines all services offered to every customer based on their profile (needs, passion, talents, and competency).

Since some information already provided by the master data, KMS has no concern with user management, user profile, and course-dependent information (such as course program, curriculum, and RACI matrix) and therefore may focus on managing the knowledge.

The design for KMS refers to fig. 1, which is the KMS internal business process. To accommodate knowledge acquisition, member is allowed to submit a document through a specific workflow related to his or her member type. As an example, students are allowed to submit their paper review assignment through only "paper review" workflow. After submission, the document will go through an editorial and a reviewing process by a specific group of expert, dedicated for a specific knowledge subject type. The editorial and reviewing process should accommodate a process that can return and forward the document to certain user, including the author for revision. After going through the editorial and reviewing process, the document might be approved to become a knowledge catalogue in the KMS. To support this process, an administrator can therefore should be able to design and create a specific workflow.

III. Implementation

A. Master Data

Master data contain all basic, important and shared data between all functionalities to ensure data integrity for reporting purposes. Master data, through authentication and authorization, will provide all information contained to every system that needs the information for their transactions [9]. Figure 5 explains information integration from master data:

1. Customer, including students (candidate, active, and alumni), lecturer, supporting staff, industry, parents, community
2. Product, including course (regular, special, bundling) and service
3. Organization, including organization structure, job identification (with its job description and job specification, respectively), and the employee in charge
4. User, including password management and role assignment (RACI matrix)

Fig. 5. Master data concept [9]

B. Knowledge Management System

Knowledge Management System is a platform where we can use to acquire tacit knowledge, store them into explicit knowledge, manage the knowledge, and empower the knowledge. One possibility of empowerment of the knowledge is presentation of the knowledge or arrangement of knowledge by using eLearning. There are several advantages of an eLearning based on Knowledge Management System:

1. We can create a course freely by using cross knowledge study

2. We can ensure the integrity of the stored knowledge through edit-review-approve mechanism
3. We can freely update the reference whenever a newer edition is available
4. We can create unlimited number of courses by using abundant stored knowledge without time limitation

3. Actor, is the person who responsible to do the Task to move a specific document from one state to another. Actor is defined in master data, for example to respond "who is the direct supervisor for a specific staff?", "who lecture course SK21001 in a specific academic year?", and "who is the expert on knowledge management?"

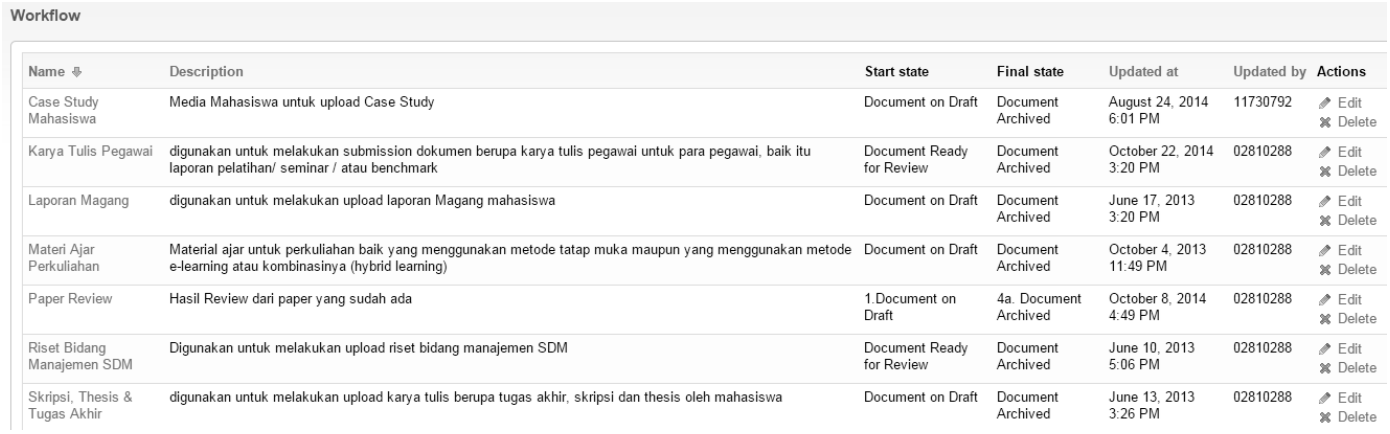
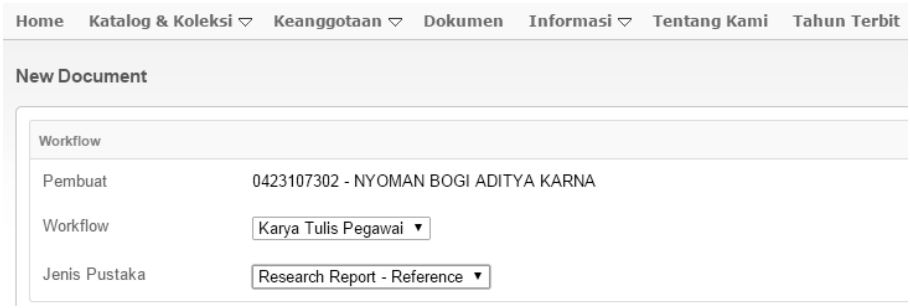


Fig. 6. Knowledge Management System – Workflow Designer



4. Subject type, is the classification of document, determined by author to choose a specific group of expert for editorial and reviewing purposes. Subject type uses DDC (Dewey Decimal Classification), a standard catalogue classification uses by librarians.

Fig. 7. Knowledge Management System – Document Submission

To provide flexibility for knowledge acquisition, as depicted in fig. 6 and fig. 7, we create a workflow designer module where administrator (or librarian) can freely create a workflow for a specific need. For example, librarian can create a workflow "Karya Tulis Pegawai" to accommodate paper submission by staff, which is only accessible by member type staff. The workflow consists of:

1. State, is the definition of document state at one specific time, for example "Document on draft", "Document ready for review", "Document approved", and "Document need revision". State can be freely defined by librarian to accommodate a flexible workflow
2. Task, is the state migration requirement that explain in what specific case a document can move from one state to another. Librarian can freely define task to accommodate a flexible workflow. There could be several tasks originating from a state to accommodate several options, for example an editor may choose a document state of "Document need revision" or "Document approved"

After user login to the KMS, he or she may choose a specific workflow according to the native content of the document. After choosing the workflow, user may choose a specific knowledge subject to assign the group of expert for editorial and reviewing process.

After the editor approves the document, the final step is the "Transfer Method" which is accessible by librarian to redefine the document's metadata and classification (subject). After a document transfer, it will become a catalogue of knowledge in the KMS. Course creator can then use this catalogue to disseminate freely in any course.

C. *eLearning*

As depicted in fig. 8, in eLearning, an authorized user (course creator) can create a course using five steps:

1. Subject, where course creator chooses which subject is supported by this course. This step is not mandatory, because the course does not have to be related with a specific course in curriculum
2. Syllabus, where course creator defines syllabus for the course. This step includes the definition of course objective and prerequisite

3. Schedule, where course creator defines the schedule for this course, including how many lecture will be conducted in the course and what the supporting knowledge document needed (suggested reading material) for each lecture
4. Topic, where course creator can defines topics for each chapter in lectures
5. Reading, where course creator can define the reference for this course, based on specific documents (e-book, lecture slides, book, etc. in Knowledge Management System)

Figure 9 shows link of knowledge documents called from a specific course in e-learning. In schedule section, a knowledge document is linked to a specific part of schedule, which means it become a mandatory material for the schedule. In reading section, a knowledge document is linked as an additional material to the course.

ELearning on top of Knowledge Management System can be powerful as long as all users committed to share their knowledge. The only problem is how to create an atmosphere to make everyone eager to share his or her knowledge freely [10].

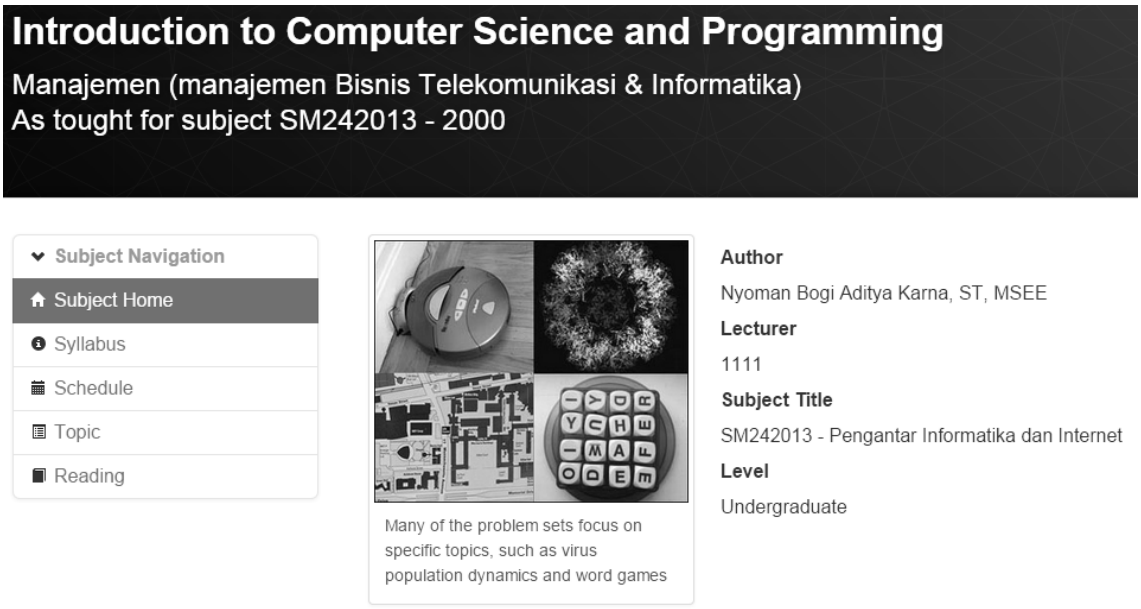


Fig. 8. eLearning based on Knowledge Management System

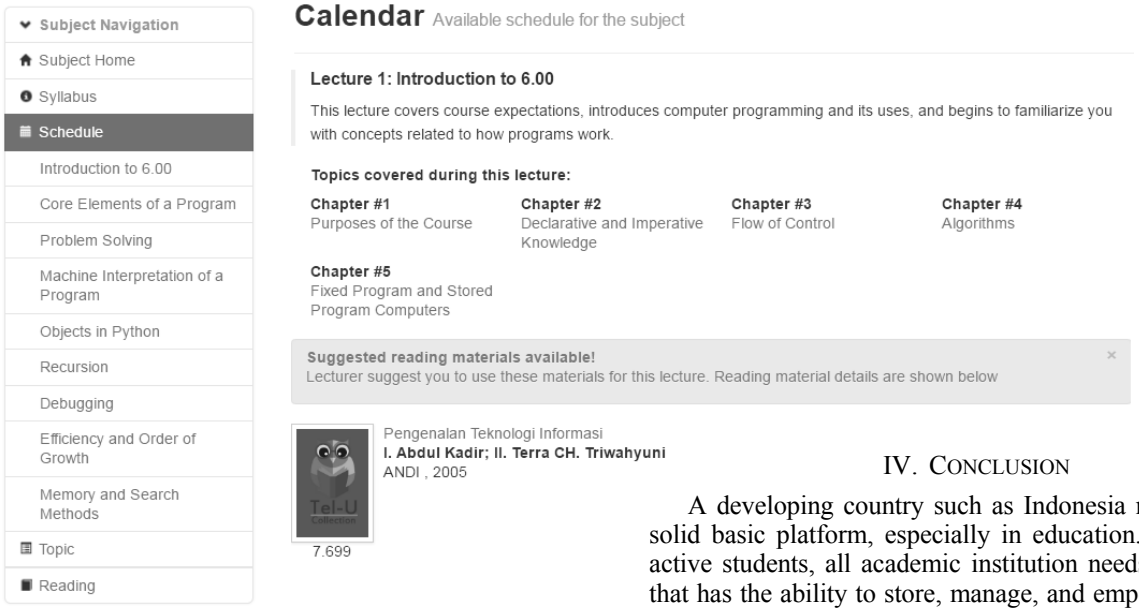


Fig. 9. A linkage between e-Learning and knowledge document is done in Schedule and Reading sections

IV. Conclusion

A developing country such as Indonesia needs a hard and solid basic platform, especially in education. With 5.144.659 active students, all academic institution needs a free platform that has the ability to store, manage, and empower knowledge. Therefore, it is time for all academic institution to move from tacit knowledge to explicit knowledge, and therefore we need Knowledge Management System to fulfill that dream.

From stored knowledge in Knowledge Management System, educational institution has the ability to create an online course and distribute them to community. Beside for accreditation point of view, this service will also fulfill the obligation for the lecturer for community services by providing an accessible online course.

Using eLearning on top of the Knowledge Management System, we can expect to have a better learning organization that has the capability to share knowledge in a bigger scope [11]. To further expand the knowledge catalogue, we can expect to retrieve the knowledge from other systems, such as web page and expert system. There are several options for knowledge sharing mechanism such as Open Archives Initiative Protocol for Metadata Harvesting usually used by librarians [12], SPARQL Protocol and RDF Query Language usually used by webmasters [13], and Knowledge Query and Manipulation Language usually used by KBS (Knowledge-based System) [14-15].

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