

Value Delivery of Information Technology Investment: A Conceptual Framework

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Abstract—Organizations, be it private or public, are making huge spending on information technology (IT). These spending, whether for productivity or strategic reasons, become the fundamentals and tools on how organizations evaluate their IT investment. Evaluating every investment, before and after being made, is very crucial for organizations in determining successful decision that has or will be set. Especially when decision to invest is onset, the expectation of values or benefits from the investment become substantial to arrive at such decision to invest. This study reviews and analyzes eight pertinent studies that model IT investment values and benefits and propose a model to describe the value delivery of an IT investment evaluation. Based on two-staged filtration method, 110 variables are narrowed and converge into 23 variables which categorized into five factors. In this paper, the five factors of IT investments value delivery are discussed which are *financial, operational, organizational, strategic, and service*.

Index Terms—Information technology, investment, values, evaluation.

I. INTRODUCTION

Organizations, be it private or public, are making huge spending on information technology (IT). As the spending on IT increases, the awareness on the IT returns becoming significant. Organizations are concerned on how millions of dollar invested can be translated into dollar returns. That is why, in the past, the issue of 'IT productivity paradox' was intensely discussed and investigated. In 1990s, [1] explained paradox as a discrepancy or contradictory of the advances of the computer technology with the output of productivity of individual firms, industry and national economy. In other words, the increase in technology investment does not produce increase in productivity. Somehow, the issue has resolved and there are many findings that unwind the concern. Nevertheless, the scrutiny of the IT investment returns has not ended with unanimous findings [2]. Nowadays, the concern of IT investment returns has shifted from productivity perspectives towards other forms of values and benefits [3]-[7].

There are many reasons why organizations are spending on IT. Back in early 1980s, the investment on computer technology was mainly to increase productivity performance and efficiency. The trend has changed now where investment

in IT are reflected in the organization's strategic planning for competitiveness and survival. Strategically, implementation of IT is wisely made to align with business processes, therefore to increase firm performance [8]. These reasons, whether productivity or strategic gains, become the fundamentals and tools on how organizations evaluate their IT investment. Reasons are translated into justification which formulated into IT investment evaluations. Evaluating every investment, before and after being made, is very crucial for organizations in determining successful decision that has or will be set. When worth of investment is identified, values or returns from the investment will be established.

This paper seeks to identify the values that IT investment delivers to the organization. IT investment values delivery based on a conceptual model is developed. The discussion of the elements was based on the common ground shared among several IT evaluation models from the literature. The review has resulted in a proposed value delivery model.

II. LITERATURE REVIEW

An investment is defined as the allocation of capital to a proposal whose benefits are to be realized in the future [9]. These benefits are the anticipations of values and worth that organizations may reap after the investment has turned fruitful. Similarly, IT investment is defined as "the actual expenditure of resources on selected information technology or IT-related initiatives with the expectation that the benefits from the expenditure exceed the value of the resources" [10]. IT investments are expected to create values for any organization, private or public sector and, at least for the long-term, to return more than their costs (*ibid*).

A. IT Investment Decision Making

Creating values into the organization is usually started with making the right decisions in investments. One way of arriving at the decision is by determining the total amount of assets held by the organization, the composition of these assets and the business risk personality as perceived by the organization [11]. Because the future is always uncertain, the risk of not receiving the benefits must also be considered. This defines the main components of the decision process as the cost of the investment, the benefits to be realized, the timing of those benefits and the "uncertainty" of risk of realizing the benefits (*ibid*). Rather investigating the whole lot of decision making components, the focus of this paper is to unveil the second part, which is the identification of benefits/values of IT investment to be realized.

Inevitably, in deciding which IT investment alternative is giving the best value, undertaking rational decision making presumably necessary. Approaches are developed to help

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organization making the right decision in selecting the best IT investments. Those approaches are diversified ranging from financial to multifaceted methods.

B. IT Investment Evaluation Methods

There are many kinds of methodologies available at evaluating IT investments. Different perspectives and groundwork contribute greatly to diversification of evaluation methods. Some uses financial formulations that address the cost and benefits of the IT investment to be measured through dollar sum amount, leaving intangibility of the IT values to zero. However, some opt to use multi criteria approaches that consider several elements of IT evaluation including intangible value of IT.

There are more than sixty methods of IT investment evaluations [12]. They are diversified and classified into four main categories, which are 1) financial methods (i.e. Net Present Value, Internal Rate of Return, and Cost Benefit Ratio) 2) operation method/management science methods (i.e. Analytical Hierarchy Process (AHP), and Decision/Bayesian Analysis) 3) technique specifically designed for particular IT and/or organizations (i.e. Information Economics, Bedell's Method, and Benefit/Risk Analysis) and 4) other methods (i.e. Balanced Scorecard, Critical Success Factors, and Value Chain Analysis) (ibid). Despite the variability of the methods, they all share one common goal, which is assessing the value of IT investment.

C. IT Investment Values and Benefits

IT values are important especially in formulating the IT investment evaluation methods. In selecting which IT projects worth investing, IT values become the metrics of evaluations of the portfolio that determine the success of IT project selection. Since there are many approaches to IT investment evaluations, ranging from financial to non-financial, multi-dimensional to hybrid, and so forth, the success of these evaluations relies heavily on the values that they carry and how well the values being significant to the organizations in determining the IT investment payoff.

Ref. [13] offers seven principles in evaluating IT investment. The study also identifies the downside risks and the upside opportunities. Among the benefits of IT investment that being highlighted by this study are *divisibility and expandability, marketing in-house systems, timing value, and flexibility and option value*.

Another study, by [14], identifies technology management taxonomies that explain three major benefits or IT investment which are *strategic, tactical, and operational* benefits. Under these three categories of benefits lie 23 metrics of IT values.

Ref. [15] provides a value categorization of IT value for public (nonprofit) organizations. Similar to [14], [15] categorizes the values into six categories which are *foundational, policy formulation, democratic, service, internal, and external*. There are about 30 metrics that explain each of the categories of benefits.

Ref. [16] and [17] propose evaluation of IT investment that based on considerations and benefits criteria. Consideration criteria are the requirements to be satisfied in order for the IT investment to be successful, whereas benefits criteria are the evaluation of values or benefits of the IT investment. [16] identifies five consideration criteria and one benefit criteria,

whereas [17] identifies four consideration criteria and one benefit criteria. A total of ten and nine metrics for benefits evaluations are proposed by [16] and [17] respectively.

Research by [6] uses a framework of IT evaluation that based on input and output criteria. Similar to [16] and [17], input is similar to consideration criteria whereas the output is the benefits of IT investment which the study further divided into *strategic, information, and transactional* benefits. Under output criteria, a list of nine benefits metrics of IT investment identified.

Ref. [18] introduces a framework that evaluate IT investment using business value and risk criteria. The four business values identified are *Return on investment, strategic match, competitive advantage, and strategic architecture alignment*. Further 15 business value metrics are listed in this framework.

A different approach by [19] combines the consideration criteria together with the benefits criteria in a same category. The study refers to the criteria as ranked importance decision making criteria. In this study a total of ten decision-making criteria are listed under the category of *strategic and operational and tactical*.

Even though all of the studies mentioned earlier share similar purposes, there are some differences that set them apart. Most of the studies perform empirical works and data are collected from many sectors such as manufacturing [18] service [17] public [15] and energy [6]. Some studies propose guidelines [6], [13] and some propose techniques for evaluation [6], [18] such as AHP, Fuzzy logic, and Multi Criteria Decision Making (MCDM).

III. METHODOLOGY

Eight pertinent studies that model IT investment values are selected and analyzed. These studies are chosen due to the fundamental elements of the models describing the important variables of evaluating IT investment. Apart from that, building on the extensive body of knowledge that is already incorporated in the available methods is crucial as [10] have pointed out the weaknesses of new methods that lack of frame of reference. 101 variables or metric presented by the studies are analyzed and compared.

Two-stage filtrations approach is used. The first filtration only considers variables or metrics that are being identified by at least two research studies. This is to ensure that the selected variables are mutually agreed to be important by research. The first filtration leaves 64 metrics for further analysis.

Second filtration involves finding similarities between the 64 metrics. Some metrics that share similar terminology but using different names are combined and a new appropriate name that distinguishes those metrics is identified and given. After the second filtration, a number of 23 metrics are left for further classification. Appendix A shows the list of metrics identified after two stages of filtration.

These 23 metrics are pooled together in terms of terminology. Once all the identified metric are grouped, a proper categorical name to identify the grouped factor is given based on the description of the group factor. For

example two metrics, *improved growth and success* and *market leadership*, fall under the same group. Based on both metrics' attributes, grouped factor is defined as "strategic" factor. Undeniably, the naming of the grouped factors somehow is influenced by the categorical names used by previous studies.

Therefore, based on classifications of the metrics, five factors are formed to explain the value delivery of IT investment. These factors are *financial*, *operational*, *organizational*, *strategic*, and *service*. Next section further discusses the model.

IV. VALUE DELIVERY OF IT INVESTMENT MODEL

Based on the literature *review*, a conceptual model to describe value delivery of IT investment has been developed. Fig. 1 illustrates the five factors.

Table I further *summarizes* each of the factors' conceptual definitions, important metrics to describe the value delivery factors, and the literature sources that presented the variables.

A. Financial Value

Most investments are concerned with financial values. Apprehensively, when evaluating IT investment, revenue and/or costs becomes the essentials. For the businesses, the ability of the IT investment to turn into profitable ventures to the organizations and the ability of the invested IT to be able to reduce costs in the organization is the most valuable criteria.

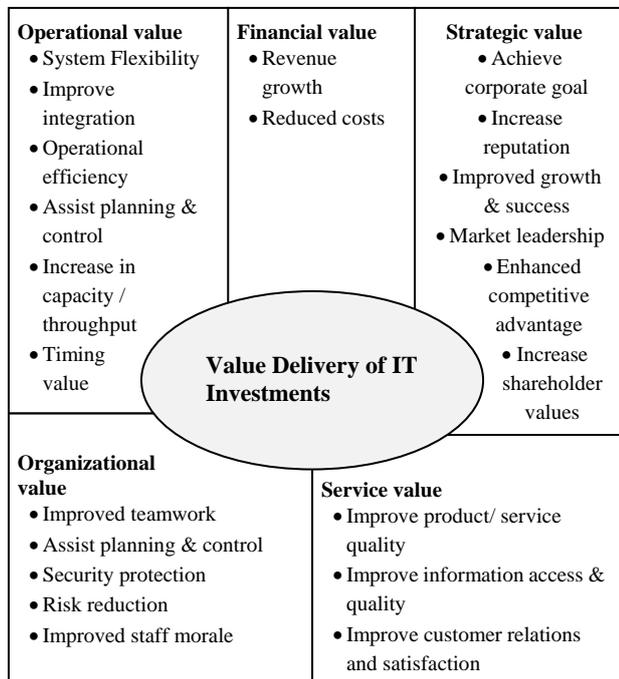


Fig. 1. Conceptual model for the value delivery of IT investment.

B. Operational

The evaluation of the IT investment must consider the impact of the technology towards the operations of the business. Hence, IT investments are expected to deliver values to the business functionality of the organization. IT is anticipated to improve flexibility, efficiency, and capacity planning of the business processes. In other words, IT

strengthens firm performance of the businesses.

TABLE I: THE CONCEPTUAL DEFINITIONS AND METRICS OF THE VALUE DELIVERY OF IT INVESTMENT

Factors	Conceptual definition	Metrics	Literature Sources
Financial value	The monetary values of investment which accounts for money in and out of the organization.	Revenue growth Reduced costs	((13), [18]) ([6], [14], [15], [19])
Operational value	The improvement in the business functionality and processes in the organizations facilitated by the IT investment	System flexibility Improve integration Operational efficiency Assist planning & control Increase in capacity / throughput Timing value	((13)-[15], [17] [19]) ([14], [18]) ([14], [15], [17], [18]) ([14], [17]) ([13]-[15]) ([13], [14])
Organizational value	Organizational resources that include human, assets, infrastructure that are benefited from the IT investment	Improve teamwork Assist planning and control Security protection Risk reduction Improve staff morale	((14), [11]) ([14], [17]) ([17], [19]) ([6], [15], [16]) ([15], [16])
Strategic value	Corporate benefits through management and planning accomplished through IT investments	Achieve corporate goal Increase reputation Improved growth and success Market leadership Enhanced competitive advantage Increase shareholder values	((17)-[19]) ([14], [16]) ([14], [18]) ([14], [18]) ([6], [14]-[19]) ([15], [18])
Service value	Improvements of treatments, information, products and services to the stakeholders especially the customers	Improve product/ service quality Improve information access & quality Improve customer relations & satisfaction	((14), [16], [18], [19]) ([6], [15], [17]) ([6], [15]-[18])

C. Organizational

IT provides values to the organizational resources. IT able to provide protection of the organization's assets such as infrastructure, software and data, provides job enrichment, and improve accuracy of decisions across organizations. Employees are benefited from the IT investment that create values through improve working environment. Management decisions and actions are improved, hence reducing more business risks.

D. Strategic

Upper management concerns of IT investments are centered towards the improvement of management and planning of the organization. IT investment increases the well being of the organization through increase of image, competitive advantage, leadership, and achievement of mission and objectives. IT becomes the competition tools that distinguish organizations. It facilitates the synergy value that forms between alliances and partnership, which benefit the stakeholders the most.

E. Services

IT investment delivers values to the customers of the organizations as well. The chain of values of IT investment created from the research, production and marketing channels compounded to give impact to the customers at the end. Improvement over quality of products and services and customer relations and satisfaction are the outcome of IT investment.

V. CONCLUSION

In making IT investment decisions, identification of IT values are important in evaluating or assessing the benefits of the IT investment. There are many kinds of IT value delivery, looking from different aspects of perspectives. Considering the wide variety of IT values, this study are sought to identify the established variables that have been proven through past empirical studies. This paper has identified five major factors that describe the IT investment values to the organizations, which are *financial, operational, organizational, strategic, and service* values.

However, this conceptual model is not conclusive yet. Further research need to be undertaken to expand the conceptual model to include the identification of IT investment enablers or determinants. This part of assessment also needs critical review of existing models from the literature before such model can be built.

Combination of these two parts of assessment, enablers and value delivery, will provide a comprehensive conceptual model that can be further utilized to develop an evaluation methodology of an IT investment.

APPENDIX

APPENDIX A. LIST OF METRICS AFTER TWO-STAGE FILTRATION

NO	IT INVESTMENT VALUES	Clemons & Weber (1990)	Irani & Love (2001)	Bannister (2001)	Gumasekan <i>et al.</i> (2001)	Stewart & Mohamed. (2002)	Chou <i>et al.</i> (2006)	Azadeh <i>et al.</i> (2009)	Nasher <i>et al.</i> (2011)
1	Revenue	√				√			
2	Improved Growth and success		√			√			
3	Market Leadership		√			√			
4	Enhanced Competitive Advantage		√	√	√	√	√		√
5	Improve Customer Relations & satisfaction			√	√	√	√		
6	Flexibility	√	√	√			√		√

7	Improved Product/service Quality		√		√	√			√
8	Improved Teamwork		√		√				
9	Improved Integration		√			√			
10	Operational efficiency/efficiency improvement		√	√		√	√		
11	Timing Value	√	√						
12	Assist planning & control		√				√		
13	Improved Accuracy of Decision		√	√			√		
14	Improved Information Access & quality			√			√		
15	Reduced Costs		√	√				√	√
16	Security protection						√		√
17	Risk Reduction			√	√			√	
18	Increase in Capacity/throughput	√	√	√					
19	Assist to achieve corporation goal						√	√	√
20	Shareholder values			√			√		
21	Government requirement			√	√				√
22	Improved Staff Morale			√	√				
23	Increase reputation			√	√				

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