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Methodology Development of Information Technology Value Engineering using Systems Engineering Approach

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***Abstract* — This study directs to research the developed business performance based on optimal costs, which is enabled by an IT value engineering concept, namely an engineering method due to IT inclusion within an organization to generate excellent performances at minor cost. Thus, the method is using systems engineering in which the processes through an engineering design process by defining the problem, generating alternative solutions, selecting a solution, detailing the design, validating the model. Furthermore, this methodology combines with the resource-based view and the partial adjustment theories. At that point, the results disclose a parallel fashion model to remain business performance completely at minimum costs.**

Keywords—business performance; partial adjustment; IT value engineering; systems engineering.

I. INTRODUCTION

The presence of Information Technology (IT) in business organizations should acquire enhanced conducts, not only manifested as business enablers [10], but also revealed with more values [6] such as business process effectiveness, cost efficiency, and profit maximization, which will improve business performances. In other words, to obtain worthy performance achievement, the organization must exploit IT not only as a working tool but also as a means to empower businesses with creative ways to restore the IT productivity paradox [13] syndrome.

Consequently, there should be criteria in terms of valuable performances represented generally by financial and operational indicators, articulated as the sustainable competitive advantage. Consistent with the criteria, a business proposal should be created, whereas the criteria of the sustainable competitive advantage should be referred, too. In this case, the function of IT should also be promoted as the strategic factor.

The research studies the IT value engineering methodology from the systems engineering point of views, whereas the engineering process is defined as a description of a methodology to explain the relationship between business performances and IT resources. Moreover, the term engineering is described as the creative exploitation of energy, materials, and information in organized systems of men, machine, and environment systems which are useful in terms of contemporary human values [9]. In the meantime, IT values are beneficial because of the IT inclusion within business processes in order to stimulate effectiveness and efficiency in organizational operations such as cost reductions, and so forth. While the definitions of systems engineering are different, although all share the major concepts of the systems approach such as holism, synthesis, interrelationships, along with the engineering-project-based ideas of system lifecycle and requests [16].

Furthermore, to investigate the IT system within a business, the Resource-Based View (RBV) becomes a fundamental theory [14], in which, according to valuable performances of the organization, then IT systems, consisting of several components, the engineering processes can be accomplished with the aim of meeting those criteria. Additionally, those engineering stages will create the IT value engineering methodology. For that reason, the IT value engineering is a systematized studying of IT significances in order to convey a valuable organizational performance at the optimal costs through engineering IT and business, which involved it. Accordingly, the engineering design process should be composed of defining the problem, constructing alternate solutions, judging to select a solution, detailing the design as a model, defending the model, and authenticating the model [9].

Moreover, the research demonstrates that the systems engineering approach collaborated with the RBV theory are able to let the IT value engineering methodology completely works. Meaning that the central problem, namely the superior performance of the IT-based firms at lower costs will manifest through engineering performances and cost distributions. Meanwhile, this research has closely related to the preceding studies concentrating on the IT value model from the ontological approach towards IT value engineering [1] and the IT value model using variance-based Structural Equation Modeling (SEM), similarly towards IT value engineering [2]. Also, this study is related to a number of studies discussing the relationship between IT resources to business performances, such as [5], [10], [15], and so forth. Similarly, this study applies the partial adjustment valuation approach in building the logical and mathematical relationships among system components [13].

Thus, the remainder of the study provides the research results with a subsequent order. Section two discourses literature reviews, depicting the Resource-Based View theory and systems engineering processes. Section three explicates a research methodology as a fundamental of this study. While, section four is the result of the systems engineering model, which also encompasses discussions about the model and its validation. To end with, the section five will conclude all.

II. Literature Review

A. *Resource-Based View*

[10] stated that the resource-based view (RBV) is the major theory that has been adopted to comprehend the relationship between IT and firm performance among theories. The RBV was firstly proposed by Wernerfelt (1984), who argued that to achieve competitive advantages, a firm has to possess valuable and rare resources. While, Barney (1991) categorized resources as physical capital, human capital and organizational capital [3]. Further, the character of resources, which are strategically significant to pursue firm's competitive advantages are [10]: 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, [15] argued that between firm's IT resources and IS capabilities own constructive relationships, which leads to understanding IT capability that the ability to deploy advantages of IT resources joining with other resources.

B. *Systems Engineering Lifecycle*

Systems engineering consists of various processes, methods, instructions, and philosophies to govern, investigate, plan, improve, accomplish, and execute a complete solution of the recognized problem. Additionally, the presentation of the systems engineering relates to the characters of the entity, in which the systems engineering facilitates to improve an integrated explanation in accordance with the IT improvement qualifications [11]. Meanwhile, the concurrent engineering proposes to determine systems engineering problems by solving concurrently, which all procedures of systems engineering are accomplished altogether [12].

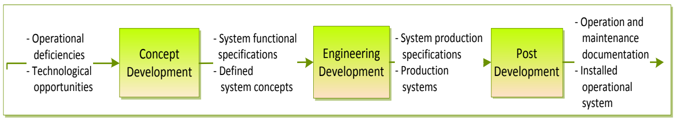

Fig. 1. Principal phases in a system lifecycle [8, p. 75]

Furthermore, the systems engineering process lifecycle possesses several alternatives, however, those cycles almost have the same identity, namely the goal of the systems engineering effort and systematic steps in making the effort. The systems engineering lifecycle of this research is referring to [8] version as potted in Fig.1.

Fig. 1 explicates that the systems engineering lifecycle commences from a concept development, which is the input are two things: operational deficiencies and technological opportunities. The operational deficiencies are market-driven input and the technological opportunities are technology-driven input, whereas they undertake processing in the block, then cause the output: system functional specification and defined system concepts. Both outputs become inputs for the engineering development block that processes them to issue system production specification and production systems. Likewise, those outputs will become an input for the post-development block, which is a deployment activity of the system to the users by providing them with operation and maintenance documentation and installed the operational system.

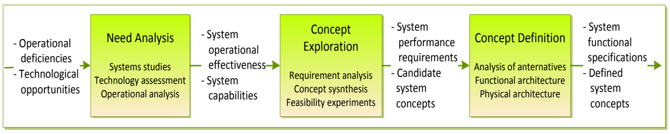

Fig. 2. Concept development phases of a system lifecycle [8, p.76)

Furthermore, Fig. 2 is an interpretation of the concept development block of Fig. 1, whereas the concept development handles its input by means of need analysis, concept exploration, and concept definition activities. [12] related this phase to problem identification, critical features, and requirements identification, and interfaces with legacy system identification [12], in which the goal of this stage is to delimit the problem and its functional specification.

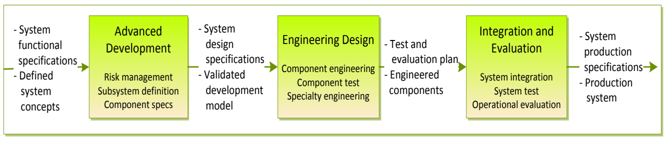

Fig. 3. Engineering dev. phases in a system lifecycle [8, p. 78]

Moreover, Fig. 3 depicts methods of engineering development to continue the concept development stage. This stage contains the advanced development, engineering design, and integration and evaluation blocks. The advanced development handles input through risk management, subsystem definition, and component specification activities, which the inputs are system functional specifications and defined system concepts, and subsequently the outputs are system design specification and validated development model. In addition, the engineering design block handles the outputs of the advanced development block, in which the procedure works with component engineering, component test, and specialty engineering to produce tests and evaluation plan and engineered components. Those outputs become the inputs of the integration and evaluation block, which encompasses system integration, system test, and operational evaluation. Ultimately, the last outputs of the engineering development stage are system production specifications and production system.

The objective of this stage is to interpret the functional specifications into the design such that, in turn, it will become an abstract design to define the identified requirements. Therefore, it outlines the functional leading edge of the components and categorizes the component relationship.

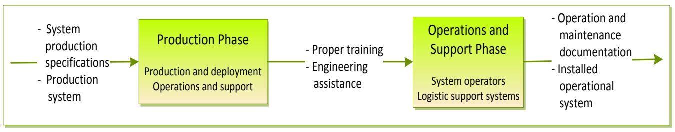

Fig. 4. Post-development phase in a system lifecycle [8]

Likewise, Fig. 4 is the stage of the system implementation as the results of engineering developments. Two processes blocks are there: production stage and operation and support stage, which the production stage handles system production specifications and production systems by relating production and deployment to organize appropriate training and engineering assistance.

C. Systems Engineering Method

To complete the systems engineering lifecycle, [8] explicated the method of the systems engineering, which vertically analyzes each stage of the systems engineering lifecycle, and whereas the lifecycle horizontally falls apart the stage as follows [8]:

1. A number of requirements are analyzed to adjust them into the system. Consequently, all prerequisites and requirements should become materials to be considered.
2. All functional aspects are defined to be valuable functions in articulating the system by transforming and segregating the requirements into functional diagram blocks.
3. All physical aspects are defined to follow up the previous function definition. Also, harmonizing the system is to provide the system stable, while performance, threat, budget, and timetable are within the criteria.
4. The model design is validated to reflect all significant characteristics of the requirements and constraints in the reality logically, mathematically, or physically.

III. Research Methodology

Intrinsically, the research methodology regards to the systems engineering disclosure processes presented by [8] and [12], which are then packaged in the quasi-six sigma philosophy [9] as follows:

A. Defining the Problem

The principal problem of this research is to accomplish the need of valuable performances of the IT-based business organization to sustain competitive advantages at IT optimum costs. Since this problem includes various factors, for example, functional subsystems of RBV perspectives, financial systems, competitive forces, business performances, risk management, resource management, and so forth. Hence, to solve this problem needs systems engineering approach incorporating various components into a unity cracking the desirable values.

B. Generating, Evaluating, and Selecting Alternative Solutions

Several alternative solutions could be a means to unravel the problem such as increasing the firm performances while the IT capital is constant, improving the IT competency and capability of the organization, and cost optimization by encouraging innovation, restructuring, IT cost saving/ efficiency, and effective IT procurement. Certainly, each alternative possibly retains advantages and disadvantages, thus, the favored solution might be an arrangement of all alternatives.

C. Detailing Design

As stated by [8], the systems engineering lifecycle stages and the systems engineering methods are mutual, in which for each engineering stage of a horizontal nature, will be investigated using these engineering methods vertically. This pace is performed for the concept development and the engineering development stages, including each block of the stages. In the meantime, the post-development stage is not reviewed here.

D. Developing and Validating the Model

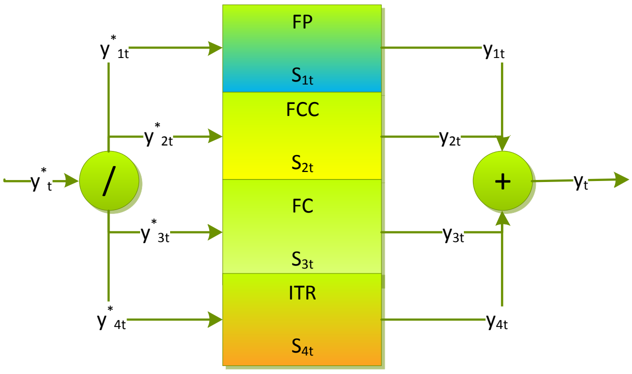

Fig. 5. Four subsystems of the IT value engineering model in a parallel relationship

Furthermore, as the result of C point above, the systems engineering of the information technology value engineering methodology can be represented as a model in Fig. 5, which depicts that the central subsystems consist of firm performance (FP), firm core competence (FCC), firm capability (FC), and IT resource (ITR). Each subsystem is bonded in a parallel fashion, in which the parallel connection mathematically exemplifies an add operation. Thus, it requires that the input (y^*_t) should be divided into four sub-inputs, i.e. y^*_{1t}, y^*_{2t}, y^*_{3t}, and y^*_{4t} or $y^*_t = y^*_{1t} + y^*_{2t} + y^*_{3t} + y^*_{4t}$. Likewise, each subsystem has each speed of adjustment (S_{it}, i = 1,2,3,4 and t = period) [13], i.e. FP takes S_{1t}, FCC takes S_{2t}, FC takes S_{3t}, and ITR takes S_{4t}. Additionally, the speed of adjustment may be static or dynamic behavior [13]. Likewise, the output may contain four sub outputs, i.e. y_{1t}, y_{2t}, y_{3t}, and y_{4t}. Accordingly, it can be written down as $y_t = y_{1t} + y_{2t} + y_{3t} + y_{4t}$.

With the partial adjustment valuation approach [13], each subsystem could be mathematically manifested as follows (see Fig. 5):

Firm Performance (FP):

$$y_{1_t} - y_{1_{t-1}} = S_{1_t}(y^*_{1_t} - y_{1_{t-1}}) \tag{1}$$

$$y_{1_t} = S_{1_t} y^*_{1_t} + (1 - S_{1_t}) y_{1_{t-1}} \tag{2}$$

Firm Core Competence (FCC):

$$y_{2_t} - y_{2_{t-1}} = S_{2_t}(y^*_{2_t} - y_{2_{t-1}}) \tag{3}$$

$$y_{2_t} = S_{2_t} y^*_{2_t} + (1 - S_{2_t}) y_{2_{t-1}} \tag{4}$$

Firm Capability (FC):

$$y_{3_t} - y_{3_{t-1}} = S_{3_t}(y^*_{3_t} - y_{3_{t-1}}) \tag{5}$$

$$y_{3_t} = S_{3_t} y^*_{3_t} + (1 - S_{3_t}) y_{3_{t-1}} \tag{6}$$

IT Resource (ITR):

$$y_{4_t} - y_{4_{t-1}} = S_{4_t}(y^*_{4_t} - y_{4_{t-1}}) \tag{7}$$

$$y_{4_t} = S_{4_t} y^*_{4_t} + (1 - S_{4_t}) y_{4_{t-1}} \tag{8}$$

If eq. (2), eq. (4), eq. (6), and eq. (8) are totaled together would result in eq. (9):

$$y_t = S_{1_t} y^*_{1_t} + (1-S_{1_t}) y_{1_{t-1}} + S_{2_t} y^*_{2_t} + (1-S_{2_t}) y_{2_{t-1}} + S_{3_t} y^*_{3_t} + (1-S_{3_t}) y_{3_{t-1}} + S_{4_t} y^*_{4_t} + (1-S_{4_t}) y_{4_{t-1}} \quad (9)$$

Where y_t = the real output at period t, y_{1t} = the real output of FP at period t, y^*_{1t} = the desired output (input) of FP, y_{1t-1} = the real output of the previous period (t-1), and S_{1t} = the speed of adjustment of FP at period t. Similarly, y_{2t} = the real output of FCC at period t, y^*_{2t} = the desired output (input) of FCC at period t, y_{2t-1} = the real output of the previous period (t-1), and S_{2t} = the speed of adjustment of FCC at period t. Then, y_{3t} = the real output of FC at period t, y^*_{3t} = the desired output (input) of FC at period t, y_{3t-1} = the real output of the previous period (t-1), and S_{3t} = the speed of adjustment of FC at period t. Finally, y_{4t} = the real output of ITR at period t, y^*_{4t} = the desired output (input) of ITR period t, y_{4t-1} = the real output of the prior period (t-1), and S_{4t} = the speed of adjustment of ITR at period t.

Furthermore, the model as in Fig. 5 will be assessed by the real data of PT. Telekomunikasi Indonesia, Tbk. (Telkom), which is the biggest Information and Communication Technology (ICT) provider in Indonesia that is also as an IT-based firm. Additionally, Telkom has been listed on the Indonesia Stock Exchange (IDX) and the New York Stock Exchange (NYSE). Furthermore, the procedure and outcome of the model assessment will be exhibited in the discussion below.

IV. Discussion of The Result of The Systems Engineering Process

A. *The IT Value Engineering Model*

In short, the systems engineering procedures result in the IT value engineering methodology model as comprehended in Fig. 6, which is required to resolve the problem, namely to improve the level of competitive advantage in IT-based firms with lower IT spending. The input of the system is the desired output (also see Fig. 5): the desired revenue (y^*_t) at period t. This input (y^*_t) will be subsequently distributed into four subsystems, namely firm performance (FP), firm core competence (FCC), firm capability (FC), and IT resource (ITR).

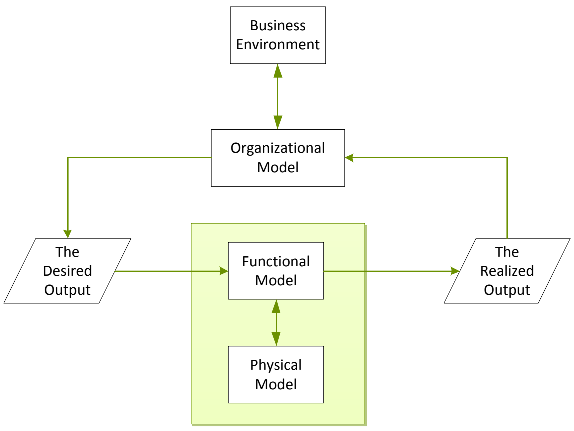

Fig. 6. System engineering of IT value engineering methodology model

The model intends to counter the IT needs-based system, namely a competitive performance with IT costs as low as possible. Accordingly, the model in Fig. 6 shows a complex systems engineering in order to meet the need, in which the model also respects the business environment enforcing the system effectively and efficiently works. In addition, the business environments are inspirations to organize the business to face competitiveness and business turbulences. Also, the system operates feedback systems in order to recover the performance, whereas the system can work at the optimum cost. The feedback players are grouped on the organizational models, see Fig. 6, as the advantage recipients of the system, who may be on the strategic levels, such as senior managers, on the tactical levels of the firm, such as middle managers, etc. They have carried out firm's mission with the intention that they desired effective and efficient management of the core competency of the firm, and so forth

Conversely, the system also has to deal with risks such as business risks, interface risks, data risks, and so forth. The risk assessment should be a thought of carefulness in controlling the business in order for the planned goals to be managed smoothly achieved. It appears that the model proposes a complete perspective in the undertaking value creation of the IT value engineering.

B. *Validation Results of the Model*

The model validation is viewed from two types: the first is the validation of the IT value engineering model, and the second is the validation of the rational relationship among the subsystems by applying the partial adjustment valuation to optimize the model, including the Cobb Douglass-based production function. Categorically, the first validation is, as mentioned in the justification above, namely that the resulting models have a parallel fashion among subsystems.

Table 1. Estimation results of parallel relationships of functional subsystems of IT value engineering methodology model, compared with Telkom's data (in billion Rupiah)

Period	Telkom revenue	Parallel estimation	Parallel difference
2004	33,948	34,570	622
2005	41,807	41,935	128
2006	51,294	50,330	(964)
2007	59,440	57,957	(1,483)
2008	60,689	60,764	75
2009	64,597	64,047	(550)
2010	68,629	66,837	(1,792)
2011	71,253	72,079	826
2012	77,143	77,035	(108)
2013	82,967	82,374	(593)
2014	89,696	87,217	(2,479)

Furthermore, by using the data of Telkom during 2004 to 2014, the first validation is mathematically tested through a sequence of the partial adjustment estimation as seen in eq. (1) to eq. (8). The equation should be estimated in a non-linear least square application using SPSS 22, which seems that for the parallel fashions, it has generated substantial speed of adjustment (S_{it}, i = 1,2,3,4 and t = period) = 0.571 (also assumed for this validation, the scale of the S_{it} has been static further). As for other parameter magnitudes, due to space restrictions, the numbers are not exposed in this paper. Likewise, it is assumed that the capital allocations are assumed as follows: 30 % for FP, 10 % for FCC, 25 % for FC, and 35 % for ITR.

For that reason, the figures in Table 1 demonstrate the estimation results accomplished by eq. (9). It gives the impression that the results of the parallel estimation are close by to the real data of Telkom (see Table 1). Thus, the parallel fashion could be applicable and acceptable in creating the model.

Moreover, the second validation substantively tests the major problem, namely to stimulate superior business performances at optimum costs, whereas the model is referred to as the parallel model as in Fig. 6 above. Certainly, several assumptions are developed regarding the validation, for example, the Cobb-Douglas production function [13] is applied to each the desired output (the starred y^*_{it}, i = 1, 2, 3, 4) of subsystems. The Cobb-Douglass function is like this:

$$y_t^* = \alpha K_t^{\beta_1} L_t^{\beta_2} I_t^{\beta_3} \qquad (t = 1, 2, ..., n) \tag{10}$$

Whereas y^*_t = the desired output, K_t = the regular capital, L_t = the labor expense, I_t = the IT capital, α = total factor productivity, and β_1, β_2, β_3 = the output elasticities of regular capital, labor expense and, IT capital respectively. Thus, the partial adjustment for each subsystem will become as follows:

$$y_t = S_t\, y_t^* + (1 - S_t)\, y_{t-1} = S_t\, \alpha\, K_t^{\beta_1}\, L_t^{\beta_2}\, I_t^{\beta_3} + (1 - S_t)\, y_{t-1} \tag{11}$$

Moreover, in order to optimize the cost, the partial derivatives of eq. (11) should justify these conditions [7], [4]:

$$\frac{\partial y_t}{\partial K_t} = 0, \quad \frac{\partial y_t}{\partial L_t} = 0, \quad \frac{\partial y_t}{\partial I_t} = 0 \tag{12}$$

Moreover if the eq. (10), (11), and (12) are manipulated, it will result in the subsequent equation as the total cost of yielding y units in the low-cost likely technique is as the eq. (13) and (14).

$$\begin{aligned} C(p_1, p_2, p_3, y_t) &= p_1 K + p_2 L + p_3 I \\ &= B\ p_1^{\frac{\beta_1}{(\beta_1+\beta_2+\beta_3)}}\, p_2^{\frac{\beta_2}{(\beta_1+\beta_2+\beta_3)}}\, p_3^{\frac{\beta_3}{(\beta_1+\beta_2+\beta_3)}} \\ &\quad \left[y_t - (1 - S_t) y_{t-1}\right]^{\frac{1}{(\beta_1+\beta_2+\beta_3)}} \end{aligned} \tag{13}$$

Where B:

$$\begin{aligned} B = S_t^{\frac{-1}{(\beta_1+\beta_2+\beta_3)}} \alpha^{\frac{-1}{(\beta_1+\beta_2+\beta_3)}} \Bigg[&\left(\frac{\beta_1}{\beta_2}\right)^{\frac{\beta_2}{(\beta_1+\beta_2+\beta_3)}} \left(\frac{\beta_1}{\beta_3}\right)^{\frac{\beta_3}{(\beta_1+\beta_2+\beta_3)}} \\ &+ \left(\frac{\beta_2}{\beta_1}\right)^{\frac{\beta_1}{(\beta_1+\beta_2+\beta_3)}} \left(\frac{\beta_2}{\beta_3}\right)^{\frac{\beta_3}{(\beta_1+\beta_2+\beta_3)}} \\ &+ \left(\frac{\beta_3}{\beta_1}\right)^{\frac{\beta_1}{(\beta_1+\beta_2+\beta_3)}} \left(\frac{\beta_3}{\beta_2}\right)^{\frac{\beta_2}{(\beta_1+\beta_2+\beta_3)}} \Bigg] \end{aligned} \tag{14}$$

Whereas p_1, p_2, and p_3 are unit prices of the regular capital (K_t), the labor expense (L_t), and the IT capital (I_t) respectively, y_t is the real output of period t, y_{t-1} is the real output of previous period t-1, and C is the total cost. The second assumption is the capital and revenue allocations in the parallel fashion are as follows: 30 % for FP, 10 % for FCC, 25 % for FC, and 35 % for ITR. This allocation, including the capital and revenue, is in order to grasp parameter estimates.

Additionally, in line with the non-linear least square estimation using SPSS 22, the output elasticity coefficients are equivalent for each subsystem, namely $\beta_1 = 0.328$, $\beta_2 = 0.326$, and $\beta_3 = 0.116$. As for the total factor productivity coefficient is dissimilar for each, namely $\alpha_{FP} = 29.938$, $\alpha_{FCC} = 22.453$, $\alpha_{FC} = 27.712$, and $\alpha_{ITR} = 28.897$. Furthermore, the third assumption is that p_1, p_2, and p_3 are equivalent, namely 1 unit. Consequently, by employing the eq. (13) and the eq. (14), Table 2 is the result of the estimation process demonstrating the cost minimization for Telkom revenue during 2004 to 2014.

Table 1. Cost minimization of Telkom's revenues

Year	Telkom's data (billion Rp)		Capital estimation using the eq. (13) (billion Rp)					Capital-saving	
	Revenue	Invested Capital	FP	FCC	FC	ITR	Total	(billion Rp)	%
2004	33,948	34,744	6,414	2,237	5,596	8,204	22,450	12,294	35.4
2005	41,807	37,025	8,311	2,899	7,251	10,630	29,091	7,934	21.4
2006	51,294	43,681	10,811	3,771	9,432	13,828	37,843	5,838	13.4
2007	59,440	49,798	12,557	4,380	10,956	16,062	43,955	5,843	11.7
2008	60,689	54,655	11,588	4,042	10,110	14,822	40,562	14,093	25.8
2009	64,597	61,229	13,050	4,552	11,386	16,692	45,680	15,549	25.4
2010	68,629	66,434	14,095	4,917	12,297	18,028	49,337	17,097	25.7
2011	71,253	65,381	14,496	5,057	12,647	18,542	50,742	14,639	22.4
2012	77,143	70,816	16,677	5,818	14,550	21,331	58,375	12,441	17.6
2013	82,967	80,798	18,226	6,358	15,901	23,313	63,798	17,000	21.0
2014	89,696	91,259	20,259	7,067	17,675	25,913	70,914	20,345	22.3

It performs that Table 2 discloses each capital for each subsystem (FP, FCC, FC, and ITR) estimated by the eq. (13) and (14). Meanwhile, the revenue in accordance with the estimation interests, each subsystem collects an allocation of revenue as stated above that should be equivalent to the Telkom total revenue as in the second column of Table 2. The capital estimation aims to seek the minimum cost for the realized revenue as seen in the second column of Table 2, in this case in Telkom. While the realized capital is as seen in the third column of Table 2. If the realized capital is compared with the estimated capital, it will be the difference as shown in the last column of Table 2, which is 22.01 % in average as capital saving. Hence, there will be significant capital savings, however, by making an allowance for, monitoring risk influences, and maintaining the business environments.

V. CONCLUSION

This paper theoretically begins with creating the IT value model using Resource-Based View theory. For the model, the Partial Adjustment Valuation theory becomes a reference in assembling logical relationship between inputs and outputs. Meanwhile, this paper aims to create engineering work in terms of the engineering of IT value model.

In addition, the central problem of this research is to research the optimum resources, e.g., IT resource cost, for required business performances. This problem is solved by the systems engineering approach through the engineering design process to result in IT value engineering model. Previously, the methodology applies two dimensions of the point of views: horizontal and vertical. The horizontal dimension addresses systems engineering lifecycle phases while the vertical dimension explicates systems engineering method. The two-dimension analysis results in tables as seen in appendices.

Furthermore, using the analysis results, a synthesized composition is performed to constitute a block diagram, which describes a model in terms of the systems engineering of IT value engineering methodology. Hence, it results in two types of model structures: serial and parallel fashions. Likewise, by benefiting Cobb-Douglas production function involved within the Partial Adjustment Valuation, the cost optimum of the firm required performances could be completed. For that reason, it should be an experiment such as a simulation about work mechanisms of the systems. Accordingly, the simulation tried

Telkom's data during 2004 to 2014, which the results demonstrated two significant conclusions: the IT value engineering methodology model will be accepted by parallel fashions in connecting its subsystems, and the second that the model could facilitate cost minimization.

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