



THE IMPLEMENTATION OF MODEL SERVICE ORIENTED ARCHITECTURE TO ANALYZE STUDENT SATISFACTION TOWARDS COURSE BY IMPORTANCE PERFORMANCE ANALYSIS (STUDY CASE: SEMARANG UNIVERSITY)

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Abstract — The application of Service Oriented Architecture (SOA) model may integrate one information system to others. Also, SOA can handle the complexity of hardware platforms, software, and other services development in the college. There are many services systems exist in the university, for instance student satisfaction system by questionnaire. Student satisfaction is very important to be used as an evaluation of the college. Student satisfaction was analyzed using Importance Performance Analysis (IPA) by using quadrants for each competency. This study discusses the application of SOA and IPA model to analyze student satisfaction towards the course. Student satisfaction data was taken using questionnaires sent to the student satisfaction information system for 70 respondents for each course. It is found that sending the data using SOA and JavaScript Object Notation (JSON) is very efficient with the average value of page generation time for 1,5414 seconds. In addition, the analysis of student satisfaction towards each course is ranged from 3,72 to 4,09 with a satisfaction scale of 1 - 5. Therefore, the level of student satisfaction at the course is categorized in the satisfactory scale.

Keywords— Student Satisfaction, Service Oriented Architecture, Importance Performance Analysis, JavaScript Object Notation

I. INTRODUCTION

Information and communication technology in a business becomes important to help the business processes. Information and communication technology can overcome time, distance and place as business parameters to improve company performance [5]. Numerous kinds of applications in a business require integration of the information system. There are four types of integration in information system, such as data integration, application integration, business integration and presentation integration [15].

Service Oriented Architecture is software design based on structured set of services that provide full functionality of a complex application [12]. Service Oriented Architecture is used for information system integration using Web Services but with different hardware and software platforms [8]. Both web services and Service Oriented Architecture are advantageous in decision making [1]. Education, especially university, has complex information system and thus need integration among every information system to deliver best services for students. Measuring the quality of service is an essential element to improve the services to be better, more efficient and more effective. One success factor of a university is students' satisfaction towards services quality provided by the university. The level of students' satisfaction to the university was analysed using Importance Performance Analysis [6]. Importance Performance Analysis is an analysis to rank various bid attributes based on the degree of importance and how well the performance of a company or agency [11]. Importance Performance Analysis can determine the ranking of each service attribute both in performance and expectation according to the respondents' assessment scores. The results of attributes ranking can be described using Cartesian diagram. Cartesian diagram is divided into four quadrants, which are quadrant I, quadrant II, quadrant III, and quadrant IV and bounded by two intersecting lines perpendicular to X point as the average score of performance and Y point as the average score of hope [6]. Prior research examined SOA application based on decision aspect [1]. There is peer to peer-based regulation framework for decentralized SOA relatively [2], services security scanning based on Service Oriented Architecture in web services [14]. Innovation in tourism management to facilitate reef using Importance Performance Analysis[3]. Importance Performance Analysis of hospital information systems in the perspective of nurses [4].

This research conducted is different from the previous studies. The difference lies in research object, as this study examines student satisfaction towards course. In addition, this study uses two systems, which are questionnaire system and satisfaction system, and integrated using SOA by JSON data. This study employs a questionnaire using 5 aspects; there are infrastructure, educators' reliability, warranties and treatment, responsiveness, the understanding of students' interest. From the above, we need a system that uses Service Oriented Architecture to analyse student satisfaction using Importance Performance Analysis. The system is expected to be used into consideration in the decision-making for executives at the university.

II. SERVICE ORIENTED ARCHITECTURE MODEL

Service Oriented Architecture (SOA) is defined service software that provides one or more functions and can be combined to other functions and from other services. When the functions are combined, the service will operate independently. Service will accept request and then process and provide answers. It is usually executed using web interface [13]. The model of Service Oriented Architecture can be seen in Figure 1.

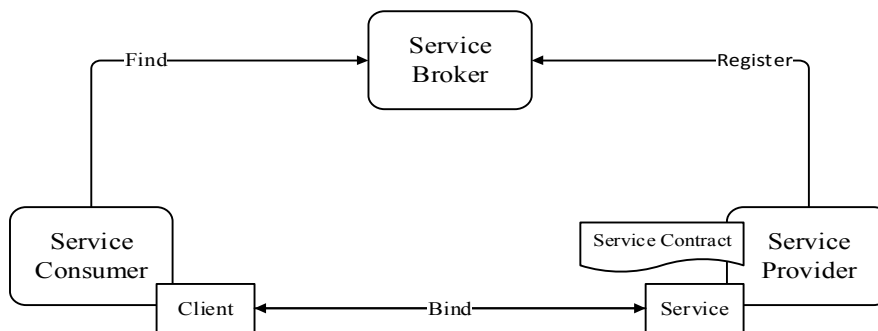


Fig 1- Service Oriented Architecture Model

III. QUESTIONNAIRE TEST

A valid instrument can measure the characteristics of intended object. Validity test is required to find out whether research instrument can be used to measure the object accurately. Either valid or invalid is based on the correlation between attributes that will describe the ability level of instruments [10]. Validity test is executed using Pearson method or Product Moment Correlation Method, ie by correlating item score in the questionnaire to the total score. The formula of Pearson Product Moment is as follows:

$$r_{xy} = \frac{n \sum x_i y_i - (\sum x_i)(\sum y_i)}{\sqrt{(n \sum x_i^2 - (\sum x_i)^2) (n \sum y_i^2 - (\sum y_i)^2)}} \quad (1)$$

Reliability test is employed to identify the stability of an instrument. Reliability test reveals to the extent measurement results are relatively consistent or accurate. These measurements can be assessed with static analysis to determine the measurement error or the wrong measure. The Cronbach's Alpha formula is as follows:

$$r_{11} = \left[\frac{K}{K-1} \right] \left[1 - \frac{\sum \sigma_b^2}{\sigma_t^2} \right] \quad (2)$$

IV. IMPORTANCE PERFORMANCE ANALYSIS MODEL

Importance Performance Analysis is an analysis to rank various bid attributes based on importance degree and how well the performance of the company or agency. The main function of IPA is to present information related to service factor that needs improvement according to the customers [11]. The stages to be carried out are as follows [9]:

First Step : Measuring the level of conformity to find how satisfy the customer to the services provided by the following formula:

$$Tki = \frac{\bar{X}_i}{\bar{Y}_i} * 100 \% \quad (3)$$

Second Step: Make a map of importance performance position as a structure divided into four quadrants and delimited by two perpendicular intersecting lines at the points as follows:

$$\bar{X} = \frac{\sum X_i}{n} \quad (4)$$

$$\bar{Y} = \frac{\sum Y_i}{n} \quad (5)$$

Third Step : Performing analysis by mapping all the variables affecting service quality into four quadrants as in Figure 2.

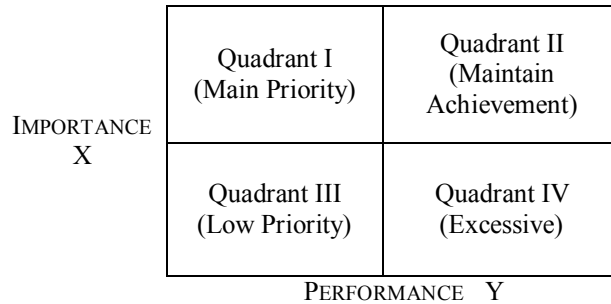


Fig 2- IPA Quadrant

V. RESULTS

Service Oriented Architecture design for student satisfaction system can be seen in Figure 3, below.

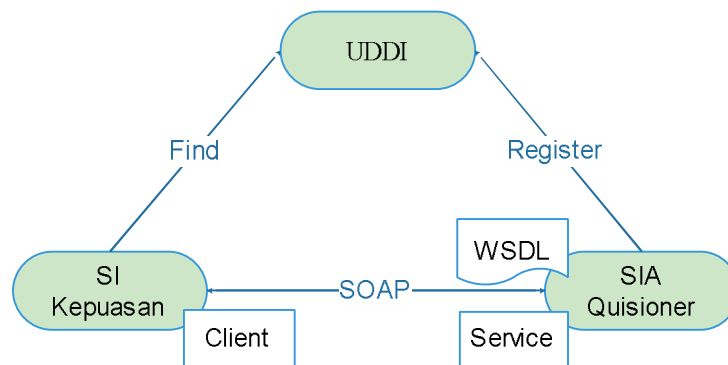


Fig 3.SOA Model to Analyze Student Satisfaction

The calculation of student satisfaction using Importance Performance Analysis is performed through these following steps:

a. QUESTIONNAIRE TEST

a. questionnaire was distributed for each course as many as 70 respondents. The test result for the performance is in Table 1 and the expectation is as shown in Table 2.

b. Measuring the level of student satisfaction by implementing Importance Performance Analysis model as follows:

- 1) Determining the level of student satisfaction by calculating the average score of performance assessment X_i 6639 with an average score of expectation in Y_i 6968 and produces 95.29. Satisfaction scale at a satisfactory level of 3.66.
- 2) Identifying position map started with find the x-axis value of coordinate point by dividing performance score to 70 respondents. Then, for the y-axis, expectation score is divided to 70 respondents as described in Table 3.
- 3) Determining mapping of each variable in x-axis and y-axis toward two secants from coordinates point in x and y axes of step 2 (see Figure 3)

TABLE 1- QUESTIONNAIRE TEST OF PERFORMANCE

Competence	Law			
	Coefficient of correlation xy	r table 5 %	Validity	Reliability
P1	0,56	0,24	valid	0,96 (Very high)
P2	0,61		valid	
P3	0,72		valid	
P4	0,76		valid	
P5	0,58		valid	
P6	0,66		valid	
P7	0,77		valid	
P8	0,75		valid	
P9	0,68		valid	
P10	0,82		valid	
P11	0,77		valid	
P12	0,66		valid	
P13	0,78		valid	
P14	0,8		valid	
P15	0,8		valid	
P16	0,76		valid	
P17	0,77		valid	
P18	0,75		valid	
P19	0,69		valid	
P20	0,77		valid	
P21	0,77		valid	
P22	0,77		valid	
P23	0,76		valid	
P24	0,79		valid	
P25	0,73		valid	
P26	0,71		valid	

TABLE 2- QUESTIONNAIRE TEST OF EXPECTATION

Competence	Law			
	Coefficient of correlation xy	r table 5 %	Coefficient of correlation xy	Reliability
P1	0,68	0,24	valid	0,97 (Very High)
P2	0,74		valid	
P3	0,56		valid	
P4	0,71		valid	
P5	0,42		valid	
P6	0,69		valid	
P7	0,66		valid	
P8	0,64		valid	
P9	0,7		valid	
P10	0,77		valid	
P11	0,74		valid	
P12	0,63		valid	
P13	0,77		valid	
P14	0,69		valid	
P15	0,76		valid	
P16	0,74		valid	
P17	0,67		valid	

P18	0,68	valid
P19	0,73	valid
P20	0,63	valid
P21	0,67	valid
P22	0,73	valid
P23	0,73	valid
P24	0,68	valid
P25	0,73	valid
P26	0,74	valid

TABLE 3. DETERMINING MAP POSITION OF IPA

Question	Respondent	X_i	Average X_i	Y_i	Average Y_i	Quadrant
RG1	70	231	3,30	256	3,66	Q3
RG2	70	245	3,50	270	3,86	Q1
RG3	70	230	3,29	255	3,64	Q3
RG4	70	248	3,54	264	3,77	Q3
RG5	70	220	3,14	246	3,51	Q3
RG6	70	258	3,69	278	3,97	Q2
RG7	70	258	3,69	268	3,83	Q2
RG8	70	264	3,77	278	3,97	Q2
RG9	70	280	4,00	284	4,06	Q2
RG10	70	260	3,71	275	3,93	Q2
RG11	70	260	3,71	267	3,81	Q4
RG12	70	250	3,57	258	3,69	Q3
RG13	70	251	3,59	266	3,80	Q3
RG14	70	265	3,79	270	3,86	Q2
RG15	70	275	3,93	280	4,00	Q2
RG16	70	262	3,74	266	3,80	Q4
RG17	70	251	3,59	263	3,76	Q3
RG18	70	276	3,94	283	4,04	Q2
RG19	70	260	3,71	268	3,83	Q2
RG20	70	261	3,73	271	3,87	Q2
RG21	70	253	3,61	267	3,81	Q3
RG22	70	253	3,61	265	3,79	Q3
RG23	70	253	3,61	262	3,74	Q3
RG24	70	256	3,66	273	3,90	Q2
RG25	70	258	3,69	266	3,80	Q4
RG26	70	261	3,73	269	3,84	Q2
Secant			3,65		3,83	

Pemetaan Kuadran IPA

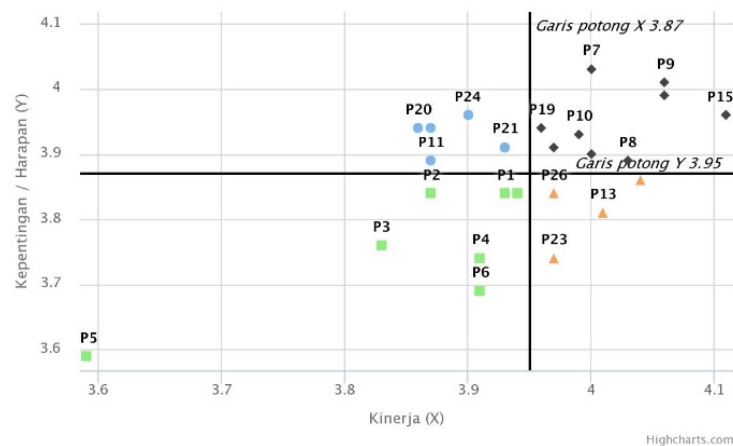


Fig 3- Quadrant Mapping of IPA

TABLE 4. QUADRANT ANALYSIS TABLE

KUADRANT	DESCRIPTION
Quadrant 1	In Quadrant 1 (Main Priority) is important factor that need improvement according to the students, however performance of the university authorities have not satisfied students optimally, thus the students feel disappointed. Attributes in this quadrant are P11, P14, P20, P21 and P24.
Quadrant 2	Quadrant 2 (Maintain Achievement) is the most desirable quadrant by students. The attributes in quadrant 2 is considered as appropriate to the services perceive by students. Quadrant 2 is also an important factor and expected as supporting factor for student satisfaction. The attributes in Quadrant 2 are as follows: P7, P8, P9, P10, P12, P15, P18, P19, P25.
Quadrant 3	Quadrant 3 (Low Priority) has factors with low, unimportant or unexpected perception level by the students. Therefore, university needs to improve the performance. The attributes in Quadrant 3 are: P1, P2, P3, P4, P5, P6, P22.
Quadrant 4	Quadrant 4 (Excessive) contains unimportant or unexpected factors by students, and thus university is recommended to allocate its resources to other factors with higher priority level. The attributes in Quadrant 4 are as follows: P13, P16, P23, P25.

A comparison of page generation time XML to JSON is described in Figure 4.

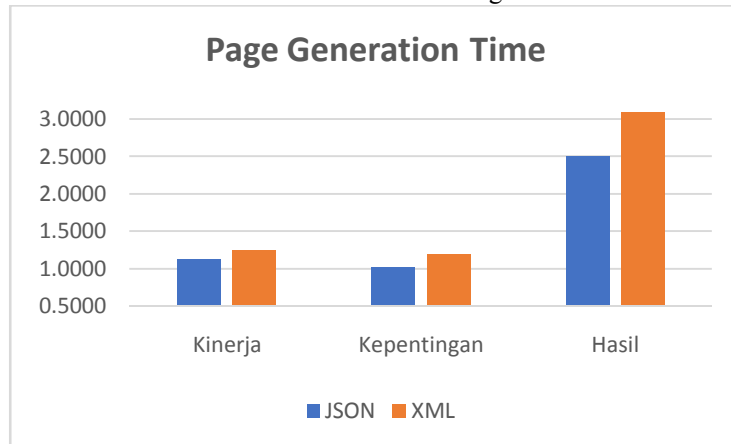


Fig 4- A Comparison of JSON to XML

VI. CONCLUSION

Based on the research of the application of Service Oriented Architecture (SOA) and Importance Performance Analysis (IPA) to analyse student satisfaction towards course, it is concluded that:

- The application of web services using SOA model provides convenience services in managing questionnaire related to student satisfaction compared with the previous process.
- By the result of questionnaire calculation using IPA method, existing course at Semarang University gain student satisfaction level in the range of 3.72 to 4.09 with a scale of 0-5. Therefore, student satisfaction level there is categorized as "satisfactory".

REFERENCES

- Boumahdi, F., and Chalal R., 2013, "SOAda Service Oriented Architecture with a Decision Aspect" International Journal of Procedia Computer Science Volume 22 (2013) 340 – 348.
- Cameron, A., Stumptner, M., Nandagopal, N., Mayer, W., dan Mansell, T., 2015, "Rule-based peer-to-peer framework for decentralised real-time service oriented architectures" International Journal of Computer Programming Volume 97 (2015) 202 – 234.
- Coghlan, A., 2012, "Facilitating Reef Tourism Management through an Innovative Importance Performance Analysis Method" International Journal of Tourism Management Volume 33 (2012) 767 – 775.
- Cohen, J.F., Coleman, E., and Kangethe, M.J., 2015, "An Importance Performance Analysis of Hospital Information System Attributes: A Nurses Perspective" International Journal of Medical Informatics Volume 86 (2015) 82-90.

- [5] Firmansyah, A., 2011, "Implementasi Service Oriented Architecture (SOA) dalam Sistem Transaksi Perbankan di Perguruan Tinggi", National Journal of Development Center of Information System and Technology for Education and Management (DCISTEM) Padjadjaran University, Bandung.
- [6] Irmaini, Z., and Sugiarti, 2010, "Aplikasi Importance Performance Analysis dalam Menilai Kualitas Pelayanan Pembuatan Kartu Ak.1 pada Dinas Tenaga Kerja dan Transmigrasi Kabupaten Cilacap", National Journal of Science and Technology Volume 19 No 2.
- [7] Iswani, A., and Yanti, T.S., 2011, "Analisis Faktor-Faktor Kepuasan Mahasiswa Terhadap Pelayanan Universitas Islam Bandung sebagai Institusi Pendidikan Tinggi" Prosiding SNaPP 2011: Sosial, Ekonomi, Dan Humaniora Prosiding SNaPP2011 : Sosial, Ekonomi, Dan Humaniora Volume 2 Nomor 1.
- [8] Marini, 2012, "Penerapan Model Service Oriented Architectur Pengintegrasian Sistem Informasi STIMIK Atma Luhur" Seminar Nasional Teknologi Informasi & Komunikasi Terapan 2012 Volume 2 Nomor 1.
- [9] Nugraha, R., Harsono, A., and Ardianto, H., 2014, "Usulan Peningkatan Kualitas Pelayanan Jasa pada Bengkel X berdasarkan Hasil Matrix Importance Performance AnalysisStudi Kasus di Bengkel AHASS PD. Sumber Motor Karawang" Jurnal Online Institut Teknologi Nasional Reka Integra Volume 1 Nomor 3.
- [10] Ong, J.O., and Pambudi, J., 2014, "Analisis Kepuasan Pelanggan dengan Importance Performance Analysisdi SBU Laboratory Cibitung PT. Sucofindo (Persero). Jurnal J@TI Undip Volume 9 No 1.
- [11] Riyanto, A., h., and Riyanto, B., 2015, "Analisis Peningkatan Pelayanan Stasiun Bogor terhadap Kepuasan Jasa Kereta Api dengan Metode Importance Performance Analysis", National Journal of Planologi Undip Volume 11 No. 4.
- [12] Shi, H., Li, T., Liu, R., Chen, J., Li, J., Zhang, A., and Wang, G., 2015, "A service-oriented architecture for ensemble flood forecast from numerical weather prediction" International Journal of Hydrology Volume 527 (2015) 933–942.
- [13] Teixeira, M., Ribeiro, R., Oliveira, C., and Massa, R., 2015, "A Quality Driven Approach for Resources Planning in Service Oriented Architecture", International Journal of Expert Systems with Applications Volume 42 Hal. 5366 – 5379.
- [14] Wang, S., Gong, Y., Chen, G., Sun, Q., and Yang, F., 2013, "Service Vulnerability Scanning Based on Service Oriented Architecture in Web Service Environments" International Journal of Systems Architecture Volume 59 Nomor 9 (2013) Halaman 731 – 739.
- [15] Yogiswara, Wijono, and Dahlan, H.S., 2014, "Kinerja Web Service pada Proses Integrasi Data", National Journal of EECCIS Volume 1, No 1.