Model Enterprise Architecture for Information Technology Services in Universities

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ABSTRACT

Enterprise Architecture Documents are very important in the development of Information Technology systems in an institution. The Enterprise Architecture contains a strategic plan for the development of ICT and the services that will be run by the system. The preparation of the IS/IT strategic plan at Universitas Negeri Manado is a step in aligning information systems and technology in accordance with the Universitas Negeri Manado business processes and strategies. The method used in this research is descriptive qualitative research using primary and secondary data and building an information technology enterprise architecture using the TOGAF framework model. Collecting data with interviews, documentation, questionnaires, and direct observation of the organization. The analysis used is the Value Chain, SWOT, PEST, Porter's Five Force, and Critical Success Factor (CSF) methods. The results of this study are the form or formulation of the Enterprise Architecture strategic plan of IS/IT in accordance with the Universitas Negeri Manado, in the form of data architecture, applications, and technology to support the business processes of Universitas Negeri Manado.

Keywords: IT enterprise architecture, TOGAF, IT Masterplan, Technology Services, ICT

INTRODUCTION

In the world of education, both primary, secondary, and higher education cannot be separated from the role of IS and IT (IS/IT). IS/IT has shifted from just support to operational needs related to organizational activities. The use of information systems and information technology in

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various activities of the teaching and learning process at an educational institution is not something that is complementary and additional, but a necessity in improving the process and results of the implementation of education carried out. The role of ICT embodied in IS/IT is a tool, which is used to be at the forefront and win the competition between other educational institutions. There is no exception for universities, public and private universities. Planning and implementation of IS/IT is something that must be owned and implemented in educational institutions, especially universities. Departing from this, it turns out that there are still many educational institutions that have not been able to implement and use IS/IT as a tool to excel in the competition. To achieve the vision and mission of higher education, the role of IS/IT is needed, so that the utilization and infrastructure of IS/IT becomes a tool that can be used to support processes and strategies to achieve goals, achieve the vision and mission and carry out the Tridharma of higher education. The use and application of IS/IT will bring added value to the competitive advantage of the institution itself.

Manado State University has a great responsibility to become an excellent higher education institution at home and abroad. One of the main characteristics to meet this is the development of Information and Communication Technology, hereinafter referred to as ICT, which greatly affects the level of progress, prosperity, and competitiveness of an institution. With the right application, ICT can empower and educate people to a higher level of progress. On a micro-scale, Manado State University fully believes that only through the right ICT, the vision and mission of Manado State University can be realized immediately. The proper application of ICT requires the campus community and its environment, especially the Manado State University academic community, to be able to master this technology as one of its core competencies. In other words, the purpose of ICT development at Manado State University should be directed to support the achievement of the vision and mission of Manado State University and increase the role of the academic community to renew Indonesian society into the era of knowledge. At the same time, the Manado State University academic community masters ICT as a competency according to their field.

The process of developing ICT at Manado State University is fully directed at achieving the vision of Manado State University as Logistics. In line with this, the direction of ICT development at Manado State University is the ICT-Base Campus, which is a campus environment that is supported by adequate ICT services. To reach this direction, it is necessary to identify programs and activities, physical facilities, and resources that are in an integrated ICT system. Manado State University's good ICT services will enhance the role of the Manado State University academic community in producing science, technology, and art, as well as content needed by society and industry. Thus, the mission of Manado State University can be carried out effectively, efficiently, and accountably. The main function of the ICT-base Campus system at Manado State University is to provide integrated information, computing, and communication services to all members of the Manado State University academic community and the outside community that are adequate to build high-quality services.At the Manado State University at this time, the utilization and use of IS/IT are still very small and have not even been carried out, this has an impact on academic activities. In the era of information development like now, the ease of information to support academic needs is something that is very important, but with the lack of planning and implementation of IS/IT access to information becomes very difficult and learning resources are minimal. Lack of information sources and difficulty in meeting academic information needs is the current condition of Manado State University. The same thing happened to the academic support activities themselves, such as administration and staffing. Data and information from each section and work unit are not well distributed and not centralized. Alignment of IS/IT implementation strategies with business processes is a must so that IS/IT implementation can run in synergy and provide benefits to the organization. The preparation of IS/IT strategic plans needs to be carried out

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so that development planning, development, and implementation of application systems and technologies are integrated and aligned with the organization's business processes, so as to produce competitive capabilities and good IS/IT implementation. Manado State University does not yet have an integrated IS/IT planning, development, and facilities roadmap, so the preparation of IS/IT strategic plans needs to be done to translate the vision and mission of Manado State University into the needs of Information Systems and Information Technology, as well as IS/IT development and implementation sustainably

The problem in this study can be identified as Manado State University has not fully implemented the application of IS/IT in supporting the operational activities of the institution itself. In addition, the lack or even the absence of IS/IT implementation has an impact on the weak ability to compete in terms of getting new students for Manado State University. On the other hand, Manado State University does not yet have an IS/IT strategic plan which will hinder the planning, development, development, and implementation of application systems and technology. Another problem is that the IS/IT strategy is often not aligned with the organization's business strategy. This research is only limited to the preparation of IS/IT strategic plans at Manado State University. IS/IT strategic planning is made in the form of enterprise architecture which includes data architecture, applications, and technology. The application architecture and technology architecture are created using the Enterprise Architecture Planning (EAP) methodology within the Zachman framework.

The purpose of this research is to compile or create and produce Enterprise Architecture documents of IS/IT strategic plans at Manado State University. The theoretical benefits of research are scientific documentation that is useful and contributes to Manado State University and to researchers themselves. In addition, providing concrete examples of the application of theories and methods related to research in solving real-world problems. The practical benefit of research is to produce IS/IT strategic plans that support the planning, implementation, and development of IS/IT at Manado State University. The practical benefits of research are as well as policy directions and control over the use and development of IS/IT in accordance with the needs and business strategies of Manado State University and provide input for decision makers at Manado State University to take effective steps for IS/IT development in the form of IS/IT organizations. Given these problems, this study aims to create an Enterprise Architecture document of IS/IT strategic plans for ICT development at Manado State University which can be used as a guide that can be used in ICT development at Manado State University.

METHOD

2.1. Types of research

This study uses a type of research with qualitative descriptive methods and builds an information technology enterprise architecture using the TOGAF framework model. The problems that become the object of research are collected and analyzed to get a true picture of the object of research.

2.2. Data Collection Instruments and Techniques

The data in this study used primary data and secondary data. Data collection methods used are interviews (using interview guidelines which contain Value Chain analysis, SWOT, Porters Five Forces analysis, Critical Success Factor (CSF) analysis and PEST analysis), observation, questionnaires (by giving questionnaires to respondents) and documentation.

2.3. Samples and Sampling Techniques

The sampling technique used is purposive sampling. In this study, the object taken is a university, so the data sources are:

1) Rector of Manado State University;
2) Vice Chancellor;
3) Dean;
4) Head of Institution;
5) Head of Department;
6) HEAD of Student and General Administration;
7) Head of UPT Computer;
8) Related Parties.

2.4. Data analysis

This study uses the Enterprise Architecture Planning (EAP) planning methodology with the Zachman framework approach to analyze system requirements and prepare IS/IT strategic plans at Manado State University. Meanwhile, for the analysis of the strategic structure of the IS/IT strategic plan at Manado State University, using the Value Chain method, PEST analysis, SWOT analysis, Porters Five Forces and Critical Success Factor (CSF).

2.5. Research Framework

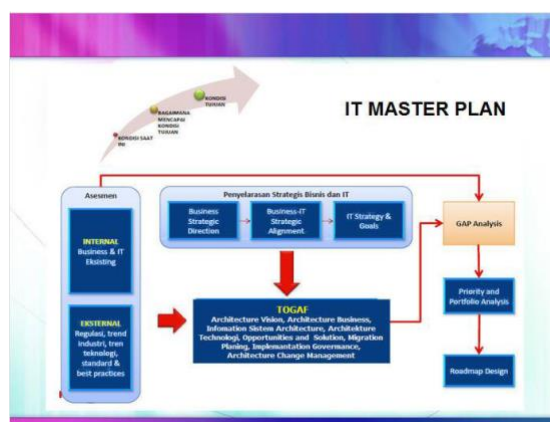In this study, each stage will be adapted to the TOGAF framework. See figure 1.

Figure 1. Research Flow Diagram

2.6. Research Phase

This research was conducted following the following causal phases:

1. Preliminary phase: framework and principles

This phase is the preparatory and initial stage to define the framework and principles, aiming to confirm the commitment of stakeholders, determine the detailed framework and methodology that will be used in the development of the enterprise architecture. In this study, the framework used is The Open Group Architecture Framework (TOGAF) with the Architecture Development Method (ADM) methodology to design an adaptive information technology architecture at Pamulang University.

2. Requirements Management Phase

In this phase, the organization's requirements are explored and documenting user needs. The purpose of this phase is to provide a process for managing architectural requirements throughout the phases of the ADM cycle, identifying enterprise requirements, storing them and then passing them on to the relevant phases. The requirements needed in this phase include academic administration, financial administration, research processes and service. The development of information systems must be in accordance with management requirements to achieve organizational goals

3. Phase A : Architecture Vision

Defining the scope, business objectives, business objectives, organizational profile, organizational structure, identification of stakeholders, organizational vision and mission, and obtaining approval, as well as mapping all strategies to be carried out. This phase also aims to create a uniform view of the importance of enterprise architecture to achieve organizational goals formulated in the form of a strategy and determine the scope of the architecture to be developed. At this stage contains the questions asked to get the ideal architecture.

4. Phase B : Business architecture

Describe the current business architecture, goals, and determine the gaps between the business architectures. In this phase, the initial conditions of the business architecture are defined. In this phase, business modeling is also carried out by choosing the right tool to describe the business architecture. Business architecture modeling is done by identifying the main functional areas, defining business functions, and supporting functional areas

5. Phase C : Information System Architecture

Emphasizes how the information system architecture is built which includes the data architecture and application architecture that will be used by the organization. In the data architecture, it is done by identifying all the data components that will be used by the application to produce the information needed by the organization based on the needs of the defined business functional areas. The identification carried out is to determine candidate data entities, define data entities, and create relationships between business functions and data entities. Techniques that can be used are ER-Diagrams, class diagrams, and object diagrams. In the application architecture, it is done by identifying candidate applications, determining the type of applications needed to process data and support the business, as well as modeling the application architecture.

6. Phase D : Technology Architecture

In this phase, the technology requirements for processing data are defined. The initial step taken is to determine the candidate technology that will be used to produce technology selection for the existing technology platform in the application including software and hardware. The technique used is to identify the principles of the technology platform, which consists of seven areas including operating systems, data management, applications, hardware, communications, user computing, and security. This technique provides an overview of the network contained in an organization. In general, the technology architecture will compare the planning and development of old and new technologies. This gap analysis will place the new technology infrastructure that will be needed in future implementation. Techniques that can be used are environment and location diagrams, and network computing diagrams

7. Phase E : Opportunities and solutions

This phase emphasizes the benefits derived from enterprise architecture. An evaluation of the gap of the enterprise architecture which includes business architecture, data, application architecture, and technology architecture is carried out to further develop a strategy for the solution. Evaluation and strategy for this solution can be used as the basis for stakeholders to choose and determine the architecture to be implemented

8. Phase F : Migration Planning

In this phase, an assessment is carried out in determining the migration plan of an information system. To determine the migration that will be carried out and applied, usually at this stage for modeling based on the priority of the flow that runs on the organizational unit and decisions on the main and supporting needs in the organization for the implementation of information systems.

9. Phase G: Implementation Governance

Prepare recommendations for the implementation of implementation governance that has been carried out, the governance carried out includes organizational management, information technology management, and architectural governance. Confirm the scope for priority deployment of the planned implementation, have guidelines for the development of the project to be implemented, arrange for the operational implementation of the implementation of the project results.

10. Phase H: : Architecture Change Management

This phase carries out a management plan for the architecture that has been implemented by monitoring technological developments and ongoing changes in the organizational environment. And determine whether to do the next EA development cycle. Because it is possible to develop the existing architecture considering the business needs of the organization can change at any time according to organizational conditions. Monitoring the development of the information system that is built, managing the necessary risks if there are changes at the individual, business organization, and technology levels.

RESULTS AND DISCUSSION

Before starting this business modeling, you must first determine questions regarding the guidelines used by the university in running its business. The Tridharma of Higher Education is the central activity of a university. This core activity cannot be carried out properly if there is no support from other activities such as financial management, building and infrastructure management as well as human resource management, and others. To identify the main and supporting functional areas of the university, the university is depicted in a value chain. Each of the main and supporting activities can be explained as follows. The main function consists of three activities, namely: student admissions, academic operations, and academic discharge. New Student Admission is an activity to accept new students while Academic Operations is described as an

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academic activity aimed at students starting from matriculation to graduation. So academic termination is an activity related to student dismissal. Support functions consist of Asset & Infrastructure Management, Human Resources Management, and Financial Management. Asset Management Support & Infrastructure is the activity of managing goods and services, including activities from planning their existence to their elimination. Meanwhile, Human Resource Management is the activity of determining the needs and allocation of human resources. Lastly is Financial Management which includes financial management activities. To model business architecture, there are various techniques that can be used, such as Business Process Modeling Notation (BPMN), Functional Decomposition Diagram (FDD), Unified Modeling Language (UML) diagram, and Integration Definition for Function Modeling (IDEF0). In the second stage of TOGAF ADM, namely Business Architecture, also provides techniques that can be used to model the business architecture, including BPMN.

Before modeling the existing business architecture in universities, the following will be carried out first by formulating the derivatives of business functions and supporting functions based on the value chain. The derivative forms of the main and supporting business functions will be illustrated with a Functional Decomposition Diagram (FDD). In order for the business architecture model to be well understood, the defined business functions can be described with BPMN. The BPMN process model is a graphical representation of one or more aspects of the management system of an organization because it directly provides a clear picture of who is the decision maker for each process. One example of BPMN for the function of determining the academic calendar of universities. In addition to the results of the analysis and documentation of the business processes that have been made, it is also necessary to evaluate the business processes so as to produce more effective and efficient business processes.

Data Architecture Model

The data architecture must be able to identify data that supports business functions as defined in the business model. To define the data architecture, first, the candidate data entities are registered by brainstorming the people, places, and events that have meaning (information) related to the university business model. To define the data architecture, TOGAF ADM recommends a catalog (Data Component Catalog) that contains data sets that exist within the organization. Another recommendation is the Business Function Matrix which describes the relationship between business functions and data entities that exist in universities. The following will explain some of the Data Component Catalog in a university. See figure 2-7.

Figure 2. BPMN Determination of Academic Calendar
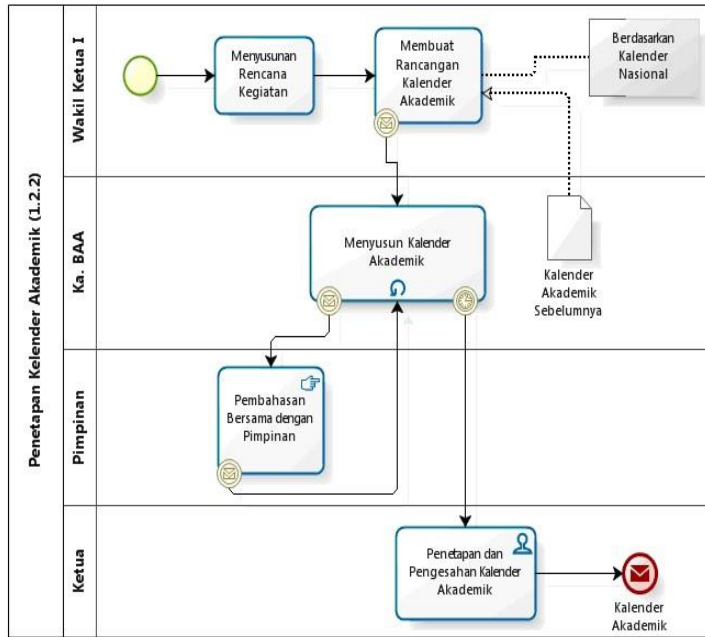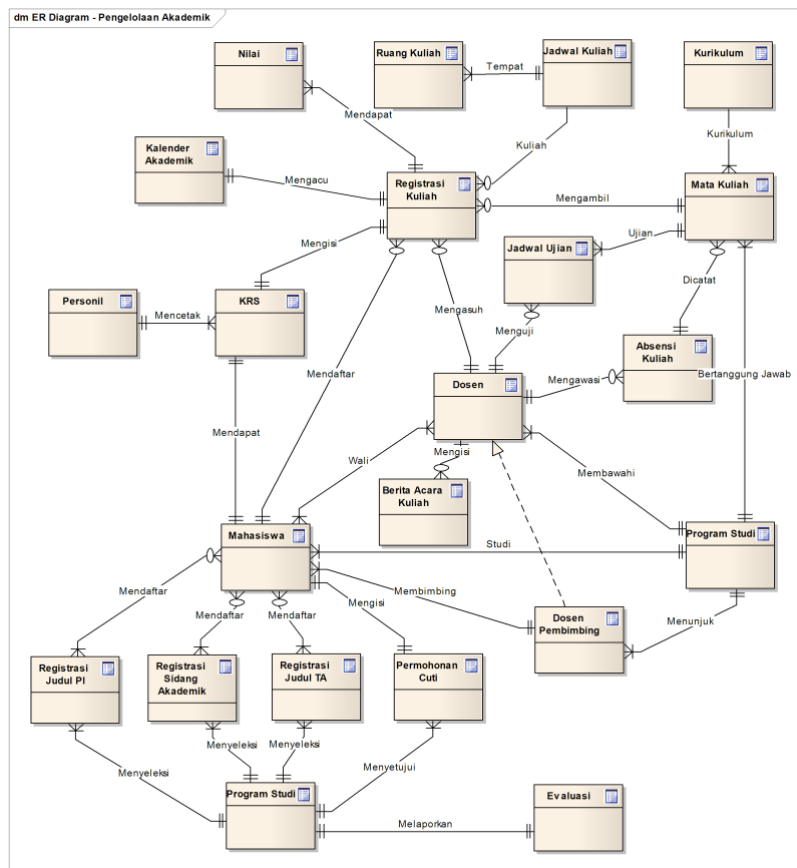

Figure 3. Academic Operational ER Diagram

Figure 4. *Application Portfolio Catalog*

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APLIKASI (columns, left to right):
- Sistem Pelaporan Keuangan
- Sistem Pengelolaan Honor Dosen
- Sistem Pengelolaan Biaya Pendidikan
- Sistem Akuntansi Hutang dan Pembayaran
- Sistem Akuntansi Keuangan
- Sistem Anggaran
- Sistem Pelaporan Manajemen Aset & Sarana Prasarana
- Sistem Pengelolaan Logistik
- Sistem Pemesanan
- Sistem Pengadaan
- Sistem Pelaporan Manajemen Sumber Daya Manusia
- Sistem Manajemen Promosi dan Kepangkatan
- Sistem Administrasi Honor, Gaji dan Potongan
- Sistem Manajemen Pelatihan dan Pendidikan
- Sistem Manajemen Rekruitmen
- Sistem Manajemen Laporan Waktu & Cuti
- Sistem Manajemen Personil

FUNGSI / FUNGSI PENDUKUNG (rows, by group):

Manajemen Aset dan Sarana Prasarana
- Pengelolaan Vendor
- Pengelolaan Pemesanan Barang/Jasa
- Pengelolaan Penerimaan Aset
- Pengelolaan Penilaian Inventaris
- Pelaksanaan Penelusuran Inventaris
- Pengelolaan Penghapusan Inventaris
- Pengelolaan laporan dan evaluasi sarana prasarana

Manajemen Sumber Daya Manusia
- Pengelolaan Potongan
- Pengelolaan Cuti
- Pengelolaan dan Pengumpulan Laporan Waktu
- Pengelolaan Tunjangan
- Pengelolaan Perhitungan Honor
- Pengelolaan dan Perhitungan Gaji
- Pengelolaan Informasi Personil
- Pengelolaan dan Pelaksanaan Rekruitmen
- Pembinaan Personil
- Pengembangan Personil
- Pengelolaan pelaporan dan evaluas SDM

Manajemen Keuangan
- Perencanaan dan Persiapan Anggaran
- Penyusunan Anggaran
- Pengesahan Anggaran
- Pelaksanaan Revisi Anggaran
- Menetapkan Alokasi Anggaran
- Pelaksanaan Monitoring dan Evaluasi Anggaran
- Menetapkan Akuntansi Keuangan
- Pengelolaan Pelaporan Keuangan
- Pengelolaan Penerimaan Keuangan
- Pengelolaan Akuntanasi Hutang dan Pembayaran
- Pengelolaan Biaya Pendidikan
- Pengelolaan Pembayaran Honor Dosen

Figure 5. Application Relationship Matrix with Business Functions
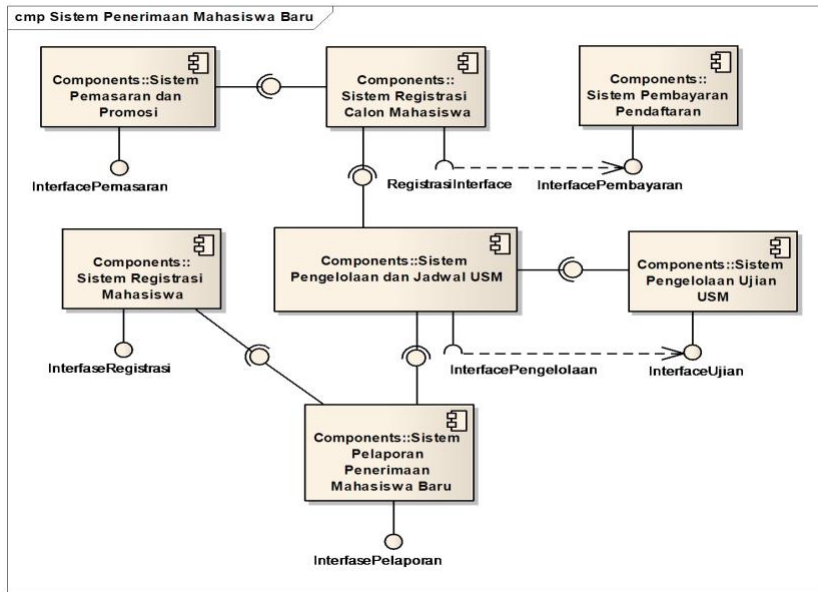
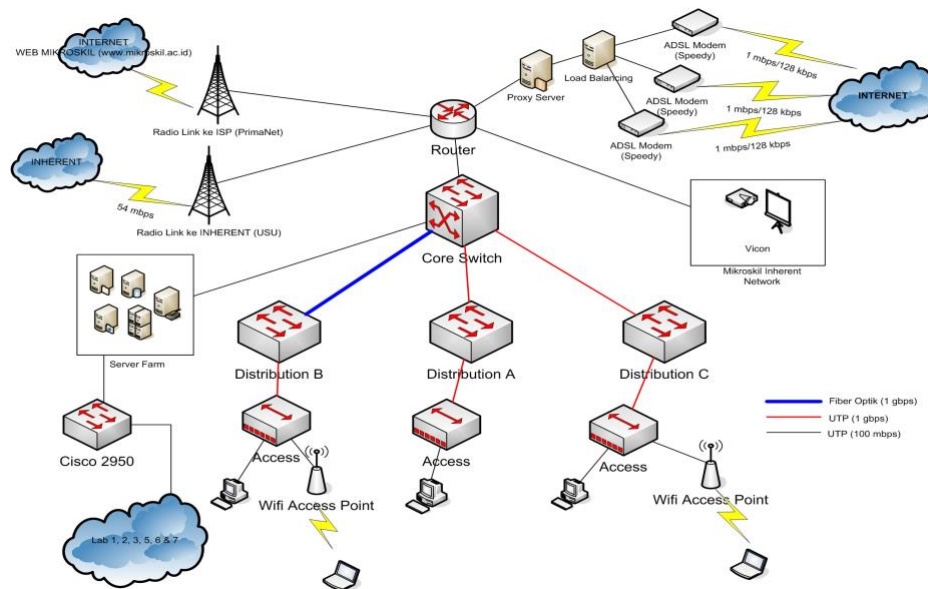**Figure 6.** Student Admission Application Communication Diagram

Figure 7. Conceptual Network

Academic Operational Entities including among others are
1. Study Program Entity
2. Major Entity
3. Infrastructure Facility Entity (Lecture Room)
4. Semester Entities
5. Curriculum Entity
6. Academic Calendar Entities
7. Herregistration Entity (Lecture Registration)
8. Lecturer Entity

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9. Student Entity
10. Course Entities
11. Class Schedule Entities
12. Lecture Minutes Entity
13. Lecture Attendance Entity
14. Entity Exam Schedule
15. Entity of Examination Report (UTS & UAS)
16. Value Entity (KHS, Transcript)
17. Entity KRS
18. Academic Leave Entities
19. Academic Session Registration Entity
20. PI Title Registration Entity
21. Registration Entity Title TA
22. Evaluation Entity

Based on the candidate data entities that have been defined, the next step is to describe the data architecture required in the previously described functions and business models. The data architecture will be presented in the form of an E-R diagram, the E-R diagram was chosen considering that the data architecture only identifies and defines data entities. For the purpose of visualizing these data entities and their conceptual meanings, the E-R diagram is good and sufficient. Figure 6 will be given an example of an ER Diagram for Academic Operational Functions for new student registration. The next step is to create a Business Function Matrix, which aims to determine data entities that can be created (created), used (referenced), and data that can be improved (updated) of existing business functions in universities. The business functions defined in the business architecture model are related to data entities in the form of a matrix.

Application Architecture Model

Application Architecture has a goal to define the applications needed to manage data and support business functions that exist in universities. An application architecture model is a definition of what an application does to manage data and provide information for executing business functions. The application architecture can be defined using the Application Portfolio Catalog, System -/Function Matrix, and Application Communication Catalog techniques. The Application Portfolio Catalog stage aims to define the list of applications used by universities, the application architecture has the aim of managing data and business functions that exist in universities. An example of an Application Portfolio Catalog of applications in universities can be seen in Figure 4.

Then the System/Function Matrix stage aims to identify business functions that are directly supported or carried out by the application. In general, the steps for mapping the relationship between applications and business functions are by 1) determining the use of applications used by the organization's business functions based on the needs of the business function by reviewing the business processes and data used, 2) determining the usage policies and how the services in the application are used. Support business functions, 3) support gap analysis between the role of applications in supporting the organization's business processes, 4) determine the role of applications in supporting business functions, and identify the need for future application changes. An example of the application relation matrix with business functions can be seen in Figure 5.

The last stage in the application architecture model is the Application Communication Catalog which aims to describe all models and mappings related to the form of communication between applications used by universities. This diagram will also show the application and the

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interfaces between the application components that will be used. This application communication description is described logically in the hope of showing the relevant application architecture to be designed and developed.

Technology Architecture Model

The purpose of this stage is to build the desired technology architecture, starting from determining the basic technology concepts to the required alternative technologies. Technology architecture is seen as defining the technology platform that will be used to provide an application environment for managing data and as a tool to support business functions within the university.

The first step is to determine the principles of the technology platform to define the principles of the technology to be used. The goal is to make the definition of technology clearer and more measurable, it is necessary to define the principles of a technology platform which includes hardware, software, and communication. The resulting technology architecture is conceptual so it is not a detailed needs analysis, but only provides an overview and needs to be reviewed when implementing it. The architecture is defined to ensure that the technology is reasonable, feasible, and consistent with the business, data, and application architecture. In general, the conceptual configuration of the technology can be divided into 2 parts, namely: (1) Conceptual Higher Education Network, and (2) Business System Architecture. Each of these configurations of the conceptual technology. See figure 8.
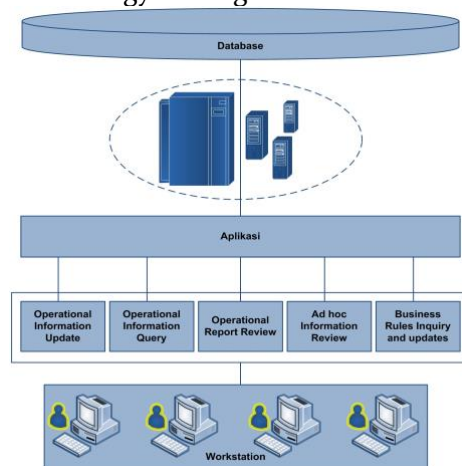

Figure 12. Business System Architecture

In the principles of technology, it is identified that the technology needed is network technology that connects one part to another. Therefore, in determining the technology platform, the thing that needs to be considered is the location of the business that will be the area for placing the technology infrastructure.

Migration Strategy and Implementation

The enterprise architecture gap analysis identifies differences between the basic architecture and the target architecture, which consists of 5 (five) views, namely business views, work organization, information, functional, and infrastructure. The implementation phase migration time should be reduced from the initial phase to the final phase to achieve organizational goals.

These phases should be organized according to priorities and interdependencies between systems. One result of the application architecture is how the dataset or record is described by the application. The usefulness of the application's relationship with data entities in a system can be explained as follows. The relationship between applications and data entities in a system has two uses, namely: 1) to indicate the requirements under which the sharing of data and applications that support the university's business functions takes place, and 2) it is used to inform implementation plans based on the principle that all data-generating applications must be implemented first. Based on this principle, a data-based application deployment sequence can be generated, so that the resulting data can be used by the application which is then used.

CONCLUSION

The preparation of the IS/IT strategic plan at Manado State University is a step in aligning information systems and technology in accordance with the Manado State University's business processes and strategies. The results of the analysis used by the Value Chain, SWOT, PEST, Porters Five Force, and Critical Success Factor (CSF) methods produce or formulate the Enterprise Architecture of IS/IT strategic plans in accordance with Manado State University, in the form of data architecture, applications and technology for Supporting Manado State University's business processes.

REFERENCES

Arrianto Mukti Wibowo. Pengantar IT Infrastructure Library versi 3. Fakultas lmu Kompoter, Universitas Indonesia.

Blokdijk, G. (2008). ITIL IT Service Management – 100 Most Asked Questions on IT Service Management and ITIL Foundation Certification, Training and Exams. London: Emereo.

Bovim, A., Johnston, K., Kabanda, S., Tanner, M., & Stander, A. (2014). ITIL adoption in South African: A capability maturity view. e-Skills for Knowledge Production and Innovation Conference 2014 (pp. 49-60). Cape Town: Informing Science Institute .

Cater-Steel, A., & Wui-Gee, T. the Role of It Service Management in Green IT. Australasian Journal of Information Systems, 17 (1), 177–195.

CDW-G. (2011). ITIL for Government. Whitepaper.

De Haes, S., & Van Grembergen, W. (2004). IT Governance and its Mechanisms. 1 (1),27–33.

ITIL v3 Foundation Study Guide. Release version 4.2.2.5. Copyright 2009, taruu LLC.

Idena, J, dan Eikebrokk, T.T., 2013,Implementing IT Service Management: A systematic literature review, International Journal of Information Management 33, 512– 523.

Lapão, L. V., Rebuge, Á., Silva, M. M., & Gomes, R. (2009). ITIL assessment in a healthcare environment: The role of IT Governance at Hospital São Sebastião. Studies in Health Technology and Informatics , 150, 76–80.

McNaughton, Blake, Ray, Pradeep, dan Lewis, Lundy, 2010, Designing an evaluation framework for IT service management, Information and Management 47, 219 –225.

OGC, 2007, The Official Introduction to the ITIL Service Lifecycle, TSO, London.

OGC, 2007, Service Design, TSO, London

Paulk, Mark C. Et al. Capability Maturity Model for Software (Version 1.1). Technical Report.

Pemkot Tangerang. (2010). Kegiatan Penyusunan Pedoman Petunjuk Teknis dan Peraturan Komunikasi Online Antar SKPD di Lingkungan Pemerintah Kota Tangerang. Tangerang: Pemkot Tangerang.

Peter Fanning. ITIL Version 3 – Service Operation. Office of Government Commerce.

Peter Fanning. ITIL Version 3 – Service Transition. Office of Government Commerce.

Pereira, de Sousa, and da Silva, MM. 2010. A Maturity model for implementing ITIL v3. 6th World Congress on Services.

Potgieter, B. C., Batha, J. H., & Lew, C. (2005). Evidence that use of the ITIL framework is effective. 18th Annual Conference of the National Advisory Committee on Computing Qualifications (pp. 160–167). Christchurch: National Advisory Committee on Computing Qualifications.

Tan, W.-G., Cater-Steel, A., & Toleman, M. (2009). Implementing It Service Management : a Case Study Focussing on Critical Success Factors. Journal of Computer Information Systems , 50 (2), 1-12.

UCISA. (2002). ITIL Case Study on the University. Oxford: UCISA.

Zhen, W., & Xin-yu, Z. (2007). An ITIL-based IT Service Management Model for Chinese Universities. Software Engineering Research, Management & Applications, 2007. SERA 2007. 5th ACIS International Conference on (pp. 493-497). Busan: IEEE.

Budi Daryatmo (2007), Perancangan Cetak Biru Teknologi Informasi,. Vol. 3, No. 3; 2007, Published by STMIK MDP Palembang.

Ishak dan Alias (2005), Designing A Strategic Informaion System Planning Metodology For Malaysian Institutes of Higher Learning (ISP-IPTA). Volume VI, No. 1, 2005.

Harwikarya, Mujiono Sadikin, Devi Fitrianah, Mohammad Mustofa Sarinanto, Ida Nurhaida, and Arif R (2015), IS Strategic Plan for Higher Education Based on COBIT Assessment: A Case Study, International Journal of Information and Education Technology, Vol. 5, No. 8, August 2015

Ade Yuliana, Kridanto Surendro (2009), Rekomendasi Perencanaan Strategi Sistem Informasi (SI), Jurnal Sekolah Teknik Elektro dan Informatika Institut Teknologi Bandung,2009.

Veronica S Moertini (2008), " Pengembangan Sistem dan Sarana Teknologi Informasi untuk Perguruan Tinggi Indonesia". Rapat Umum Anggota APTIK, Bandung, 10-12 Maret 2008.

Firmansyah (2008), dengan judul " Perancangan Master Plan Sistem Informasi Manajemen Politeknik Swadarma ". Jurnal Kompleksitas Vol 1 Nomor 9 Tahun 2008

Maniah (2011), Information Technology (IT) MASTER PLAN Badan Geologi Bandung. PROSIDING SEMINAR NASIONAL, ISBN : 978-979-796-189-3.

Indra Silanegara, Bayu Adhi Tama, Diat Nurhidayat (2011), Perencanaan Strategis Teknologi Informasi (Studi Kasus: Politeknik Negeri Jakarta, Vol.6 No.1 (Januari 2011)

Budi Yuwono, Rein Nusa Triputra, Muhammad Nasri (2009), Iinformation Technologi Plan As An

IT Governance Maturity Driver, Journal of Information Systems, Volume 5, Issues 1, April 2009

Yeni Kustiyahningsih (2013), Perencanaan Arsitektur Enterprise Menggunakan Metode TOGAF ADM (Studi Kasus : RSUD Dr.Soegiri Lamongan), Prosiding Seminar Nasional Manajemen Teknologi XVIII Program Studi MMT-ITS, Surabaya 27 Juli 2013

Rahman Rosyidi, Purwadi (2014), Perancangan Pengembangan Arsitektur Sistem Informasi Akademik Dengan Menggunakan TOGAF (Studi Kasus : STMIK Amikom Purwokerto)

Roni Yunis, Kridanto Surendro (2009). Model Enterprise Architekture Untuk Perguruan Tinggi Di Indonesia, Seminar Nasional Informatika 2009 (semnasIF 2009) ISSN: 1979-2328

Aradea, Husni Mubarok, Gea Aristi (2012), Perancangan Arsitektur Informasi Untuk Mendukung Pengembangan Sistem Informasi Akademik Di Perguruan Tinggi, Jurnal Penelitian SITROTIKA Volume 8, Nomor 2, Juli 2012

Roni Yunis, Kridanto Surendro, Erwin S. Panjaitan (2010), Pengembangan Model Arsitektur Enterprise Untuk Perguruan Tinggi, Volume 8, Nomor 1, Januari 2010 : 9–18

Kuswardani Mutyarini (2006), Arsitektur Sistem Informasi Untuk Institusi Perguruan Tinggi Di Indonesia, Prosiding Konferensi Nasional Teknologi Informasi & Komunikasi untuk Indonesia 3-4 Mei 2006

Agus Prasetyo Utomo dan Novita Mariana(2011), Analisis Tata Kelola Teknologi informasi (It Governance) pada Bidang Akademik dengan Cobit Frame Work Studi Kasus pada Universitas Stikubank Semarang, Jurnal Teknologi Informasi DINAMIK Volume 16, No.2, Juli 2011 : 139149, ISSN : 08549524.

Setiawan EB. 2009. Perancangan Strategis Sistem Informasi IT TELKOM untuk menuju World Class University. Didalam: Seminar Nasional Aplikasi Teknologi Informasi: Yogyakarta, 20 Juni 2009.

Boar, B., "The Art of Strategic Planning for Information Technology, 2nd Ed", John Wiley & Sons, 2001.

Earl, M.J., Management Strategies For Information Technology, 1st Ed , Prentice Hall, 1996.

Laudon, Kenneth C. And Laudon, Jane Price, Management Information System: Managing the Digital Firm, 8th edition, New Jersey: Pearson Prentice Hall, 2004.

E.W. Martin et al, "Managing Information Technology: What Managers Need to Know, New York: Prentice Hall, 1994.

Minoli, Daniel, "Enterprise Architecture A to Z: Frameworks, Business Process Modeling, SOA, and Infrastructure Technology", United States of America: Auerbach Publications, Watson, H.J. and Carte, T.A. (2000). Executive, 2008.

Raynard, Boyce, "TOGAF The Open Group Architecture Framework 100 Success Secrets: 100 Most Asked Questions – The Missing TOGAF Guide on How to Achieve and Sustain Superior Enterprise Architecture Execution", 2007.

Rogerson, Simon dan Christine Fidler, "Strategic Management Support Systems", 1994.

Spewak, Steven, H, "Enterprise Architecture Planning (Developing a Blueprint for Data, Application and Technology)", John Wiley & Sons, Inc, 1992.

Tozer, E.E. "Strategic IS/IT Planning", Professional Edition, Betterworth-Heinemann, Boston, 1996.

Ward, John dan Joe Peppard, "Strategic Planning For Information System", 2th ed, John Wiley & Sons, England, 2002.

Ward, J., Griffiths, P., "Strategic Planning for Information System", 3 rd Ed, John Wiley & Sons, 2003.

Zachman, J.A, "A Framework for Information Systems Architecture", IBM System Journal, 1987.