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KNOWLEDGE MANAGEMENT AND ISO/IEC 19796-1-BASED E-LEARNING BUSINESS ARCHITECTURE DESIGN FOR INDONESIAN HIGHER EDUCATION WITH TOGAF ADM APPROACH

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ARTICLE INFO	ABSTRACT
	E-Learning and distance learning implementation is part of the Indonesian Government's response to face the industrial revolution 4.0 and the disruption of higher education innovations. E-Learning implementation in Indonesian Higher Education typically short-term project, only for transferring learning material, and very few of them used e-learning as integrated framework. E-Learning adoption and implementation in higher education needs organizational approach, quality framework, and integration to be success. E-Learning implementation in Indonesian Higher Education must be in line with three pillars of Indonesian Higher Education and adopt quality design approach that comes from a good framework. This study aims to offer a design of e-learning business architecture in Indonesian higher education that is in line with three pillars of Indonesian Higher Education, and follows the quality framework of ISO 19796 , PDCA cycle, and continuous improvement based on knowledge management. E-Learning business architecture design carried out using TOGAF ADM approach. The e-learning business architecture design results for Indonesian Higher Education are outlined in 5 parts, which are e-learning business architecture motivation, e-learning business functions and services, e-learning organizations, e-learning business processes, and e-learning business roles and actors.

INTRODUCTION

Facing the industrial revolution (RI) 4.0, the Ministry of Research, Technology, and Higher Education of the Republic of Indonesia initiated a policy of distance education, and online learning (e-learning). With e-learning, higher education in Indonesia can offer a wide selection of learning models, from face-to-face learning, blended learning, to fully online learning. The

development of e-learning is expected to be able to increase higher education access so that the student enrollment rate for higher education in Indonesia will increase from 31.5% to 40% in 2022-2023 (Kemenristek Dikti, 2018).

E-Learning implementation in Indonesian Higher Education held as short-term project, majority for sharing learning material, and only few of them used e-learning as integrated framework. There are challenges for Indonesian Higher Education to implement e-learning with strategic plan and quality assurance mechanism (Berliyanto & Santoso, 2018). From e-learning adoption and implementation by universities or virtual learning institutes, it is clear that the successful e-learning implementation needs organizational context to facilitate and control development of e-learning. Information communication and technology (ICT) needs to integrate with people role in organization including teacher, learner, course, and other resources. The organizational context and its integration with ICT are critical to the success of the e-learning implementation (McPherson, 2002).

The increasing need for e-learning in higher education requires the adoption of a quality design approach (quality system). The implementation of a good quality system for e-learning must come from good frameworks and standards (Bari & Djouab, 2014). ISO/IEC 19796 provides a framework of a process model in quality management and quality assurance for information technology-based learning, education, and training (ISO and IEC, 2005). In addition to design good e-learning system, continuous improvement in e-learning quality management system that supported by knowledge management process is needed for optimization of the e-learning system.

ISO 19796-1 provides a process framework for ICT-based learning. The process framework includes Need Analysis (NA), Framework Analysis (FA), Conception/ Design (CD), Development/Production (DP), Implementation (IM), Learning Process (LP), and Evaluation / Optimization (EO) (Standardization & Normalisation, 2005). From quality management perspectives, these process frameworks may follow quality management process. The quality management process used PDCA (Plan-Do-Check-Action) since 400 years ago. Plan and Check relate to data collection activities, study the situation that occurs to define actions to be taken. Plan and Check are carried out by certain methods and are related to the research process (Hoyle, 2018). Data collection activities is collecting knowledge-as-data. Research or study is creating or improving knowledge (Information Resource Management Association, 2012).

Learning resources or digital content in e-learning is a form of knowledge (knowledge-as-data) (Information Resource Management Association, 2012)(Williams et al., 2014). In addition to content, learning data and activities can be converted into useful information into new insights through the research process (Goverment, 2012). This understanding is a form of knowledge (knowledge-as-meaning) (Information Resource Management Association, 2012). The PDCA cycle that involves knowledge in it, should include the knowledge management process. The knowledge management process deals with the creation, retrieval, transformation, and use of knowledge (Information Resource Management Association, 2012). E-Learning process framework managed by PDCA cycle require integration with knowledge process.

On the other hand, higher education in Indonesia is strictly regulated both in terms of regulation and quality assurance. Higher education in Indonesia is obliged to organize the Three Pillars of Indonesian Higher Education, namely education, research, and community service. Learning is part of the educational process. The learning environment is an ecosystem where the interaction among learners, lecturers, and learning resources is a place. Research is related to improving or gaining understanding based on systematic scientific methods, while community service is related to one of the activities to educate the nation's life (Goverment, 2012).

There are requirements for good e-learning implementation in one side, and obligation to conduct three pillars in other side. For success e-learning implementation, the integration between these two sides is important. It has come to research question about how to design e-learning business process architecture where that's architecture come from good quality framework and can be a medium to integrating the three pillars of Indonesian Higher Education.

Integrating the e-learning process framework according to ISO 19796-1 with education, research, and community service in Indonesian Higher Education, may use knowledge as object

point of view. Education or learning process is knowledge transfer and knowledge creation process. Learning material is kind of knowledge-as-data that could be comes from research or community services. Its type of integration of three pillars according to national accreditation board (BAN PT, 2018). From knowledge as object point of view, research is knowledge creation, and community services is knowledge sharing for community. From knowledge process point of view, it's possible to arrange this integration trough e-learning business architecture that adopts a quality design approach from a good framework (Bari & Djouab, 2014).

There are needs for a response to RI 4.0 with an e-learning system based-on ISO 1976, knowledge management, an integration with campus policies and strategies (three pillars of Indonesian higher education). This response is stated in the design of an enterprise architecture that can integrate all requirements (Pasaribu et.al., 2019). One of enterprise architecture is Business Architecture, and Business processes and organizational activities (Osadhani et.al., 2019). This integration architecture will provide the ability for universities to carry out organizational and business changes, carry out three pillars of Indonesian higher education, and adapt to change, including supporting IT needs in higher education (Kornyshova & Barrios, 2019).

TOGAF ADM is an efficient and effective way as a guide in integrating requirements and developing Enterprise Architecture according to organizational conditions (Santikarama & Arman, 2016; Edward et.al., 2015). Higher education can take advantage of TOGAF ADM to define an enterprise architecture including the business architecture (Firmansyah & Bandung, 2017). With TOGAF ADM, 8 phases of architecture design are carried out, namely vision, business architecture, application, technology, solutions, migration, implementation, and change management (Desfray & Raymond, 2014). The e-learning architecture design in this research is carried out until business architecture phase, it is hoped that the design results can be one of the solutions for Indonesian higher education to implementing e-learning and the dynamics of the industrial revolution 4.0.

From the research question and explanation above, the aim of this study is to offer a design of e-learning business architecture for Indonesian higher education that is in line with Three Pillar of Indonesian Higher Education and follows the quality framework of ISO 19796 and PDCA cycle based on knowledge management.

RESEARCH METHOD

TOGAF Architecture Development Model (ADM) Cycle is methods to create enterprise architecture. There are 8 phases in the TOGAF ADM Cycle, A-Vision phase; B-Business architecture phase; C-Information system architecture phase; D-Technology architecture phase; E-Opportunities and solutions phase; F-Migration planning phase; G-Implementation governance phase; and H-Architecture change management phase (Desfray & Raymond, 2014). E-Learning business architecture design in this research, follows the stages of TOGAF ADM Cycle phase A and phase B. The design stages for Indonesian Higher Education e-learning business architecture as shown in Figure 1.
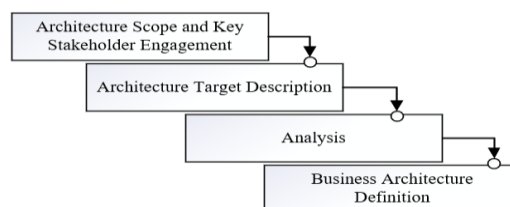

Figure 1. TOGAF ADM business architecture design stage

Data collection for architecture development is based on literature study, regulation study, benchmarking, expert explanation, and 6 years' experience in developing e-learning architecture and implementation in higher education. Literature study refers to e-learning success models,

knowledge management, ISO, and challenge in development e-learning in Indonesian higher education. Regulatory study refers to government regulation and national accreditation for higher education (BAN PT). Benchmarking data used for architecture comparation. Benchmark data comes from e-learning architecture in Bandung Institute of Technology (ITB), Indonesian University (UI), Indonesian Massive and Open Online Course (SPADA Indonesia), and Indonesia Open University (UT). Expert explanation refers to e-learning workshop, e-learning technical training, and e-learning upgrading in 2014-2018. There are several experts from host of SPADA Indonesia (Indonesian higher education massive open online course), Expert team from BELMAWA Dikti, and expert from Indonesia Open University (UT). For 6 years' experience included 264 e-learning program review in 2014 to 2018, and project for development of center for e-learning and open education in universities in 2018 – 2020.

1. Architecture Scope and Key Stakeholder Engagement

At this stage, the scope of business architecture is defined, starting from development to process customer (e-learning customer). To define business architecture definition, data from literature study, expert, and benchmarking is used to define key stakeholders and its requirements. The key stakeholders involved such as regulators, universities, lecturers, students, study programs, and university management.

2. Architecture Target Definition

Based on the scope and requirements of the stakeholders involved, objective of the e-learning business architecture in Indonesian Higher Education is made.

3. Analysis

Based on research main problem and objectives to design and integrate e-learning architecture with three pillars of Indonesian Higher Education, the analysis is carried out to fulfill this requirement. First analysis is integrating three pillars into e-learning system. Analysis conducted based on knowledge as object point of view. Second analysis is defined e-learning process based on ISO 19796-1 and integrate that process with three pillars of higher education. The third analysis is makes PDCA process based on e-learning process and integrating that process with knowledge management (knowledge process). Result of analysis represented in table and figure to describe business architecture of e-learning. Detail analysis needed to configure e-learning business architecture. The analysis involves needs analysis, functional analysis, business process analysis, role and responsibility analysis. All the analysis made to implementing a knowledge management-based quality management system (PDCA) in e-learning where e-learning system described as process framework according to ISO 19796-1.

4. Business Architecture Definition

In terms of architecture descriptions, business architecture mainly concentrates on the business motivation elements (drivers, goals, objectives), business functions and services, organizational units, business processes, and business roles and actors (Desfray & Raymond, 2014). Based on these TOGAF ADM references, the definition of the e-learning business architecture of higher education in Indonesia based on ISO 19796-1 process framework and knowledge management is made into 5 parts, which are:

a. E-Learning business architecture motivation at higher education in Indonesia,
b. E-Learning business functions and services at higher education in Indonesia,
c. E-Learning organizations in higher education in Indonesia,
d. E-Learning business processes at higher education in Indonesia, and
e. E-Learning business roles and actors in higher education in Indonesia.

RESULTS AND DISCUSSION

Three pillars of Indonesian Higher Education as part of e-learning system we can find in e-learning business motivation to e-learning function and service architecture. E-Learning system and its quality management system that developed with ISO 19796-1 process framework and knowledge process and its integration with three pillars of Indonesian Higher Education, describe in five part of e-learning business architecture below.

A. E-Learning Business Architecture Motivation at Higher Education in Indonesia

Business motivation provides an overview of the context and objectives of e-learning business architecture in Indonesian Higher Education. Context (scope) and objectives define from internal and external stakeholders interest, and the internal vision of the university. This definition is motivation of e-learning business architecture.

1. Scope Definition

The accreditation of higher education institutions (AIPT) expects integration between each pillar, which means how research results can be systematically enriched in education and teaching, including community service (BAN PT, 2018). The main system of teaching remains in line with the definition of the learning process, namely the interaction of students, educators, and learning resources in a learning environment (Mendikbud RI, 2020). By paying attention to the requirements of the regulation, the e-learning system for higher education in Indonesia that integrates the three pillars of Indonesian Higher Education is made as in Table 1.

Table 1. Three pillars of Indonesian Higher Education integration within e-learning

Three Pillars	Indonesian Higher Education e-Learning Scope
Education	The e-learning system includes e-learning development and e-learning delivery & services. e-Learning development consist of learning resources and an electronic learning environment. e-Learning delivery & services related to the interaction of students and teachers with learning resources in a learning environment.
Research	Research in e-learning systems related to research in e-learning design and improvement. The object of research is content (learning resources) design and improvement, educators and students, learning environment, and analysis of e-learning system improvement.
Community Services	Community services in the e-learning system is carried out by providing access to learning resources (content) and a learning environment for the community (open courses) as well as online learning professional services for partners both universities and companies.

2. Key Stakeholders Involvement

Indonesian higher education e-learning system with the scope of integration of teaching, research, and community service as shown in Table 1, has several stakeholders. Each stakeholder come with the following involvement and interests.

3. E-Learning Architecture Objectives

Based on scope of the e-learning system business architecture and key stakeholders motivation in Indonesian higher education, there are 4 motivational keywords that become the vision of Indonesian higher education e-learning system business architecture:
a. the fulfillment of regulations and accreditation standards for e-learning-based programs in the face of the industrial revolution 4.0,
b. achievement of e-learning system innovation in supporting the achievement of university strategic goals,
c. availability of access and e-learning system services with good easiness and reliability.
d. achievement of learning outcomes and graduation targets.

B. E-Learning Business Functions and Services at Higher Education in Indonesia
1. ISO 19796-1 Integration

ISO 19796-1 is framework for process in information technology - learning, education and training quality management, assurance, and metrics. This process framework can be integrated with three pillars of Indonesian Higher Education. This integration as shown in Figure 2.

Table 2. Stakeholders involvement in Indonesian higher education e-learning System

E-Learning System Scope	Key Stakeholders	Stakeholder Involvement and Motivation
The 1st Pillar (Education): e-Learning Development	Lecturer	a. Involvement: e-learning contents development. b. Motivation: e-learning contents meet the requirement and standard.
	e-Learning Manager	a. Involvement: e-learning system and technology development. b. Motivation: achievement of e-learning development program and target.
	HE Manager	a. Involvement: e-learning development vision. b. Motivation: achievements of e-learning development key performance.
The 1st Pillar (Education): e-Learning Delivery & Services	Students	a. Involvement: e-learning system and process customer. b. Motivation: course completion and certification.
	Lecturer	a. Involvement: teacher in e-learning delivery and services. b. Motivation: learning outcome achievement by students.
	e-Learning Manager	a. Involvement: customer service and support in e-learning delivery. b. Motivation: consistency, easiness, and reliability of e-learning services.
	Program Manager	a. Involvement: owner of online learning (e-learning) program. b. Motivation: completion and productivity (graduation) of learning program.
The 2nd Pillar (Research): e-Learning Design & Improvement	Lecturer	a. Involvement: e-learning system researcher and developer. b. Motivation: e-learning system design based on standards and requirements.
	Program Manager	a. Involvement: run e-learning system research and improvement. b. Motivation: innovation to improve e-learning system effectiveness and efficiency.
	HE Manager	a. Involvement: e-learning system development direction and vision. b. Motivation: to achieve KPI in e-learning strategic development
The 3rd Pillar (Community Services): Open-Courses	Publics	a. Involvement: e-learning program (process) customer. b. Motivation: open access for learning material or courses (open courses).
	e-Learning Manager	a. Involvement: open courses services and support. b. Motivation: consistency, easiness, and reliability of e-learning services.
The 3rd Pillar (Community Services): Professional Services	Other Higher Education Partner	a. Involvement: customer for e-learning professional services. b. Motivation: target and project objectives achievement.
	e-Learning Manager	a. Involvement: professional services delivery. b. Motivation: Achievement of program KPI or target.

In Figure 2, the 2nd pillar (research) occurs during the development of an e-learning program. Research process takes place in program feasibility study by considering internal and external aspects. Research objectives in this phase are market, regulation, and feasibility study. The next more micro research is course design (conception and design). This research related to study about student learning styles, learning methods, media, and learning technology. The results of the research can be stated in the e-learning program learning plan (online learning plan), online media design, and online learning technology design.
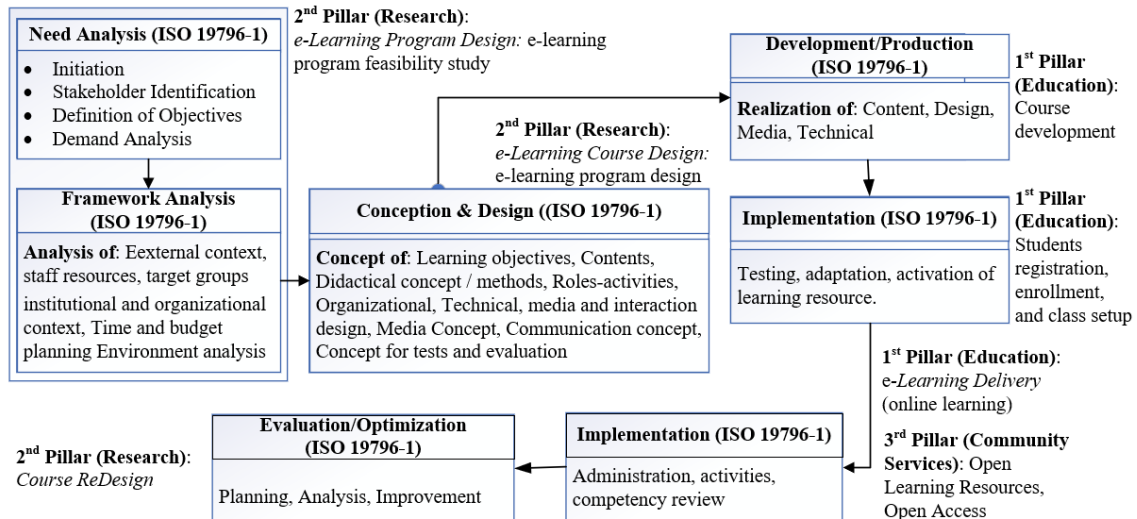

Figure 2. ISO 19796-1 and three pillars process-based integration

In Figure 2, the 1st pillar (education) occurs during course development, student registration and enrollment, and e-learning delivery. The first pillar transferred knowledge to student. The same knowledge in form of learning resources can be open to public or community. Public open access to learning resource is the 3rd pillar from three pillar of higher education. Knowledge-as-data creates by research in form of learning program and learning material used for knowledge transfer and knowledge sharing. This delivery is integration in three pillars itself.

2. Knowledge Management Integration

Knowledge management process is about creation, retrieval, transformation, and use of knowledge. Knowledge can be in the form of content and data (knowledge-as-data) or in the form of understanding (knowledge-as-meaning) (Information Resource Management Association, 2012). Integration of knowledge management to the management system of e-learning, define what data to be store, retrieve, used, and update during e-learning or management process. The data are important for monitoring, control, improvement or change by research, or quality assurance in e-learning process. In the e-learning program design and course design stages, there is an explicit form of knowledge creation. The form of knowledge is in course and content (knowledge-as-data). e-Learning program design and course design stage is a type of plan (P) activities according to PDCA Cycle. In the implementation phase (online lectures), there is a process of taking knowledge and transforming knowledge from lecturers to students. Students will have new knowledge (knowledge-as-meaning) about learning materials, and lecturers will have new knowledge in the form of lecture experiences (knowledge-as-meaning). Implementation (online learning delivery) stage is a type of Do (D) activities in PDCA Cycle.

In the check (C) phase or evaluation phase, the course design data and old learning contents are integrated with the new experience of the lecturer to make course design improvements, program design improvement, and learning contents improvement. All the improvements execute in Action (A) phase. The Check and Action phase in the PDCA cycle is closely related to new knowledge creation and storage of new knowledge in the form of online learning portfolios and

online program portfolios. The PDCA process and knowledge management process integration in the e-learning process architecture for Indonesian higher education is depicted in Figure 3.
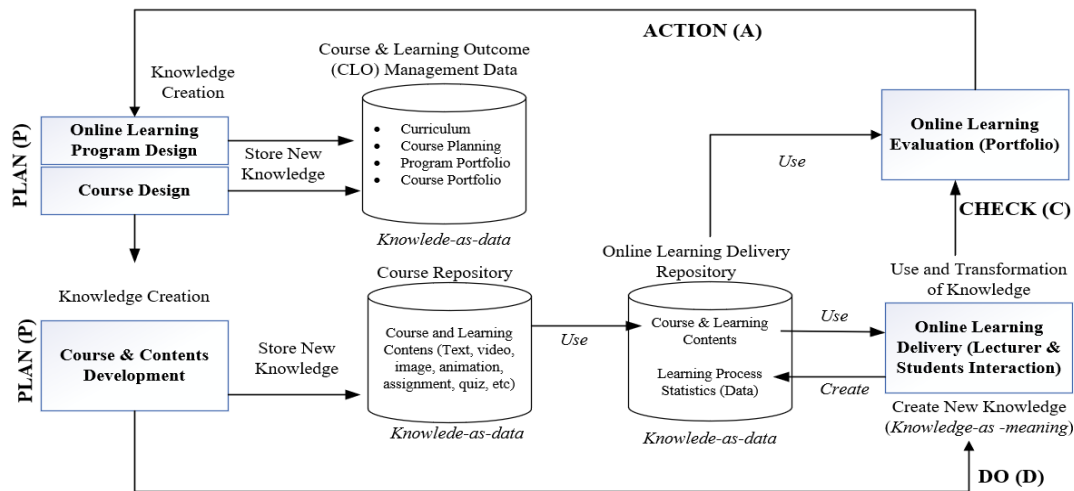

Figure 3. PDCA cycle and Knowledge Management integration in e-learning process

3. E-Learning Business Process Level-1

Based on ISO 19796-1 and three pillars of higher education integration, research (the 2nd pillar) in the e-learning process architecture held in program design and course design, while the implementation of online learning delivery is kind of the 1st pillar or education. ISO 19796-1 process framework also come with the need of other process such as content development process (course procurement), course setup, and the need for a redesign for program improvement or portfolio-based course improvement.

The knowledge objects that are stored in the e-learning architecture repository are knowledge-as-data such as courses and course (learning) contents. By providing access to external parties (open courses), this knowledge sharing can be the basis for carrying out the third dharma, namely community service.

The customers of research and online teaching process are students and lecturers. Providing services or access to outsiders gives other higher education students access the learning material. Beside other universities student, open access course also can be accessed by companies or general or public students. From this point of view, e-learning process architecture customer could be lecturer, internal students, other universities student, and public access. An overview of the e-learning business process architecture that is in line with the three pillars of higher education, integrate with ISO ISO 19796-1, and knowledge management process is depicted in Figure 4.
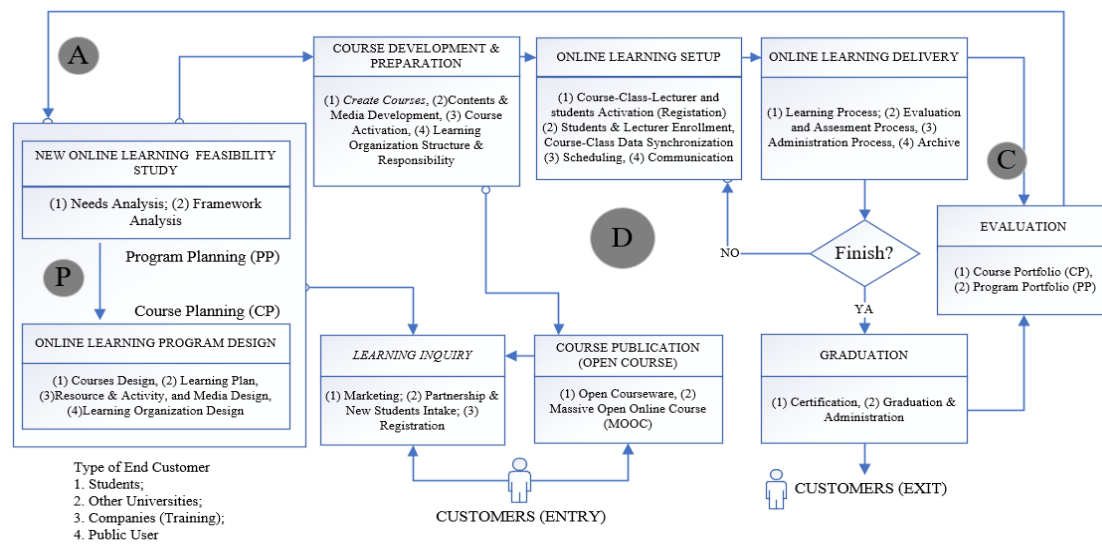
Figure 4. E-Learning business process architecture (level – 1)

C. E-Learning Business Functions and Services in Higher Education in Indonesia

There is challenged to run business process, including e-learning business process architecture. One of the challenge is ability to manage and optimize multiple functions that is comprise in business process (Telukdarie, 2019). Business process architecture contains multiple functions with crucial interdependencies. There are several functions and services in the e-learning business architecture for Indonesian higher education with regard to ISO 19796-1, knowledge management, and the functions of the three pillars. The functions and services proposed by this research are given in Table 3.

Table 3. Stakeholders involvement in Indonesian Higher Education e-learning system

Business Functions	Services and Contribution to e-Learning System
Program & Course Design (**F1**)	a. Service in e-learning program open or close b. Service in program certification and accreditation c. Service in online learning design and research d. Service in online learning course and program portfolio
Course & Contents Development (**F2**)	a. Service in contents and media development & training b. Service in production house for learning material
E-Learning Program Delivery (**F3**)	a. Online learning delivery and services b. Online learning administration c. Online learning assessment services
E-Learning Technology (**F4**)	a. e-Learning infrastructure and technology development b. e-Learning infrastructure and technology training c. e-Learning infrastructure and technology services
E-Learning Quality Assurance (**F5**)	a. e-Learning quality assurance process b. e-Learning quality assurance audit
e-Learning Business Function (**F6**)	a. Online learning (e-learning) program marketing b. Online learning (e-learning) program partnership c. Online learning (e-learning) program account management

D. E-Learning Organizations in Higher Education in Indonesia

Implementing e-learning system and architecture comes with organizational challenge and change management. To support this change, one of them is change in organizational structure (Yulherniwati et. al., 2018). Organization in the e-learning system architecture consists of units

(department) that carry out functions and services in the e-learning system. To facilitate organizational change management and challenge, proposed architecture design, use organizations or unit or department that already exist in most universities in Indonesia. The proposed organizational units (department) involved based on e-learning business processes and e-learning functions in Indonesian higher education depicted in Figure 5.

E. E-Learning Business Roles and Actors in Higher Education in Indonesia

In the object-oriented design perspective, e-learning business architecture (system) have three main actors at least. Each actor carry out functions in units or department related to them, and responsible for activities in the process. The actors and the roles performed by each actor are described in Table 4.
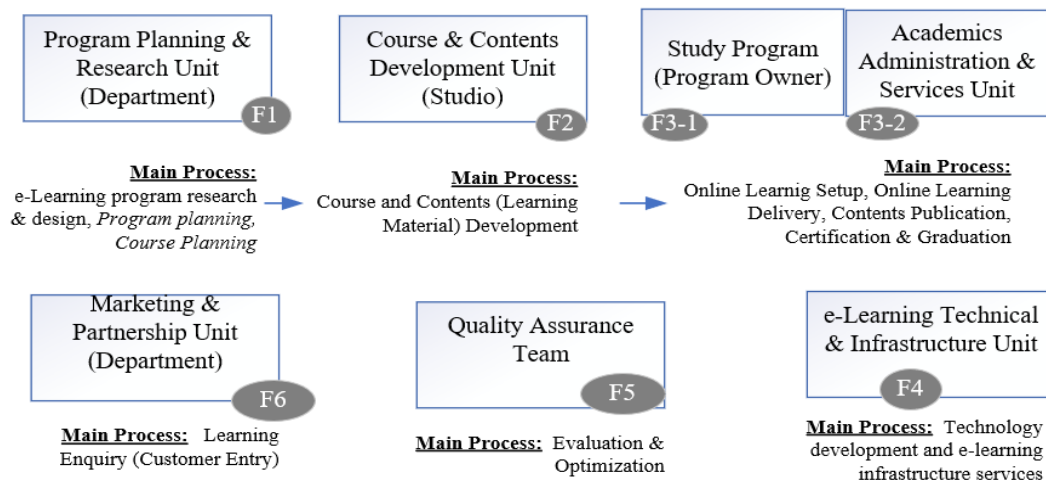

Figure 5. Proposed e-Learning Organizational Units in Indonesian Higher Education

Table 4. Actor and roles in proposed e-learning business architecture

Actors	Roles
Unit or Department	a. Create, read (review), update (CRU) related function. Unit related and its function based on Table 3 and Figure 5 b. Run or execution each function related to unit or department.
Lecture	a. Course contents creator (subject matter expert) b. Teacher for each class (online class instructor and manager) c. Evaluator and grader in online learning (e-learning)
Students	a. Learner in online learning (e-learning) b. Access course and follow the instruction

CONCLUSIONS

The business architecture of the e-learning system in Indonesian higher education must be in line with regulations and three pillars function of Indonesian Higher Education. The e-learning business architecture must be built from a good quality design approach with knowledge management or data-based process improvement. There is scope for e-learning business architecture design based on this issue, that is start from e-learning programs design, course design, contents development, online learning delivery, graduation, evaluation for improvement, and publication as open course. This proposed process in e-learning business architecture activities, are in line with three pillars of higher education, ISO 19796-1 process framework, and in line with PDCA quality management system. As part of business architecture design, beside business process, there are organization and technology that support the business process. Indonesian higher education e-learning business architecture should be supported by

organizational units such as e-Learning Program Research and Planning Units, Course and Contents Development Studio, e-Learning Program Owner, Academic Administration and Services, Technical and Infrastructure units, Quality Assurance Units, and Marketing and Partnership Unit. All activities in business process architecture and work of units and actor in e-learning system must be supported by a knowledge base technology. For knowledge-as-data technology, this research proposes Course and Learning Outcome Management System and Course Repository Management System. For knowledge-as-meaning technology, this research proposes Online Learning Repository.

ACKNOWLEDGMENTS

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