

# Valuation Methodology of Information Technology (IT) Value in the IT-based Business

## A Case Study at a Leading Telecommunication Company

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*Abstract:* This study aims to propose measuring the IT value, which is still in a lengthy discussion because concrete solutions have not existed to explicate it. Therefore, this study tries to present a sequence of methods to assess this value through both qualitative and quantitative methods. The presented methodology addresses the IT valuation by means of the IT value definition approach as a result of the division between the IT functions and the IT costs, which is achieved by analyzing functions and costs previously, consecutively, results in the intrinsic IT value. Additionally, this value at that point works together with the business environment, i.e. the Business Model Canvas so it brings up a new added value entitled an extrinsic IT value. Thus, the entire IT value manifests as the product of these two values. Furthermore, Telkom data appear to examine this valuation methodology, where the results show that an alignment appears between the presented valuation methodology and the case study, although it still needs a number of improvements. Based on this valuation methodology, the IT value engineering concept can be optimistic to continue research at the subsequent time.

*Keywords:* valuation, IT value, methodology, business environment, intrinsic value, extrinsic value.

### 1. Introduction

Business organizations have massively depended on information technology (IT) as a business enabler and transformer. Accordingly, IT has become an interesting object to study, especially to argue against an IT productivity paradox topic in research fields to quantify its value compared with its investment. Meanwhile, in practice, IT has delivered numerous advantages to the organization such that almost no commercial organizations without involving IT in its operations. This perspective is consistent with the fact that worldwide IT spending always grows over time as shown by the Gartner survey [8].

This paper aims to study a valuation methodology to estimate the IT value, which originates from the IT utilization within a business organization as a combination of assets, capabilities, environment interactions so that results in a productive use of IT [7]. Also, this relates to that IT does not create business values in an isolated environment, but needs combining with other internal organizational factors [6]. Thus, the IT value comprises a variety point of views from internal and external factors, in which IT has been a strategic factor of the organization [6], [20].

Therefore, this study tries investigating a solution to estimate the IT value resulted from both the IT inclusion as an intrinsic value and the IT environment as an extrinsic value. Moreover, both the intrinsic and the extrinsic values work together to produce the IT value, which manifests in a currency or other forms. For that reason, the intrinsic value is derived from the value implied in the IT as a result of a division of the IT function by its cost. Meanwhile, the extrinsic value is a consequence of organization of the intrinsic IT value managed in the business environment. Likewise, if the intrinsic IT value is properly aligned with the business organization, the resulted value can be extraordinary because it is a

multiplication of the intrinsic and the extrinsic values. On the contrary, if the alignment of IT and the business is corrupt, the entire values can be corrupt as well. In essence, this methodology rests on the value engineering methodologies [9].

Furthermore, this study applies the methodology to a case study conducted at PT. Telekomunikasi Indonesia, Tbk. (Telkom) as the largest and leading Information and Communication Technology (ICT) provider in Indonesia. The functions of Telkom's IT services are based on eTOM (enhanced Telecom Operation Map) business process framework [25],[30]. The result shows that the value of IT within the organization has significant roles, both the intrinsic and the extrinsic values are intertwined, also, depending upon tune of the top and the corporate culture.

Correspondingly, this paper is a follow-up study of previous studies which have been carried out by [1] and [2], which focused on IT value engineering studies. Additionally, those papers had related to previous papers proposed by [13][21] and [21] addressing the relationship between IT and business performance. Particularly, this paper is a revised and expanded version of a paper as in [3] and an attempt implementation of the ideas written on [9]. On the contrary, this paper is outside of past studies such as Strassmann (1997) who argued that there was no apparent relationship between IT spending and any measures of organization profitabilities, such as return on asset, return on equity, and economic value added [4].

Furthermore, the principal contributions of this study are subsequent:

- 1) This study essentially adopts the methodology based on [9], however, this methodology is only partly to measure the intrinsic IT value. Furthermore, the extrinsic IT valuation methodology employs methods developed by an ontology approach, see the Equations (15) to (19), and borrow the Business Model Canvas's logic [15], [16] to be adopted as the IT business context. In other words, the study offers a comprehensive IT valuation methodology as a major contribution, from inner and outer point of views (see Figure 2).
- 2) This study proposes a value engineering-based methodology, which has not been used in previous studies to measure the IT value at least on the references of this study. For example, methods of research [13], [14], and [21] have used a statistical approach, such the structural equation modeling, for a quantitative matter.
- 3) This study results in the valuation methodology of IT value, which is not only to refashion the patterns of relationships between the IT cost and the firm performance in a different way but also to result in the concrete calculation of the IT cost and the firm performance. This is in contrast to the study conducted by [21], which outlined how the testing IT resources and capabilities affect firm performance. Similarly, in a study of [13] and [14], which put more emphasis on testing whether information technology and organizational resources have a significant effect on firm performance.

The remainder of the paper presents the topic as follows. Section two addresses literature reviews, discussing the value definition, IT value creation and its model, which refers to the Resource-Based View, the value engineering, and the Business Model Canvas. Section three discusses a research methodology that bases this study. Section four is a case study performed for PT. Telekomunikasi Indonesia, Tbk. (Telkom). Section five is a discussion and a recommendation. The last is section six, which is concluding all.

## **2. Literature Review**

### **A. Value Definition**

A value refers to usefulness, worth, benefit, etc., which reveals if the interaction among two or more systems or subsystems occurs. A 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 occurs due to a force that drives the systems to work, in which the force reveals as a usefulness, a worth, a benefit, and the like. In other words, this understanding helps to accomplish the stage of a value creation by benefiting system processes.

Consequently, 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 ensued value obtained from an accomplishment, and the perceived value is what consumer relatively perceives [14]. 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. Afterward, the cost value, i.e. the all cost values dedicated to result in the item; the esteem value, i.e. the value of additional costs to pay the additional items as well; and the exchange value, i.e. the value of an item to change something else [28], [29].

As a fundamental nature of a value definition of this study, the definition in the Equation (1) is a basic concept to engineering the value. This equation technically formulates a value (V) as an expression of a division of function (F) by cost (C) as proposed by [10] as follows:

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

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*

In order to optimally produce values, IT systems should perform to support the business processes, which represent system functions to operate the business and deliver advantages to the stakeholders, such as customers and shareholders. Meanwhile, these functions describe cost centers of infrastructures, which should run these business processes. Obviously, the infrastructures consist of the IT infrastructure, although its capacity depends on types of organizations. In other words, this reason relates to the Equation (1) above, whereas a value is equivalent to a division of functions by costs. Accordingly, the IT value creation can occur if the value itself is worth for the stakeholders to invest the infrastructures in operating the organization functions.

Moreover, the IT value can result from a complex system that consists of various subsystems, components, subcomponents, and parts. Several subsystems may be a moment in time, shareholders, individual attributes, assignment impacts, external relationships, and management. As measuring the IT value, it is important to think about measurements that should concentrate on [27]. Likewise, performing the IT valuation involves complex issues including social accomplishment so it requires over a period of time. Thus, the IT infrastructures and the organizational factors should operate in a synergistic fashion, in which these factors are parts of the IT-based system as well. The IT-based system, as well as the organization, contains IT and non-IT human resources, IT management skills, procedures and policies, information benefits, affiliation benefits, way of life, and rules.

### *C. IT Value Creation Model: Resource-Based View*

Liang et al. (2010) stated that resource-based view (RBV) theory is the major theory adopted to comprehend the relationship between IT and firm performance. The theory was firstly proposed by Wernerfelt (1984), who argued that to achieve a competitive advantage, a firm has to possess valuable and rare resources [13]. Meanwhile, Barney (1991) categorized resources as physical capital, human capital and organizational capital [7]. Further, Barney characterized resources as strategically significant to pursue firm's competitive advantages if they are: 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 due to imperfectly imitable; and non-substitutable, no other resources can replace the original resource [17].

Moreover, valuable IT resources are consecutively able to provide a firm with their capability to sustain a competitive advantage. Therefore, Ravichandran and Lertwongsatien (2005) argued that between firm's IT resources and capabilities own constructive relationships [12], so it leads to comprehending the IT capability, which exists as "the ability to mobilize and deploy IT-based resources in combination or co-present with other resources and capabilities" [4] on one hand. On the other hand, Bharadwaj (2000) mentioned that a firm's IT capability draws from fundamental strengths in IT infrastructure, human IT resources, and IT-enabled intangibles. The IT infrastructure helps the firm launch innovative applications faster than the competitor does. While the human IT resources play to conceive of and implement such applications faster than the competitor implements. Likewise, the IT-enabled intangibles allow the firm to leverage pre-existing organizational intangibles, such as customer orientation and synergy within the firm [4].

#### *D. IT Value Engineering*

As mentioned above, the IT value contains a variety of viewpoints, whereas between academics and practitioners, as well as between IT managers and IT professionals, have different comprehensions [23][27]. The researchers and practitioners believe that the IT role has matured in driving operational and strategic business to improve sustainable competitive advantages. While IT managers and professionals concentrate on providing infrastructure for informing to include not only work processes but the group dynamics issues of collaboration so that IT can ultimately develop value technology.

Meanwhile, engineering semantically pertains to an engine paradigm to solve a problem. In practice, an engine moves in a self-perpetuating condition resulted from locking readily available forces against each other in a stable cyclic (closed-loop) fashion [11]. Furthermore, about a value engineering concept, Tohidi (2011) stated that its idea is to employ the project, augment accomplishment, and diminish costs in all life cycles of the project. In this case, the lifetime value of engineering project with the productivity increment can join to result in the project value, i.e. the output is divided by input. Hence, the implementation of the value engineering is boiling down on the performance improvement [26]. Additionally, he mentioned that the value engineering is constantly dealing with the growth of technology, reducing the unnecessary costs that do not relate to improving the quality of products or services. On the contrary, in the value engineering, the usage of knowledge, the recognition of problems, the methodology of problem solving, the development of creative solutions could combine with comprehensive approaches [26].

Furthermore, Sharma (2012) added that the value engineering is a structured method to investigate the function of systems and its completeness in dealing with the accomplishment of systems fundamental functions at the lowest cost. However, on the other hand, the functions of systems consistently keep up a better performance, trustworthiness, quality, and security [24]. In other words, the value engineering is a structured study of functions to assure the user's needs with a quality outcome at the lowest life cycle cost by means of applying creativities. Accordingly, the value engineering helps organizations compete extra effectively by decreasing costs, increasing profits, improving quality, solving problems, saving time, using resources more effectively, etc.

In terms of the IT value, the IT generally boils down to effectiveness and efficiency of processes, including achieving the best organization performance. Thus, IT should disseminate value-added advantages through a strategic alignment with the whole organizations. Hence, the IT value engineering is a structured study of the IT functions to deliver advantageous business performance at the lowest costs by means of engineering IT and business parameters within a business environment.

*E. Business Model Canvas: IT Value Engineering Environment*

Using an ontological approach, Osterwalder (2004) defined a business model as “a conceptual tool that contains a set of elements and their relationships and allows expressing a company’s logic of earning money. It is a description of the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitably and sustainable revenue streams” [15].

In order to explore for further research, the IT value conceptual model should work together with a business model, which describes what an organization does and how it can make money [5]. However, in this study, the business model is a means where the IT value conceptual model can work with. For that reason, to deal with the business model, the business model canvas (BMC) turns out to be an IT value engineering environment because it describes, challenges, designs, and invents business models more systematically. In addition, there are nine building blocks making up the model; namely customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partners, and cost structures [15].

The explanation of each block is as follows:

1. Customer Segments define groups of people or organizations, where the business aims to reach and serve. The customer segments are those who have needs to justify a distinct offering through different distribution channels, require different types of relationships, have different levels of profitability, and interest in a subset of the value proposition.
2. Value Propositions describe bundles of products or services that create value for a specific customer segment, value delivered to the customer (benefit/cost), customer problem being solved, customer needs being satisfied, and value propositions assigned to customer segments.
3. Channels describe how a firm communicates with and reaches its customer segments to deliver a value proposition. Their functions are raising awareness among customers about firm’s products and services, helping customers evaluate a firm’s value proposition, allowing customers to purchase specific products and services, delivering a value proposition to customers, and providing post-purchase customer support.
4. Customer Relationships describe the types of relationships a firm establishes with specific customer segments. This is necessary to perform in terms of customer acquisitions, customer retentions, and boosting sales (upselling), in which their contact could be personal or automated.
5. Revenue Streams are the cash a firm generates from each customer segment and represents the customer segment’s quantification of the value proposition.
6. Key Resources describe the most important assets required to make a business model work and allow an enterprise to create and offer a value proposition, reach markets, maintain relationships with customer segments and earn revenues.
7. Key Activities describe the most imperative things a firm must do to make sure its business model work.
8. Key Partners describe the network of suppliers and partners that make sure the business model works to obtain an optimization and an economy of scale, reduction of risk and uncertainty, and acquisition of particular resources and activities.
9. Cost Structure describes all costs incurred to operate a business model, cost-driven business models focus on minimizing costs whenever possible, and value-driven business models are less concerned about cost, focusing instead on value creation [5], [15], [16].

**3. Research Methodology**

*A. Research Scheme*

In order to achieve the purpose of this research, the scheme of research roadmap is as follows on Figure 1:

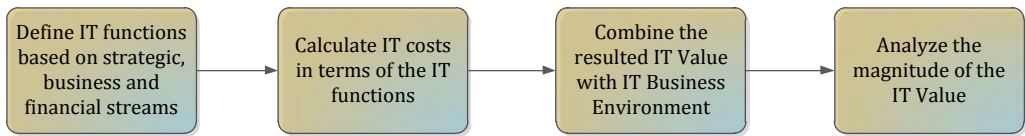


Figure 1. Research scheme of IT valuation

As a continuation of the past researchers, this study starts up from the IT value definition, which stems from the Equation (1) that the value is a division of IT functions by its costs. Furthermore, the IT functions consist of the following three categories: strategic, business, and financial streams [22]. In addition, the IT value also comes from IT resources that completely have the capability to improve the performance of the organization [21]. Moreover, the IT value should come together with the business environment, which the total IT value ultimately reveals as a joint value of the complete business.

*B. IT Value Function*

Based on the research scheme above, the IT valuation originates from the IT functions containing the following three streams [22]:

- Strategic streams, whereas the IT spending has tight alignments to the business organization to strategically improve the organizational performance. In other words, the streams relate to the high-level business processes.
- Business streams, which are the result of the resource allocation and execution to the business processes within the organization. Therefore, IT is a basis to retain and raise the organizational performance indirectly by enabling the business operations.
- Financial streams, which directly depict the organizational performance reflecting the invested IT spending to the organization.

*C. Determination of IT Functions*

Table 1. List of functions of IT

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

In order to verify the IT functions, previously it appears as seen in Table 1, whereas  $f_1, \dots, f_a$ , etc. are samples of the detailed functions [9]. Hence, as mentioned above, the IT functions consist of three streams: strategic, business, and financial streams. Furthermore, 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 are the improvement of the

fundamental ones; and the superior functions are advanced IT roles, which contribute the highest values to the business. Additionally, each level has detailed functions, which have the serial number of the appropriate number of functions. For example, according to Table 1, the fundamental functions of the strategic stream have  $a$  detailed functions, i.e.  $f_1$  to  $f_a$ . The enhanced functions have  $(b-a)$  detailed functions, i.e.  $f_{(a+1)}$  to  $f_b$ . Likewise, the superior functions have  $(c-b)$  detailed functions, i.e.  $f_{(b+1)}$  to  $f_c$ . So do the streams of business and finance, in which this function analysis results in an index unit of the function parameter.

In addition, the serial number is just as sequencing to determine the estimation priority. In this case, the priority order starts from the strategic to the financial stream. Similarly, the order level starts from the fundamental then ends on the superior level.

In order to measure the IT functions in a quantification fashion, it conducts through such steps [9]:

1. Determine the index of the Scale of Strategy (SS), the Scale of Business (SB), and the Scale of Finance (SF).
2. Calculate these indexes based on an arithmetic manipulation as follows:

As  $i =$  indicates the  $i$ th 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, to formulate the index of the Scale of Strategy (SS) (see Table 1) is as follows:

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

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

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

With the similar step, the index of the Scale of Business (SB) manifests as follows (see Table 1):

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

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

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

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

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

$$MF = \sum_{i=1}^m P_i \tag{9}$$

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

Furthermore, the Function Parameter (F) is an average of the scales of strategic, business, and financial streams. In here [9] suggests adding a performance effectiveness factor ( $e_j$ ) as correction factors to each scale of the stream. Thus, the F and  $e_j$  can appear as seen in Equations (11) and (12) below:

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

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

Where as  $e_j$  = the performance effectiveness factor of the  $j^{\text{th}}$  ( $j = 1$  to 3 in this study) stream of functions. This factor performs based on completeness of the IT functions of each stream in the implementation in the field. It means that the more complete functions in the implementation, the more effective the performance of the functions, therefore, the F looks as an index unit.

*D. IT Cost Calculation*

Table 2. Cost parameter components

Cost Category	Cost Components
1. Capital Expenditure (CE)	CE <sub>1</sub>
	.....
	CE <sub>n</sub>
2. Operational Expenditure (OE)	OE <sub>1</sub>
	.....
	OE <sub>m</sub>

In order to assess the IT costs, the Life-Cycle Cost Analysis (LCCA) technique provides us with the comprehensive calculation of costs. The LCCA is an elemental outline process in terms of the scheming of the preliminary and the forthcoming cost of a project. The LCCA is useful to estimate at any kind of the project scheme as an effective tool to assess the capital and operational expenditure [19]. Therefore, to assess the IT cost firstly is to classify the cost sources into two large categories: capital and operational expenditure. Moreover, each

category should be broken down into in depth cost components. For example, the capital expenditure comprises design, construction, installation costs, etc. While, the operational expenditure consists of operation, labor, maintenance costs, etc. Further, Table 2 shows a comprehensive cost component scheme, which the capital expenditure involves  $CE_1$  to  $CE_n$ , and the operational expenditure contains  $OE_1$  to  $OE_m$ .

According to [9], the cost component estimate can go through the following steps (see table 2):

- 1). Determination of formulation variables, such as:
  - a.  $CE = CE_1 + \dots + CE_n$  where  $CE_1, \dots, CE_n$  are the cost increases for CE components respectively
  - b.  $OE_t = OE_{1t} + \dots + OE_{mt}$  where  $OE_t$  is operational expenditure at the end of the  $t^{\text{th}}$  year. Likewise,  $OE_{1t}, \dots, OE_{mt}$  are the cost increases for operational expenditure respectively at the end of the  $t^{\text{th}}$  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 is equivalent to a weighted average cost of capital)
  - e.  $t$  = the year of the cash flow
  - f.  $N$  = the specified length of economic life of the 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 rest on owner estimates, planning of budgets, budget realizations in last years, etc.
  - h.  $C$  = Cost Parameter

- 2). Formulation of the cost parameter.

As recommended by [9],  $OE_t$  represents the operational expenditure at the end of the  $t^{\text{th}}$  year. However, this scale converts to the value at the start of the 1<sup>st</sup> year with the discount rate  $i$  and the economic life length  $N$ . In other words, the net present value estimates  $OE_t$  [9][19] as follows:

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

$$C = \begin{cases} 1 & , 0 < C_r < m \\ \frac{C_r - m}{M - m} & , m \leq C_r < M \\ 1 & , C_r \geq M \end{cases} \tag{14}$$

As appear in the Equation (14), the  $C$  parameter is in the range 0 and 1, which 1 is the highest index of the cost parameter. Thus, based on the Equation (1), the value index equals to the Equation (11) divided by the Equation (14), in which the resulted value is at the three situations. Firstly,  $V = 1$  means that the function is identical to the cost, hence, the added value is normal; secondly,  $V < 1$ , depicting that the function is less than the cost, which sequentially endangers the business competitive advantage; and thirdly,  $V > 1$ , where is the best value addressing the highest efficiency of the organizational management. Additionally, because this value comes from the inner power as the built-in IT value, afterward, its term is the intrinsic IT value.

#### *E. IT Value and its Business Environment*

As declared by [6], IT cannot work in an isolation environment, hence, it is appropriate if the IT value blends together with the further values originated from the interaction with the business context. For this reason, the BMC could be a business environment to facilitate a business context of the IT value. The BMC consists of nine building blocks, which are

customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partners, and cost structures [15], [16]. The last four blocks, i.e. key resources, key activities, key partners, and cost structure can make up the inner power of IT resources as the intrinsic value as seen in Figure 2. Accordingly, they are part of those blocks arranging the function parameters represented by the key activities and the cost parameters represented by the cost structure (see the Equation (1)) that each of them is also strengthened by the key partners and the key resources on one hand.

On the other hand, the first five blocks of the BMC, i.e. customer segments, value propositions, channels, customer relationships, and revenue streams act on behalf of the external business environment of the IT value. Those blocks work as business drivers so that the intrinsic IT value may be superior to before due to the reinforcement of those blocks. However, the opposite result can also happen, which the intrinsic IT value lessens because of unhealthy management of the business drivers. In this case, the customer segments are the first driver to develop the business context, whereas the other three blocks (value propositions, channels, and customer relationships) are managerial facilities to reinforce the intrinsic IT value so it can deliver extra other values. Meanwhile, the revenue stream is the front of the business performance in a financial perspective to measure the business. Accordingly, the resulted value due to this consequence is entitled as extrinsic IT value. Therefore, the total value is a multiplication of the intrinsic and the extrinsic values, as figured out in Figure 2.

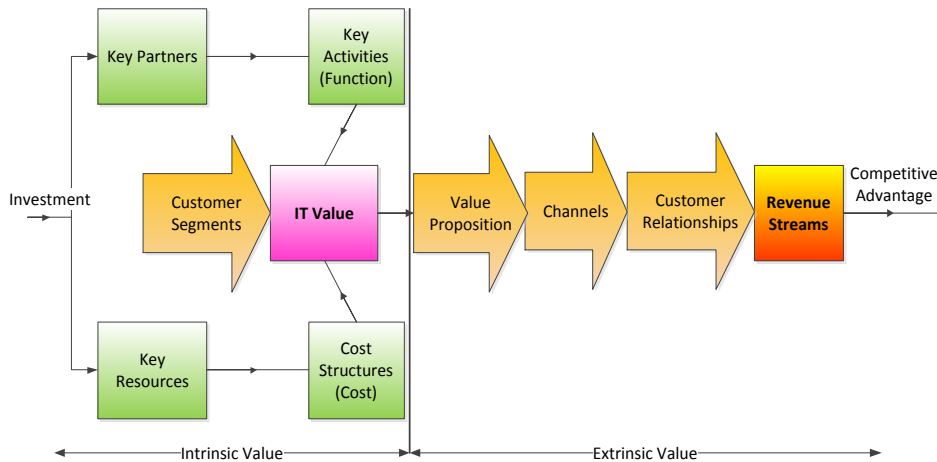


Figure 2. IT value in its business environment

Furthermore, consistent with Figure 2, the total IT value represented by Revenue Streams (RS) is the multiplication of the intrinsic value (InV) and the extrinsic value (ExV) or

$$RS = InV * ExV \tag{15}$$

Whereas the InV establishes in the Equation (1), while, the ExV is as follows:

$$ExV = Value\ proposition(VP) * Channels(Ch) * Customer\ relationship(CR) \tag{16}$$

In which VP, Ch, and CR materialize in respective formulations in this fashion:

$$VP \rightarrow \begin{cases} =1, & \text{if } VP \text{ is the industry standard business suit} \\ 0 < VP < 1, & \text{if } VP \text{ is less than the industry standard business suit} \\ > 1, & \text{if } VP \text{ is greater than the industry standard business suit} \end{cases} \tag{17}$$

$$Ch \rightarrow \begin{cases} =1, \text{if the } Ch \text{ is available and operated by the Organization} \\ 0 < Ch < 1, \text{if the } Ch \text{ is not available} \\ > 1, \text{if the } Ch \text{ is available and operated by the Organization and} \\ \quad \text{Partners} \end{cases} \quad (18)$$

$$CR \rightarrow \begin{cases} =1, \text{if there are customer or service segments} \\ 0 < CR < 1, \text{if there are not customer or service segments} \\ > 1, \text{if customer or service segments are preferred by top managements} \end{cases} \quad (19)$$

#### F. Data Collection

To clarify and validate both the intrinsic and the extrinsic values, a case study can substantiate this valuation methodology, in which the case study relates to a telco industry as one segment of IT-based industry segments. In essence, the telco industry is representative to be a sample due to the information technology and communication (ICT) industry providers. The selected firm as a sample is Telkom, which has listed on the Indonesia Stock Exchange and the New York Stock Exchange [18]. Annually, Telkom publishes its Annual Report including the Financial Statement, which part of that becomes the data source for this study. In addition, the Annual Reports are not only comprehensive data but also legitimate because the reports have already been audited and agreed by the Annual General Meeting of Shareholders.

#### G. Data Analysis

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

Table 3. Research data analysis phases

#	Stage	Method
1	To analyze a group of functions of Telkom's operation, split into three: strategic, business, and financial streams. Each function stream consists of the fundamental, enhanced, and superior level of functions. Then the index of each stream and function parameter are estimated.	Resource-Based View eTOM (enhanced Telecom Operation Map) Framework Telkom Annual Report 2013 The Equations (2) to (12)
2	To analyze and assess a group of costs	Life-Cycle Cost Analysis (LCCA) Present Value The Equations (13) and (14)
3	To assess the intrinsic IT value	Value analysis The Equation (1)
4	To combine the intrinsic IT value with the Business Model Canvas (BMC) environment.	The BMC analysis Telkom Annual Report 2013
5	To assess the index of Value Proposition, Channels, and Customer Relationship building blocks to result in the extrinsic IT value	The Equation (16, 17, 18, and 19) Annual Report analysis The eTOM and LCCA
6	To assess the total value of IT represented by Revenue Streams (RS)	The Equation (15) Value engineering analysis
7	To compare the RS index with the index of Cost Parameter (C) to translate the indexes to currency, so the measurement unit of business performances should be quantified in percent	Financial statement, i.e. Return on investment analysis Value engineering

#### 4. The Case Study

This case study considers that the Telkom's IT services business processes rest on eTOM (enhanced Telecom Operation Map) framework because the eTOM provides telco industries with further comprehensive services that would meet customers' service quality needs [25],[30]. According to the eTOM framework, the IT functions that should conform to an ICT industry are in table A.1 in Appendix.

Table 4. Estimation 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

According to Table 3 and A.1 (see Appendix), also using the Equations (2) to (12), the estimation of the function parameters results in figures as follows in Table 4. Hence, by the Equation (11), the Function parameter (F) = 0.82.

While, the cost components organizing the ICT expenditure at Telkom are as seen in Table 5 below, whereas the list of the real CE of Telkom can be seen in Table A.2 in Appendix [18]:

Table 5. Cost components of ICT expenditure (adopted from [18])

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

From Table A.2 in Appendix, the total CE in 2013 is at Rp 24,898.0 billion. If assumed that the OE equals to 8%<sup>1</sup> of the CE (the OE magnitude in the [18] does not appeared), then the 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. Thus, the discount rate is pegged Telkom for 2013 amounted to 13.5% [18], by using the Equation (13), the outcomes of detailed estimation can result in the following Table 6:

Table 6. 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

<sup>1</sup> 8% is taken based on the example calculation of OE of one project of Telkom

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 <sub>r</sub> (Rp billion)				35,493.63

In order to obtain the C (cost parameter) index, it refers to the Equation (14), which requires m and M, representing the acceptable and reasonable value range of cost specified by developers, as the thresholds. As stated above, m and M refer to the last realization of the C<sub>r</sub>. Therefore, m and M here come from the value of Telkom's C<sub>r</sub> the smallest and highest during the past ten years, i.e. 2004-2013. The smallest C<sub>r</sub> is in 2004, i.e. Rp 12,574.02 billion, while the largest is in 2013. Thus, m = 12,574.02; M = 35,493.63; and C<sub>r</sub> = 35,493.63. Consequently, that M = C<sub>r</sub>, afterward, the value of C = 1, according to the Equation (14). For that reason, the intrinsic value (InV), according to the Equation (1), is equivalent to a division of the function parameter (F) = 0.82 divided by the cost parameter (C); i.e. InV = 0.82 (< 1), which means that the unnecessary costs happen, which do not contribute to the required functions for the alternative. Therefore, eliminating these unnecessary costs, while maintaining the required performance, quality and safety of the functions, are a necessity.

Meanwhile, to estimate the extrinsic value is based on [18] data. Accordingly, if the VP (value propositions) is a description of bundles of products or services that create values for a specific customer segment, such as value being delivered to the customer (benefit/ cost), customer problem being solved, customer needs being satisfied, and value propositions assigned to the customer segments. Afterward, obtaining from [18] that the bundles of Telkom products and services are in compliance with the product standards, in which a telco industry should be so, such as fixed wireline services, fixed wireless services, cellular services, the internet and data communication services, network services, interconnection services, and ancillary services [18]. As a result, that Telkom has offered standard VPs as a telco industry, thus, the value of VP equals to 1 according to the formula of the Equation (17).

On the other hand, Ch (channels) depicts as how a firm communicates with and reaches its customer segment to deliver a value proposition. The Ch functions are raising responsiveness among customers about a firm's products and services, helping customers evaluate a firm's value proposition, allowing customers to purchase specific products & services, delivering a value proposition to customers, and providing post-purchase customer support. Therefore, to measure the Telkom's Ch is through understanding the type of Ch and cooperation with the third parties. [18] states that types of Telkom's Ch consist of Plaza Telkom and GraPARI (as walk-in customer service points), Contact Centers (serving products and services through call centers), Partnership Stores (extensions of distribution channels, cooperating with the third parties), Feet on The Street (direct marketing such door-to-door marketing, etc.), Authorized Dealers and Retail Outlets (distribution outlets, cooperating with the third parties), Account Management Teams (those who manage relationships to customer segments), Telkom Solution Houses (special channels for enterprise customers), SME (Small and Medium Enterprises) Centers (communication centers for e-commerce solutions), and Telkom website [18]. According to this clarification, it can estimate the Ch's value by the Equation (18). In addition, from the nine types of channels, two types collaborate with the third parties, namely Partnership Stores, and Authorized Dealers and Retail Outlets. Thus, in this case-study context, the overall channels actually consist of 11 types. Therefore, the value of Ch is 11 divided by 9, which equals to 1.22, see the Equation (11).

Furthermore, the CR (Customer Relationships) describes the types of relationships a firm establishes with specific customer segments. This is necessary to perform in terms of customer

acquisitions, customer retentions, and boosting sales (upselling), in which their contact can be personal or automated. In this case, Telkom has segmented its customers into four segments: corporate, home, personal, and other segments, whereas the corporate segments provide customers with telecommunications services such as interconnection, leased lines, satellite services, VSAT (Very Small Aperture Terminal), contact centers, broadband accesses, information technology services, data and internet services as companies and institutions. While, the home segment is home consumers, who usually subscribe to fixed wireline services, pay TV, data and internet services. Moreover, the personal segments are individual consumers, who subscribe to mobile cellularity and fixed wireless services including mobile accesses and information technology services, data and internet services. The others are segments dedicated to building management services [18]. Besides that, the management of customer segmentation at Telkom does not complete at the operational level only, but also manage from the top management such as Consumer Service Directorate that manages the consumer business segment, Enterprise and Business Service Directorate that controls the enterprise and small-medium enterprise business segment, and Wholesale and International Service Directorate that focuses on the wholesale and international business segment. Thus, the value of CR obeys the estimate as follows: each service segment is 1, if all 4 segments exist, the total value is 4. While, the three special directorates manage the segmentation services, each of which is weighted  $0.125^2$  so that the total value of 0.375. In addition, the total value of the segment plus the total value of the directorate will be 4.375. Thus, the value of CR is 4.375 divided by 4, which is equal to 1.09, which this estimate is based on the Equation (19).

Therefore, the extrinsic value (ExV) is a multiplication of the VP, the Ch, and the CR as designated by the Equation (16). Hence, the  $ExV = 1.22 * 1.00 * 1.09 = 1.33$ . Furthermore, the overall IT value, represented by RS (Revenue Streams), is the multiplication of the Intrinsic Value (InV) with the ExV as indicated by the Equation (15). Consequently, the  $RS = 0.82 * 1.33 = 1.09$ , which means that if the intrinsic IT value is poor (less than 1), it can be magnified by the role of the well managed extrinsic IT value. This case study shows that the final value is greater than 1 (1,09), indicating the best value addressing the highest efficiency of the organizational management as well. In other words, the final figure indicates that the IT value provides a firm with a worthy performance, if the IT capability optimally works as infrastructures and blends together with the favorable business environment, too.

## 5. Discussion and Recommendation

It is motivating to assess the real IT value within the business organizations because the factors affecting the values are various, consisting of technical, managerial, environmental, and numerous additional aspects. However, the valuation of IT has been accomplished although its results are still covering several weaknesses, which lie on both the intrinsic and extrinsic IT valuations. For example, in the intrinsic IT value, the complications happen in determining functions covered by the IT's role in the organization. The complications arise about whether these functions are created as a direct correlation with the IT procurement or may also refer to ideal standard functions to perform by an IT-related industry, which also follows a particular framework. However, the sum of functions qualitatively manifests by means of the annual report analysis confronted with the eTOM framework. Meanwhile, the eTOM framework is the business process reference because it has become an ideal framework for telco industries. Likewise, in estimating the cost parameter, the complications also come into view because no direct indicators connect each cost to the functions and vice versa. Hence, the cost parameter estimation is by an accumulation approach between the CE and the OE components, even though this calculation was still consistent with the Life Cycle Cost Analysis as well.

Additionally, the assessment of function and cost factors considers the internal business environment represented by the four blocks of the BMC, i.e. the key resources, the key activities, the key partners, and the cost structure. For that reason, it needs to assume that the

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<sup>2</sup> All directorates are eight (8), so that each weighs  $1/8 = 0.125$

four blocks have mixed together in the assessment of the functions and the costs automatically. Therefore, the value of each block needs no additional assessments in the intrinsic IT valuation due to its unification into the function and the cost analysis.

Meanwhile, the assessment of the extrinsic IT value has not yet considered the cost components, the capability, and their potentials, in which their assessments are merely based on availability levels. For example, the value of the VP (value proposition) relates to the existence of industry products and services that are suitable for. Similarly, the value of Ch (channels) connects with the quantity of channels the organization has and does not observe the channels from the quality point of views, such quality of services, operational cost, service effectiveness, etc. Likewise, the identical way happened at the CR (customer relationship), its value rests on the availability of customer or service segments, which is no estimate of its capacity, customer satisfactions, operational costs, etc. Definitely, those factors are parameters of accuracy in determining the extrinsic IT value. However, to measure these parameters take time and need enormous efforts, so if any, those should be included in the estimations or as a correction factor for the value index calculations. Also, the extrinsic IT value has not considered behavior and culture of services, such as friendly services, easiness of access, service level guarantee, etc.

In order to try to assess the business performance parameters such as the return on investment (ROI), the figures of the index is useful to do so. For example, the ROI is equivalent to the  $(RS - C)$  divided by the C index, results in 27%. However, [18] does not present the ROI figures, hence, no clarification concerning the objectivity of the estimated ROI and no comparison with the real ROI. Additionally, at Telkom no CE tracking tools trace contributions of the invested capital to the business performance. Therefore, it is problematic to measure the success or failure of an investment. For that reason, the result of this study is also hard to confront with the realization of business performance as a result of the CE.

Correspondingly, several recommendations to Telkom are as follows:

- 1) To develop and implement the CE tracking tools to simply measure the invested capital success or failure. This tools should be able to distinguish the business performance whether is an effect of the last spending, the new one or the combination of all.
- 2) To determine the critical success factors within overall business processes by decomposition of those processes to perform the business criticalities as a success or a failed account. Take them as the critical success factors, in which this way is also useful to decompose the building block of the business process so it is easy to persuade in bringing the organization extrinsic values up.
- 3) To assess periodically the IT value, especially the IT infrastructures at Telkom do not only as the support infrastructures but also as the business themselves because Telkom is an IT-oriented service corporation. Sequentially, this valuation helps the management measure the business performance and quickly make the decision.
- 4) In order to perform the accurate measurements, especially in the extrinsic IT value, it is recommended to provide cost of services to involve in the extrinsic assessments. In turn, it allows the assessor to assess the performance exactly.

## 6. Conclusion

This study tries offering the solution for the IT valuation with the value engineering methodology approach, which stems from two aspects of valuations. The first comes from the inner value of IT resources own, entitled the intrinsic IT value. Furthermore, the second originates from the IT resource business environment, which is an effort to rest the IT on a business context, whereas may enlarge the intrinsic IT value or downgrade it depending upon the business environment potentials. However, IT does not work in an isolated environment, accordingly, this study uses the BMC as the business context. Afterward, this value produces an extrinsic IT value, which combines with the intrinsic IT value. As a result is the overall IT value, which is a multiplication of both the intrinsic and the extrinsic values.

To examine the valuation methodology, a case study conducted at Telkom confirming that this methodology works considerably, in which the entire IT value is larger than 1 (1,09), indicating the best value addressing the highest efficiency of the organizational management. In other words, the ultimate figure indicates that the IT value provides a firm with a worthy performance, if the IT capability optimally works as infrastructures and blends together with the favorable business environment, too. However, several waivers of a number of measurement parameters must be there, as this is necessary to facilitate the valuation process in accordance with the developed research methodology. Consequently, this solution looks simple and easy to use on one hand, however, on the other hand, this simplicity ignores some parameters. For example, the valuation of the extrinsic IT value has not yet considered the cost, the quality of services, the accessibility, the capacity, etc. In addition, the valuation is just based on the availability levels of those services.

Accordingly, this study suggests Telkom quite a few recommendations to attempt this methodology to the practical application. And of course, this study needs future works, which should emphasize on the extrinsic value measurement comprehensively. Likewise, this comprehensiveness lies on the estimated parameters within the business environment. In other words, the more complex the business environments the more accurate the valuation.

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## Appendix

Table A.1. List of IT functions in Telco industries

*Note:* The writings that were written off are functions that do not work at Telkom

Groups of IT Function	Levels of Functions (eTOM 8)	
<b>Strategic</b>	Fundamental	1. Marketing & Offer Management, 2. Service Development & Management, 3. Resource Development & Management, 4. Supply Chain Development & Management.
	Enhanced	5. Market Strategy & Policy, 6. Product & Offer Portfolio Planning, 7. Product & Offer Capability Delivery, 8. Marketing Capability Delivery, 9. Sales Development, 10. Product Marketing Communications & Promotion, 11. Product & Offer Development & Retirement, 12. Service Strategy & Planning, 13. Service Capability Delivery, 14. Service Development & Retirement, 15. Resource Strategy & Planning, 16. Resource Capability Delivery, 17. Resource Development & Retirement, 18. Supply Chain Strategy & Planning, 19. Supply Chain Capability Delivery, 20. Supply Chain Development & Change Management
	Superior	21. Gather & Analyze Market Information, 22. Establish Market Strategy, 23. Establish Market Segments, 24. Link Market Segments & Products, 25. Gain Commitment to Market Strategy, 26. Gather & Analyze Product Information, 27. Establish Product Portfolio Strategy, 28. Produce Product Portfolio Business Plans, 29. Gain Commitment To Product Business Plans, 30. Define Product Capability Requirements, <del>31. Capture Product Capability Shortfalls, 32. Approve Product Business Case,</del> 33. Deliver Product Capability, 34. Manage Handover to Product Operations, 35. Manage Product Capability Delivery Methodology, 36. Define Marketing Capability Requirements, 37. Gain Marketing Capability Approval, 38. Deliver Marketing Infrastructure, 39. Manage Handover to Marketing Operations, 40. Manage Marketing Capability Delivery Methodology, 41. Monitor Sales & Channel Best Practice, 42. Develop Sales & Channel Proposals, 43. Develop New Sales Channels & Processes, 44. Define Product Marketing Promotion Strategy, 45. Develop Product & Campaign Message, 46. Select Message & Campaign Channels, <del>47. Develop Promotional Collateral, 48. Manage Message and Campaign Delivery, 49. Monitor Message &amp; Campaign Effectiveness,</del> 50. Gather & Analyze New Product Ideas, 51. Assess Performance of Existing Products, 52. Develop New Product Business Proposal, 53. Develop Product Commercialization Strategy, 54. Develop Detailed Product Specifications, 55. Manage Product Development, 56. Launch New Products, <del>57. Manage Product Exit, 58. Gather &amp; Analyze Service Information,</del> 59. Manage Service Research, 60. Establish Service Strategy & Goals, 61. Define Service Support Strategies, 62. Produce Service Business Plans, 63. Develop Service Partnership Requirements, 64. Gain Enterprise Commitment to Service Strategies, 65. Map & Analyze Service Requirements, <del>66. Capture Service Capability Shortfalls,</del> 67. Gain Service Capability Investment Approval, 68. Design Service Capabilities, 69. Enable Service Support & Operations, 70. Manage Service Capability Delivery, 71. Manage Handover to Service Operations, <del>72. Gather &amp; Analyze New Service Ideas, 73. Assess Performance of Existing Services,</del> 74. Develop New Service Business Proposal, 75. Develop Detailed Service Specifications, 76. Manage Service Development, 77. Manage Service Deployment, 78. Manage Service Exit, 79. Gather & Analyze Resource Information, 80. Manage Resource Research, 81. Establish Resource Strategy & Architecture, 82. Define Resource Support Strategies, 83. Produce Resource Business Plans, 84. Develop Resource Partnership Requirements, 85. Gain Enterprise Commitment to Resource Plans, 86. Map & Analyze Resource Requirements, <del>87. Capture Resource Capability Shortfalls, 88. Gain Resource Capability Investment Approval, 89. Design Resource Capabilities,</del> 90. Enable Resource Support & Operations, 91. Manage Resource Capability Delivery, <del>92. Manage Handover to Resource Operations,</del> 93. Gather & Analyze New Resource Ideas, 94. Assess Performance of Existing Resources, 95. Develop New Resource Business Proposal, 96. Develop Detailed Resource Specifications, 97. Manage Resource Development, 98. Manage Resource Deployment, <del>99. Manage Resource Exit,</del> 100. Gather & Analyze Supply Chain Information, 101. Establish Supply Chain Strategy & Goals, 102. Define Supply Chain Support Strategies, 103. Produce Supply Chain Business

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		Plans, 104. Gain Enterprise Commitment to Supply Chain Plans, 105. <del>Determine the Sourcing Requirements</del> , 106. <del>Determine Potential Suppliers/Partners</del> , 107. Manage the Tender Process, 108. Gain Tender Decision Approval, 109. Negotiate Commercial Arrangements, 110. Gain Approval for Commercial Arrangements, 111. Manage Supplier/Partner Engagement, 112. Manage Supply Chain Contract Variation, 113. Manage Supplier/Partner Termination
<b>Business</b>	Fundamental	1. Customer Relationship Management, 2. Service Management & Operations, 3. Resource Management & Operations, 4. Supplier/Partner Relationship Management.
	Enhanced	5. CRM Support & Readiness, 6. Selling, 7. Marketing Fullfilment Response, 8. Order Handling, 9. Problem handling, 10. Customer QoS/SLA Management, 11. Customer Interface Management, 12. Retention & Loyalty, 13. Bill payments & Receivable Management, 14. Bill Invoice Management, 15. Bill Inquiry handling, 16. Rating & Discounting, 17. Manage Billing Events, 18. Billing & Collections Management, 19. SM&O Support & Readiness, 20. Service Configuration & Activation, 21. Service Problem Management, 22. Service Quality Management, 23. Service Specific Instance Rating, 24. RM&O Support & Readiness, 25. Resource Provisioning, <del>26. Resource Trouble Management</del> , 27. Resource Performance Management, 28. Resource Data Collection & Distribution, <del>29. Resource Mediation &amp; Reporting</del> , 30. Manage Workforce, 31. S/PRM Support & Readiness, 32. S/P Requisition Management, 33. S/P Problem Reporting & Management, 34. S/P Performance & Management, 35. S/P Settlements & Payments Management, 36. S/P Interface Management
	Superior	37. Support Customer Interface Management, 38. Support Order Handling, 39. Support Problem Handling, 40. Support Billing & Collections, 41. Support Retention & Loyalty, 42. Support Marketing Fulfillment, 43. Support Selling, 44. Support Customer QoS/SLA, 45. Manage Campaign, 46. Manage Customer Inventory, 47. Manage Product Offering Inventory, 48. Manage Sales Inventory, 49. Support Bill Invoice Management, 50. Support Bill Payments & Receivables Management, 51. Support Bill Inquiry Handling, 52. Manage Prospect, 53. Qualify Opportunity, 54. Negotiate Sales/Contact, 55. Acquire Customer Data, 56. Cross/Up Selling, 57. Develop Sales Proposal, 58. Manage Sales Accounts, 59. Issue and Distribute Marketing Collaterals, 60. Track Leads, 61. Determine Preorder Feasibility, 62. Authorize Credit, 63. Receive PO & Issue Orders, 64. Track & Manage Customer Order Handling, 65. Complete Customer Order, 66. Issue Customer Orders, 67. Report Customer Order Handling, 68. Close Customer Order, 69. Isolate Customer Problem, 70. Report Customer Problem, 71. Track & Manage Customer Problem, 72. Close Customer Problem Report, 73. Create Customer Problem Report, 74. Correct & Recover Customer Problem, <del>75. Assess Customer QoS/SLA Performance</del> , <del>76. Manage QoS/SLA Violation</del> , <del>77. Report Customer QoS Performance</del> , <del>78. Create Customer QoS Performance Degradation Report</del> , 79. Track & Manage Customer QoS Performance Resolution, <del>80. Close Customer QoS Performance Degradation Report</del> , 81. Manage Contact, 82. Manage Request (Including Self Service), 83. Analyse and Report on Customer, 84. Mediate & Orchestrate Customer Interactions, 85. Establish & Terminate Customer Relationship, 86. Build Customer Insight, 87. Analyse & Manage Customer Risk, 88. Personalize Customer Profile for Retention & Loyalty, 89. Validate Customer Satisfaction, 90. Manage Customer Billing, 91. Manage Customer Payments, 92. Manage Customer Debt Collection, 93. Apply Pricing, Discounting, Adjustments & Rebates, 94. Create Customer Bill Invoice, 95. Produce & Distribute Bill, 96. Create Customer Bill Inquiry Report, 97. Assess Customer Bill Inquiry Report, 98. Authorize Customer Bill Invoice Adjustment, 99. Track & Manage Customer Bill Inquiry Resolution, 100. Report Customer Bill Inquiry, 101. Close Customer Bill Inquiry Report, 102. Perform Rating, 103. Apply Rate Level Discounts, 104. Enrich Billing Events, 105. Guide Billing Events, 106. Mediate Billing Events, 107. Report Billing Event Records, 108. Manage Service Inventory, 109. Enable Service Configuration & Activation, 110. Support Service Problem Management, 111. Enable Service Quality Management, 112. Support Service & Specific Instance Rating, 113. Design Solution, 114. Allocate Specific Service Parameters to Services, 115. Track & Manage Service Provisioning, 116. Implement, Configure & Activate Service, 117. Test Service End-to-End, 118. Activate Service, 119. Issue Service Orders,

		<p>120. Report Service Provisioning, 121. Close Service Order, 122. Recover Service, 123. Create Service Trouble Report, 124. Diagnose Service Problem, 125. Correct &amp; Resolve Service Problem, 126. Track &amp; Manage Service Problem, 127. Report Service Problem, 128. Close Service Trouble Report, 129. Survey &amp; Analyze Service Problem, 130. Monitor Service Quality, 131. Analyse Service Quality, 132. Improve Service Quality, 133. Report Service Quality Performance, 134. Create Service Performance Degradation Report, 135. Track &amp; Manage Service Quality Performance Resolution, 136. Close Service Performance Degradation Report, 137. Mediate Service Usage Records, 138. Not Available Process, 139. Report Service Usage Records, 140. Guide Resource Usage Records, 141. Enable Resource Provisioning, 142. Enable Resource Performance Management, 143. Support Resource Trouble Management, 144. Enable Resource Data Collection &amp; Distribution, 145. Manage Resource Inventory, 146. Not Available, 147. Manage Logistics, 148. Allocate &amp; Install Resource, 149. Configure &amp; Activate Resource, 150. Test Resource, 151. Collect, Update &amp; Report Resource Configuration Data, 152. Track &amp; Manage Resource Provisioning, 153. Report Resource Provisioning, 154. Close Resource Order, 155. Issue Resource Orders, 156. Recover Resource, 157. Survey &amp; Analyse Resource Trouble, 158. Localize Resource Trouble, 159. Correct &amp; Recover Resource Trouble, 160. Track &amp; Manage Resource Trouble, 161. Report Resource Trouble, 162. Close Resource Trouble, 163. Create Resource Trouble Report, 164. Monitor Resource Performance, 165. Analyse Resource Performance, 166. Control Resource Performance, 167. Report Resource Performance, 168. Create Resource Performance Degradation Report, 169. Track &amp; Manage Resource Performance Resolution, 170. Close Resource Performance Degradation Report, 171. Collect Management Information &amp; Data, 172. Process Management Information &amp; Data, 173. Distribute Management Information &amp; Data, 174. Audit Data Collection &amp; Distribution, 175. Mediate Resource Usage Records, 176. Report Resource Usage Records, 177. Manage Appointment Schedule, 178. Assign Work Order, 179. Track &amp; Manage Work Order, 180. Plan and Forecast Workforce, 181. Administer Workforce, 182. Report Manage Workforce, 183. Close Work Order, 184. Issue Work Order, 185. Support S/P Requisition Management, 186. Support S/P Problem Reporting &amp; Management, 187. Support S/P Performance Management, 188. Support S/P Settlements &amp; Payment Management, 189. Support S/P Interface Management, 190. Manage Supplier/Partner Inventory, 191. Select Supplier /Partner, 192. Determine S/P Pre-Requisition Feasibility, 193. Track &amp; Manage S/P Requisition, 194. Receive &amp; Accept S/P Requisition, 195. Initiate S/P Requisition Order, 196. Report S/P Requisition, 197. Close S/P Requisition Order, 198. Initiate S/P Problem Report, 199. Receive S/P Problem Report, 200. Track &amp; Manage S/P Problem Resolution, 201. Report S/P Problem Resolution, 202. Close S/P Problem Report, 203. Monitor &amp; Control Service Performance, 204. Track &amp; Manage S/P Performance Resolution, 205. Report S/P Performance, 206. Close S/P Performance Degradation Report, 207. Initiate S/P Performance Degradation Report, 208. Manage Account, 209. Receive &amp; Assess Invoice, 210. Negotiate &amp; Approve Invoice, 211. Issue Settlement Notice &amp; Payment, 212. Manage S/P Requests (including Self Service), 213. Analyze &amp; Report S/P Interactions, 214. Mediate &amp; Orchestrate Supplier/Partner Interactions</p>
<p><b>Financial</b></p>	<p>Fundamental</p>	<p>1. Strategic &amp; Enterprise Planning, 2. Enterprise Risk Management, 3. Enterprise Effectiveness Management, 4. Knowledge &amp; Research Management, 5. Financial &amp; Asset Management, 6. Stakeholder &amp; External Relations Management, 7. Human Resources Management</p>
	<p>Enhanced</p>	<p>8. Strategic Business Planning, 9. Business Development, 10. Enterprise Architecture Management, 11. Group Enterprise Management, 12. Business Continuity Management, 13. Security Management, 14. Fraud Management, 15. Audit Management, 16. Insurance Management, 17. Revenue Assurance Management, 18. Process Management &amp; Support, 19. Enterprise Quality Management, 20. Program &amp; Project Management, 21. Enterprise Performance Assessment, 22. Facilities Management &amp; Support, 23. Knowledge Management, 24. Research Management, 25. Technology Scanning, 26. Financial Management, 27. Asset Management, 28. Procurement Management, 29. Corporate Communications &amp; Image Management, 30. Community Relations Management, 31. Shareholder Relations Management, 32. Regulatory Management, 33. Legal Management, 34. Board &amp; Shares/Securities</p>

		Management, 35. HR Policies & Practices, 36. Organization Development, 37. Workforce Strategy, 38. Workforce development, 39. Employee & Labor Relations Management
	Superior	40. Manage Revenue Assurance Policy Framework, 41. Manage Revenue Assurance Operations, 42. Support Revenue Assurance Operations, 43. Warock, 44. Monitor Revenue Assurance Controls, 45. Create Revenue Assurance Trouble Report, 46. Assess Revenue Assurance Trouble, 47. Resolve Revenue Assurance Trouble, 48. Track & Manage Revenue Assurance Trouble Resolution, 49. Report Revenue Assurance, 50. Close Revenue Assurance Trouble Report

Table A.2. List of Capital Expenditure of Telkom (adopted from [18])

	Years Ended December 31,		
	2013 (Rp billion)	2012 (Rp billion)	2011 (Rp billion)
<b>Telkom (parent company)</b>			
Broadband service	3,285.5	1,662.0	1,875.0
Network service	1,874.4	2,060.0	1,979.0
Optimizing legacy	191.0	86.0	156.0
Support	362.1	232.0	192.0
<b>Subtotal for Telkom</b>	<b>5,313.0</b>	<b>4,040.0</b>	<b>4,202.0</b>
<b>Subsidiaries</b>			
Telkomcel	15,662.0	10,656.0	8,472.0
Others	3,923.0	2,576.0	1,929.0
<b>Subtotal for subsidiaries</b>	<b>19,585.0</b>	<b>13,232.0</b>	<b>10,401.0</b>
<b>Total for Telkom Group</b>	<b>24,898.0</b>	<b>17,272.0</b>	<b>14,603.0</b>



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