

Enterprise Architecture: Key to Successful Digital Business Transformation

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Abstract— Continuous improvement in an organization, particularly one which offers various types of services, cannot be separated from the presence of new technology. Integrating businesses and information technology resources can accommodate quick and precise adaption to changes. The purpose of this study is to develop a business architecture model using The Open Group Architecture Framework (TOGAF) Architecture Development Method (ADM). In particular, this study aims at the business architecture of STMIK Pontianak whose depiction uses Business Process Mapping (BPM) and the notation employs Business Process Mapping Notation (BPMN). Afterward, it conducts business process gap analysis. Data collection utilizes a planned interview method by means of questionnaires to respondents which later is presented in enclosed answers. The scale of measurement in these questionnaires employs a Likert scale, while the percentage of each question is calculated in the software of Microsoft Excel. Findings show that of 100% information technology services and business architecture information systems targeted, only 40% of STMIK Pontianak Information Technology (IT) services have been computerized. This suggests STMIK Pontianak to reconstruct its main business model in order to provide valuable human resourcer for larger communities.

Keywords— enterprise architectural, TOGAF, ADM, BPMN, Industrial Revolution 4.0

I. INTRODUCTION

Business environment has been undergoing continuous alterations [1], as technology increasingly offers new types of business services [2]. Corporations should adapt to the transformations [3,4] to survive the competition [5], thus improve their strategic alignments [6], and utilize potential IT system to produce new business models [7]. Digital revolution and the Industry 4.0 era have significantly influenced all aspect of companies' sustainabilities, including in the education sector [8,9]. Universities should equip students with up-to-date skills and knowledge to fit in the labor markets [10,11]. The Industry 4.0 accommodates various key elements of learning, such as the element of teaching, learning, research, innovation, service, and infrastructure [12]. The advantage of IT has become the main digital transformation driver for companies in enhancing competitiveness in various sectors through stakeholders' coordination [13,14]. Digital transformation requires obvious understanding and strategy on how to explore new tactical business opportunity sistematically [15,16]. Thus, it becomes a challenge for universities to strategically win the competition in the same way non-profit companies do [17].

Organization might experience failures in all domain businesses integration including people, business processes, application and technology infrastructure due to lack of company architecture's comprehension [18,19]. Enterprise

Architecture (EA) is a discipline in which provides a general pattern of framework that is possibly reapplied by any organization in all businesses [20], and is able to bring into line with business and IT within companies [21]. EA bridges communication gap between businesses and stakeholders [22]. The important of business and IT alignment provides benefit for organisations to recognise their business architecture, information resources, information system, and technology, yet to identify their weaknesses and obstacles [23]. Through the EA model, the usage of IT is possibly harmonized with the organizational goals [24]. However, it requires the institution architecture domain guideline to affirm better alignment between IT and business [25].

The Pontianak School of Information and Computer Management (STMIK) is an educational institution on the IT basis. Institutionally, its operational activities have run quite satisfactory. Unfortunately, there are inadequate infrastructure systems support in several business processes. In developing corporate EA, especially in the university environment, TOGAF is a well-recommended EA framework [26] that offers a comprehensive approach in planning, designing, implementing, and managing information architectures for an organization [27,28]. TOGAF also emphasizes a holistic business and technical approaches [29]. TOGAF framework has complete, integrated, and flexible process [30]. The main TOGAF framework is the Architecture Development Method (ADM) that serves as a guideline in planning, designing, developing, and implementing information system architecture for organization [31].

II. RESEARCH METHOD

The aim of this study is to construct a business architecture model in TOGAF ADM framework. The study shows three brief explanations on how to understand corporate EA needed by STMIK Pontianak in order to carry out its business transformation. First, define the scope and requirements of the research, and establish all stakeholders are involved in the sufficient system implementation. Second, provide a support system for the institution in order to develop seamless, effective, and align-to-organization goal's implementation. Third, establish the competitive systems in a defined future plan.

This research discusses on the main business architecture of STMIK Pontianak whose depiction uses Business Process Mapping (BPM) and the notation utilizes Business Process Mapping Notation (BPMN). Afterward, the study conducts business process gap analysis. BPMN is a user-oriented and standardized graphical notation which is operated globally for business process modeling [32]. Data collection utilizes a planned interview method by means of delivering

questionnaires to 15 respondents which later is presented in enclosed answers. The scale of measurement used in these questionnaires was a Likert scale, while the percentage of each question is calculated in the program of Microsoft Excel.

III. RESULT AND DISCUSSION

1. Phase of Preliminary: Framework and Principles

STMIK Pontianak has an integrated IT business process. Its competitive advantage is the ability of the system to link various resources to the information and communication technology. Both the main and the supporting functional activities of STMIK Pontianak are illustrated in a value chain diagram consisting of primary activities and supporting activities (see figure 1).



Figure 1. STMIK Pontianak Value Chain Diagram

Figure 1 above shows two main different activities. The activity of the Human Resource Management Unit relates to the allocation of human resources. The activity of the Asset and Infrastructure Management Unit comprises: planning, maintenance and asset removal. The Financial Management Unit manages financial stuffs. In the Student Admission Unit, it consists of marketing activities for new students. The Academic Operational Unit carries out academic operational activities for students from enrolment to graduation. The Graduation Unit manages students who graduate. Meanwhile, the Career Center provides network development for alumni in line with business community for internships and access to employments. STMIK Pontianak value chain system has support its business operational in both main and supporting activities.

STMIK Pontianak has provided inovative and adaptive learning model in creating skillful graduates in the aspect of data and technological literacy. It is crucial for higher educational institutions to reconstruct their curriculum into a responsive-to-the-industrial-revolution one, by referring to digital-based skill, thus, graduates gain competitiveness against competitors. STMIK Pontianak, in particular, requires learning model alteration in the sector of communication, collaboration and networking. Following is STMIK Pontianak EA Principal Catalog (see table 1):

TABLE I. STMIK PONTIANAK ENTERPRISE ARSITEKTUR PRINCIPAL CATALOG

EA Principal	Description
Business Principles	Commit and capable to reconstruct business model
	Capable in adopting business model which is adaptive to the Industrial Revolution 4.0
	Compatible to the main function of STMIK Pontianak businesses
	Universal for all service units of STMIK Pontianak
Data Principles	Responsible, accurate, accessible, and well-established integrity and data management

	Protected from unauthorized user and publication
	Priority to data control and availability
Application Principles	Applicable to any technology platform, highly accurate, Flexible to changes based on necessities.
Technology Principles	Adaptive
	Multiplatform
	Supportive to system

Table 1 makes the point that each principal is described into a detailed description as they are relatable in developing EA.

2. Phase Business Architecture

Business architecture in STMIK Pontianak depicts the activities on daily and systematic basis refers to its vision and mission. In achieving its vision and mission, STMIK Pontianak establishes several business objectives, namely, (1) prepare students to be the global community members who have academic abilities and/or professional to produce and to apply the information and communication technology skills; (2) develop and disseminate science and technology. Following are table of the business function and the sub processes of business functions: Student Admission, Academic Operational, Graduation Unit and Career Centers.

a. Student Admission Business Function (PMB)

The student admission business function focuses on the management of new student admission, including promotional activities, new student admission and new student registration. The following is the function of the new student admission business (see table 2).

TABLE II. STUDENT ADMISSION BUSINESS FUNCTION STMIK PONTIANAK

No. Process	Sub Process	Detailed Activities
1.1	Promotion	Arrange Student Admission Team
		Set Student Admission budget
		Set Promotion Strategy
		Arrange Time Schedule
		Produce Promotion Report
1.2	Selection	Set the requirement for the selection
		Establish the selection test material
		Schedule the Enrolment
		Asses Selection Test
		Announce the selection result
1.3	Registration	Examine the documents
		Deliver Student ID Number
		Assess Study Program Orientation
		Produce student enrolment report

Table II shows that STMIK Pontianak has achieved the ideal activities in the context of Student Admission Business Function. Following is a flow of student admission business function using the Business Process Mapping Notation (see figure 2).

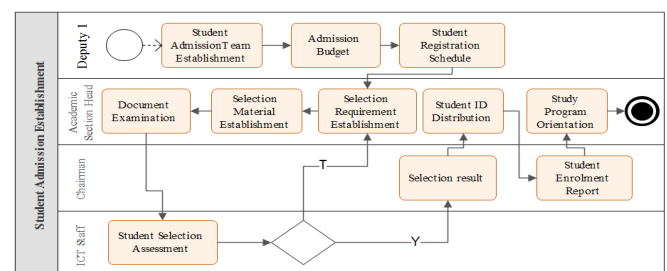


Figure 2. Modeling of Student Enrolment Business Processes

Figure 2 shows that business process model has to involve several business units in the process of student enrolment.

b. Academic Operational Business Function

The Academic Operational Business is an activity to accommodate the teaching activities during the semester (see table 3).

TABLE III. ACADEMIC OPERATIONAL STMIK PONTIANAK

No. Process	Sub-Process Name	Detailed Activities
1.1	Curriculum Planning and Academic Administration Policy	Establish curriculum
		Arrange Academic calendar
		Arrange Academic supervisor
		Arrange Course Schedule
		Complete Study Plan Form (KRS)
		Replace Study Plan Form (PKRS)
		Leave
1.2	Learning Process Implementation (PBM)	Lecture
		Monitor and evaluate Lecture
		Arrange Examination Committee
		Examination
		Assess School grade Administration (KHS)
		Assess School Transcript
		Assess Student internship
1.3	Research Paper	Assess Research paper Administration
		Assess Research Paper Proposal Seminar
		Assess Research Paper Trial Administration
		Assess Research Paper Trial
1.4	Scientific Journal	Assess Scientific journal Administration
		Assess Scientific journal Publication

Table III shows the whole STMIK's operational processes that has been divided into four sub-processes: academic curriculum planning and its policies, learning process implementation, research paper, and scientific journal.

Following is the flow of the Academic Operational Business Function using Business Process Mapping Notation (see figure 3).

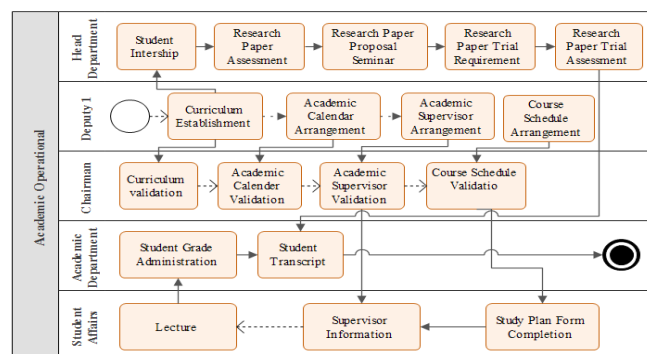


Figure 3. Modeling of Academic Operational Business Processes

Figure 3 shows STMIK's academic operational business processes modeling that involves many business units as these processes accommodate the whole academic operations in one term.

c. Graduation Unit Business Function

The graduation business process is all activities related to the final period of a student's college including the

process of determining graduate's status up to the academic commencement process (see table 4).

TABLE IV. ACADEMIC COMMENCEMENT BUSINESS FUNCTION STMIK PONTIANAK

No. Process	Sub-Process Name	Detailed Activities
1.1	Commencement Status Establishment	Establish dropout student
		Establish student's withdrawal
		Establish student's graduation
1.2	Graduation	Yudisium
		Establish Yudisium time schedule
		Establish Yudisium's Committee
		Complete Certificates and Transcripts
		Assess Yudisium ceremony
		Produce Yudisium report

Table IV shows the whole academic commencement in STMIK Pontianak that has been divided into two sub-processes: student commencement status establishment and graduation.

Following is the flow of the Academic Commencement Business Function using the Business Process Mapping Notation (see figure 4).

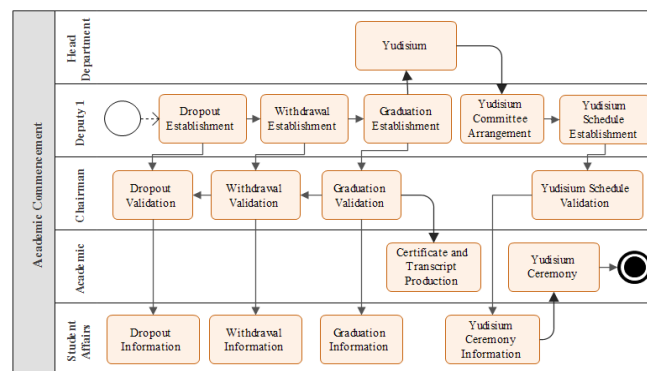


Figure 4. Academic Commencement Business Process Modeling

Figure 4 shows STMIK's academic commencement business process modeling that channels all units in collaboration to attain the objective.

d. Career Center Business Function

Career Center is established in order to build and develop collaboration network with business communities in terms of assisting students and graduates to gain immediate access to apprenticeships or workforce based on their educational background (see table 5).

TABLE V. CAREER CENTRE BUSINESS FUNCTION STMIK PONTIANAK

No. Proses	Sub-Process Name	Detailed Activities
1.1	Alumni Navigation	Record Alumni Biodata
		Record Alumni employment
		Record Alumni structural position
1.2	Stakeholders Navigation	Record graduate competency
		Record graduate qualification
		Establish curriculum relevancy
		Record user satisfaction
1.3	Job vacancy	Manage Job vacancies
		Announce Job vacancies

Table V shows the detailed career centre business function in STMIK Pontianak splited up into three sub-processes: alumni and stakeholders record tracking, and job vacancy. However, students of STMIK Pontianak has not been fully-accomodated in this business function.

Based on the current description of STMIK Pontianak business model through observation and literature review aforementioned, the following steps are business process analysis and sub-processes definition. Following is the results of the achievement target analysis of the main business processes of STMIK Pontianak (see table 6)

TABLE VI. MAIN BUSINESS TARGET ACHIEVEMENT ANALYSIS STMIK PONTIANAK

No.	Sub-Process Name	Successful Indicator
Student Admission (PMB)		
1	Promotion	Socialization and profile presentation carried out to schools in West Kalimantan areas
2	Selection test	Maximum number of students passed the selection test
3	Student Registration	Student registration increased
Academic Operational		
4	Curriculum Planning and Academic Administration Policy	The Indonesian National Qualification Framework Curriculum (KKNI) has been achieved
5	Learning Process Implementation (PBM)	The learning process up to final examination
6	Research Paper	Research Paper completion fits student's study plan
7	Scientific Journal	Maximum number of student submitted their scientific journals
Academic Commencement		
8	Commencement Establishment status	The rising number of graduates
9	Graduation	Targetted graduates have been achieved
Career Centre		
10	Alumni data collection	Alumni data collection has been well recorded
11	Stakeholder data collection	Stakeholder data collection has been well recorded as productive employees
12	Job vacancy	Job vacancy information channelled the alumni employment opportunity

STMIK Pontianak's main business target analysis achievement measured by succesful indicator shown in table VI has been accomplished.

3. Gap Analysis of Business Architecture

Gap analysis of business architecture refers to the first phase of TOGAF ADM which describes the gap between the current and the target business architecture of STMIK Pontianak. The recent business architecture highlights types of the IT support/services and their impacts on business processes. The target business architecture designates the applicable IT plannings to overcome the current shortcomings and obstacles (see table 7).

TABLE VII. GAP ANALYSIS OF BUSINESS ARCHITECTURE STMIK PONTIANAK

No.	Current Business Architecture	Solution	Target Business Architecture
1	Promotional process has not fully utilized information	Requires promotional application to support socialization	IT business architecture plan and its implementation

	technology (IT)	and profile presentation	
2	Unclear IT business model in the promotional and student admission processes	Requires IT work procedure development	IT service support to attract potential students
3	Face-to-face learning model	Requires blended learning method using e-learning technology	Utilize IT blended learning method
4	Partial support of Career Center to Alumni regarding the employment opportunities	Requires collaborative network within companies and industries to provide qualified and responsive graduates	IT business architecture channels career centre and employment information for alumni

Source: Survey and interview in STMIK Pontianak

Gap analysis method has been utilized to compare the current business architecture with its target. Table VII shows some obstacles STMIK Pontianak faced in running this business due to less-technology utilization environment.

4. Identification of the IT and IS utilization at the current STMIK Pontianak

Based on the observations and questionnaires, the utilization of IT and IS of STMIK Pontianak in carrying out its key business functions on student admission, academic operational, academic commencement and career centers have not run optimally.

TABLE VIII. BUSINESS ARCHITECTURE QUESTIONNAIRES STMIK PONTIANAK

No	Questions	Answer	
		Y (%)	N (%)
1	Has the promotional strategy been fully supported by IT program?	60	40
2	Has the selection test utilize IT application?	100	0
3	Has the student enrolment utilize IT application?	0	100
4	Can Study Planning Form (KRS) be completed online?	80	20
5	Has the learning model utilize e-learning methos?	50	50
6	Are the learning activities being monitored through the information system application?	0	100
7	Has the result of studies been accessed online?	100	0
8	Can thesis tutorial be performed in an online system?	0	100
9	Can student commencement status be determined automatically by the system?	0	100
10	Has alumni record been searched by the application system?	40	60
11	Can alumni access the system online?	0	100
12	Can Job vacancies for alumni be accessed in an online system?	50	50
Total		40%	60%

Based on data calculation of the questionnaires in relation to student admission, academic operational, academic commencement, and career center business functions as shown in table 8, the recent data in total indicates that 40% of the respondents said 'Yes' to all questions, and 60% of the respondents said 'No'. Of 100% IT and IS services targetted in business architecture, only 40% of them had been computerized.

Viewpoints, STMIK Pontianak has not fully implemented IT and IS systems to support each part of the processes in its business architecture. This has been proved in the activity of Student Admission's promotion and Alumni Navigation. These two important activities have shown that STMIK Pontianak has not achieved the progress of admission, as ideally prospective students in the era of Internet of Things (IoT) most exploit internet to obtain information. Therefore, STMIK Pontianak should develop a comprehensive information system facilities to reach prospective students. Similarly, the comprehensive information system facilities will provide an excellent STMIK Pontianak Alumni network, especially for those who have careers to share for career information. Moreover, it suggests that STMIK Pontianak necessitates to implement digital-based business transformation in overcoming the so called not fully implemented computerized business processes.

There are three digital transformation actions which can be applied by STMIK Pontianak, namely, (1) enriching customer experience, (2) transforming operational process and (3) reinventing business models (see table 9). These three actions have been obtained over the field survey as an effort to adapt to the rapid market development.

TABLE IX. DIGITAL TRANSFORMATION ACTIONS IN STMIK PONTIANAK BUSINESS ARCHITECTURE

Action	Description
Enriching Customer Experience	Accustom consumer to digital technology
	Collaborate IT implementation with consumer
	Adopt blended learning model
	Provide reachable Android application to consumer
Transforming Operational Process	Produce the inimitable process operational transformation
	Create reliable software to increase the efficient and productivity of services to achieve new advantages
	Utilize the software to support blended learning model
Reinventing Business Model	Create a new business model using digital technology
	Utilize sosial media to develop business model in several activities, such as promotion for study program
	Develop effective communication to consumers using IS services
	Provide information to companies regarding graduate's expertise and experience.

It is essential to enrich consumer experience prodigiously in favor of gaining more prospective students. The marketing unit obliges to provide detailed and attention-grabbing college information to consumers by utilizing up-to-date mobile and internet technology. The operating process transformation requires the institution to develop innovative technology with a view to succeed the competition. This can be exemplified by creating applications that provide publicly shareable information. Thus, it re-invents relevant school business models that fits to the current employment requirements.

The educational institution that provides the information system services for the prospective students through lecturer services to communities will establish an ongoing innovative communication with outside parties and gives positive value for graduates in obtaining employment opportunities.

IV. CONCLUSION

Enterprise Architecture delivers a way for companies or institutions to be able to operate their businesses in response to the dynamic market. The business architecture of STMIK Pontianak has been discussed, and has provided an obvious view, especially to the Student Admission, Operational Academic, Graduation Unit, and Career Center Business Function, that in some business processes, STMIK Pontianak has already utilized information technology (IT) and information system (IS) services. However, the application of their services has not been fully achievable at some points, specifically in the promotional activities in the context of new student admission, teaching and learning activities, and the alumni's navigation. Thus, STMIK Pontianak should reconstruct its main business model in order to provide well-established human resources in achieving a competitive advantage in the era of Industrial Revolution 4.0. It is necessary for STMIK Pontianak to integrate its business and IT resources, so that, it can flexibly accommodate the adaptive improvement precisely. In the future, this research can be enhanced in the aspect of data architecture, application architecture, and technology architecture.

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