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Research paper

Information system planning strategy on higher education institution based computer: a case study of a STIKOM yos sudarso purwokerto Indonesia

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Abstract

The study aims to describe planning strategies of information technology and information system on higher education based computer, especially College of Computer Science Yos Sudarso Purwokerto or "Sekolah Tinggi Ilmu Komputer Yos Sudarso Purwokerto" (STIKOM Yos Sudarso Purwokerto) Indonesia. The method was Enterprise Architecture Framework, in which each components of framework must utilities some analysis like SWOT analysis, IT Balanced Scorecard and Portfolio Application Framework. The result from Enterprise Architecture Framework documentation, can give a description to institution about development strategy of information system which is compatible with higher education institution vision and mission, as well as give input related to technology infrastructure condition and resource of institution. It is hoped that the blueprint can be implemented as a manual for developing institution.

Keywords: *Enterprise Architecture; SWOT Analysis; IT Balanced Scorecard; Portfolio Application.*

1. Introduction

Information Technology (IT) and Information System (IS) has become a primary need for every business sectors in Indonesia. The role of IT and IS has been proven in giving value added to every products and services of organization [1], in terms of manufacture [2], production [3], service [4], banking [5], government [6], as well education [7]. According to Hall, information system is a combination of formal procedure in which the data were classified, processed into information, and distributed to users [8].

Education is an important for nation to increase science and knowledge. Based on the data from Ministry Research, Technology and Higher Education which organized all higher education institutions registered in Indonesia, there are 4.504 legitimate higher education institutions including 3.136 Private Higher Education, 1.060 Islamic Higher Education, 186 State Higher Education and 122 Public Higher Education. The huge amount of higher education institutions in Indonesia shows the high competition, especially for Private Higher Education.

By the high competition, every higher education institution attempts to increase their value of services to win the competition. Consequently, the role of IT and IS becomes important to pay attention because IS usage concept is not only as a support but also as an enabler, in which its role is to make business processes easier and to make information technology a strong driver in creating new ideas which, at first, it is difficult to do without technology information support. A good information system will be useful for institution, so there is a need to determine information system strategy which is compatible with organization business strategy [9]. Information system development strategy requires analysis toward external and internal factor employing SWOT analysis. By the employment of SWOT analysis, the institution can identify the strengths, weaknesses, opportunities and threats internally and externally from company [10]. From the result of SWOT diagram, the institution can determine what kind of policy should be taken.

STIKOM Yos Sudarso is one of private higher education institution in Purwokerto employing information technology as learning curriculum as well as business value improvement in its every service. This is done to make institution compete other institution not only in Banyumas regency but also beyond.

Regarding the underused information technology in STIKOM Yos Sudarso Purwokerto, especially information system development, it is hoped that this study can identify information about basic potential related to internal and external strategy factors which can be used for information system strategy development in STIKOM Yos Sudarso Purwokerto. Besides, documenting enterprise architecture related to information system is useful to make information system strategy planning in STIKOM Yos Sudarso which is appropriate to institution business need, as well as create information system application need plan in STIKOM Yos Sudarso to increase value of higher education in the future (Future Application Portfolio).

2. Research method

The study deployed Enterprise Architecture Framework method, containing discussion related to Goals & Initiatives, Product & Services, Data & Information, System & Application, Network and Infrastructure. The components in that framework applied in STIKOM Yos Sudarso Purwokerto were goals, process, standard

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and resource which can extensively line of business institution. Fig. 1

In the present architecture, STIKOM Yos Sudarso Purwokerto has EA components in each level of frameworks. It functions to create basic resource and activity, so the difference between the present and future activities reveals.

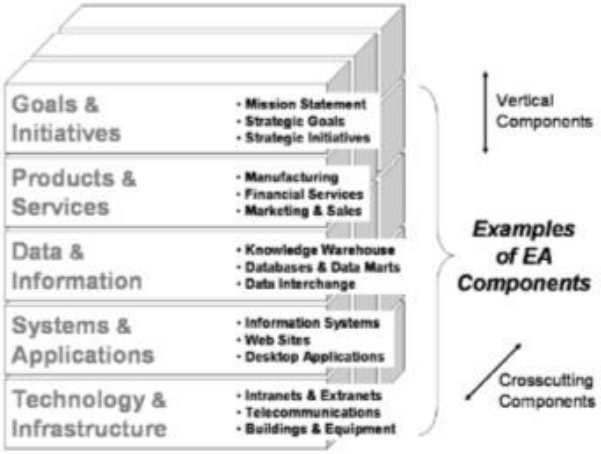


Fig. 1: Elements of Enterprise Architecture Framework [11].

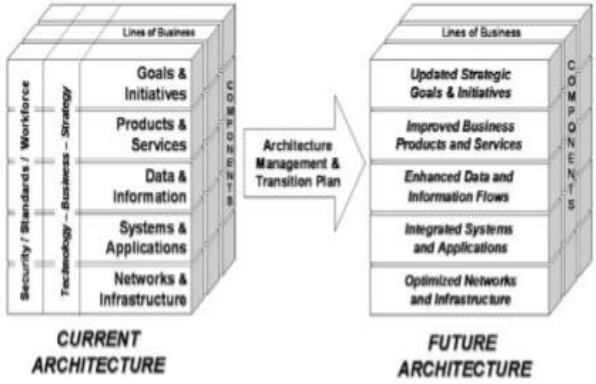


Fig. 2: Elements of EA Documentation [11].

This future architecture containing EA components belongs to STIKOM Yos Sudarso Purwokerto in which it is new or changes related to institution need to support new strategy initiative, operational or technology need.

By documenting Enterprise Architecture Framework, we need some analysis and methods applied, as the following explanations:

- SWOT analysis uses to analyze internal and external factor in terms of business process and information system, so the researcher can determine Goals & Initiatives of this study. It is often used in environmental management as a diagnostic method to identify key factors affecting the success or failure of organization projects [12].
- IT Balanced Scorecard is used to measure information system performance in STIKOM Yos Sudarso Purwokerto based on 4 perspectives, including institution contribution, user orientation, operational improvement and future orientation. It aims to know if information technology has supported vision, mission and strategic goal of STIKOM Yos Sudarso Purwokerto as well as to document it into Goals & Initiatives components of Enterprise Architecture Framework. Balanced Scorecard becomes an effective method to measure IT performance in organization, which supports organization in translating IT department strategy in specific purpose, action plan, and performance standard [13].
- Activity Diagram and Use Case Diagram are used to see the business process and information system development planning which is appropriate to user functional need.
- Portfolio Application Framework is used to interpret the present and used information system condition; higher education potential and application need to increase higher education value in the future (Future Application Portfolio); and description of SI application contribution of organization and future development.
- Enterprise Architecture Framework is used to identify scope of architecture which has to be documented and to make a relationship among architecture area in STIKOM Yos Sudarso Purwokerto.

3. Results and discussion

Based on the data obtained, the appropriate analysis is conducted to document enterprise aarchitecture created from combination of some analysis.

3.1. SWOT analysis

SWOT Analysis is used to identify basic potential information of internal and external factors which determines strategy used in strategy development [14]-[16]. It is done regularly to formulate STIKOM Yos Sudarso Purwokerto strategy. The analysis compares external factor (opportunities and threats) and internal factor (strengths and weaknesses). The SWOT Analysis of STIKOM Yos Sudarso Purwokerto is presented in Table 1. SWOT analysis of STIKOM Yos Sudarso Purwokerto is described in the followings.

a) Internal factor analysis: business strengths and weaknesses and IS/IT of STIKOM Yos Sudarso Purwokerto.
b) External factor analysis: business opportunity and threat and IS/IT of STIKOM Yos Sudarso Purwokerto.

Table 1: SWOT Analysis of STIKOM Yos Sudarso Purwokerto

Code	Strengths	Code	Weaknesses
S1	The availability of computer and information technology	W1	Has IT been used maximally?
S2	The strong leadership commitment is proved by supporting effort of institution development	W2	Lack of information system development/ renewal
S3	Leader support in applying technology	W3	The weakness of integration in terms of function because of ineffective control functions in realizing vision and mission of higher education.
S4	Having the high uniqueness related to orientation in graduate competition development based humanities value	W4	STIKOM Yos Sudarso is still young
Code	Opportunities	Code	Threats
O1	The opening of CIT development utilization in supporting organization management	T1	Unsimultaneous management among divisions.
O2	Development and progress of information technology	T2	Lack of system manager competition
O3	There is a potential to integrate data and information	T3	Competition among education institutions in Information Technology
O4	The increase of society awareness to give their children education until computer higher education institution.	T4	Fast information technology development

From the Table 1, EFAS and IFAS matrixes are formulated. EFAS matrix is formulated from out of STIKOM Yos Sudarso Purwokerto data as follows (see Table 2). Also, IFAS matrix are presented in Table 3.

Table 2: EFAS Matrix

External strategy factors	Value	Rating	EFAS Value	Comment
Opportunity:				
• The opening of CIT development utilization in supporting organization management	0.13	4	0.52	It is important in decision making
• Development and progress of information technology	0.2	3	0.6	Information technology innovation
• There is a potential to integrate data and information				Increasing SI management
The increase of society awareness to give their children education until computer higher education institution	0.26	4	1.04	
	0.14	2	0.28	Information technology become an opportunity in the future
Sub total	0.73		2.44	
Threats:	0.09	2	0.18	There is disharmony
• Unsimultaneous management among divisions.	0.07	2	0.14	Less effectiveness and efficiency of SI
• Lack of system manager competition				
• Competition among education institutions in Information Technology	0.06	1	0.06	A huge amount of higher education institution in IT
Fast information technology development	0.05	2	0.1	Changes in IT
Sub Total	0.27		0.48	

Table 3: IFAS Matrix

Internal strategy factors	Value	Rating	IFAS Value	Comment
Strength:				
The availability of computer and information technology	0.21	4	0.84	Having IT infrastructure
The strong leadership commitment is proved by supporting effort of institution development	0.09	3	0.27	Strong leadership for developing higher education
Leader support in applying technology	0.15	4	0.6	The leader is aware about the importance of IT
Having the high uniqueness related to orientation in graduate competition development based humanities value	0.2	2	0.4	Humanistic graduate competition
Sub total	0.65		2.11	
Weaknesses:				
Has IT been used maximally?	0.2	1	0.2	It tends to be manual
• Lack of information system development/ renewal	0.06	1	0.06	The present information system didn't develop further
The weakness of integration in terms of function because of ineffective control function in realizing vision and mission of higher education	0.05	1	0.05	Less of IS usage in helping control function
STIKOM Yos Sudarso is still young	0.04	2	0.08	The small amount of higher education graduate
Sub Total	0.36		0.39	

After knowing IFAS and EFAS values, SWOT diagram is formulated to know STIKOM Yos Sudarso Purwokerto status.
To find it out is done by the difference between IFAS and EFAS
X Axes (internal) = strengths – weaknesses = 2.11 – 0.39 = 1.72
Y Axes (external) = opportunities – threats = 2.44 – 0.48 = 1.96
Fig. 3 shows the SWOT diagram.

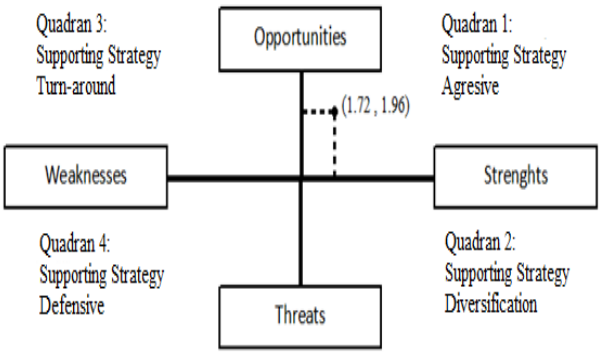


Fig. 3: SWOT Diagram.

3.2. IT balanced scorecard

IT Balanced Scorecard will be used to measure the performance of STIKOM Yos Sudarso Purwokerto information technology system with reference to 4 perspectives, including institution contribution, user orientation, operational improvement, and future orientation. It can be seen on Table 4. It aims to know if information technology sector has supported vision, mission and strategic goals of STIKOM Yos Sudarso Purwokerto.

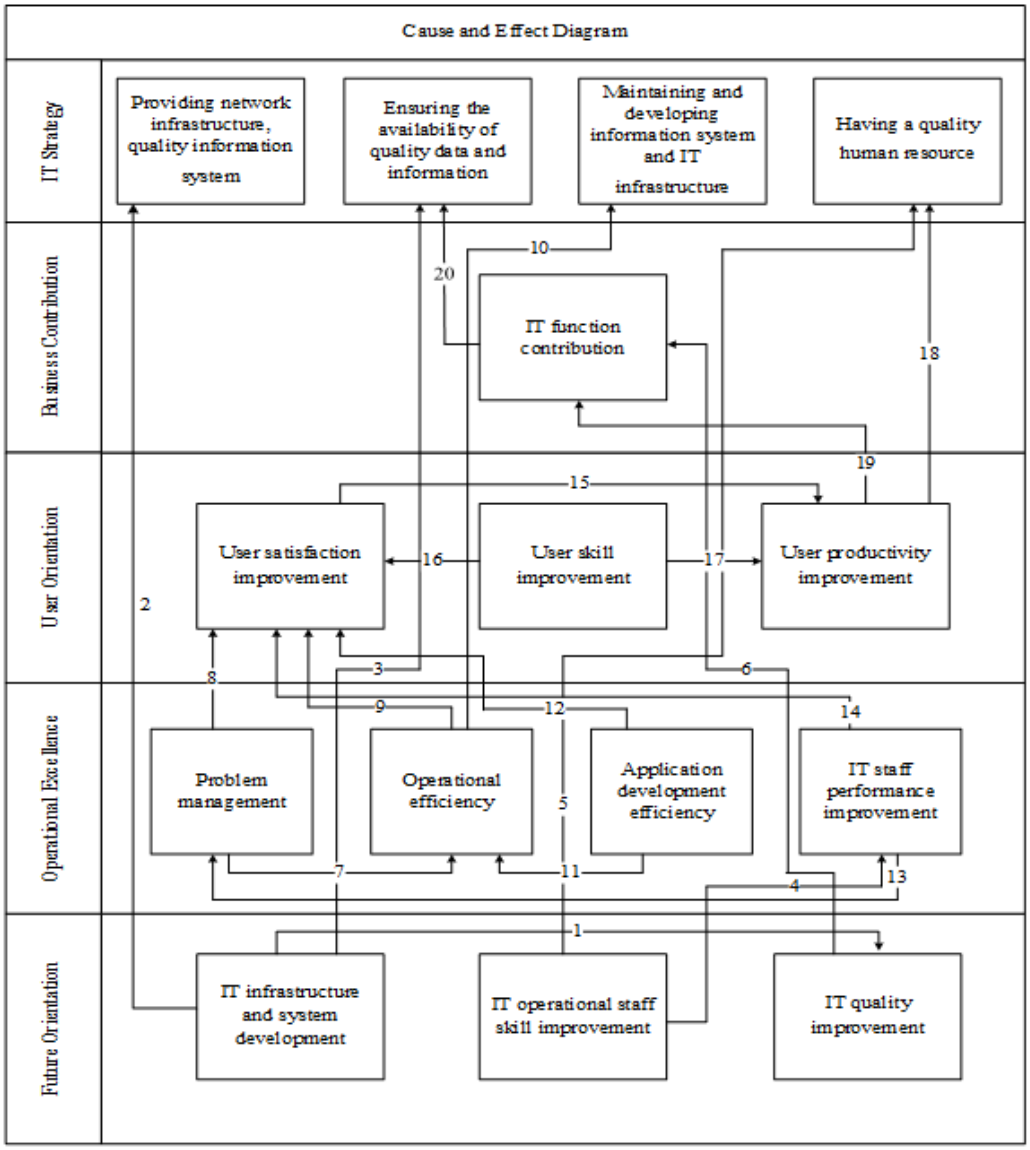


Fig. 4: Cause and Effect Diagram of IT Balance Scorecard.

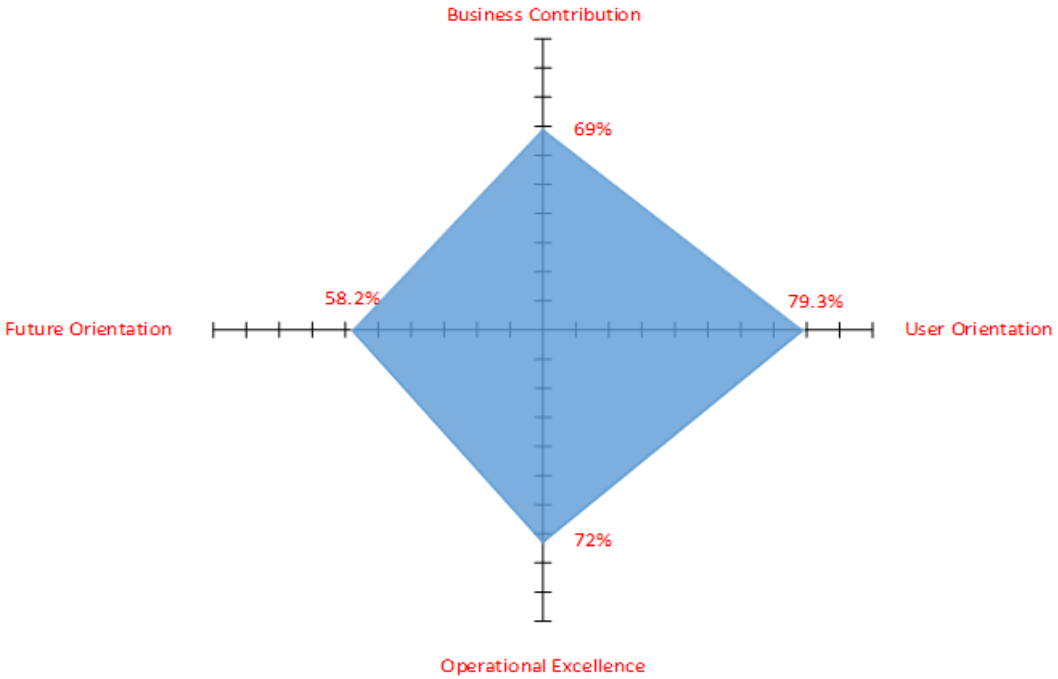


Fig. 5: IT Balanced Scorecard Measurement Results.

Explanation in cause and effect relationship

1) IT System and infrastructure development → IT quality improvement. By developing IT system and infrastructure, IT quality automatically will also improve.
2) IT system and infrastructure development → Providing a quality network infrastructure, information system. The good IT system and infrastructure can fulfill the needs of human resource on network and information system in STIKOM Yos Sudarso Purwokerto.
3) IT system and infrastructure development → Ensuring the availability of quality data and information. By conducting IT system and information development, IT division will attempt to develop information system to fulfill the need of data and information through the good information system evolution.
4) IT operational staff skill improvement → IT staff performance improvement. By improving IT operational staff skill, it automatically will improve IT staff performance better. IT staff will be more competent in coping with all problems and will give better performance.
5) IT staff skill improvement → Having quality human resource in IT usage. Improving IT operational staff skill is one of institution need realizations in having quality human resource in IT usage.
6) IT quality improvement → IT function contribution. IT quality improvement will give significant contribution toward IT function.
7) Problem management → Operational efficiency. A good management problem will give efficiency in conducting daily operational.
8) Problem management → The increase of user satisfaction. A good problem management will also increase information system user satisfaction.
9) Operational efficiency → The increase of user satisfaction. A definite operational efficiency will increase user satisfaction, because operational unit work becomes faster and easier.
10) Operational efficiency → maintaining and developing information system and IT infrastructure. A better operational efficiency will ease information system and IT infrastructure resource maintenance and development.
11) Application development efficiency → Operational efficiency. By the good and efficient application development evolution, institution operational event will be faster, effective and efficient.
12) Application development efficiency → The increase of user satisfaction. The fast and good application development will help user in doing his/her work and will also increase information system user satisfaction.
13) IT staff performance improvement → Problem management. A good IT staff performance will be able to solve problem and to improve problem management better.
14) IT staff performance improvement → The increase of user satisfaction. IT staff performance improvement as user in solving many problems can increase user satisfaction due to good application performance.
15) The increase of user satisfaction → User productivity improvement. The increase of user satisfaction will stimulate user productivity in solving many problems.
16) User skill improvement → The increase of user satisfaction. User skill improvement will also increase user satisfaction, because the used application can cope with many problems.
17) User skill improvement → user productivity improvement. By improving user skill, user productivity in solving problems will also improve.
18) User productivity improvement → Having quality human resource in IT usage. User productivity improvement is a realization of company strategy in having quality human resource, especially in using IT device.
19) User productivity improvement → IT function contribution. Improving user productivity will give a good IT function contribution in a useful IT application assembling.
20) IT function contribution → Ensuring the availability of quality data and information. The bigger IT function contribution will help in providing a better quality data and information.

Table 4: Formulating Strategic Goal of IS/IT

Perspective	It Balanced Scorecard	Strategy	Strategic Goal
Business Contribution	Institution Contribution Perspective	Providing network infrastructure, quality information system	IT function contribution
User Orientation	Orientation User Perspective	Ensuring the availability of quality data and information.	User satisfaction improvement User skill improvement User productivity improvement
Operational Excellence	Operational Improvement Perspective	Maintaining and developing information system and IT infrastructure	• Problem management • Operational efficiency • Efficiency of network infrastructure, system and application development IT staff performance
Future Orientation	Future Orientation Perspective	• Having a quality human resource Providing and giving improvement in innovative IT strength and to maintain system and information technology well	Information system and IT infrastructure development Staff skill improvement IT development innovation

After creating cause and effect diagram (See Fig. 4), IT Balanced Scorecard is formulated based on strategic objective, measurement result (See Fig. 5) and its achievement (see Table 5).
IT balance scorecard measurement result based on four perspectives is shown in Fig. 5, in which its value measurement can be seen in Table 5. Besides, the measurement result considers value parameter in Table 6. Therefore, it can be concluded that the measurement based business and future orientation is very bad, but the measurement based user orientation and excellent operation perspectives is bad as shown in Table 7. Consequently, a good strategy in information system development is required to improve organization performance in the future

Table 5: Strategic Objective and Its Achievement of IT Balanced Scorecard

Strategy Standard	Strategic Objective	Measurement Result	Achievement
Business Contribution IT Function Contribution A.1 % Process of STIKOM Yos Sudarso business utilizing information system application	100%	50%	50%
A.2 % Availability network infrastructure, system, application and data.	> 90%	80%	88%
Total			138%
Average User Orientation			69%

User Satisfaction Improvement			
A.1 % User satisfaction level of application utilization easiness.	>95%	72.5%	76.3%
A.2 % User satisfaction level of information system application performance	>90%	80%	88%
A.3 % User satisfaction level of given solution	> 90%	75%	83%
Total			247.3%
Average			82.4%
User Skill Improvement			
B.1 % User training implementation	> 80%	50%	62.5%
B.2 % User comprehension level of information system application	> 80%	85%	100%
Total			162.5%
Average			81.25%
User productivity improvement			
C.1 % Level of timeliness in finishing work	100%	90%	90%
C.2 % User accuracy level in doing activity	100%	70%	70%
C.3 % Expected output level	100%	63%	63%
Total			223%
Average			74.3%
Operational Excellence			
Problem Management			
A.1 % Problem solved on time	100%	63%	63%
Total			63%
Average			63%
Operational Efficiency			
B.1 % Availability level of data communication network.	100%	82%	82%
Total			82%
Average			82%
Application development efficiency			
C.1 Time of application development	4 months	5 months	80%
C.2 % Timeliness level in developing information system information	95%	71.3%	75%
Total			155%
Average			77.5%
IT staff performance improvement			
D.1 Time needed by IT staff to solve user problem of information system application.	2 days	3 – 4 days	57%
D.2 % User satisfaction level over solution from IT staff.	95%	70.3%	74%
Total			131%
Average			65.5%
Future Orientation			
A. System and IT infrastructure development			
A.1 % how many times institution develop IT infrastructure	2 times / year	Once/year	50%
Total			50%
Average			50%
IT operational staff skill improvement			
B.1 IT staff training frequency in a year	> 3 times / year	once / year	33.3%
B.2 User training frequency	> 4 times / year	twice / year	50%
Total			83.3%
Average			41.65%
IT quality improvement			
C.1 % IT staff which is, at least, bachelor degree	100%	100%	100%
C.2 % IT support of institution performance	100%	66%	66%
Total			166%
Average			83%

By evaluating the result of performance measurement, matrix assessment is created based on value category and then the result of IT performance measurement table is formulated, as follows (see Table 6):

Table 6: Assessment Matrix Based Value Category

Value	Value category
0% - 70%	Very Bad
71% - 80%	Bad
81% - 90%	Good
91% - 100%	Very Good

The following is a result of IT performance measurement (see Table 7).

Table 7: The Result of IT Performance Measurement

Perspective	Contribution	Measurement Result	Value
Business Contribution	IT function contribution	69%	Very Bad
Average		69%	Very Bad
User Orientation	User satisfaction improvement	82.4%	Good
	User skill improvement	81.25%	Good
	User productivity Improvement	74.3%	Bad
Average		79.3%	Bad
Operational Excellence	Problem management	63%	Very Bad
	Operational efficiency	82%	Good
	Application development efficiency	77.5%	Bad
	IT staff performance Improvement	65.5%	Very Bad
Average		72%	Bad
Future Orientation	System and IT infrastructure Improvement	50%	Very Bad
	IT operational staff skill improvement	41.65%	Very Bad
	IT quality improvement	83%	Good
Average		58.2%	Very Bad

The following Table 8 is the brief summary of performance measurement result:

Table 8: Summary of Performance Measurement Result

Perspective	Measurement Result
Business Contribution	69%
User Orientation	79.3%
Operational Excellence	72%
Future Orientation	58.2%
Average	69.625%

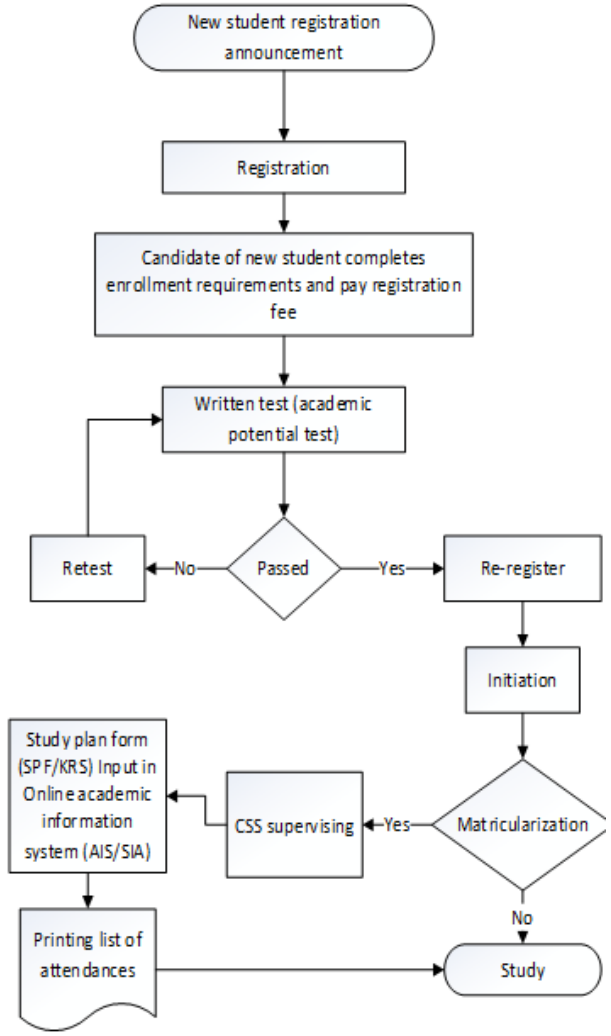


Fig. 6: New Student Enrollment Process Diagram.

3.3. Enterprise architecture

This documentation of analysis result and recommendation which has been proposed to STIKOM Yos Sudarso Purwokerto uses Scott A. Bernard framework, its components are explained in the followings:

3.3.1. Goals and initiatives

Goal and Initiatives is explained through SWOT analysis and IT Balanced Scorecard.

3.3.2. Product and services

Products and services of STIKOM Yos Sudarso are shown in New Student Enrollment Process Diagram (see Fig. 6). Developing New Student Enrollment Information System expectedly gives value added related to the easiness of accessing information about enrollment. The diagram is shown Fig. 6.

3.3.3. Data and information

Documentation related to institution data and information is summarized based on data accessibility with internet usage in each institution business process. Data accessibility with internet usage is shown in the Table 9.

Table 9: Data Accessibility with Internet Usage

Data	Data Management System			
	Manually`	Using computer without network	Using computer with local network (Intranet)	Using computer with broad network (Internet)
Student				√
Payment				√
Study Plan Form (SPF)				√
Schedule				√
Grade				√
Academic Transcript				√
Graduate				√
Lecturer				√
Staff				√
Support Staff				√
Finance				√
Inventory				√
Library				√
Total	N_A=	N_B=	N_C =	N_D = 13

3.3.4. System and applications

System and applications is describes in a framework portfolio application. It aims to give description about information system application which is good for institution and to give benefits in the future. It is explained in the followings.

Some recommendations of information system strategy is created based on the previous application including:

- New Student Enrollment Information System
- Staff and Lecturer Recruitment Information System
- Cooperation Information System
- Lecturer and Student Academic Information System
- Payment Administration Information System
- Online Attendance System
- Subject Schedule Information System

Table 10: Portfolio of STIKOM Yos Sudarso Application

		Strategic	High Potential
Contribution potential of IS/IT to achieve and to support STIKOM Yos Sudarsi Purwokerto	High	New Student Enrollment Information System (+) Staff and Lecturer Recruitment Information System (+) • Cooperation Information System (+) • • Lecturer and Student Academic Information System (+) • • Payment Administration Information System (+)	• Online Attendance System (+) • Subject Schedule (+) Information System (+)
	Low	Key Operational Academic Information System Payment Information System Staffing Information System	Support Inventory Information System Library Information System LPPM (Institute of Research and Community Service) Alumni Information System
		High	Low
		STIKOM Yos Sudarso Dependency of Information System Application	

To give one of descriptions about New Student Enrollment System development, the researcher uses Use Case Diagram created

after User Need Analysis. The diagrams are shown in Fig. 7 and Fig. 8.

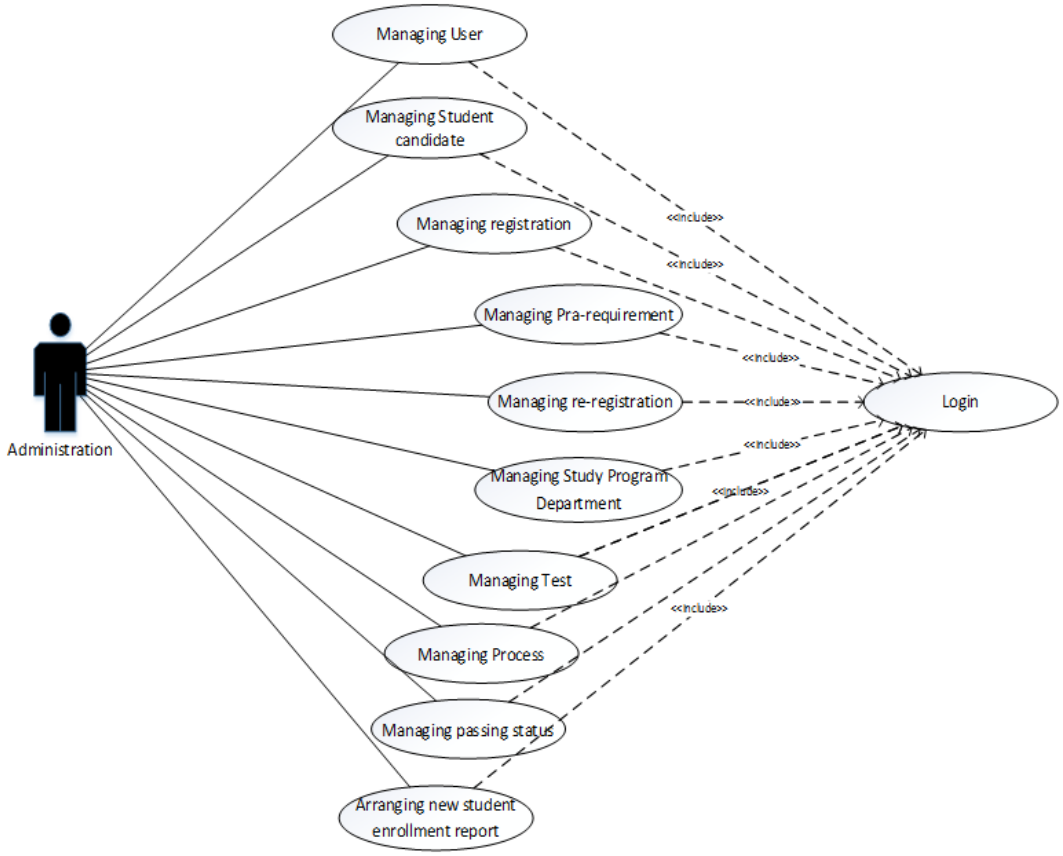


Fig. 7: Use Case of New Student Enrollment Information System Diagram for Administrator.

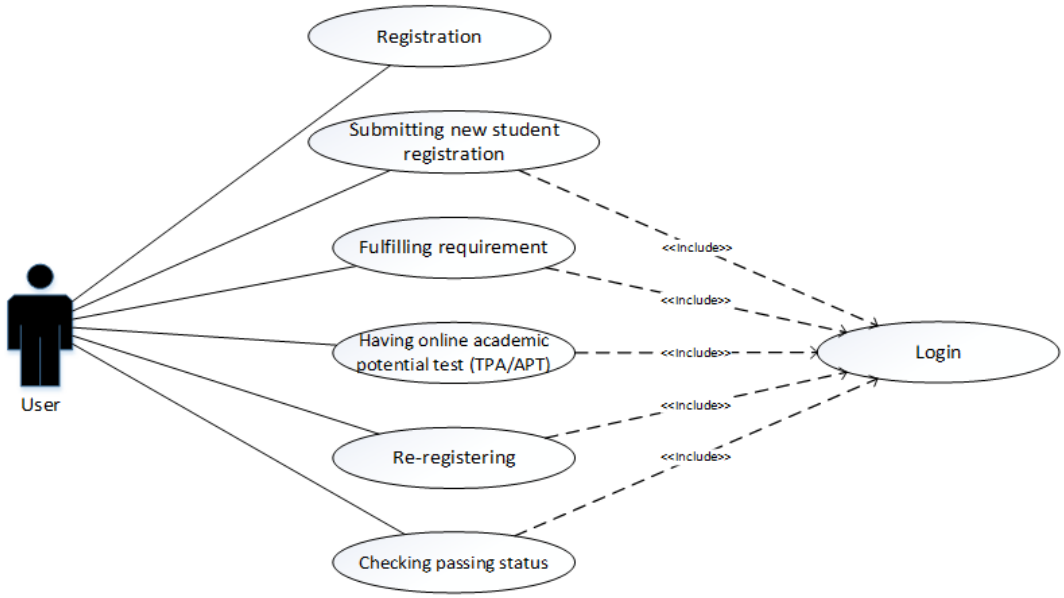


Fig. 8: Use Case of New Student Enrollment Information System Diagram for User.

3.3.5. Network and Infrastructure

STIKOM Yos Sudarso has internal network with using star typology and ISP, so each node can access internet service providing by institution. It also has three-story building, and in the terrace there are gazeboes used by student to keep in touch one another. By using microtic router, network classes are divided appropriately in each class. It is also added in each laboratory, lecturer, General Administration Office, Academic Administration and Finance Office and chairperson rooms. Hotspot is also available in gazeboes. Some access point is provided in each story so internet usage is available in each story. Internet network scheme in di STIKOM Yos Sudarso Purwokerto is shown in Fig. 9.

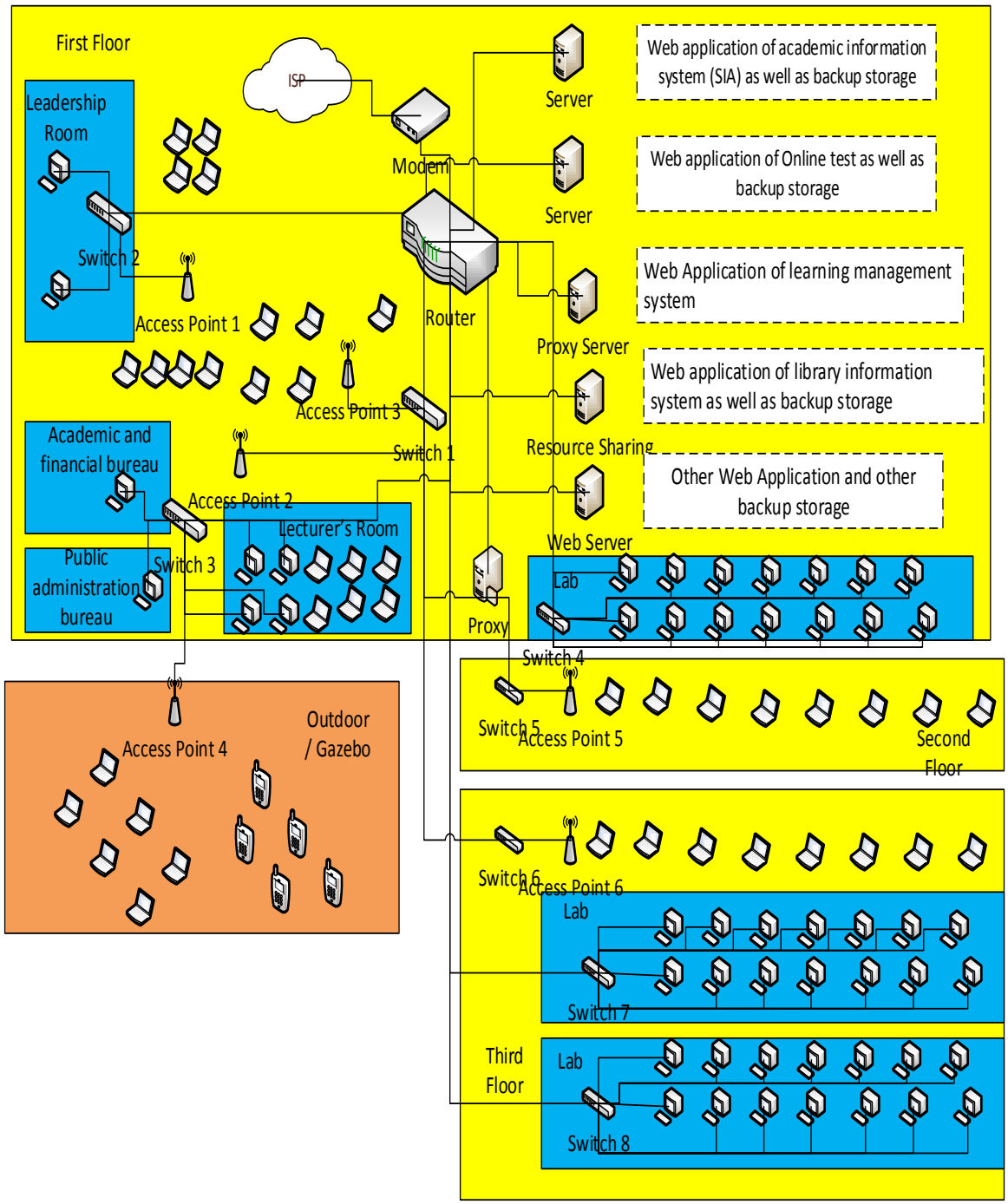


Fig. 9: Internet Network of STIKOM Yos Sudarso.

4. Conclusion

Based on analysis result, it is concluded that internal and external factor analysis result with reference to SWOT Analysis can give a description about strengths, weaknesses, opportunities and threats which has to be faced by STIKOM Yos Sudarso in terms of business and information technology. Besides, IT Balanced Scorecard analysis result can give indication about higher education condition in accordance to 4 perspectives including institution contribution, user orientation, operational improvement and future orientation. Furthermore, documentation result of Enterprise Architecture created by researcher is expectedly able to give a clear description related to information technology infrastructure and information technology resource of STIKOM Yos Sudarso Purwokerto, as well as further information system development strategy for STIKOM Yos Sudarso Purwokerto.

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