

EXPLORATION ON ENTERPRISE ARCHITECTURE COMPONENT FOR HIGHER EDUCATION INSTITUTION IN INDONESIA

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ABSTRACT. *The aim of this study was to find out the component of existing Enterprise Architecture (EA) that had been implemented in Higher Education Institutions (HEI). The focus of this study was HEI in Indonesia, that was the HEI's National Quality Assurance Standard as a case. To define the component, this study applied a Systematic Literature Review (SLR) to clarifying the composition of the EA framework. There were two EA frameworks that had been commonly used in HEI to further analyze the study, which were TOGAF and Zachman. The same process was done to define the HEI governance component. To seek the update education situation in 4.0 era, the exploration search was not just from HEI quality assurance and HEI value chain, but it came also from the future university. As a result, the EA component has seven groups and eight groups of components for HEI. Component between EA and HEI map was used to seek the relationship between components. HEI can use the map as a guideline when deciding to implement EA in their organization. Another result is that there are 16 components that are not directly discussed as Indonesia's National Quality Assurance Standard.*

Keywords: Enterprise architecture, EA framework, Systematic literature review, Higher education institution, Institution governances

1. **Introduction.** EA is applied to achieving business strategies and creating value [2]. Based on the results of Jairak's research on information technology governance at universities in Thailand, it was found that adherence and commitment to the use of information technology in accordance with strategic plans did not become specific measure in universities. So, information technology planning is not clearly visible in the university's master plan [4]. The transformation that occurs in the education sector has always focused more on pedagogy than changes that are influenced by information technology. Therefore, EA adoption may not be fully supported in this domain or is considered a priority that is prioritized compared to other private sector organization that is more profit-oriented [7]. The independence of private higher education institutions, especially in Indonesia requires strategic planning that can support the development of universities to maintain sustainability. The application of information technology to the governance of higher education organizations supports them to achieve the strategic objectives, especially their preparation to face the changing education in the 4.0 era. Sustainability of a higher education institution in the community is determined by the value that universities can create. This research focuses on the EA framework that is suitable to be applied to private universities by paying attention to what factors must be prepared by the institution.

2. Problem Statement and Preliminaries. Choosing the right EA framework for the organization is a difficult and complex work because some qualitative and quantitative problems exist. In the case of selecting a problem that must be resolved, the organization must carry out the analysis carefully and use the right criteria, so that EA can meet the needs of the organization. Organizations need to involve stakeholders to choose the EA framework [10]. The purpose of this study is to analyze the EA framework implementation in the specific HEI to answer the question, “What is the EA component that is suitable for higher education institution governance?” Exploration of EA component that is suitable for Higher Education Institution (HEI) helps education institution to choose the right EA framework.

3. Review Methods. The focus of this research is to analyze the EA framework based on TOGAF and Zachman. Further analysis of each EA framework component in addition to in-depth analysis is done with the aim of seeing the interrelationships and interactions between them. Referring to Figure 1, it answers the research question, “What is the EA framework component that is in line with higher education institution governance?” The study needs to explore higher education governance that affects the carrying out of EA framework in higher education. The stage processes of identifying EA framework components that are proper for private HEI through a literature review published in journals or conferences discussed the established EA framework. Each component is then clustered using the affinity diagram approach developed by Kawakita Jiro. Affinity diagrams are one diagram of seven tools used in quality control management. This research adopts an affinity diagram or commonly called the KJ Method (short for Kawakita Jiro). It consists of (1) component determination based on the results of the literature review; (2) compilation of a list of all components found; (3) grouping similar components into groups; (4) naming each group; (5) depiction of the last diagram.

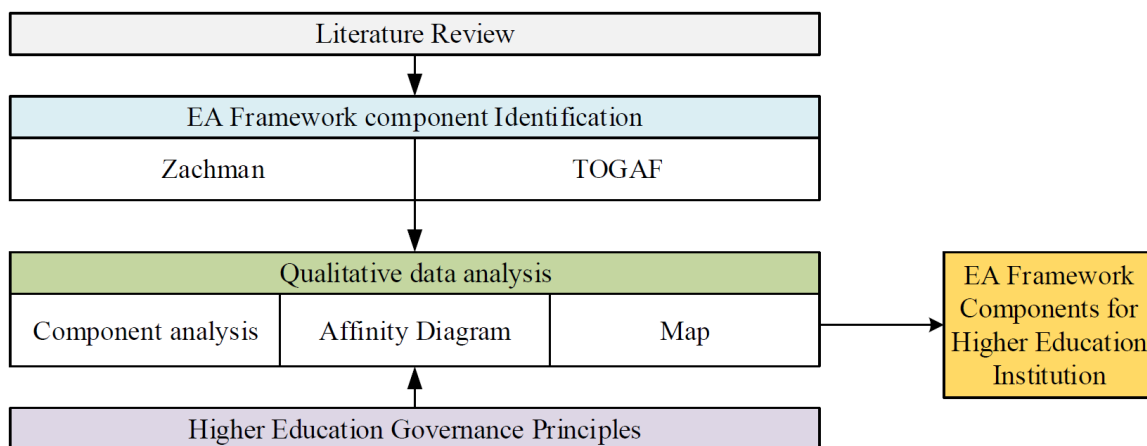


FIGURE 1. Research framework

4. Results and Discussions. This study focuses on two common EA frameworks used in HEI which are TOGAF and Zachman [8].

4.1. Compilation of EA TOGAF framework components. The component analysis of EA framework uses TOGAF Version 9.1 [1] which consists of four domains that are part of EA. The four domains consist of:

- Business Architecture that explains business strategy, governance, organization, and key business processes;
- Data Architecture that explains the structure of physical logical organization, data assets, and management of data sources;

- Application Architecture that provides a blueprint for individual applications including interactions and linkages between the main business processes within the organization;
- Technology Architecture that explains the logic of software and hardware capabilities needed to support business data, as well as application services development including information technology infrastructure, middleware, networks, communications, processing, standards, and many others.

4.2. Composition of EA Zachman framework. Component of the EA framework according to Zachman (<https://www.zachman.com/about-the-zachman-framework>) consists of columns and rows. The column contains a perspective consisting of executive perspective, business management perspective, architect perspective, engineer perspective, technician perspective, and enterprise perspective. While the column consists of what (data), how (function), where (network), who (people), when (time), and why (motivation).

- Scope Context (Executive Perspective). The Executive Perspective line represents the perspective of executives in organizations such as the board of directors or executive management. This viewpoint does not look at the type of technology used by organizations, but only looks at whether the technology used has an impact on the position of the organization and whether the technology can provide excellence in competition with competitors.
- Business Concept (Business Management Perspective). This line represents the perspective of business management such as the director or CEO of an organization. This perspective pays attention to the business directly and generally translates business into a model that can provide business direction in the future.
- Systems Logic (Architect Perspective). This perspective is interested in logical building blocks from an organization to run a business model and translate each into enterprise building blocks. The used technology supports the business model and components such as customer databases or workflow systems which is one of the building blocks. In this perspective, business-IT alignment is a concern, especially the choice of technology to be used.
- Technology Model (Engineer's View). This line represents the perceptions of engineers in the company in building and developing identified building blocks on the architecture. This perspective will translate as well as transform enterprise building blocks into system construction requirements and specifications that build the system.
- Tool Components (Technician's View). This line represents the perspective of business technicians such as those who implement databases and implement workflow systems. This perspective implements constructional designs based on previous perspectives.
- Operation Instances (Enterprise's View). This line represents the perspective of how the company is run like the physical form of the office where customers will enter, server space, and system backup for the customer database system.

4.3. Grouping of similar components of TOGAF and Zachman framework. Figure 2 presents combined components of the EA TOGAF and Zachman framework in which each group can be grouped by looking at the similarities in the shape or nature of the component. Grouping components can be gathered to strategy groups, organizational groups, process groups, application groups, data groups, technology groups, and stakeholder groups.

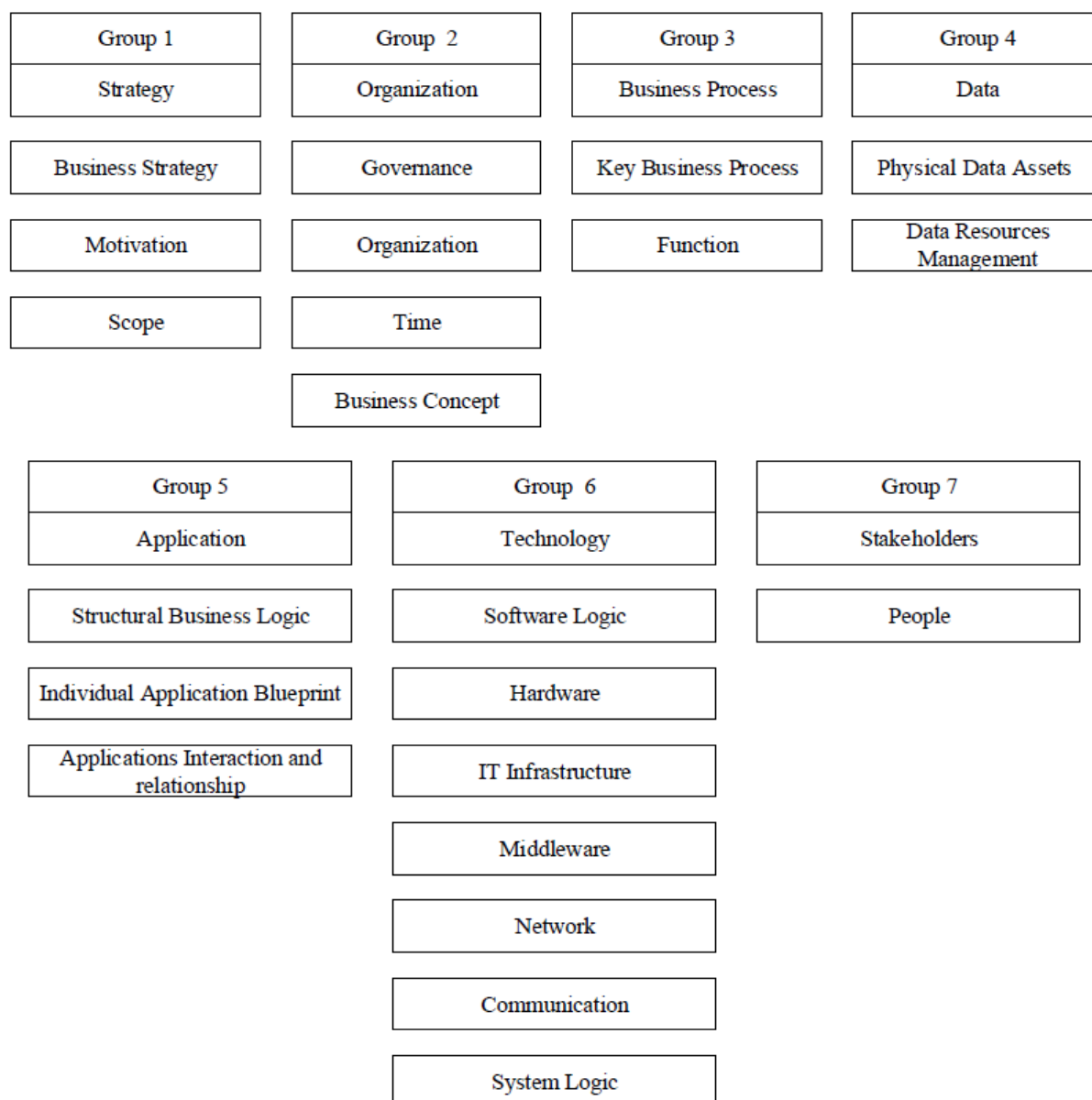


FIGURE 2. Affinity diagram EA based on TOGAF and Zachman

4.4. **Principles of higher education governance.** All HEIs in Indonesia are regulated by the government and they have obligation to fulfill the quality standards namely internal quality assurance standards referring to the National Standards for Higher Education (SNDIKTI) based on Peraturan Menteri Pendidikan Tinggi, Riset dan Teknologi No. 44 year 2015 and updated No. 50 in the year 2018. In its implementation, the evaluation of these standards is set in Akreditasi Perguruan Tinggi or Accreditation of Higher Education (APT) which is monitored by the Badan Akreditasi Nasional Perguruan Tinggi or National Higher Education Accreditation Agency (BAN PT) for all universities in Indonesia. Evaluation of the quality of higher education institution performance is carried out through assessments of higher education institution accreditation standards (APT 3.0 the year of 2018), consisting of 9 standards that have been adjusted to the requirements of the National Higher Education Standards. Those are Standard 1: Vision, mission, goals, and strategies; Standard 2: Administration, governance, and cooperation; Standard 3: Student; Standard 4: Human Resources; Standard 5: Process Resources; Standard 6: Education; Standard 7: Research; Standard 8: Community Service; Standard 9: Outputs and Outcomes of Tridharma.

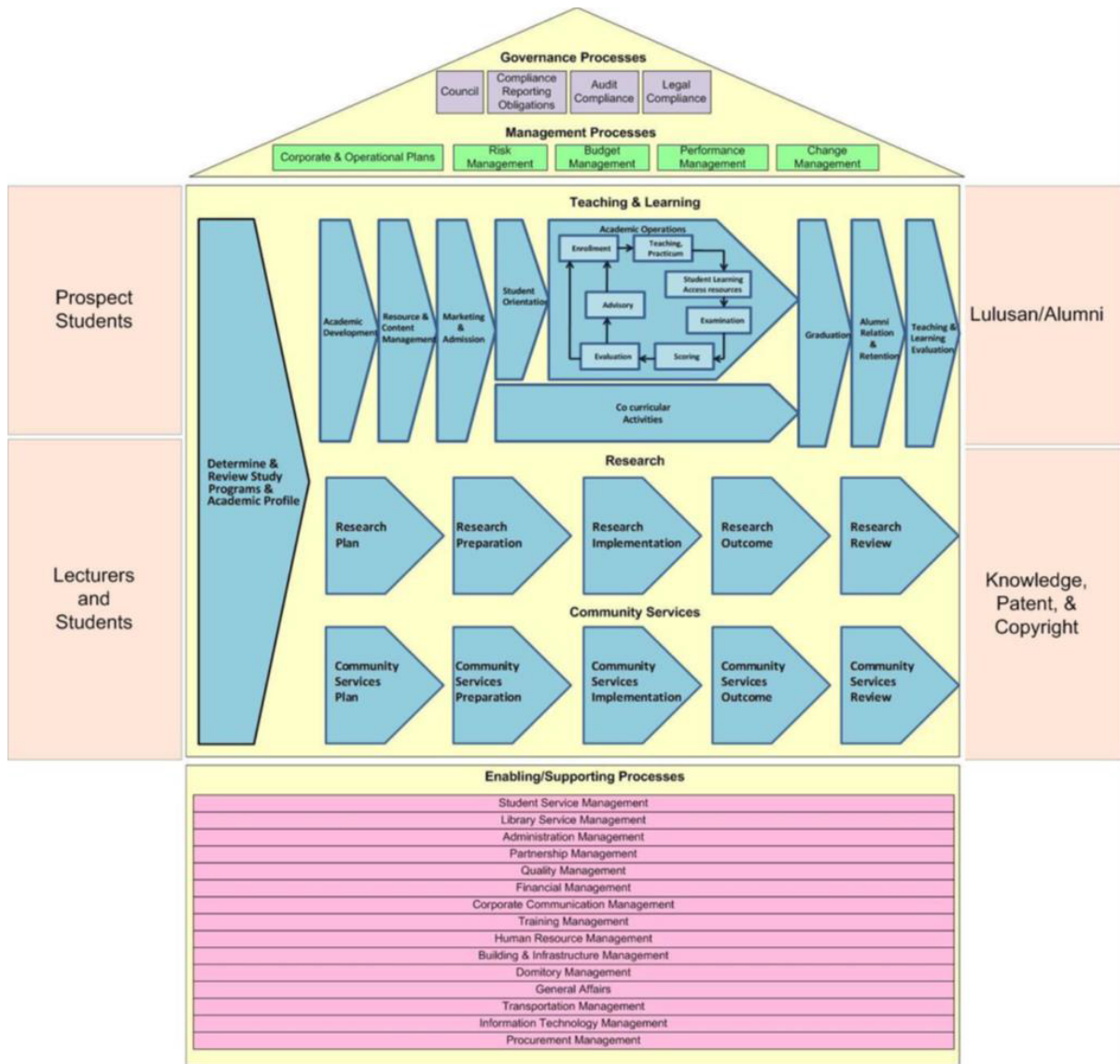


FIGURE 3. Higher education value chain [6]

In general, business process in universities is different from industry. This difference can be seen from the higher education value chain by Meyliana [6]. It describes the value chain in higher education based on Michael Porter’s value chain approach that explains the business processes in universities. Activities in HEI are divided into two major groups, namely the main activities and supporting activities. The description of the value chain can be seen in Figure 3.

Based on the results of exploration and mapping of the development of higher education in the future, the higher education value chain and the quality factor of higher education institutions and higher education institution accreditation based on the standards of the Indonesian National Accreditation Agency in 2018, there are 43 components that are obtained that governed university governance. Of all these factors, the grouping of similar components is then carried out with the aim of simplifying the analysis process by using the affinity diagram (see Figure 4).

Based on Figure 4, it can be seen that not all components that need to be considered by universities are assessment material used in the institutional accreditation. Assessment of institutional accreditation is one indicator showing the quality of higher education institutions in Indonesia that have quality in accordance with the Indonesian National Higher Education Standards. These components are: social impact, learning resources,

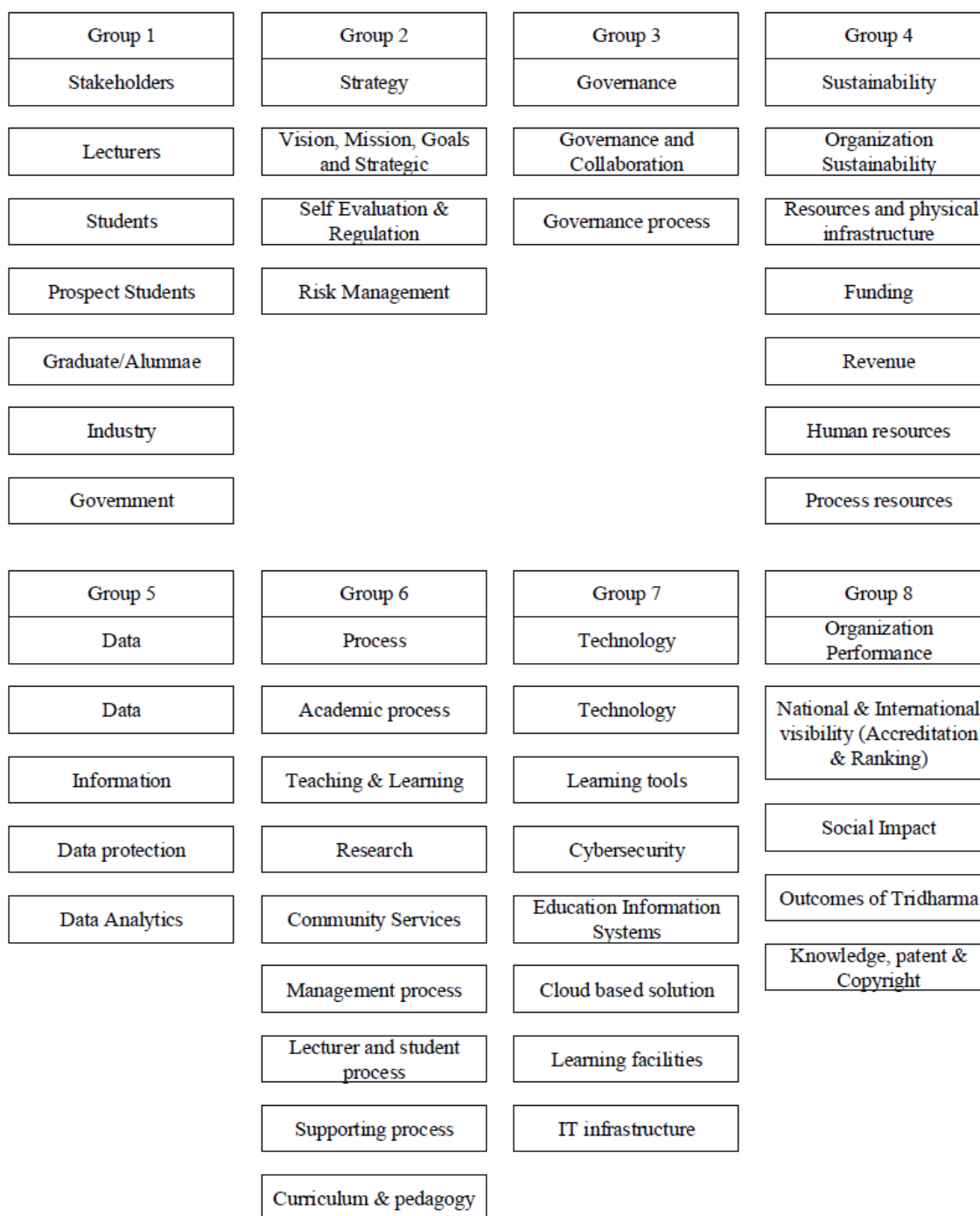


FIGURE 4. Affinity diagram group components of higher education governance

commercialization of research, learning tools, content distribution, data, information, security/cybersecurity, cloud-based solution, data analytics, industry, IT infrastructure, knowledge access, services, outsource the back office function, and Student experience. Table 1 explains the relationship between the components of EA and the components of higher education governance.

While EA components with higher education governance components are shown in Table 2.

5. **Conclusions.** Based on the analysis, it can be seen that there are seven components of EA component based on TOGAF and Zachman and eight components for HEI governance. The evolution of education is consistent with the technology revolution that HEI needs concern. The preparation of HEI’s strategy based on internal quality assurance standards

TABLE 1. Mapping EA components with higher education governance components

No.	Higher Education Components	Future University [3]	University of Future [9]	HEVC [6]	Higher Education Quality [5]	APT3.0
1	Lecturer	v	v	v	v	v
2	Academic Process	v	v	v	v	v
3	International and National Visibility (accreditation and ranking)				v	v
4	Social Impact	v			v	
5	Regulation		v		v	v
6	Sustainability		v		v	v
7	Physical Infrastructure				v	v
8	Funding	v	v		v	v
9	Revenue		v			v
10	Vision, Mission Goals and Strategic		v		v	v
11	Governance	v	v	v		v
12	Student	v			v	v
13	Human Resources/Staff		v			v
14	Teaching and Learning	v	v	v		v
15	Learning Resources		v			
16	Research	v		v	v	v
17	Community Services	v		v		v
18	Outcomes of Tridharma					v
19	Prospect Student		v	v		v
20	Supporting Process		v	v		v
21	Lulusan & Alumni			v		v
22	Knowledge, Patent and Copyright	v		v	v	v
23	Commercialization of Research		v			
24	Learning Tools	v	v			
25	Content Distribution		v			
26	Data	v				v
27	Information					
28	Curriculum & Pedagogy	v	v			v
29	Security & Cybersecurity	v				
30	Education Information Systems	v				v
31	Cloud-based Solution		v			
32	Data Analytics	v				
33	Learning Facilities	v	v			v
34	Programme (inc. Certification)		v			v
35	Partnership	v	v			v
36	Industry	v	v			
37	IT Infrastructure	v	v			
38	Government	v				v
39	Knowledge Access		v			
40	Global Mobility	v	v			v
41	Services		v			
42	Outsourcing the Back Office		v			
43	Student Experience	v	v			

TABLE 2. Mapping EA components with higher education governance components

	Strategy	Organization	Business Process	Data	Application	Technology	Stakeholders
Stakeholders	v	v	v	v	v	v	v
Strategy	v	v					v
Governance	v	v	v	v	v	v	
Sustainability	v	v					
Data	v		v	v	v		
Process		v	v	v	v		
Technology	v		v	v	v	v	
Organization Performances	v	v		v			v

directs universities to have the quality that is in accordance with the standards set by the government, especially in Indonesia. Information technology support for achieving organizational strategy is one of the factors that must be considered by universities. The implementation of EA framework helps HEI to define what focus needs to be developed in the future. The study aims not only to help HEI implement the right EA framework for them, but also to create a value that can fit with education 4.0 era.

This study focuses on Indonesia's HEI and using the National Quality Assurance Standard as view, which can give different result in the other country. The literature review limited only for TOGAF and Zachman for EA framework.

This study can be a baseline to develop EA framework that fits for HEI specifically in Indonesia HEI context.

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