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For What IT's Worth: Insights into the True Business Value of IT

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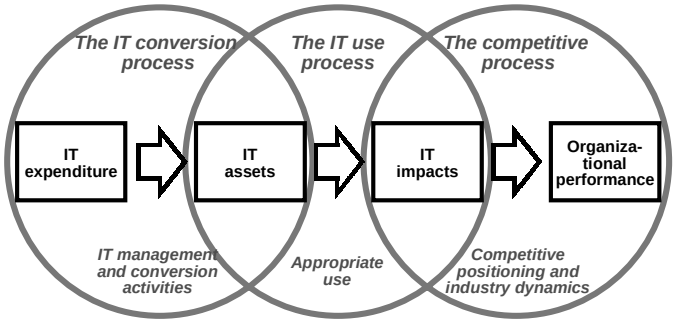
INTRODUCTION

The true value of information technology (IT) is a topic that is cause for a lot of discussion. Skepticism roars again in the boardrooms of many companies, as the e-business hype exploded in the face of many 'believers' of the new-economy gospel. Without strong technological developments to thrive upon and an uncertain economic perspective the pressure on IT budgets is high. For investments in IT the requirement of sufficient returns and a clear 'business case' is even more severe than before. However understandable the question, the answer is not that simple. This paper aims to give some insight in the possibilities of and problems with determining the value of IT.

In the research to the value of IT two approaches can be distinguished: the variance approach and the process approach (Davaraj & Kohli, 2002). The variance approach measures the relationship between IT investments and organizational performance in terms of higher revenues, lower costs, improved market share, etc. This approach focuses on the 'what' question. *What* is the relationship between IT investments and organizational performance? The advantage of this approach is that it reveals statistically 'proven' effects of IT. These effects are of particular relevance for the development of economic policy. The disadvantage of the approach is that the effects are valid in general, but might not appear for a particular investment in a particular company. Its relevance for corporate decision makers therefore is limited. On a company level more insight in the 'how' question is required. *How* do IT investments improve organizational performance? This question is addressed in the process approach. The framework presented by Soh and Markus (Figure 1) shows this approach. This paper is built-up along this framework. First we will explore the relation between IT expenditures and IT assets. In the next paragraph the organizational impacts will be discussed. The third paragraph considers the relation between IT impact and organizational performance. The paper will be concluded with some proposals for a more balanced understanding of the value of IT.

Figure 1: The process approach for understanding IT value. (Soh & Markus, 1995)

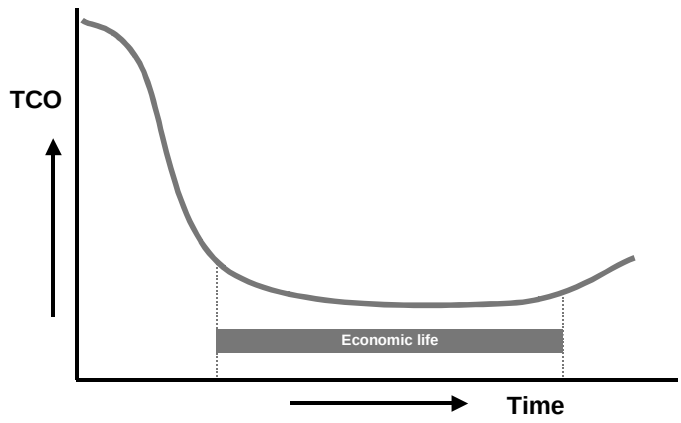


IT EFFICIENCY

Utilizing available technologies as optimal as possible and switching to new technologies at the right moment are the keys to a minimal cost of managing and maintaining the IT in an organization. A well-established concept is this area is that of the Total Cost of Ownership (TCO). TCO covers all costs related to the asset. All cost meaning both registered and unregistered 'hidden' costs, for example peer support in solving a problem. Regarding the optimal use of technologies, and the effects on the TCO, a lot of research has been done by the Gartner Group.

The relationship between TCO and the life cycle of a technology is a less researched field (Davaraj & Kohli, 2002). Figure 2 shows the expected relationship between the TCO and the life cycle of a technology. In its younger years, the knowledge and utilization of a technology are less developed, resulting in a relatively high TCO. If the technology evolves into an industry standard, the TCO will decline as the technology matures. At the end of its life cycle the use of the technology will decline and the TCO will rise again as a result of scarcity of resources. Its economic life has passed and the technology is outperformed, probably both technically and economically, by a newer technology. An example of this lifecycle is the rise of MS-DOS and its replacement by MS-Windows as the standard operating system for personal computers. Within a technology a similar life cycle pattern can be expected for successive versions or releases.

Figure 2: The expected relationship between TCO and the life cycle of a technology.

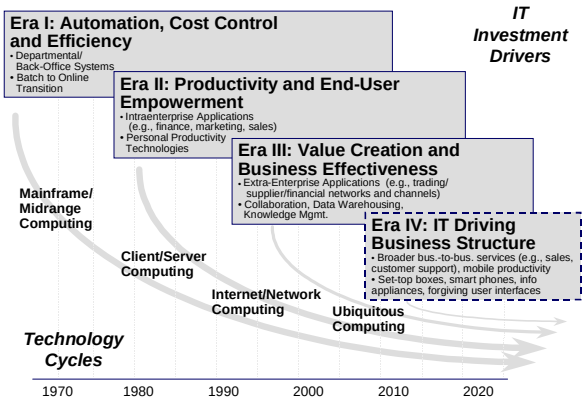


For a discussion about the value of IT it is good to understand that TCO does not express a value. TCO expresses a cost! This cost reflects the IT Efficiency challenge; one of the most important challenges for CIOs and IT Executives:

How to minimize the cost of utilizing, managing and maintaining the current IT, whilst delivering the agreed 'quality of service'?

Notwithstanding the fact that TCO has no value on its own, a decline in TCO has! IT investments that result in a higher IT efficiency, for example the implementation of a IT management suite, contribute to a lower TCO of the managed IT systems or components. The decline of TCO that can be achieved is a return on the investment involved.

Figure 3: The development of IT. (Gartner Group)



IT EFFECTIVENESS

Another challenge for CIOs is the question:

How to maximize the 'business value' of IT investments.

This challenge addresses not the efficiency of IT, but its effectiveness. How does IT contribute to the business strategy and goals?

Understanding the impact of IT

The impact of IT on business is rapidly shifting from an efficiency enhancing production factor towards a source of business innovation. This development is illustrated in figure 3. The changing role of IT has to be reflected in the way IT investments are evaluated. The traditional 'IT-economics' focus on cost savings should evolve to also include productivity and business value drivers. This notion has inspired several authors (e.g. Hammer & Mangurian, 1987, Riggins, 1999, Smit & Silvius, 2001) to provide frameworks for identifying value of IT solutions. From these frameworks a common understanding arises that IT can make a business more *efficient*, more *effective*, more *flexible* and/or more *innovative*. These four 'sources of value' identify the way IT creates value for an organization. The four terms mentioned summarize the development of the value of IT over the past decades. Starting from a calculation tool to improve *efficiency* in administrative processes, the opportunity to provide decision makers with more detailed information much quicker than before arose, hereby improving the *effectiveness* of the organization. In recent years it has become clear that a revolutionizing technology like the Internet can open up new markets, new products or provide new means of developing customer loyalty, thereby *innovating* the business of a company. So, from an enabler of business IT developed into an innovator of business. The latest notion is that the lower cost of communication, which IT provides, enables organizations to swap resources more easily, e.g. moving business activities offshore, thereby enhancing the managerial *flexibility*.

Figure 4: The Generic Business Model.

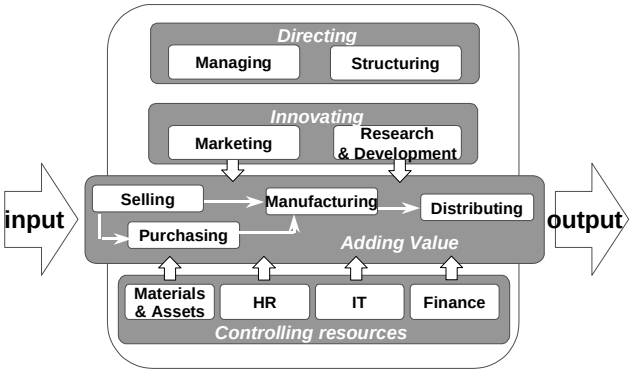


Figure 5: The IT value grid. (Smit & Silvius, 2001)

4 sources of value	Efficiency	Effectiveness	Innovation	Flexibility
Price		*Enable for price differentiation*		
Product			*Enable build to order*	
Promotion	*Enable one-to-one marketing*		*Create new promotion channels*	
Placement		*Enable when/where you want delivery*		
4 dimensions of competition				
Value Adding	*Increase use of production resources*		*Create new channels*	*Allow for deferral of investments*
Innovating				
Directing		*Speed-up decision making*		
Controlling	*Automate supportive tasks*			*Increase scalability of resources*
resources				
4 groups of business processes				

Understanding more of the impact of IT

Thus, for a better understanding of the impact of IT on an organization we should consider its effect in terms of efficiency, effectiveness, innovation and flexibility. Logically, these 'sources of value' can be applied to the external positioning of the organization or to the internal business processes.

For understanding the external positioning marketing, provides us with the four 'P's: *Price*, *Product*, *Placement* and *Promotion*. Combining the sources of value with these fields of competition provides a practical 'grid' to identify the possible effects of an IT investment. For example, an IT system that allows a company to differentiate its prices is identified on the grid as having an impact in the field *effectiveness* combined with *price*.

To understand how IT adds value to the internal business processes, these processes are categorized in the main business functions of the Generic Business Model, as developed by James Martin & Associates: *adding value*, *innovating*, *controlling resources* en *directing*. An example of adding value in the *directing* function is the implementation of a management information system that allows for better decision-making.

The IT value grid, as illustrated in figure 5 with a number of sample impacts, provides a useful aid to understand, communicate and discuss the impact of an IT investment. Without this understanding, any discussion about the value of IT will be without foundation.

A preliminary understanding however is that the relation between IT and business value is not always straightforward. Business applications will usually have an identifiable impact on business processes, but for components of the IT infrastructure their effect is mostly indirect as enabler of applications. These 'levels' of impact brought us to distinguish three categories of IT 'value drivers'. The first category, 'IT Business Value Drivers' consist of business applications with a direct impact on the business. The second category is the 'Derived IT value drivers' and consists of the IT infrastructure and the data architecture of the organization. The third category, 'IT value enablers', consists of the variables regarding the organization of IT in the company.

Business and IT alignment

After creating a good understanding of how an IT investment influences the business, the next step is to come to understand the returns of this impact. Since IT itself has no returns, the returns are always in 'the business', it is helpful to have a close look at the business. First of

Figure 6: The complex relation between IT and business value.

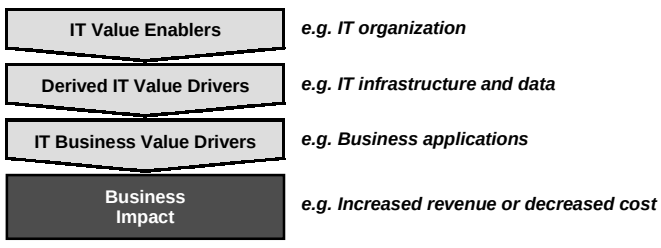
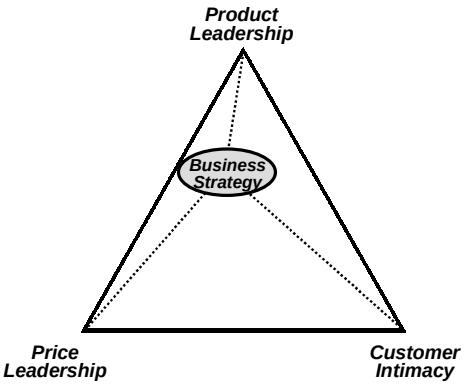


Figure 7: Typology of business strategy



all the strategy and goals of the business have to be considered. After all, it is this strategy IT should align with.

In modern business strategy literature, three dominant strategies are identified: *Product Leadership*, *Customer Intimacy* and *Price Leadership* (Treacey en Wiersema, 1997). In a *Price Leadership* strategy the organization only survives if it realizes high volumes with low costs. IT investments that create business efficiency, for example an ERP system that optimizes the utilization of resources, are particularly relevant in this type of strategy. In a *Product Leadership strategy* the Unique Selling Proposition of the company is that of high quality of products and services. For these companies the ability of IT systems to enable this quality would therefore probably be of greater value than the efficiency of the company. For example, a smart warehouse management system that enhances order fulfillment by optimizing stock levels could fit this strategy. Finally, in a Customer Intimacy strategy the organization will benefit most from IT systems that strengthen their ability to tailor their offer to the customer's needs. An example of such a system could be a CRM application for a fashion retailer that allows him to capture the measurements, preferences and buying history of his individual customers.

The manner in which business strategy gives input to the evaluation of IT investments can be summarized in table 1.

A possible weakening of the argument made above is that all 'values', efficiency, effectiveness, innovation and flexibility, are always relevant, regardless the strategy. This is true of course, but the analysis of the business strategy provides an indication of the relative weight of the criteria used in the evaluation of IT investments. However we should add that another angle is missing: the business functions.

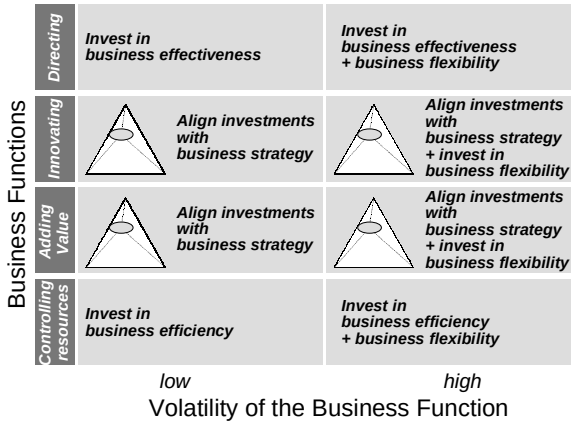
Not all business functions 'make the difference' in the strategy of a company. In the typology of business functions provided by the Generic Business Model (figure 4) typically the 'adding value' and 'innovating' business functions create the Unique Selling Propositions of the organization. Logically, the impact of business strategy on the valuation of IT investments will be most relevant for investments in IT systems with an impact on these 'adding value' and 'innovating' business functions. Supporting functions like facility management or personnel administration are also important but do not typically have a direct effect on the external positioning of the organization. For IT investment supporting these business functions, 'business efficiency' will therefore be the most important source of value.

Adding the volatility of the business function can further expand the alignment between the sources of value and the business function.

Table 1: Relationship between Business Strategy and dominance of the sources of value.

Dominant Business Strategy	*Corresponding dominant source of value*
Price Leadership	Business Efficiency
Product Leadership	Business Effectiveness
Customer Intimacy	Business Innovation

Figure 8: The relation between business functions, business strategy and the sources of value of IT investments.



Logically, the more volatile the business function, the more valuable the flexibility that IT can add to that business function.

An overview of the relationship between business strategy, business functions and the sources of value of IT can be illustrated as follows (figure 8).

Valuing investments

After creating an understanding of the impact of IT on business and the relevance of this impact in relation to the business strategy, the issue of valuation is next on the list. This is a typical economic issue for which it is irrelevant whether the investment is in IT or in any other resource. As long as the effects of the investment are understood, calculating the value of it is merely a financial technicality.

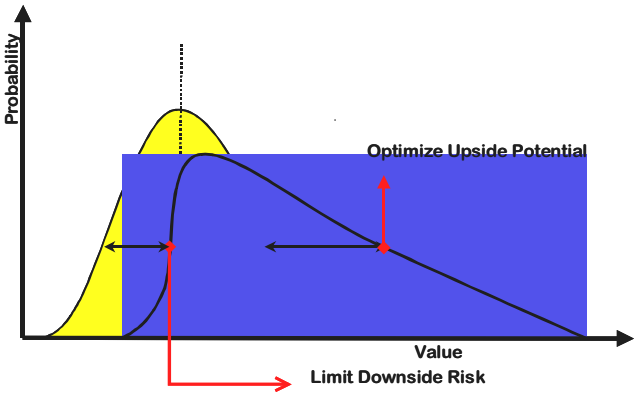
This sounds almost too good to be true. Indeed, it is not quite that simple. Valuation methods all have assumptions and limitations. Table 2 provides an overview of these valuation methods and their most important qualities and limitations.

The shortcomings of these methods are especially clear when IT investments are made to participate in today's E-Business economy. In this arena it is hard to make informed decisions when many variables are in flux. Traditional calculation methods are all limited in their ability to cope with risk and managerial flexibility. For example if a project proves to be a success, it can be sped up. If however the market deteriorates, the investment outlays of the project can be lowered or postponed. Despite the logic of this, in reality management adapts plans based on actual conditions all the time, this flexibility is not adequately valued in any of the valuation methods mentioned earlier. The result is an inadequate decision process for new projects. In some cases this even

Table 2: Overview of investment valuation methods.

Valuation method	*Qualities*	*Limitations*
Return on investment	• Easy to calculate • Easy to interpret (a simple percentage) • In line with the financial administration	• Outcome sensitive to amortization method • Ignores the time-value of money • Ignores risk
Pay-back period	• Quite easy • Intuitively coping with risk	• Ignores part of the revenues • Simplistic, does not determine value
Internal Rate of Return	• Includes the time-value of money • Easy to interpret (a simple percentage) • Based on cash-flows	• Complex • Not in line with the financial administration • Ignores risk • Multiple outcomes, or none, possible
Discounted Cash Flow / Net Present Value	• Includes the time-value of money • Based on cash-flows • Copes with risk	• Complex • Complex to interpret • Not in line with the financial administration • Not conclusive in case of projects with different durations
Economic Value Added	• Includes the opportunity value of money • In line with 'shareholder value'	• Value calculation based upon one of the other methods • Not in line with the financial administration

Figure 9: The effect of real options on value. (Smit & Silvius, 2001) Downside risk is limited by enabling investors/ management to abandon the investment or to wait with future investments. Upside value is optimized by enabling investors/ management to expand investment, to progress with projects or to seek other opportunities for the initial investment.



results in competitive investment proposals being rejected. Therefore it is clear that companies need to come up with new ways of judging IT investments.

Understanding the options

A new insight is provided by the Real Options Valuation (ROV) theory. In the ROV an additional value is calculated on top of the Net Present Value (NPV) of a project. This 'flexibility value' valuates the optionality of the investment. Optionality reflects the ability to alter the investment outlay and the timing of outlays based on changes in the competitive environment. ROV treats the possibilities of adapting the investment plan as (real) options.

The *opportunity* to invest can be seen as a call option, involving the right to acquire an asset for a specified price (investment outlay) in a future moment. A call option gives the holder the right, for a specified price within a given amount of time, to exercise the option to acquire the underlying asset. The techniques derived from option pricing, quantify the management's ability to adapt its future plans to capitalize on favorable investment opportunities or to respond to undesirable developments in a dynamic environment by cutting losses.

The Value of the real-option depends on three major elements:

- maturity of the option;
- business or project risk;
- interest rates.

A valuable insight that can be gained from option theory is the effect of changes of the variables of the investment on the value of the investment. Table 3 shows these effects. An interesting fact is that, for example, an increase in the volatility of the returns decreases the NPV, but increases the ROV!

Table 3: The effect of changes in the variables of the underlying investment.

	Effect on NPV	Effect on ROV	Effect on the sum of NPV and ROV
Present Value of the cash-flows ↗ :	↗	↗	↗
Height of the investment ↗ :	↘	↘	↘
Volatility of the returns ↗ :	↘	↗	?
Level of the interest ↗ :	↘	↗	?
Maturity of the option ↗ :	↘	↗	?

Corporate strategists embrace the ROV approach, acknowledging the importance of active managerial flexibility in adapting to a changing market environment.

Taking the competition into account

Another addition to the traditional valuation methods is the notion that the returns of an investment are not only influenced by the organizations own decisions, but also by the decisions of the competition. For example the first telecom operator that implements an innovative new service will enjoy, temporary, first mover advantages that the other players will miss when they implement the same service. Combining the real options approach with game theory, taking into account competitive counteractions, closes the gap between traditional corporate finance theory and strategic planning. Management investment decisions are made with the explicit recognition that they may invite competitive reaction, which in turn impacts the value of the firm's investment opportunity. The strategic value of early commitment in such cases must be set off against the option value of waiting and may potentially justify early investment. These decisions are often seen as strategic games against both nature and competition.

Of course, in many cases the players may not exactly be 'symmetrical', with one of them enjoying a more dominant market power position. The value of organizational capabilities and of a firm's bundle of corporate real options, like uncertainty itself, is idiosyncratic to each firm. Similarly, the exercise price of a corporate real option may be idiosyncratic, depending on what other resources and assets the firm already has. Exercising the option to launch a new Windows-based software package, for instance, will be less expensive for Microsoft than for another player, by virtue of its earlier strategic investments and complementary assets that enable dominance in the desktop market. The firm pre-empted competition and captured a dominant share of the market by setting the product standard early on. Analysis of competitive behavior and the effects on the valuation of real options is executed using elements of the Game Theory.

A 'Grab the dollar' game, for example, is a strategic context that is often associated with IT investments. Firms obtain a negative payoff when they end up investing simultaneously. 'Grab the dollar' illustrates the situation where the current market prospects are only favorable if one of the players invests, but simultaneous investment results in a battle with an expected negative payoff. Only the first player captures the dollar (e.g., patent), but when they all enter the market, they all end up loosing the battle. A dominant firm has an advantage to win this simultaneous game.

A complete evaluation framework

Based on the insights provided by the real options and game theories the traditional NPV calculation can be expanded to include the effects of managerial flexibility and competitive behavior. This 'Expanded NPV' can be calculated as:

Expanded NPV = direct NPV + flexibility value + strategic value

Figure 10: A complete valuation framework.

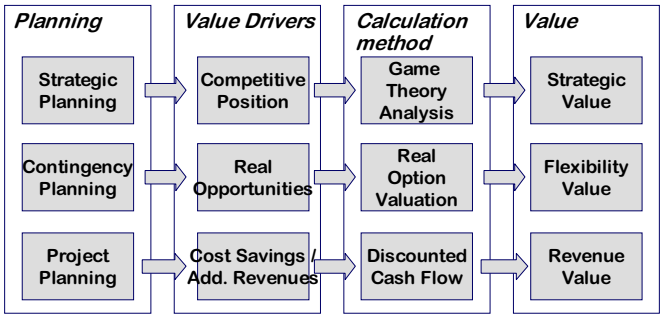


Figure 11: The relationship between the impact of an investment and the relevance of different value elements.

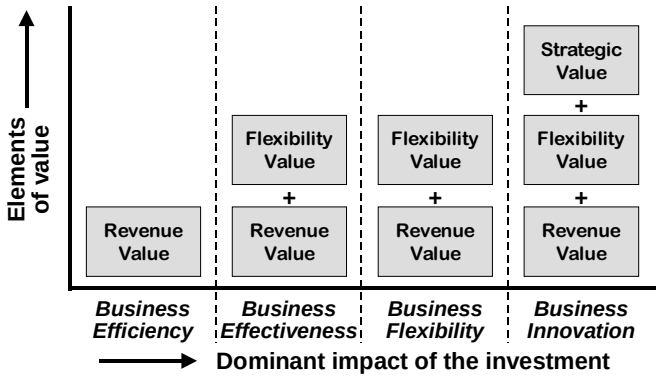


Figure 10 summarizes this more complete valuation framework. This framework provides a better understanding of the value of IT investments. What does this mean for the calculation of the value? In theory the knowledge is available to calculate a 'complete' value according to the framework. This calculation however will be complex and hard to understand in boardrooms. It is a drawback not to be taken lightly. The tendency to fall back on simple and comprehensible calculation methods leads to systematic underestimation of the value of IT investments especially when their effects are more than just efficiency improvement. This pitfall should be well understood. Financial theory just cannot provide us with a simple and undisputed figure or percentage that expresses the complete value of an investment. It is therefore the opinion of the economist Professor Michael Brennan that '*It is better to have the approximately optimal solution to the right problem than the exact solution to the wrong problem!!!!* (Actual quote on the 2000 Real Options Group conference, May 2000).

This opinion may not be very satisfying but it is not without grounds. A last insight to be added is the characteristic of the investment under scrutiny. For an IT system with a mainly internal 'business efficiency' impact, the additional 'flexibility value' and 'strategic value' will not be that significant. However, if an IT system has impact on the external positioning of the organization, the additional value elements will be significant for a good valuation of the investment. Logically a relationship between the impact of the investment and the relevance of the different value elements can be suspected, as is shown in figure 11.

CONCLUSION

The value of IT is a much discussed and often misunderstood subject. This paper aims to add new insight to the discussion by providing a practical grid in understanding the impact of IT investments on the organization and by showing the conceptual relationships between IT value and business strategy and functions. In its use of the latest developments in financial theory this paper hopefully develops a more complete framework for the valuation of IT projects. This framework warns about rushing into possibly wrong decisions about IT investments based on incomplete calculations of value.

Unfortunately we are far away from a simple and easy-to-understand calculation method unveiling the complete and true value of any investment. For this reason company executives should focus their attention on creating a thorough understanding of how an investment in IT impacts the business of the organization, instead of focus on oversimplified value calculations based on questionable assumptions. *That's what ITs worth!*

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