

Modeling Information Technology (IT) Value:

An Ontological Approach towards IT Value Engineering

Lukman Abdurrahman, Suhardi, & Armein Z.R. Langi

Abstract—The use of IT has become a necessity in today's business because of its benefits, which has been felt in the daily work. Consequently impressed that IT spending into massive without considering again the ability to control. Therefore, it needs to research values of IT in terms of relationship to business performance so, in turn, there will be created an IT value model. The methodologies adopted to do this research are meta-analysis, Resource-Based View analysis, value engineering analysis, systems engineering analysis, and business model analysis. The study results in IT value conceptual model and IT value business model. Both models can lead to reposition the IT role within the business, on one hand. On the other hand, the models will increase its role such that “the picture” of business can be controlled due to IT value engineering as well.

Keywords—IT, value, reposition, engineering, model, business.

I. Introduction

The use of information technology (IT) has been a pervasive phenomenon in a variety of area of businesses. Empirically it has been demonstrated that IT gives more benefits for the business. Nevertheless, this issue should be examined scientifically by research through studies analyzing several variables building advantageous of IT.

The idea of this study covers the role of IT as a complement factor of a firm to increase its business performance. Empirically, we can testify that IT has much influence to add firm's competitive advantage value. For example, internet banking is one of IT-based exclusive competitive advantages to raise market shares. However, we believe that the increment of market shares does not only depend on the internet infrastructure role, but also on other factors such as corporate culture, tune of the top, etc. Thus, we want to mention that the role of IT in bringing up business performance is not everything.

This study analyzes a variety of factors that construct the role of IT value on business performance. The analysis is focused on inside factors of firms, i.e. IT resources, IT capabilities, and IT competence, and firm's competitive advantage. Their relationship is comprehended as proposed by some researchers who had studied IT value versus business performance based on Resource-Based View (RBV) theory.

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Furthermore, the analysis of the model will also be performed with an ontological approach by means of the business model canvas [18]. The resulted model describes the role and relationship of IT within business environment and appears as a lifecycle of product (P), service (S), and value (V) systems or PSV [11] or PSS [12].

II. Research Methodology

In doing this research, the activities are taken as follows:

1. Reviewing some papers based on a meta-analysis approach. The reviewed papers have discussed IT relationship to business performance with regard to RBV theory.
2. Each component further sought connection with each other by plausible grooves in the explanation of RBV. As a result, IT value conceptual model can be described as seen in figure 1 [1, 22].
3. Doing literatures review, in which IT value model can complete its views in relation to research implementation area. Here, indicators/ parameters of component and value definition are explored. Study in the section three below is one of parts of this methodology stage.
4. Similarly, systems and value engineering are reviewed in accordance with IT value. Moreover, related to an engineering term, it is necessary to let the systems performs well. Accordingly, the concept of PSV (product-service-value) that offers smart living environment is preferred as a means to allow the systems to work smart.
5. Designing and making business model of IT value concept. The business model canvas [18] is a basis for forming IT value business model. Nine building blocks reflect various conditions of organizations. There are formal logical relationships between one block and another.

III. Literature Review

A. Resource-Based View (RBV) Theory

The RBV theory, proposed by Wernerfelt (1984), is the main theory that has been adopted to study the relationship between IT and firm performance. This is because that what a firm wants to be in the future business performance absolutely depends on what resources it owns right now. Thus, the more valuable resource a firm has the more likely results in the best performance of the firm itself [14].

According to the RBV, resources have their own power to give advantage as a result of executing strategies. Therefore, Teece, Pisano, and Shuen (1997) contended that firm resources have the ability to develop resource capabilities. On the other side, Prahalad and Hamel (1990) have defined the



competence as “the collective learning in the organization, especially how to coordinate diverse production skills and integrate multiple streams of technologies.” Furthermore, Prahalad and his colleague talked about competitive advantage with more emphasis on intangible than tangible assets to select and implement the firm strategy [3].

In IT value context, the resources are exactly IT resources consisting of: (1) IT infrastructure as tangible resources, (2) IT human resources regarding technical and managerial IT skill, and (3) intangible IT-enabled resources for knowledge assets, customer services, and synergy of the three components above [4]. Moreover, Barney (1991) characterized resources to be imperative strategies if they are valuable, in which resources enable the firm to develop strategies towards increasing efficiency and effectiveness. Also rare, resources usage could lead the firm to own a great distinct advantage; inimitable, the resource is unique, so it is difficult to imitate by competitors; and non-substitutable, no other resources can replace the original resource [19].

Similarly, the capability is highlighted as IT capability resulted from its resources. The definition of IT capability is “the ability to mobilize and deploy IT-based resources in combination or co-present with other resources and capabilities” [4, p. 171]. In the meantime, Yin and Yang (2011) classified IT capabilities as: (1) IT infrastructure capability to as the ability of the IT division to supply extensive firm-wide IT infrastructure services that serve the organization's business processes, (2) managerial IT skills as the ability of the IT division to formulate, develop, and make use of IT solutions to support and improve organizational business processes, and (3) collaboration between IT and business as the ability of the IT division to build alliance with other business teams [25, p. 19].

Additionally, the concept of competency has three components: first is IT knowledge as the extent to which a firm possesses a body of technical knowledge about objects such as computer-based systems. The second is IT operations as the extent to which a firm utilizes IT to manage market and customer information, and the third is IT objects representing computer-based hardware, software, and support personnel [34].

The competitive advantage will be indicated by: (1) profitability, which should be achieved systematically [6], (2) mass customization facilitated by IS infrastructure flexibility due to good quality of its connectivity, compatibility, and modularity, and (3) speed-to-market with two categories time-to-market and delivery performance. Time-to-market addresses the elapsed time between product designation and its availability. Delivery performance refers to the ability to deliver a product within a shorter elapsed time than competitors do, measured in delivery lead-time [5].

B. IT Value Engineering

Values of information technology could be viewed from a variety of viewpoints. Jin-wen and Xiao-ying (2009) formulate a value (V) as an expression of division of function (F) by cost (C) or as follows:

$$V = F/C$$

It appears that by changing function and or cost, we can play value to go up or down in accordance with what we want to be, although in practice there are some considerations to do so [9].

Actually, the IT generally boils down on effectiveness and efficiency of processes, including achieving the best business performance. In other words, IT should disseminate value-added advantages through strategic alignment with the whole businesses. Thus, the IT value could be evaluated in terms of achievement of firm profitability, effectiveness, and tangible or intangible values created.

In the context of IT value engineering and PSV mechanism, P (product) components embodied in IT resources with equipment that can provide users with the capability of IT. S (service) components exemplified in IT capabilities that can deliver services in various types of IT services such as data communication, application, etc. While the components of V (value) are the advantages possessed by the firm as a result of IT resources and capabilities, symbolized in competence and sustainable competitive advantage.

C. Business Model

According to Merriam-Webster [16], business is defined as “(1) the activity of making, buying, or selling goods or providing services in exchange for money, (2) work that is part of a job, (3) the amount of activity that is done by a store, company, factory, etc”. While a model, according to Ramos, et al. (2012) is “a representation of a selected part of the world, the domain of interest, that captures the important aspects, from a certain point of view, simplifying or omitting the irrelevant features.” [21].

In addition, using an ontological approach Osterwalder (2004) defines a business model is as an abstract instrument consisting of several components, in which one to another has relationship forming a logical business to obtain profitability. The model also creates values such that users need to take hold of them [18].

IV. Modeling IT Value

A. IT Value Conceptual Model

Previously, Abdurrahman, et al. (2013) have analyzed the relationship of IT components through a meta-analysis approach with the summarized result as seen in table 1 [1].

Table 1. Summary of Meta-Analysis

Components	Concentration	Data Sources
IT Resources	Resource-based view: origins and implications	Barney, J.B. & Arian, A.M. (2001) Datta, A (2007) Powell, T (2007)
	Contingency Resource-Based View	Cardeal, N. & António, N., (2012)

	Resource-based perspective on IT	Bharadwaj, A.S (2000) Liang, T.P., You, J.J. & Liu, C.C. (2010) Wade, M. & Hulland, J (2004)
IT Capability	IT Capability and Firm Performance	Bharadwaj, A.S (2000) Jorfi, S., Nor, K.M. & Najjar, L (2011) Liang, T.P., You, J.J. & Liu, C.C. (2010)
	IT Capability and IT Spending Across Industries	Muhanna, W.A. & Stoel, M.D (2008)
	IT Capability and Value Creation	Lin, B.W (2007)
IT Competence	Information Technology and Core Competencies	Prahalad, C.K. & Hamel, G (1990) Tippins, M.J. & Sohi, R.S. (2003) Byrd, T.A (2001)
Competitive Advantage	Information Technology and Sustained Competitive Advantage	Cardeal, N. & António, N., (2012) Grant, G.L. & Royle, M.T (2011) Liang, T.P., You, J.J. & Liu, C.C. (2010) Byrd, T.A (2001)

According to the table 1, IT components relationship is then developed as follows in figure 1 [1]:

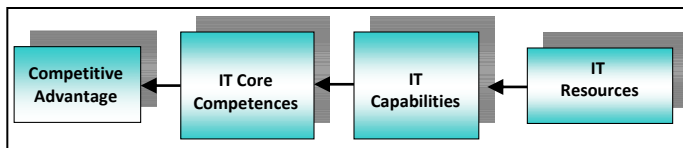


Figure 1. Conceptual Model of IT Value

IT Resources. Rooted in RBV theory, resources will be sources in order to achieve better firm performance. IT resources are considered as valuable organizational resources that can enhance organizational capabilities and eventually lead to higher performance. In light of this issue, Ravichandran and Lertwongsatien (2005) argued that between firm’s IT resources and IS capabilities own constructive relationships [13].

IT Capability. For noteworthy that between IT capability and IT competence has a close relationship. Ravichandran and Lertwongsatien (2005) mention that IT capabilities can support core competences, and in turn can contribute to better performance. In addition, the firm's ability to improve its core competencies using IT is likely to be dependent on Information Systems (IS) functional capabilities. Accordingly, firms should have strong IS functional capabilities in order to commence and keep up innovative projects targeted at enhancing the firm's core competencies [22].

IT Competence. The competencies of the IS Division in acquiring, deploying, and leveraging IT in pursuit of business strategies are likely to have a positive effect on firm performance [17]. Similarly, Ravichandran and Lertwongsatien (2005) classified IS competence into two dimensions: transformational competence, i.e. the ability to convert the organization using IT; and operational competence, i.e. the ability to provide reliable and consistent IT support to the business [22].

Competitive Advantage/ Firm Performance. The definition of firm competitive advantage is to create more economic value than a marginal competitor that achieves only break-even. A firm has competitive advantage if it systematically achieves (1) net profits [6]. Byrd, T.A (2001) mentioned that IS infrastructure flexibility has a relationship to sustained competitive advantage by acting as an enabler of both (2) mass customization, and (3) speed-to-market [5].

B. IT Value Business Model Canvas

In order to explore for further research and adapt the concept PSV life cycle [11], the IT value conceptual model remains to be assisted with a business model. The business model in real world usually describes what a business does and how it can make money, however in this research the business model is to be a means in which the IT value conceptual model can work with. It means that IT will be more valuable if it is joined other factors within business such as customers, other activities, costs, revenues, distribution channels etc.

To do the business model of this research, it refers to the business model canvas proposed by Osterwalder (2004) and then commercially promoted on <http://www.businessmodelgeneration.com/>. This business model describes, challenges, designs, and invents business models more systematically. There are nine building blocks making up the model; i.e. customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partners, and cost structures.

In conjunction with this research, the business model of IT value can be explicated through the following business model canvas as seen below in figure 2.

According to the figure 2, it appears that this research will involve broad area of IT value itself. This research will be dedicated to those who usually deal with practices such as mass market, specific customers, etc. What do they expect from this study? Absolutely they need values improvement of IT such as customization in conducting businesses, decreasing costs, increasing profits, risk reduction, improving quality, etc. Furthermore, in order to deliver the values to the customers, it can be performed by means of channeling. Related to this study, the channels can be set by way of creating direct and indirect channels. This activity, on one hand, is an endeavor to develop affairs between customers and business models. On the other one, this activity is part of developing customer relationship by means of forming communities, workshop, or personal assistances, etc.

V. Research Contribution

This research will contribute to:

- Development of methodology of IT value engineering study. At least until the idea of this research was initiated and this paper was written down, not a single paper that addresses the IT value engineering subject.

- IT value research by means of a comprehensive view regarding IT and organization performance. This is because that researched factors of IT model are complex in which the study will see many concerns in terms of building IT value engineering model. This effort is a part of the new methodology to view IT value and organization performance relationships.

- Probe Business Positioning Systems (BPS) in terms of IT value-based engineering. So far, we know that a means to trace organization positions is the balanced scorecard, which sees a firm from four organization perspectives as proposed by Kaplan and Norton (1996). In this research, the BPS will be linked to the role of IT value within an organization. It will be started from competitive advantages or organization performance perspective.

- Repositioning the perspective of the IT and organization performance relationship. All this time, IT is viewed whether or not as everything for a business organization. With this research, we are required to treat IT with a sage in a sense that IT has a rational relation to the and has complementary roles among other factors of an organization.

VI. Conclusion

The values of IT should be redefined with considering many factors surrounding a firm. IT value has empirically contributed to significant business performance to a firm as found in a case study of PT. Telekomunikasi Indonesia, Tbk [2]. However, IT role within a firm has close relationships to other factors within the firm such as corporate cultures, tune of the top, etc.

Accordingly, this research plan will deal with remodeling IT value and business performance relationship. Based on the RBV theory, IT value model is built such that delivers an IT value conceptual model. The model forms a logical block diagram, starting from IT resources, then IT capability, IT competence and ending with competitive advantages.

According to the IT value business model, the engineering of IT value can be conducted using model flexibility in terms of mathematical manipulations. However, the manipulation should concern to business needs because IT value engineering is substantially relating to increasing business performance.

The engineering is the endeavor by means of functioning and manipulating parameters of the IT value business model, which is starting from customer segments leading to cost structures. Consequently, the systems should generate more

Key Partners	Key Activities	Value Proposition	Customer Relationships	Customer Segments
Strategic alliances	Problem solving	Customization	Communities	Mass market
Subsidiaries	Production	Decreasing costs	Workshop	Niche market
Suppliers	Networking	Increasing profits	Automated services	Specific customers
	Network enhancement	Risk reduction	Personal assistance	
	Key Resources	Improving quality	Channels	
	IT resources: valuable, rare, inimitability, non-substitutable	Solving problems	Direct channels	
	IT human resources	Saving time	Indirect channels	
	Financial	Accessibility		
Cost Structure		Revenue Streams		
Fixed costs		Subscription fee		
Variable costs		Usage sale		
Change management costs		Training		
		Market dependent		
		Royalty		

Figure 2. IT Value Business Model Canvas

For the future it is hoped that this business model will generate revenue as well as customer satisfaction represents the value of the resulting research. The revenue will be resulted from usage fee, training fee, etc. Moreover, key resources of the model are IT resources with their valuable attributes, IT human resources owned by firms, financial, etc. To empower the resources, it needs some activities. Here the activity is to increase IT capability in order to generate IT competence, in turn, to result in the best business performance. To do so, partners are significant supporters. The key partners in doing this model are strategic alliances with competitors or non competitors, subsidiaries or joint ventures, suppliers, etc. Of course, those activities need funding, accordingly it should be allocated some cost to run the business model.

Related to PSV concepts above, P is represented by customer segments, value proposition, cost structure, and key resources. S component consists of channels, key activities, customer relationship. In addition, the V component is revenue streams and key partners. This research mechanism will work as long as the resulting value can trigger a continuous system operation. Meaning that IT value business model should result in more advantageous values such as business positioning systems (BPS), in which the model can provide us with business dashboard so we can measure, evaluate, engineer, and control the business. This is because that the business model will help a firm execute more practical ways of its strategies. In other words, we should control the parameters of the model as well using engineering methodology approach.

values to be a smart living mechanism. If so, the systems itself will be needed by businesses. In other words, IT value engineering will work more powerful for raising business performance. In addition, the engineering manipulation will bring about a business positioning systems (BPS) to steer and control business from IT value perspective.

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