DEVELOPING IT STRATEGIC PLANNING USING MOBILE ENTERPRISE ARCHITECTURE IN THE ACADEMIC PROCESS OF ATMA JAYA MAKASSAR UNIVERSITY

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Abstract **-** The purpose of this research was to examine the feasibility of the development of mobile enterprise strategic plan, analyze the academic process and the utilization of information technology (IT), and generate documentation IT strategic planning by implementing Mobile Enterprise Architecture in the academic process of Atma Jaya University in Makassar. Data were taken from distributing questionnaires to 297 respondents and conducting interviews to 18 respondents. Data were examined using SWOT analysis, the incorporation of academic scorecard analysis and IT balanced scorecard analysis, financial analysis, as well as analytic hierarchy process (AHP). SWOT analysis results indicate that case study is in a weak position, which possibly never take advantage of opportunities since the weakness of the stand or the power is not enough to work on it. In addition, the results of the performance analysis of the utilization of information technology using the Balanced Scorecard analysis show that the average performance is sufficient. The result of documentation of IT strategic planning was analyzed with financial analysis indicating the feasibility of implementation because it provides benefits for university of 141,32%. Furthermore, Analytic Hierarchy Process (AHP) to determine the priority of IT strategy proposals shows that the main priority is to develop portal for student and lecturer.

Keywords: IT strategic planning, mobile enterprise architecture, analysis, university

I. INTRODUCTION

The development of information technology is rapidly making university require IT strategic planning to be able to guide the future development of the university. If a university has a good strategic plan, the risk involved in the decision making of IT utilization can be reduced (Titthaisiri, 2001). The importance of strategic planning is increasing day by day in the higher education institution or university in order to plan the work, setting goals, preparing the budget in line with the objectives and targets set, classify resources according to priority objectives, as well as providing participatory management (Akyel *et al*., 2012). Currenty, University of Atma Jaya Makassar is a private college that has four faculties, the Faculty of Economics, Faculty of Engineering, Faculty of Law, Faculty of Information Technology, and also a graduate study program in Accounting.

The role of information technology in facilitating the university's activities focuses on the administrative and academic fields, where information technology is used in university management, administrative processes, increased research and teaching-learning process (Titthaisiri, 2001). Most higher education institutions receive and utilize innovative Information and Communication Technology (ICT). However, university tends to respond to ICT developments rather than controlling changes. In other words, it can be said with reasonable arrive arrival time. As a result, the use of ICT in university tends to follow the flow of the development of ICT according to their needs, not as a result of taking certain decisions. Thus, investment in university is a decision based on the problems that exist at that time compared to the long term strategy of the use of ICT (O'Mahony, 2009). In case study of the University of Atma Jaya Makassar experiencing similar problems, the use of IT at case study is based on the existing needs. The implementation of information technology is considered relatively minimal because information technology is still not operationally and thoroughly utilized. The academic process has also been limited in the internal network as well as the semi manual and semi computerized.

According to Alonso & Lamata (2006), ICT had the ability to increase the accessibility of information, facilitating communication through electronic facilities, improve learning synchronization, as well as increasing cooperation and collaboration. Application of ICT is capable of increasing the exchange of information between college students or between college students and professors. This occurs through the use of ICT products. One of ICT products largely owned and used by many people in society today is mobile phone.

In recent years, mobile technology and applications has been attached and embedded in every aspect of both personal and professional life (Unhelkar & Murugesan, 2010). In education, Guy (2009) defined mobile learning as electronic learning via mobile devices. Mobile phone has the potential to improve the teaching and learning process as a means of ICT possessed by all people. In addition, compared to other products of ICT mobile phone is considered more beneficial for teaching and learning. The rapid growth in access to mobile phones around the world is possibly potential to improve teaching, learning, and institutional efficiency to enable the transformation of the national education system (Mtega *et al*., 2012).

According to Li and Steenkamp (2010), using the framework of Enterprise Architecture (EA) did not necessarily determine how an organization start and produce good order on the implementation of information technology and business process by leveraging mobile

technology or a Mobile Enterprise Architecture (MEA). Li and Steenkamp (2010) introduced the Mobile Enterprise Architecture Framework (MEAF) where the methodology and process models can help decision makers for companies to evaluate business values and analyze the risks, business and other technical factors to launch mobile enterprise along with its transition. Methodology and process models MEAF include strategy, analysis, design, implementation, and maintenance phase in the process of adopting mobile technology in a company.

In this research examines the process of implementing Mobile Enterprise at the University of Atma Jaya Makassar. The assessment process resulted in an IT strategic planning using the methodology of collaboration between the IT Strategic Planning Case Studies University in Thailand and the Mobile Enterprise Architecture Framework (Titthaisiri, 2001; Li & Steenkamp, 2010). IT strategic planning is generated is expected to be a cornerstone for the university in implementing IT as a good and thorough in order to achieve the vision, mission, and goals of university.

Based on the background of research, the outline of the issues examined in this research is how to determine and design the development and strategic planning of information technology based mobile needed to support academic processes at case study. Objectives achieved in this research are: (1) investigating the feasibility of the development of mobile enterprise strategic plan, (2) analyzing the academic process and the use and utilization of information technology (IT) so that it can be improved or developed, and (3) generating documentation IT strategic planning by implementing Mobile Enterprise Architecture in the academic process Atma Jaya University in Makassar.

II. METHODS

The research procedure conducted in this research as illustrated in Figure 1 consists of several steps. First, the researchers do preparation of research that begins with finding the background of the development needs of IT strategic planning using the Mobile Enterprise Architecture framework in the academic process at the University of Atma Jaya Makassar. Based on this background, the researchers are able to assess the formulation of research problems. The researchers define research objectives along with the scope of the research so that the discussion is not too extensive. In the preparation, the researchers also conduct a literature review from previous studies on the development of IT strategic planning at the university, the development of mobile enterprise architecture, along with the methodologies used.

The second step is data collection, in which useful research instruments are all compiled and studied. The researchers collect data by dividing the questionnaire to the academic staffs including the Head of Administration of each faculty and major, sample lecturer of every faculty and courses, as well as samples of college students of every faculty, course, and the force at university. In addition, the researchers conduct interviews to the Rector, Vice Rector I, Vice Rector II, Academic Administration Bureau, General Administration of Planning and Information Systems Development Bureau, Bureau of Public Administration and Finance, the Deans, and the Chairman of the Program at university. The researchers also conducted direct observation academic processes running at case study. Besides, secondary data is collected in the form of written documents contained in case study.

The third step is data analysis. Data is processed and analyzed to explain the current status of IT. In addition, it is also to decide how the implementation of MEAF in the form of physical modeling, ranging from software, application portfolio, hardware procurement, infrastructure, and the use of network can be planned and developed in case study. The data is analyzed by using several methods. First, internal factors owned by case study are determined using Internal Factors Evaluation (IFE) Matrix Analysis, while external factors associated with the university opportunities and threats are defined using External Factors Evaluation (EFE) Matrix Analysis. Next, both IFE Matrix Analysis and EFE Matrix Analysis are combined using Strengths Weaknesses Opportunities Threats (SWOT) analysis to formulate key strategies as the advanced stage of implementation and objectives of case study using quantitative and qualitative approaches (Saragih & Harisno, 2014). Next, Balanced Scorecard Analysis is carried out to measure the performance of information technology governance at case study. The researchers combine the academic scorecard perspective (O'Neil *et al*., 1999) and the IT Balanced Scorecard Perspectives (Saragih & Harisno, 2014) for the analysis of Balanced Scorecard. Return on Investment (ROI) Cost Based Analysis is used to determine the feasibility of the implementation of IT investment in the strategic planning. The last data analysis methods, Analytic Hierarchy Process (AHP), is used to determine priorities on documentation in IT strategic planning. The calculation is conducted by using the tools Expert Choice AHP 11.

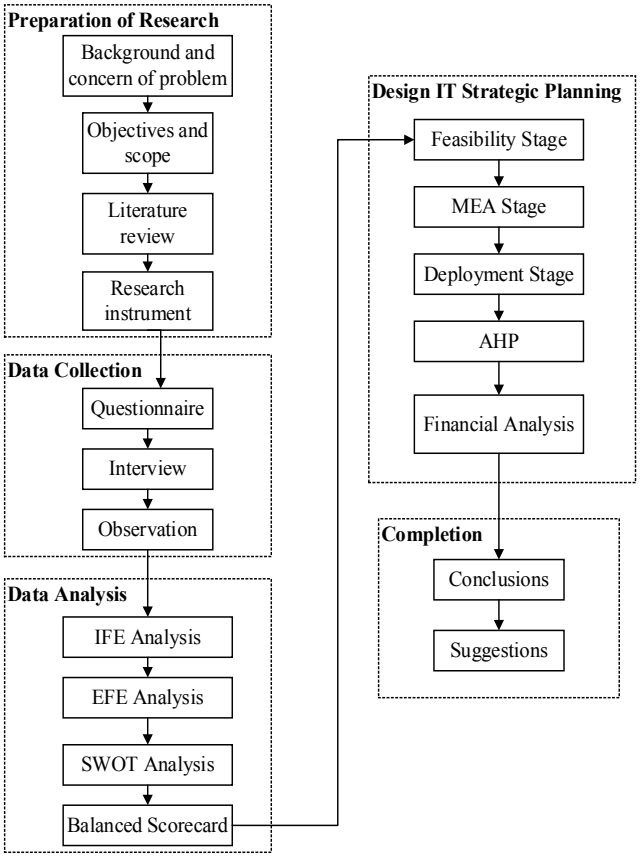

Figure 1 The Research Procedure

The final step of research procedure is to Design IT Strategic Planning documentation obtained in the form of IT strategic planning using the MEAF (Li & Steenkamp,

2010). The results of the data analysis are SWOT analysis and Balanced Scorecard, which is an input in the MEAF that consists of a Feasibility Stage to determine the mobile model that will be developed and MEA Stage for physical modeling of all view points developing mobile on academic processes of case study. Furthermore, the results of the documentation of IT strategic planning is analyzed using the AHP to determine priority on documentation in IT strategic planning and financial analysis using ROI Cost Based Analysis. Finally, the researchers draw conclusions from the results of research and provide suggestions for future research development.

III. RESULTS AND DISCUSSIONS

In the first stage, a feasibility study is carried out by the method of data collection questionnaire to the academic community with course, faculty, bureaus, and the status. The details of the number of respondents are presented in Table 1.

Table 1 Respondents Questionnaire

No	Academics	Amount
1.	Lecturers	78
2.	Administrative Staff	9
3.	Bureau Staff	7
4.	College Students	203
	Total	**297**

(Source: Data Collection)

The results of the feasibility study can be seen from several aspects: (1) Technical Feasibility is identified with the availability of the personal mobile phone every academic community that the result reached 99,66% or 296 people own a personal mobile phone. (2) Operational Feasibility is identified by level of capabilities the use of a personal mobile phone every academic community that the result reached 26,93% for internet service, 22,49% for multimedia, 24,81% for SMS, 25,64% for the phone, and 12,11% for businesses. (3) Risk Feasibility is identified as security risks using the structure of the security system that is used for this at university.

The second stage includes the assessment and analysis of the identification of the University of Atma Jaya Makassar located at Jalan Tanjung Alang 23 Makassar, South Sulawesi. Current case study has four faculties with eight courses, which are: (1) Faculty of Economics (Accounting and Management Courses), (2) Faculty of Law (Legal Sciences Course), (3) Faculty of Engineering (Course in Electrical Engineering, Mechanical Engineering, and Civil Engineering), (4) Faculty of Information Technology (Informatics and Information System Courses), (5) Accounting Course for Master degree, and (6) Psychology Course for Bachelor degree while in the management of the faculty. Vision of University of Atma Jaya Makassar is to be a university that excels in academic and professional education at the national level which is imbued by three values—excellence, integrity, and compassion. Mission of the university are (1) organizing academic and professional education that become a vehicle for character development and science, technology and the arts; (2) managing higher education is effective and efficient in an academic setting ethical and dignified; (3) conducting continuous research for the advancement of science, technology and the arts as well as the interests of the community; and (4) dedicated their expertise in the field of science, technology and the arts.

Goals of case study are (1) producing characteristic and scholar who excelled in the field of science, technology and the arts; (2) produce quality research for the development of science, technology and the arts; (3) participating in the program increased prosperity through science, technology and the arts; and (4) realizing higher education governance transparent and accountable.

Based on interview and observations, business academic process is illustrated in Figure 2 consisting of (1) Registration process can be either paper based which new college student come directly in university or online that can be accessed on http://pendaftaran.uajm.ac.id/. Then, new college students take entrance tests and check out the announcement of the test results in a paper-based form. If prospective college students pass the tests, they can directly continue to registration process and obtain information regarding the initiation. (2) Management course selection form process begins with obtaining a course selection form to the academic advisor respectively. Subsequent registration with the system of course selection form can be accessed online at http://krs.uajm.ac.id/. After registering on the system, the college students make a payment on a bank account based on virtual numbers respectively. (3) Preparation lecture process begins with a lecture meeting of the division of subjects to be able to produce lecture schedules in a paper-based form. In addition, the administrative staff prepares a list of attendance of courses and events news lectures. On the other hand, lecturers prepare lesson plans, lecture materials, and rubric value. (4) Lecture process begins with the lecturers to do the distribution of lecture materials and rubric value to college students. In every lecture meeting, the lecturer is required to fill the minutes of lectures and students attendance. Two weeks before the course ends, the administrative staff prepares official report grades, faculty evaluation sheets, and cards examinees. (5) Evaluation lecture process is done from lecturer to college students and vice versa. The evaluation from lecturer to students in the form of final grades are filled on news events, while the evaluation from students to lecturers in the form of charging lecturer evaluation sheet are filled at the time when final exams take place. (6) Management thesis process begins with obtaining a seminar title followed by a seminar results and final exam thesis. In each seminar, the college student must collect the completeness of the file which is a pre-requisite seminar. All the completeness of the file is in paper-based form. (7) Graduation process begins with the delivery of the decree Latinate citation on a diploma to Academic Administration Bureau for data verification data to the expense of diploma and official transcript and graduation registration.

The academic process at the University of Atma Jaya Makassar uses information technology as a supporting component on academic information system, library information system, course selection and result form online, university's website, and another supporting portfolio application that can be accessed in internal or external network. The computer and networks have also been used for administration, university's operations, and the lecturing process, both in the classroom and laboratory.

Results from data collection are firstly examined using SWOT analysis. It begins with IFE Matrix showing that sub-total strength is 0,98 and weakness is 0,99, and also EFE Matrix indicating that sub-total opportunity is 1,09 and

threat is 0,88. SWOT analysis has two approaches. The first one is Quantitative Approach SWOT Analysis. According to Pearce and Robinson (1998), IFE Matrix could be seen that if the strength factor is reduced by a factor of weakness produce value -0,01 which then becomes the value or point on the x axis in the quadrant. Meanwhile, EFE Matrix it can be seen that the opportunity factor is reduced by a factor of threat generating value 0,21 which then becomes the value or points on the y-axis in the quadrant. The results of SWOT analysis using quantitative approach is illustrated in Figure 3 showing that University of Atma Jaya Makassar is in quadrant III, which means that the university is quite weak. The second SWOT analysis approach is qualitative approach showing that university requires strategy WO (Weakness-Opportunity). Recommended strategies focus on reducing weakness and at the same time, taking advantages of opportunity, which are: (a) improving procurement and development, which means trying to follow the dynamics of development of the infrastructure of IT that supports the university's academic process, (b) making use IT in the process of adjusting to the academic curriculum and the latest teaching methods, (c) the whole series of academic processes using IT so that knowledge can be facilitated in order to impact the level of quality and service satisfaction, (d) doing exercises, replenishment and regeneration of the staff, (e) making plans to use IT every year taking into account the dynamics of IT development and the dynamics of development and change business processes academic of university, and (f) increasing tuition fees gradually.

The second data analysis is Balanced Scorecard which researchers are able to analyze performance measurement of information technology. The results of performance measurement information technology governance at university show percentage of the average performance based on various perspectives, detailed as follows: (1) based on academic management perspective, the average performance is 61,78%, (2) based on the perspective of stakeholders the average performance is 58,46% to 100% of strategic objectives and 30,24% to target strategies ≤ 1%, (3) the internal business perspective shows that the average performance is 74,75%, and (4) the innovation and learning perspective shows that the average performance is 54,26%. This result reveals that the overall information technology governance at the university is considered average.

The third data analysis is based on the design of IT strategic planning that determines the utilization and use of IT in the academic process at the University of Atma Jaya Makassar. This stage comes up with the result that the selection of mobile solutions are the most effective form of documentation which consists of a framework for designing ICT in the whole academic process at university.

Designing IT strategic planning using MEAF consists of several stages. The first one is Feasibility Stageon the type of operating system (OS) mobile owned by the academic community. Results of this stage shows that 79,12% of mobile academicians use Android operating system (OS), 13,13% of them use Blackberry, 4,71% uses iOS, 1,68% uses Nokia Symbian, and 1,35% did not know. It can be concluded that the choice of operating system (OS) in the design of IT strategic planning based on mobile enterprise architecture framework is Android.

Second stage in design of IT strategic planning is MEA Stage, in which there are two phases. The identification of business requirements and MEA design. The concept of MEAF is divided into two main parts, which are (1) Business Architecture consisting of m-Communication, m-Information, and m-Business and (2) Mobile Architecture consisting of m-Data, m-Application, m-Infrastructure, and m-Security.

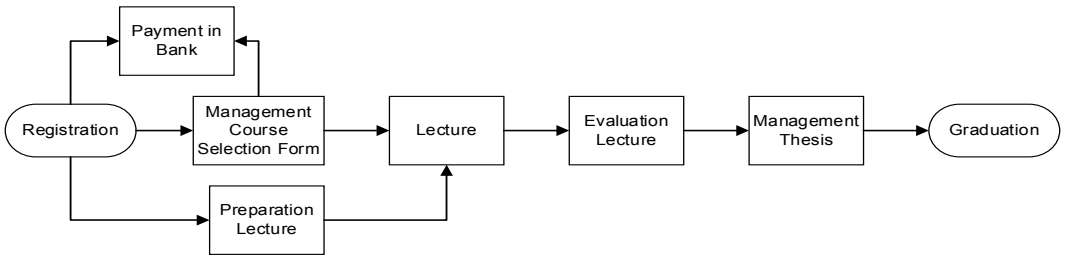

Figure 2 Business Academic Process

Figure 3 The Results of SWOT Analysis Using Quantitative Approach

The first phase is identification of business requirements in which there are many terms. In terms of m-Communication, the use of mobile phone in the series of the current academic process is via phone and SMS. In terms of m-Business, the data processing is still considered to be complicated still done largely in a paper-based form, while on a portfolio of applications available that are not constrained in database synchronization. In terms of m-Data, the current data is collected and recorded in paper-based form or input with the help of Microsoft Office software. Some of the data is also input into the database. In terms of m-Infrastructure, university has now internal and external networks. Internal network infrastructure functions to serve the Academic Information System and other academic support services that are offline. On the other hand, external network currently involves hosting outside the university for academic support services that are online. In terms of m-Security, the currently-used security network use mobile phone as a proxy gateway and Bureau of Administrative Planning and Development of Information Systems developed the proxy server for internal and external data services.

The second phase is to design MEA with several terms. In terms of m-Communication, proposed communication illustrated in Figure 4 is using instant messenger and e-mail. The proposed instant messenger is WhatsApp application. Proposed communication using e-mail still uses Microsoft Outlook with domain name @student.uajm.ac.id and @ lecturer.uajm.ac.id, as well as the addition of domain name @staff.uajm.ac.id. In terms of m-Information, regulatory changes makes information submission and dissemination no longer is paper-based form attached on a board.

In terms of m-Business, workflow is shorter because the whole process has to use ICT so that the processing of the data and information becomes more efficient. Proposal on work flow process and the announcement of new college student registration are conducted in the form of sending information in e-mails. Proposalonworkflow preparation of lectures is illustrated in Figure 5 where notifications about meetings and course schedule are made through the system.

Similarly, in terms of m-Data, the proposed data flow is no longer using paper based. Database changes into a centralized and synchronized database where the entire application portfolio is directly connected to a centralized database. Hence, the processing of data and information can be done efficiently and effectively. In terms of m-Application, there is one proposed application, Portal UAJM (Figure 6), which is a kind of portal that connects students and lecturers. It is both web-based application on http://portal.uajm.ac.id and mobile application compatible with Android OS. This application can accommodate both students and lecturers to acquire academic announcement, course selection process, lecturing and final project process, and consulting. This application is also beneficial for the Chairman of the Program to set a schedule of students' exams and lectures' meeting.

Figure 4 Proposed m-Communication

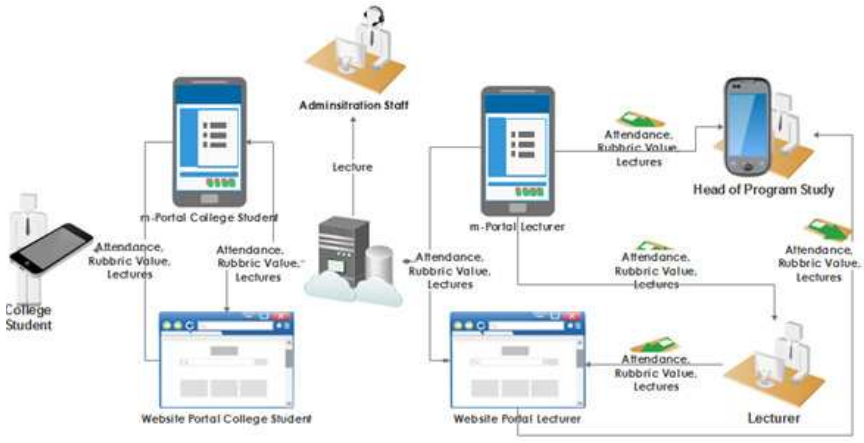

Figure 5 Proposed Workflow Lecture Process

Figure 6 Proposed Portal System

The last proposed portfolio application is to register online graduation. The web-based application that can be seen in Figure 7 on http://wisuda.uajm.ac.id. This proposed application can accommodate the graduates to fill data and document, and Academic Administration Bureau to verify graduates' data.

Figure 7 Proposed Graduation Registration

In terms of m-Infrastructure, maintaining web servers and database servers are suggested while three additional servers—mobile server, external web server, and web service center—are proposed. The process of internal information managing will go to the Academic Information System and Library Information System, only to be processed by the web service before it is stored or processed in a centralized database. Meanwhile, the need for external information processing information from the service website will be processed on an external web server, and mobile services information will be processed on the mobile server. The division is intended to facilitate the management server in case of disruption on the server so that other services can still be accessed. Before external web server and mobile server enter information into the database, they should go through a web service first.

On the other hand, proposed internet network infrastructure in university basically does not replace the existing infrastructure system. It is somehow required to develop the current network. Network development is basically intended to accommodate the mobile internet connection device. The entire proposed academic system infrastructure is illustrated and detailed in Figure 8.

In terms of m-Security, security services for email, Office 365 has been equipped with security using a strategy of defense-in-depth protection involving three layers—the physicals, logical and the data layer (Microsoft Corporation, 2016). Other communications in the proposed system is WhatsApp that uses Fun XMPP protocol for message exchange, which is efficient binary code encoded with the Extensible Messaging and Presence Protocol (XMPP). User authentication process on WhatsApp is divided into two, namely full and half handshake (Karpisek *et al.*, 2015).

After designing IT strategic planning documentation, the next stage is deployment. That means dispersing the documentation of IT strategic planning after AHP to determine priority on documentation in IT strategic planning consisting of the development of hardware, software, network infrastructure and application portfolio in the academic process of university. Thereis an analysis to determine the priority of the proposed strategic planning of IT in the academic process using AHP with the help of tools Expert Choice 11. The results are detailed in Table 2.

Table 2 Result of Analytic Hierarchy Process (AHP)

Priority	Proposed Strategy	Weight
1	Development of Portal Students and Lectures	1
2	Change database structure and Integration of current databases	0,902
3	Changes in Academic Information System	0,893
4	Development Overall Infrastructure	0,847
5	Development Internet Network Infrastructure	0,771
6	Changes in Library Information System	0,704
7	Development Server Infrastructure	0,693
8	Development of Online Registration	0,687
9	Development of Graduation Online Registration	0,670
10	Procurement Mobile Server	0,586
11	Procurement Tablet	0,478
12	Procurement Wireless Access Point	0,339
13	Procurement Backup Server	0,336
14	Procurement IP Camera	0,334
15	Procurement Hub 16 port, Hub 8 port	0,254
16	Procurement Cable LAN	0,252
17	Procurement Rack Server	0,196
18	Procurement UPS	0,174

(Source: Result of Data Analysis)

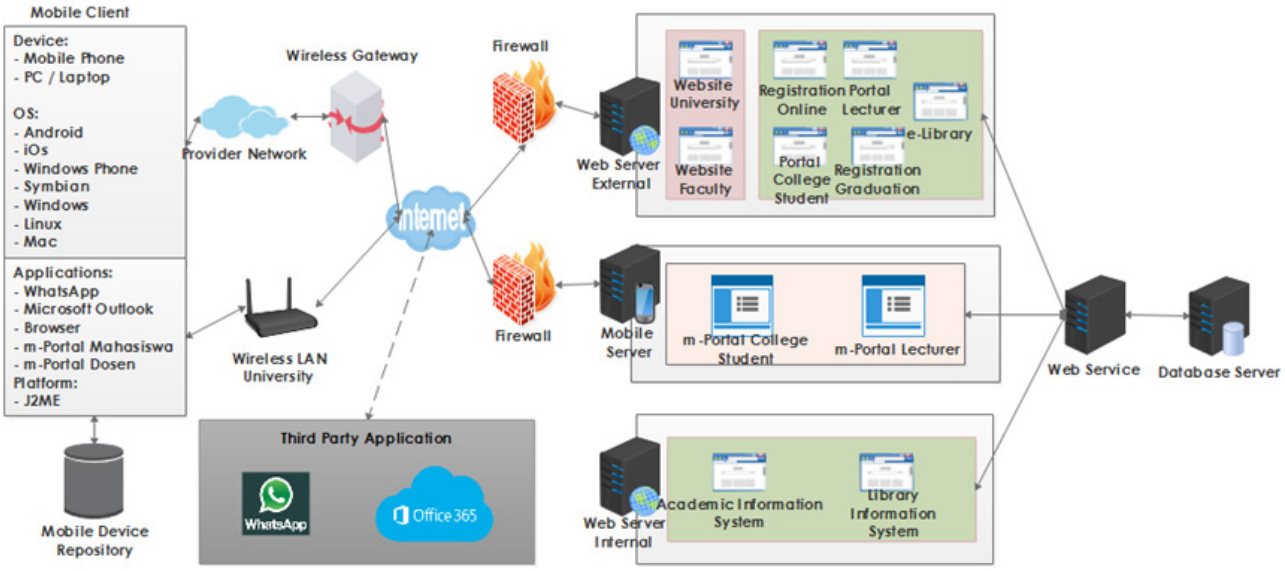

Figure 8 Proposed IT

Table 3 Results Documentation of IT Strategic Planning

No.	Description	Year I (2017)	Year II (2018)	Year III (2019)	Year IV (2020)
Procurement of Hardware and Network					
1.	Procurement Mobile Server			√	
2.	Procurement Backup Server			√	
3.	Procurement Tablet			√	
4.	Procurement Wireless Access Point			√	
5.	Procurement IP Camera			√	
6.	Procurement Hub 16 port				√
7.	Procurement Hub 8 port				√
8.	Procurement Cable LAN				√
9.	Procurement UPS				√
10	Procurement Rack Server				√
Development Portfolio Application					
1.	Change Database Structure	√			
2.	Integration of Current Databases	√			
3.	Changes in Academic Information System	√			
4.	Changes in Library Information System		√		
5.	Development of Online Registration		√		
6.	Development of Portal Students and Lectures	√			
7.	Development of Graduation Online Registration		√		
Development Network Infrastructure					
1.	Development Server Infrastructure		√		
2.	Development Internet Network Infrastructure		√		
3.	Development Overall Infrastructure	√			

(Source: Result of Data Analysis)

The other term in deployment is the analysis of ROI Cost based on calculating the investment feasibility of the proposed suggestions for the development of IT strategic planning. The result of ROI Cost Based analysis uses 15% for discount factor and four years as the IT investment period. The NPV values in the amount of Rp1.234.341.292,00 with assumption that there will be an increase in net cash flow each year as the impact of IT investments. The ROI value is 141,32% which means that the strategic planning of information technology should be implemented as it provides benefits for the university.

Based on results of data collection, data analysis, and also analysis in deployment stage, it can be concluded that results documentation II Strategic Planning based on the result of the AHP reveal the priority development of information technology for the period 2017 to 2020, as shown detailed in Table 3.

IV. CONCLUSIONS

It can be concluded that IT strategic planning using MEA in the academic process at University of Atma Jaya Makassar can be technically implemented

since the availability of personal mobile phone of every academician reaches 99,66%. Based on ROI analysis, it can be implemented with a value of 141,32%. The period of IT strategic planning is four years. Developing IT Strategic Planning using MEA is expected to improve the academic process since the data processing is still a semi-manual process, and the availability of academic information is distributed only on the internal university.

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