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Evaluation Model for the Implementation of Information Technology Service Management using Fuzzy ITIL

Rudy Yandri[a], Suharjito[a], Ditdit Nugeraha Utama[a,*], Amalia Zahra[a]

[a]*Computer Science Department, BINUS Graduate Program - Master of Computer Science, Bina Nusantara University, Jakarta, Indonesia 11480*

Abstract

Information technology (IT) service management is an essential part for development of a company's IT. This case study discusses how to convalesce IT services using the information technology infrastructure library (ITIL) framework and measure service level management (SLM) using Fuzzy ITIL (FITIL) approach. This paper aims to obtain an appropriate model for the measurement of IT service management by using fuzzy approach. Besides that, this paper aims to be able to provide an improving recommendations and IT governance based on current value (as is) and expected value (to be). The research method functioned is by measuring maturity level using best practice of ITIL v3 to condition before and after of improving process based on a questionnaire that has been performed. After obtaining the value of the maturity level for each cycle within ITIL, then the value will be created as an input for FITIL. The manufacture of FITIL is done in 4 stages, namely fuzzification, knowledge base, inference, and defuzzification. The results of the conditions before and after of the improving process have been successful in increasing the level of maturity in each ITIL cycle. The case study indicates an improvement in the increased level of maturity in SLM with FITIL approach.

Keywords: Fuzzy Logic; ITIL; Maturity Level;

* Corresponding author. Tel.: +62-812-8961-4291.
E-mail address: ditdit.utama@binus.edu

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1. Introduction

Corporate governance (CG) is made up of a series of duties, procedures, organizations, and rules which influence a technique for people to manage and supervise their companies. Furthermore, it embraces practically a relationship among numerous stakeholders and company goals. CG also comprehends principal-authorized orders for the company's directors and supervisors. It characterizes the management of standard. Board of directors develops strategic business alignment and implements it. The directors are essentially responsible in handling company's risk issue. Information itself is a vital recipe for achieving a success of company's CG program. Also, the information technology (IT) and information systems (IS) use is extremely valuable [1].

IT service management (ITSM) practically could be combined with other aspect of management [2]. It operated to encourage the company performance. Furthermore, a company implements the ITSM on the information technology infrastructure library (ITIL) framework fronting various problems [3]. The problems that emerge after the application is still not well-understood in terms of the application usage. With many users who do not understand, it is difficult for the IT division to identify the progress of handling by looking at the development of call ticket status. Another problem is that it is still difficult to control the incident handling process and apply the escalation of how long a problem can be solved. Besides, the problems also occur in the making of reports to the management, whether the trouble ticket can be completed in a matter of days, weeks, and months.

In this study, the authors will make improvement of IT governance and evaluate the continual service improvement accurately by using Fuzzy and ITIL framework. The authors will evaluate the application of IT model that refers to the ITIL framework and find out how to describe the state of IT supervision process at this time and how the improving strategy could be executed by using ITIL framework. Additionally, the use of Fuzzy Logic is expected to make it easier to understand, to have tolerance of improper data, to be talented in complicated mathematical operation modeling. It is also able to be operated for constructing and employing the makers' experiences directly, and implementing the natural language in constructed model. This fuzzy system can help make quick, precise, and accurate assessments.

ITSM is a method for handling an IT system that is rationally positioned on the IT service consumers' viewpoints on the company's business. ITSM is the opposite of IT management approach and business interaction centered on technology. ITSM focuses on the process and is, therefore, linked and has the same interests as the process improvement process framework and methodology (such as TQM, six sigma, business process management, and CMMI). This discipline does not pay attention to the details of the use of particular supplier's products or technical details of a managed system. Rather, it emphases on delivering an approach for structuring IT- interrelated actions and the interaction between technical-workers and end-users.

ITSM is a significant concern in management of IT. ITSM commonly deals with operational issues of IT management [4] (sometimes called operations architecture, operating architecture) and not with the technology expansion. For example, the software making process is not its concentration. The focus of attention is a computer system operated by the company's business development. Numerous non-technology companies (e.g. the monetary, trade, and tourism industries) have principal IT systems, although not directly wide-open to their customers.

The ITIL is a common structure that portrays best practice in ITSM. The ITIL delivers and offers a structure for IT governance and attentions on continuous assessment and enhancement of the performance of IT services provided [5]. This focus is a foremost feature in the success of ITIL worldwide and subsidizes to productive use and provided the organization's profits with the development of organization. Several of these advances are proved by customers and customers' satisfaction surge, service availability rise, revenue growth, financial savings through reduction of rework, lost time, increased use of resource management, market time positive escalation, and decision-making and risk-solving that more objective and optimum.

The original variety of ITIL consists of a collection of 31 related books concealing all attributes of IT service facility. This early type was later modified and interchanged by seven narrowly related stable books (ITIL V2), merged in the overall framework. This second version is collectively received and functioned in thousands of organization as a heart for the provision of operative IT services. Then, ITIL V2 was replaced by the next style, consisting of five core books covering the service lifecycle, together with Official Introduction.

The books safeguard every phase of the service cycle that coming from the preliminary description and business requirement analysis in service strategy and service design, through migration to the operating environment within Service transition, to operate and improvements in service operation and continual service improvement [6]. The ITIL

maturity model is constructed on five levels [7], i.e. initial, repeatable, defined, managed, and optimized; that they indicate respectively level 1 until 5.

2. Methodology

2.1. Maturity Level

At this stage, maturity level measurement as a step to assess the achievement and maturity level of the IT department, especially IT support, was performed. Maturity level is going to make process to improve IT service. This stage uses the Maturity Level matrix.

a) A weight of Maturity Level

To clearly describe the results of the analysis and examine the level of maturity in each attribute that directly contributes to the maturity level of the overall data management process, then with reference to the maturity model of ITIL, each questionnaire answer choice can be mapped into the value of maturity in Table 1.

Table 1. A Weight of Maturity Level [7]

No	Answer	Weight	A weight of Maturity Level
1	1	1.00	Very low
2	2	2.00	Low
3	3	3.00	Medium
4	4	4.00	Height
5	5	5.00	Very height

b) Current Maturity Level (as is) Service Strategy Cycle

For Service Strategy cycles, results were obtained based on the average value of the overall attribute of the data recapitulation questionnaire. It was concluded that the current IT governance condition (as is) on the Service Strategy cycle at the position of maturity level 2.73 is defined.

c) Current Maturity Level (as is) Service Design Cycle

For the Service Design cycle, the results were based on the average value of the overall attribute of the questionnaire data recapitulation. It was concluded that the current IT governance condition (as is) in the Service Design cycle at the position of the maturity level of 2.47 is repeatable.

d) Current Maturity Level (as is) Service Transition Cycle

For the Service Transition cycle, the results were obtained based on the average value of the overall attribute of the questionnaire data recapitulation. It was concluded that the current IT governance condition (as is) in the Service Transition cycle at the position of the maturity level of 2.82 is defined.

e) Current Maturity Level (as is) Service Operation Cycle

For the Service Operation cycle, the results were obtained based on the average value of the overall attributes of the questionnaire data recapitulation. It is concluded that the current IT governance condition (as is) in the Service Operation cycle at the position of maturity level 2.58 is defined.

2.2. Fuzzy ITIL

At this stage, how the use of Fuzzy ITIL to help understand the effects of each cycle within ITIL was determined. The design of Fuzzy Control has four main parts in making the basic structure of Fuzzy control system: Fuzzyfication, Knowledge Base, Inference, and Defuzzification. Variables to be used in the use of this Fuzzy ITIL are Service Strategy, Service Design, Service Transition, Service Operation and Continual Service Improvement. Fuzzy logic

itself is a conception to avoid the bias value to become a crisp value. The concept was invented by [8] and ever implemented by [9] for resolving priority problem. It became an independent impression that could be embedded to other approach, for example ITIL.

a) Fuzzyfication

In this study, there are four inputs that will be employed for fuzzification to the fuzzy set and become a fuzzy membership function. Fig. 1 below indicates a fuzzification of the inputs issued from the variables specified above.

Five linguistic values are chosen for the output of Service Strategy, Service Design, Service Transition, and Service Operation: very low, low, medium, high, very high with the following data very low = 1 - 2.3, low = 1.65 - 2.95, medium = 2.3 - 3.6, height = 2.95 - 4.25, very high = 3.6 – 5.

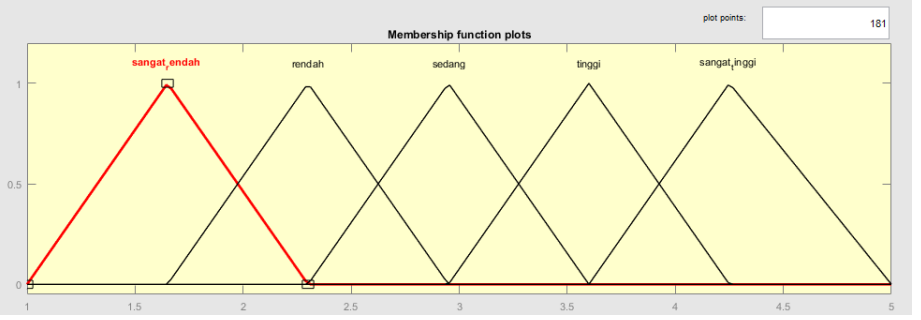

Fig. 1. Membership function

b) Knowledge Base

For planning, this variable arrangement used some rules that will most likely occur in setting up the output for current Continual Service Improvement (as is). In making this rule or statement, the more rules used, the more precise and detailed the determination of the output of the expected Continual Service Improvement. The table below presents the state rules in determining the output of the current Continuous Service Improvement (as is). The statements rules are grouped into a matrix called Fuzzy Associative Memory (FAM). By using the input: service strategy, design, transition, and operation. It is realized by operating the fuzzy rules that were technically and academically obtained and defined.

c) Inference

Furthermore, the rules specified in the knowledge base or knowledge base above can be used to obtain the current output settings. In this process, MIN-MAX reasoning is used, where MIN reasoning uses AND operator and MAX reasoning using OR operator, the result is as Fig. 2.

d) Defuzzification

The next step is defuzzification process, at this stage, the author will look for the final value of fuzzy output. There are several kinds of methods that can be used in this process. For this study, the author will use a simple method, looking for the center (centroid) of the output to be obtained. This centroid method can be written as in equation (1).

$$z^* = \frac{\int \mu_x(z).zdz}{\int \mu_x(z)dz} \tag{1}$$

Where:

$\int \mu_x(z).zdz$ is the total value of inputs
$\int \mu_x(z)dz$ is number of variable inputs

Based on the above calculation (1), output for Continual Service Improvement of 2.65 was obtained. Compared to the simulation result in MATLAB, it can be seen that the calculation result is 0.02. So, it can be concluded that the defuzzification result is valid.

Fig. 2. Current output value (as is)

3. Result and Analysis

From the results of Maturity Level evaluation that has been done in the previous discussion, the results of the measurement of the maturity level are obtained. For Service Strategy from the measurement of the level of maturity in the previous discussion, this cycle is in the position of maturity level 2.73, which is defined. For Service Design from the measurement of the maturity level in the previous discussion, this cycle is in the position of maturity level of 2.47, which is Repeatable. For Service Transition from the results of the measurement of maturity level in the previous discussion, this cycle is in the position of maturity level 2.82 which is defined. For Service Operation from the measurement of the maturity level in the previous discussion, this cycle is at the position of maturity level of 2.58, which is repeatable. From the measurement results of the maturity level, the discussion of this chapter is expected to measure the maturity level which can result in a better level of maturity.

3.1. Maturity Level

Expected Maturity Level (to be) Service Strategy Cycle

For Service Strategy cycles, the results were obtained based on the average value of the overall attributes of the questionnaire data recapitulation. It was concluded that the current IT governance conditions (as is) on the Service Strategy cycle is at the position of maturity level 2.73, which is defined, while governance conditions IT which is expected or future-oriented (to be) is in the position of maturity level 3.73, that is Managed.

Expected Maturity Level (to be) Service Design Cycle

For the Service Design cycle, the results were obtained based on the average value of the overall attribute of the questionnaire data recapitulation. It was concluded that the current IT governance condition (as is) in the Service Design cycle is in the position of maturity level of 2.47, which is Repeatable, while governance conditions IT expected

or oriented to the future (to be) is in the position of maturity level of 3.35, which is defined.

Expected Maturity Level (to be) Service Transition Cycle

For the Service Transition cycle, the results were obtained based on the average value of the overall attributes of the questionnaire data recapitulation. It can be concluded that for the current IT governance conditions (as is) on the Service Transition, cycle is at the position of maturity level of 2.82, which is defined, while for governance conditions, the expected or future-oriented IT (to be) is in the position of maturity level of 3.80, that is managed.

Expected Maturity Level (to be) Service Operation Cycle

For the Service Operation cycle, the results were obtained based on the average value of the overall attribute of the questionnaire data recapitulation. It is concluded that for the current IT governance conditions (as is) in the Service Operation cycle, the position of maturity level of 2.58 is repeatable, while for governance conditions IT expected or future-oriented (to be), the position of maturity level is 3.53, which is defined.

3.2. Fuzzy ITIL

After getting the result of calculation for Fuzzy ITIL, the author will make a calculation to obtain the expected result (to be).

a) Fuzzification

From the results of the expected Maturity Level questionnaire (to be) on the cycle of Service Strategy, Service Design, Service Transition and Service, a fuzzy set can be made as follows Service Strategy: 3.73, Service Design: 3.35, Service Transition: 3.80, Service Operation: 3.53.

b) Knowledge Base

By using the same variables and rules in the previous discussion, then on the expected Continual Service Improvement output setting (to be) can be rewritten rules that apply.

c) Inference

Furthermore, the rules that have been determined in the knowledge base above can be used to obtain the expected output arrangement. The result is figured in Fig. 3. Based on the rules, the output can be presented directly. The part with color blue is an inference output mentioned.

d) Defuzzification

The next step is defuzzification process. At this stage, the author will look for the final value of fuzzy output. The method used is the same as the previous discussion that is looking for the centroid of the output to be obtained. This centroid method can be written as follows:

$$z^* = \frac{\int \mu_x(z).zdz}{\int \mu_x(z)dz} \tag{2}$$

Where:

$\int \mu_x(z).zdz$ is the total value of input
$\int \mu_x(z)dz$ is number of variable input

Based on the above calculation results (2), the output for Continual Service Improvement is obtained, which is 3.60. Compared to the simulation results in MATLAB, it appears that the result of the calculation is the same, so it can be concluded that the defuzzification result is valid.

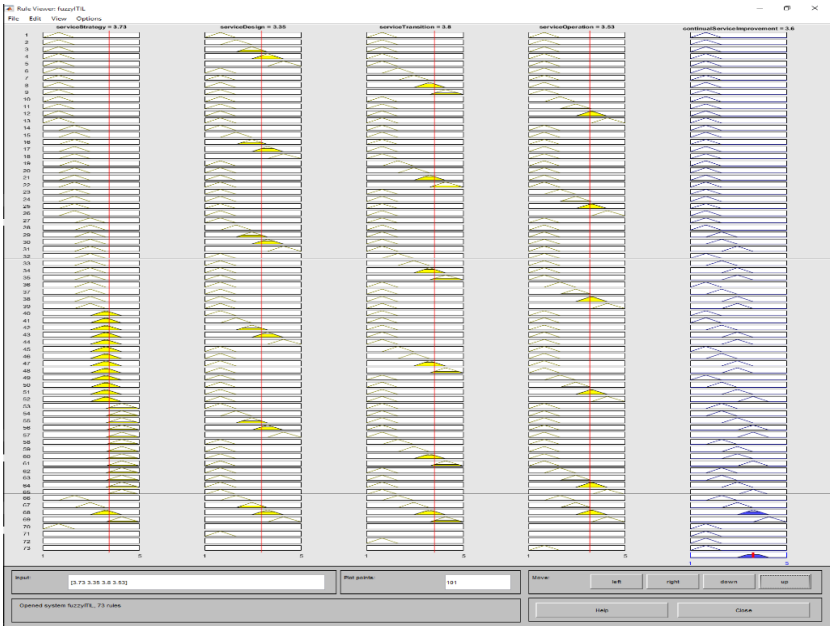

Fig. 3. Expected output value (to be)

3.3. Gap Analysis

Gap analysis is actually a method for competing and associating the actual performance with the expected one (see Fig. 4). This method is a tools that commonly functioned for management's business evaluation particularly for measuring the performance (both actual and targeted quality), such as those already listed in the business plan or annual plan on each company's function. It is also able to recognize actions being required to downgrade the corporation's quality or performance gap.

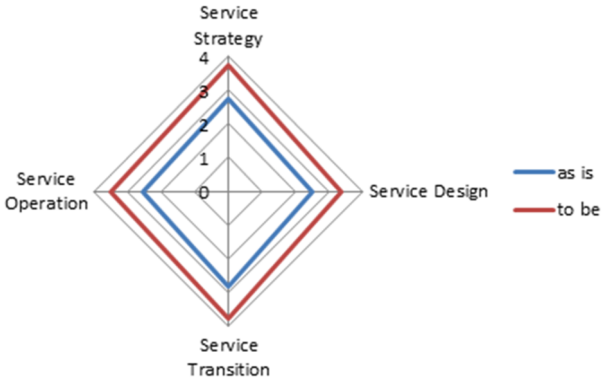

Fig. 4. Gap Analysis Result

Based on Fig. 4, the Service Strategy cycle obtained a maturity level of 2.73 for the current condition (as is), while the expected condition (to be) obtained a maturity level of 3.73. The Service Design cycle obtained a value of maturity level of 2.47 for the current condition (as is), while for the expected condition (to be) obtained a maturity level of 3.35. In Service Transition cycle obtained a maturity level of 2.82 for the current condition (as is), while the

expected condition (to be) obtained a maturity level of 3.80. In the Service Operation cycle, the value of maturity level is 2.58 for the current condition (as is), whereas the expected condition (to be) obtained a maturity level of 3.53.

4. Conclusion and Future Works

Based on the analysis of data obtained from the Telecommunication Company, it can be concluded that with the approach model of Fuzzy ITIL, the researchers can identify the maturity level of Continual Service Improvement. Further, IT governance at the Telecommunication Company can be upgraded in each ITIL cycle. The recommendations that can be given by the researchers are as follows:

1. In the Service Strategy cycle, the level of maturity is 2.73. At that value, it leads to maturity level 3, but in the process, there are still some processes that can be improved. The expected maturity level is at maturity level 4.
2. In the Service Design cycle, the level of maturity is 2.47. At that value, it then leads to the level of maturity 2. It is expected that some processes can be improved. The process is Service Management as Practice, from maturity level 1.50 to maturity level 2.04, Service Design Principles, from maturity level 1.76 to maturity level 2.40. The expected maturity level is at maturity level 3.
3. In the Service Transition cycle, the maturity level is 2.82. At that value, it leads to maturity level 3, but in the process, there are still some processes that can be improved. The process is Service Management as Practice, from maturity level 2.42 to maturity level 3.29. The expected maturity level is at maturity level 4.

In the Service Operation cycle, the maturity level is 2.58. At that value, it leads to maturity level 3, but in the process, there are still some processes that can be improved. The process is Service Management as Practice, from maturity level 1.91 to maturity level 2.59, the Service Operation Technology Considerations from maturity level 2.35 to maturity level 3.35. The expected maturity level is maturity level 4.

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