International Conference on Information Technology Systems and Innovation (ICITSI) 2014
Bandung-Bali, 24-27 November 2014
ISBN: 978-1-4799-6526-7

Development of Methodologies for Measuring IT Capability in the Information and Communication Industries

Lukman Abdurrahman
School of Electrical Engineering and Informatics
Institute of Technology Bandung
Bandung, Indonesia
33213003@students.itb.ac.id

Armein Z.R. Langi & Suhardi
School of Electrical Engineering and Informatics
Institut Teknologi Bandung (ITB)
Bandung, Indonesia
suhardi@stei.itb.ac.id & azr.langi@gmail.com

***Abstract*—There are many studies regarding the IT (Information Technology) value, however until now there are not yet any researches discussing an exact method to estimate this value. Accordingly, this study tries to present a methodology to assess this value using both qualitative and quantitative methods. The offered methodology addresses valuation of IT by means of IT value definition approach as a division of functions by costs. This valuation will be achieved by analyzing functions and costs previously, in turn, results in the intrinsic IT value. Additionally, this methodology using the Telkom data is simulated to test its accuracy. The results show that there is an alignment between the offered methodology and the case study, although there still should be improved here.**

Keywords— IT value, methodology, intrinsic value.

I. INTRODUCTION

In some industries, IT has a special room that gained particular attention as well. It has been shown empirically that IT delivers more benefits to the organization such that almost no commercial organization without involving IT in it, regardless of how big the role of IT. This viewpoint is consistent with the fact that worldwide IT spending always grows over time as shown by the Gartner survey [6].

Furthermore, there is a note that IT will well work within its environment. For that reason, there has been recognized an Information Systems (IS) terms, which is comprehended as a combination of assets and capabilities resulted from a productive use of IT [5]. In addition, IT does not create business value in an isolation environment but needs to be combined with other internal organizational factors [4]. Thus, in such organizations, IT has been viewed as strategic factors of the organizations.

In view of that, we want to offer a solution for dealing with IT in order to benefit from the values contained in it, as an intrinsic value is an innate of IT capability. This paper is a follow-up study of previous studies which have been carried out by [1], [2]. Additionally, those papers had been inspired by past papers authorized by [10] and [15] addressing the relationship between IT and business performance. Essentially, this study covers the role of IT in an organization to increase the organization performance itself.

This study addresses the way to estimate IT worth as strategic factors. The valuation will be observed from inner values of IT. The inner value is derived from the value implied in the IT as a result of division of the IT function by its cost. If the inner IT value is properly aligned with the business, the resulted value will be extraordinary because it is a multiplication of the inner and business value. This paper shows that the value of IT within the organization has significant roles.

The remainder of paper will present the topic as follows. Section two addresses literature reviews, discussing the value definition, IT model which refers to the Resource-Based View, Section three discusses a research methodology that will be base this study. Section four is a case study performed for PT. Telekomunikasi Indonesia, Tbk. Section five is discussion and recommendation. The last is section six, which is concluding all.

II. LITERATURE REVIEW

A. *Value Definition*

The value may reveal if there is an interaction among two or more systems or subsystems. One system works on the other one and vice versa, or the system works at the instigation of other systems. Why the systems would mutually operate? It may be because there is a force that drives them to work. This force is latterly called the value, usefulness, worth, benefit, and the like. In other words, this understanding can help accomplish the stage of value creation by benefiting system processes.

There are various types of values such as normative value, realist value, and perceived value. The normative value is related to required value as planned previously, the realist value pertains to resulted value that is obtained from an accomplishment, and the perceived value is what consumer relatively perceives [11]. If seen from cost management viewpoints, the other types of values are the use value, i.e. the value of required function associated with the cost. Then the cost value, i.e. the all cost values dedicated to result in the item; the esteem value, i.e. the value of additional cost to pay the

additional items as well; the exchange value, i.e. the value of an item to change something else [18], [19].

As a fundamental nature of the value definition of this research, the definition on equation (1) below will base further studies. This equation technically formulates a value (V) as an expression of division of function (F) by cost (C) as proposed by Zhong Jin-wen et al. (2009) as follows [8]:

$$V = \frac{F}{C} \quad (1)$$

According to the formula, several efforts to bring the value up are:

- For the same function (F), reduce the cost (C) or
- The cost (C) is constant, increase the function (F) or
- The function (F) slightly reduced, the cost (C) significantly decreased or
- The cost (C) a slight increase, the function (F) has increased significantly or
- The function (F) increases while the cost (C) decreases.

B. IT Value Creation Model: Resource-Based View

Liang et al. (2010) stated that the resource-based view (RBV) is the major theory that has been adopted to understand the relationship between IT and firm performance among theories. The RBV was firstly proposed by Wernerfelt (1984). The RBV argues that is to achieve competitive advantage, a firm has to possess valuable and rare resources. Barney (1991) categorized resources as physical capital, human capital and organizational capital [5]. Further, Barney characterized resources to be strategically important to pursue firm's competitive advantage if they are [12]: valuable, means that the firm is able to develop and implement strategies towards increasing efficiency and effectiveness; rare, indicates that resource usage could lead the firm to own a great different advantage; inimitable, suggests that the resource is unique, so that competitors cannot obtain it because they would be imperfectly imitable; and non-substitutable, no other resources can replace the original resource.

Valuable IT resources, consecutively, will be able to provide a firm with their capability as well. In light of this issue, Ravichandran and Lertwongsatien (2005) argued that between firm's IT resources and IS capabilities own constructive relationships [9]. Further, this leads to understanding IT capability. Here IT capability means that is "the ability to mobilize and deploy IT-based resources in combination or co-present with other resources and capabilities" [3].

Meanwhile Bharadwaj (2000) mentioned that a firm's IT capability draw from fundamental strengths in IT infrastructure, human IT resources, and IT-enabled intangibles. The IT infrastructure helps the firm to launch innovative applications faster than the competitor does. While the human IT resources will be enablers to conceive of and implement such applications faster than the competitor implements. Likewise, IT-enabled intangibles will allow the firm to leverage pre-existing organizational intangibles such as customer orientation and synergy within the firm [3].

III. RESEARCH METHODOLOGY

A. Research Scheme

As a continuation of the past researches, this study will start up from IT value definition. The definition will be rooted in equation (1) that the value is a division of IT functions by its costs. In addition, the value of IT stems from IT resources that absolutely have the capability to improve the performance of the organization. Moreover, the IT value should come together with the business environment. Eventually, the total value of IT reveals as a joint value of the complete business.

B. Framework of IT Value

By considering the way of thinking above, the valuation of IT can be derived from IT functions that were based on the following three scales [16]:

- Strategic streams, meaning that IT spending should have close alignments to the organization businesses, in which IT spending can not stand alone, but it exists in terms of raising organization performance. The strategic streams will be recognized by functions to increase the performance of the organization strategically.
- Business streams, which are the result of the allocation of resources to business processes and the execution of business processes within the organization. In regard this context; IT must be viewed as causal to retain and raise the business performance of the organization indirectly by supporting the business processes to augment its organization performance.
- Financial streams, these are the most important streams regarding organization performance. Accordingly, disclosing these streams in terms of IT value definition is a necessity to asses the effect of IT spending to the financial performance.

C. Determination of IT Functions

TABLE I. LIST OF FUNCTIONS OF IT

Streams of IT Function	Levels of Functions	
Strategic	Fundamental	$f_1, \ldots f_a$
	Enhanced	$f_{(a+1)}, \ldots f_b$
	Superior	$f_{(b+1)}, \ldots f_c$
Business	Fundamental	$f_1, \ldots f_d$
	Enhanced	$f_{(d+1)}, \ldots f_e$
	Superior	$f_{(e+1)}, \ldots f_g$
Financial	Fundamental	$f_1, \ldots f_h$
	Enhanced	$f_{(h+1)}, \ldots f_k$
	Superior	$f_{(k+1)}, \ldots f_m$

978-1-4799-6527-4/14/$31.00 ©2014 IEEE

In order to determine the IT function, it will be performed as seen in table 1 below (f_1, …, f_a, etc. are samples of detail functions only). As seen in the table 1, IT functions are broken down into three streams: strategic, business, and financial streams. Each stream has three levels of functions: fundamental functions describing the basic functions that must be owned by each stream as essential functions; enhanced functions that are improvement of the fundamental ones; and the superior functions that are advanced IT roles giving away the highest values to the business. Furthermore, each level has detail functions that can be numbered as many as each level owns. For example according to the table 1, the fundamental functions of the strategic stream have a detail functions, i.e. f_1 up to f_a. The enhanced functions have (b-a) detail functions, i.e. $f_{(a+1)}$ up to f_b. Likewise, the superior functions have (c-b) detail functions, i.e. $f_{(b+1)}$ up to f_c. So do the streams of business and finance. This function analysis will result in index unit of the function parameter.

In order to measure IT functions in quantification fashion, it is conducted by such steps [7]:

1). We have to determine the index of the Scale of Strategy (SS), the Scale of Business (SB), and the Scale of Finance (SF).

2). The calculation of these indexes bases on an arithmetic manipulation as follows:

As i = indicates the ith of analyzed functions

$$f_i = \begin{cases} 1, \text{ if function } i \text{ is ready to operate} \\ 0, \text{ if not} \end{cases}$$

$$p_i = \begin{cases} 1, \text{ for fundamental } i\text{th functions of each stream} \\ 2, \text{ for enhanced } i\text{th functions of each stream} \\ 3, \text{ for superior } i\text{th functions of each stream} \end{cases}$$

MF = Maximum Function score of each stream that should be ideally available within each stream, there is a formula to count it below.

N = real number

Accordingly, we can formulate the index of the Scale of Strategy (SS) with referring to the table 1 as:

$$p_i = \begin{cases} 1, & if\ 1 \le i \le a \\ 2, & if\ (a+1) < i \le b,\ i \in N \\ 3, & if\ (b+1) < i \le c \end{cases} \quad (2)$$

$$MF = \sum_{i=1}^{c} Pi \quad (3)$$

$$SS = \frac{\sum_{i=1}^{c} p_i f_i}{MF} \quad (4)$$

With the similar step, the index of the Scale of Business (SB) can be expressed as follows (see table 1):

$$p_i = \begin{cases} 1, & if\ 1 \le i \le d \\ 2, & if\ (d+1) < i \le e,\ i \in N \\ 3, & if\ (e+1) < i \le g \end{cases} \quad (5)$$

$$MF = \sum_{i=1}^{g} Pi \quad (6)$$

$$SB = \frac{\sum_{i=1}^{g} p_i f_i}{MF} \quad (7)$$

Likewise, the index of the Scale of Finance (SF) is in this manner (see table 1):

$$p_i = \begin{cases} 1, & if\ 1 \le i \le h \\ 2, & if\ (h+1) < i \le k,\ i \in N \\ 3, & if\ (k+1) < i \le m \end{cases} \quad (8)$$

$$MF = \sum_{i=1}^{m} Pi \quad (9)$$

$$SF = \frac{\sum_{i=1}^{m} p_i f_i}{MF} \quad (10)$$

Furthermore, the Function Parameter (F) is average of all the scales strategic, business, and financial streams. In here [7] suggested to add performance effectiveness factor (e_j) as correction factors to each scale of stream. Thus, the F and e_j can be formulated as seen in equation (11) and (12) below:

$$F = \frac{(SS * e_1) + (SB * e_2) + (SF * e_3)}{3} \quad (11)$$

$$e_j = \frac{\left[\frac{worked\ \ functions}{total\ \ functions}\right]_{\text{fundamental}} + \left[\frac{worked\ \ functions}{total\ \ functions}\right]_{\text{enhanced}} + \left[\frac{worked\ \ functions}{total\ \ functions}\right]_{\text{superior}}}{3} \quad (12)$$

Where e_j = performance effectiveness factor of the jth (j = 1 up to 3 in this study) stream of functions. This factor can be assessed by considering completeness of IT functions of each stream in the implementation in the field. It means that the more complete functions in implementation, the more effective the performance of the functions. Accordingly the F will be an index unit.

D. Calculation of IT Costs

In order to assess the IT costs, the Life-Cycle Cost Analysis (LCCA) technique provides us with comprehensive calculation of costs. The LCCA is an elemental outline process in terms of scheming of the preliminary and the forthcoming cost of a project. The LCCA is useful to be employed at any kind of the project scheme as an effective tool to assess the capital and operational expenditure [14]. Therefore to assess the IT, firstly we classify the source of the cost into two large

978-1-4799-6527-4/14/$31.00 ©2014 IEEE

categories: capital and operational expenditure. Moreover, each category is broken down into in depth cost components. For example, the capital expenditure is broken down into design, construction, installation cost, etc. The operational expenditure consists of operation, labor, maintenance cost, etc. The more comprehensive cost components scheme is shown in table 2 below. The capital expenditure is broken down to CE_1 up to CE_n, the operational expenditure is broken down to OE_1 up to OE_m.

TABLE II. COST PARAMETER COMPONENTS

Cost Category	Cost Components
1. Capital Expenditure (CE)	CE_1
	…..
	CE_n
2. Operational Expenditure (OE)	OE_1
	…….
	OE_m

According to [7], the cost components can be estimated with the following steps (see table 2):

1). Determination of formulation variables, such as:

a. $CE = CE_1 + \ldots + CE_n$ where $CE_1, \ldots CE_n$ are the cost increases for CE components respectively

b. $OE_t = OE_{1t} + \ldots + OE_{mt}$ where OE_t is operational expenditure at the end of the tth year. Likewise, $OE_{1t}, \ldots OE_{mt}$ are the cost increases for operational expenditure respectively at the end of the tth year

c. C_r = the real cost due to adding intelligent systems to a conventional community

d. i = the discount rate (the rate of return that could be a weighted average cost of capital)

e. t = the year of the cash flow

f. N = the specified length of economic life of component of IT in year

g. [m, M] = the acceptable and reasonable value range of cost specified by developers, with m and M as the thresholds. In practice those thresholds may be based on owner estimate, planning of budget, budget realization in last years, etc.

h. C = Cost Parameter

2). Formulation of the cost parameter.

As suggested by [7] as well, OE_t represents the operational expenditure at the end of the tth year. However, this scale is converted to the value at the start of the 1st year with the discount rate i and the economic life length N. In other words, OE_t is estimated using net present value [7], [14]:

$$C_r = CE + \sum_{t=1}^{N} \frac{OE_t}{(1+i)^t} \quad (13)$$

$$C = \begin{cases} 1 & ,0 < C_r < m \\ \dfrac{C_r - m}{M - m} & ,m \le C_r < M \\ 1 & ,C_r \ge M \end{cases} \quad (14)$$

As seen in equation (14), the C parameter will be on range: 0 - 1 with 1 is the highest index of the cost parameter. Based on equation (1), the value index will be calculated by division of equation (11) by equation (14). The resulted value will be on three positions: V = 1 means that the function is equal to the cost so the added value is usual; V < 1 describes that the function less than the cost, which endangers the competitive advantage of the business; and V > 1 is the best value addressing the highest efficiency of organization management. Because this value comes from the inner power as the built-in value of IT itself, we call this as the intrinsic IT value.

E. Data Collection

To validate intrinsic values, it will be performed by a case study. The case study relates to telecommunication industries as one segment of IT-based industry segments. The telco's industries may be sufficiently representative to be samples because they are information and communication technology (ICT) industry providers. The company that will be selected as a sample is that has been listed in the stock exchanges such as Indonesia Stock Exchange, New York Stock Exchange, etc. This company is PT. Telekomunikasi Indonesia, Tbk. that regularly publishes its Annual Report including the Financial Statement. The sampled data come from the Telkom's annual reports. The annual reports are not only comprehensive data, but also legitimate because they had already been audited and agreed by Annual General Meeting of Shareholders.

F. Data Analysis

Data analyses follow a sequence of stages as seen in table 3 below:

TABLE III. RESEARCH DATA ANALYSIS PHASES

#	Stage	Method
1	To analyze group of functions of Telkom's operation, split into three: strategic, business, and financial streams. Each function stream is classified into fundamental, enhanced, and superior level of function. Then the index of each stream and function parameter are calculated.	Resource-Based View eTOM (enhanced Telecom Operation Map) Framework Telkom Annual Report 2013 Equation (2) up to (12)
2	To analyze and asses group of costs	Life-Cycle Cost Analysis (LCCA) Present Value Equation (13) and (14)
3	To asses the intrinsic IT value	Value analysis Equation (1)

IV. CASE STUDY: ICT INDUSTRY

The case study was prepared at PT. Telekomunikasi Indoesia, Tbk, which is an ICT service operator in Indonesia. The functions of IT services are based on eTOM (enhanced

Telecom Operation Map) business process framework because eTOM provides telco industries with more comprehensive services that would meet with customers' service quality needs [17], [20]. According to eTOM framework, the IT functions that should conform to an ICT industry are as listed eTOM version 8.

According to table 3, eTOM, [13], and also using equation (2) up to (12) the calculation of function parameters results in figures as follows in table 4 below:

TABLE IV. CALCULATION RESULTS OF FUNCTION PARAMETERS

Streams	Parameter	Figures
Strategy	MF	315
	SS	0.82
	e_1	0.93
Business	MF	602
	SB	0.88
	e_2	0.95
Finance	MF	104
	SF	0.89
	e_3	0.96

Hence by equation (11), Function parameter (F) = 0.82.

While the the cost components that arrange the ICT expenditure at PT. Telekomunikasi Indonesia, Tbk are as seen in table 5 below, while the list of real CE of Telkom can be seen in [13]:

TABLE V. COST COMPONENTS OF ICT EXPENDITURE (ADOPTED FROM [13]

Cost Flow	Cost Components
1. Capital Expenditure (CE)	1.1 Procurement cost (Planning, Design, Construction costs) 1.2 Installation cost 1.3 Other capital cost
2. Operational Expenditure (OE)	2.1 Operations 2.2 Maintenance 2.3 Other operational costs

According to [13], the total CE in 2013 is at Rp 24,898.0 billion. If it is assumed that the OE equals to 8%[1] of the CE (OE magnitude in the [13] is not listed), then OE = Rp 1,991.84 billion per year. While the economic life (the year of cash flow) was estimated for 10 years and is also assumed to require the same OE for 10 years to come. The discount rate is pegged Telkom for 2013 amounted to 13.5% [13], by using equation (13) the results of detailed calculations can be seen in the following table 6.

In order to obtain C (cost parameter) index, it refers to equation (14). This equation requires m and M, which represent the acceptable and reasonable value range of cost specified by developers, as the thresholds. As stated above, m and M can be referred to the last realization of the C_r. Therefore, m and M here we take are the value of Telkom's C_r the smallest and greatest during the past ten years, i.e. 2004-2013. The smallest C_r is in 2004, i.e. Rp 12,574.02 billion, while the biggest is in 2013. Thus, m = 12,574.02; M = 35,493.63; and C_r = 35,493.63. Seen that M = C_r, then the value of C = 1 according to the equation (14). For that reason, the intrinsic value (InV) according to equation (1) will be a division of function parameter (F) = 0.82 divided by cost parameter (C); i.e. InV = 0.82 (< 1), which means that there are unnecessary costs which do not contribute to the required functions for the alternative. Eliminating these unnecessary costs, while maintaining the required performance, quality and safety of the functions, should be pursued.

[1] 8% is taken based on the example calculation of OE of one project of Telkom

TABLE VI. COST COMPONENTS MAGNITUDE

Year (N)	CE (Rp billion)	OE (Rp billion)	i	C_r (Rp billion)
0	24,898		1.000000	24,898.00
1		1,991.84	0.881057	1,754.93
2		1,991.84	0.776262	1,546.19
3		1,991.84	0.683931	1,362.28
4		1,991.84	0.602583	1,200.25
5		1,991.84	0.53091	1,057.49
6		1,991.84	0.467762	931.71
7		1,991.84	0.412125	820.89
8		1,991.84	0.363106	723.25
9		1,991.84	0.319917	637.22
10		1,991.84	0.281865	561.43
C_r (Rp billion)				**35,493.63**

V. DISCUSSION AND RECOMMENDATION

It is not easy to valuate the real value of IT within the business organizations. This is because that the factors influencing the values are various, consisting of technical, managerial, environmental, and many more aspects. However, the valuation of IT has been conducted by means of this study although its results are still containing shortcomings. These shortcomings lie on intrinsic valuations. In the intrinsic value, there are difficulties in determining functions covered by IT's role in the organization. The difficulties arise about whether these functions are created as a direct correlation with the IT procurement or may also refer to an ideal standard functions to be performed by an IT-related industries, which follow a particular framework. Eventually in this study, the sums of functions were determined qualitatively using the annual report analysis confronted with eTOM framework. The eTOM framework was taken because it has become an ideal framework for telco industries. Likewise, in calculating cost parameter, there are difficulties because that there were not direct indicators that connect each cost to functions and vice versa. Hence, the cost parameter was calculated by an accumulation approach between CE and OE components, even though this calculation was still consistent with Life Cycle Cost Analysis as well.

978-1-4799-6527-4/14/$31.00 ©2014 IEEE

In order to try to assess business performance parameters such as the return on investment (ROI), the figures of index could be used to do it with considering other parameters such as service management, customer relationship management, etc. Using this figure, we can assess ROI that will be compared with the financial statements. However, [13] does not present the ROI figures, then we can not clarify the objectivity of the estimated ROI also can not compare with the real ROI. Additionally, until now at Telkom there is not CE tracking tools in order to trace contribution of the spent capital to the business performance. Therefore, it will be difficult to measure the success or failure of an investment. For that reason, the result of this study is also hard to be confronted with the realization of business performance as a result of the CE. Correspondingly, we recommend to Telkom:

1). To develop and implement CE tracking tools in order to simply measure its success or its failure. This tools has to be able to distinguish business performance whether is an effect of the last spending, the new one or the combination of all.

2). To determine critical success factors within overall business processes by decomposition of those processes such that will appear business criticalities to be indicated as a success or fail account. Take them as critical success factors. This way is also useful to decompose building block of business process so it will easy to persuade to bring the organization extrinsic values up.

3). To value periodically the valuation of IT, especially IT infrastructures at Telkom are not only as support infrastructures, but also as business themselves because Telkom is an IT-oriented service corporation. This valuation helps the management measures business performances and quickly makes decisions.

VI. CONCLUSION

This study tries to offer the solution in valuation of IT. The valuation will stem from the inner value IT resources own; it is then called the intrinsic value. This value is derived qualitatively from functions measurement, which is then divided by costs. The cost measurement quantitatively refers to the life cycle cost analysis that analyses the spent investment and its operation and maintenance expenses.

This solution looks simple and easy to use on one hand. On the other one, this simplicity ignores some parameters that are also important in valuation of IT. For example, this valuation has not yet considered the quality of services, accessibility, capacity, etc. The valuation was just based on availability levels of those services.

Accordingly, this study should be followed up with future works that should emphasize on the extrinsic value measurement comprehensively. Likewise, this comprehensiveness will lie on estimated parameters within business environment. It means that the more complex the business environments the more accurate the valuation.

REFERENCES

[1] Abdurrahman, L., Suhardi, Langi, A.Z.R, "Information Technology (IT) Value Model using Variance-Based Structural Equation Modeling: Towards IT Value Engineering", The Second International Conference on Information and Communication Technology, Bandung, pp. 499-504, 28-30 May 2014

[2] Abdurrahman, L., Suhardi, Langi, A.Z.R., "Modeling Information Technology (IT) Value: An Ontological Approach towards IT Value Engineering", International Journal of Advances in Software Engineering & Research Methodology– IJSERM, 1(2), pp. 34-38, 25 June 2014.

[3] Bharadwaj, A.S., "A Resource-based Perspective on Information Technology Capability and Firm Performance: an Empirical Investigation", MIS Quarterly, 24, pp. 169–196, 2000.

[4] Cao, G., Wiengarten, F., and Humphreys, P., "Towards a Contingency Resource-Based View of IT Business Value", Syst Pract Action Res, pp. 85–106, 2011.

[5] Datta, A., "Resource Based View of Information Systems: A Critique", http://ssrn.com/abstract=1029228, download on May 17, 2013.

[6] Gartner, "Gartner Worldwide IT Spending Forecast", http://www.gartner.com/technology/research/it-spending-forecast/, download on 2 August 2014.

[7] Huang, Z., "Investment Evaluation of Intelligent Residential Communities Using Value Engineering in China", IEEE, 2010.

[8] Jin-wen, Z., and Xiao-ying, Z., "The New Tools of Enterprise's Innovation Management: Value Engineering", Proceeding of International Conference on Information Management, Innovation Management and Industrial Engineering, pp. 507-510, 2009.

[9] Lee, O.K., Xu,P.,.Kuilboer, P.J.P., and Ashrafi, N., "IT Impacts On Performance Of Service Firms Through Operation-Level Dynamic Capability", Journal of Applied Business Research, 28, pp. 1283-1293, 2012.

[10] Liang, T.P., You, J.J., and Liu, C.C., "A resource-based perspective on information technology and firm performance: a meta analysis", Industrial Management & Data Systems, 110, pp. 1138-1158, 2010.

[11] Lin, B.W., "Information technology capability and value creation: Evidence from the US banking industry", Technology in Society, 29, pp. 93–106, 2007.

[12] Powell, "Resource-Based View", Encyclopedic Dictionary of Strategic Management, pp. 1-3, 2007.

[13] PT. Telekomunikasi Indonesia, Tbk., "Creating Global Talents and Opportunities", 2013 Annual Report, 2014.

[14] Rahman, S.; Vanier, D.J., "Life cycle cost analysis as a decision support tool for managing municipal infrastructure", CIB 2004 Triennial Congress, Toronto, Ontario, pp. 1-12, May 2-9, 2004.

[15] Ravichandran, T. & Lertwongsatien, C., "Effect of Information Systems Resources and Capabilities on Firm Performance: A Resource-Based Perspective", Journal of Management Information Systems, 21, pp. 237-276, 2005.

[16] Schniederjans, M.J., Hamaker, J.L., Schniederjans,A.M., "Information Technology Investment: Decision-Making Methodology", World Scientific Publishing, 2004.

[17] Tanovic, A., "Improvement of the eTOM standard through the comparison with ITIL V3 best practices", IEEE 20th Telecommunications forum TELFOR 2012, pp. 36-39, Serbia, Belgrade, November 20-22, 2012.

[18] Webb, A(1), "Value Engineering Part 1", Engineering Management Journal, pp. 171-175, 1993.

[19] Webb, A(2), "Value Engineering Part 2", Engineering Management Journal, pp. 231-235, 1993.

[20] Wong, D., "Adapting e-TOM Model to Improve Multimedia Network Management – A Case Study with a Taiwan Multimedia Service Provider", IEEE Fifth International Conference on Intelligent Information Hiding and Multimedia Signal Processing, pp. 579-582, 2009.

978-1-4799-6527-4/14/$31.00 ©2014 IEEE