

## **IT Investment Decisions: Value, Uncertainty and Gut Feeling**

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### **ABSTRACT**

Although IT investment evaluation has been one of the core subjects of IT research since the early days of the use of computers in business and a plethora of evaluation methodologies and taxonomies have been developed, there is little doubt that IT investment evaluation still is problematic and that many crucial decisions are based on gut feeling (belief) rather than on the result of analytical tools. Obviously, there is a limit to what can be evaluated by formal methods, but all too often the switch to non formal evaluation methods or no evaluation at all is made much too soon. It is argued that the main drivers for this switch are the high level of uncertainty surrounding those IT projects, the high risk of project failure and the intangible nature of many of the expected benefits. Being unable to quantify the expected return of the project, the decision is based on gut feeling. It is our purpose to try to reconcile analytical tools to belief on the basis of a shared notion of value.

## I. INTRODUCTION

Right from the start of using computers in organizations, the economic evaluation of IT has been one of the main areas of concern and one of the leading research topics (Claver et al. (2000), Bannister and Remenyi (2000)). The limitations of traditional investment evaluation techniques such as Net Present Value (NPV) or Internal Rate of Return (IR) were apparent for typical IT projects characterized by many intangibles, conditional benefits and a high rate of uncertainty (Dos Santos (1991)). For a typical NPV calculation an estimate is made of the expected outgoing and incoming cash flows of the investment project over its expected life span and then these cash flows are discounted using the organization's risk-adjusted required rate of return. It is difficult to make accurate predictions of the outgoing cash flows. There is evidence that in many cases, IT projects require (much) more resources and time than originally budgeted (Iacovou and Dexter (2004)), as will be discussed further in the fourth part of this paper. It is even harder to make accurate predictions of the incoming cash flow equivalent of the benefits to be expected from the project and of the risk involved. Conditionality and uncertainty are inherent in two ways: organizational and technological. As an illustration of the organizational context, it is obvious that e.g. the value of better management information is only real if the information is available in the right time span, is used (committed user), is used in the right way (the right information is delivered in an understandable format in the right timeframe), has influence on the manager's behavior, and yields better economic results for the organization, which is in turn dependent on, amongst other factors, competitive reactions. On the technological side, it is a fact of life that the information technology is constantly changing, and the success of new architectures is difficult to forecast. Investments in IT typically show option like characteristics, where the implementation of new architectures can be handled in a conditional way by establishing flexible growth paths to take advantage of increasing returns (in case of wide adoption) and network effects.

IT is considered to be a strategic necessity that is difficult to manage. The economic evaluation of interorganizational information systems and strategic edge applications is extremely difficult as the potential benefits are dependent on a number of related business functions and external parties. The success of many IT projects is a complex mixture of financial, technical, organizational and social effects, both within the organization and external: competitive reactions, influence on the value system, technology acceptance behavior. The integration of the internet into enterprise resource planning strategies has fundamentally redefined the IT landscape. For many organizations IT investments (information systems and information and communication technology infrastructure) represent substantial and growing amounts, while the benefits are uncertain.

Clearly, the economic evaluation of IT investment projects still is problematic. No definite evaluation framework is available and many top

executives feel uncomfortable when they have to come to a decision concerning the commitment of a large budget to new IT projects. After all, IT projects, specifically if they are targeted at implementing radical new technology or new business models, have a bad track record. Many systems don't live up to their expectations, show unmet user requirements, and require much more time and money than originally scheduled. Quite a number of projects are abandoned during or soon after the development phase, and even if successfully implemented, a significant number of systems prove to be rather short lived. Tiernan and Peppard (2004) argue that "the value derivable from IT continues to be elusive, with most executives disappointed with the return achieved on their IT expenditure". While we don't agree with this rather pessimistic statement, it makes clear that a good evaluation is a necessity to obtain the commitment of top management. Peslak (2005), on the basis of content analysis of annual reports of the 50 largest US companies, finds there has been a major de-emphasis on IT. He argues that this indicates that information technology is viewed as less appealing to investors than in the past and that it signals a change in the relative importance of information technology relative to other corporate strategies.

The high failure rate and the lack of clear cut measures of success and value undermine the status of the IT department. The uncertainty about the value an organization derives from its IT investments, can help to explain the so called status paradox (Avison et al. (1999)): low status for IT, often outsourced and evaluated as a utility in terms of speed of delivery, quality and cost, yet of strategic importance. Though spending on IT can be very high and IT investments have provided dramatic returns for some organizations, the information function is often considered as a secondary activity without representation at the board level (Avison et al. (1999)). Information systems should be seen as investments but are often considered as a cost. If it is unclear whether an investment in IT yields a higher return than other non-IT investments, and if the IT department cannot calculate and communicate its value added, the status of the IT department remains problematic. It is not uncommon for IT to be frequently reorganized, constantly reevaluated and often the subject of outsourcing. Although surveys (e.g. Gonzalez et al. (2005)) yield positive reasons for outsourcing (top three are: focus on IS strategic issues; increased IS department flexibility; improved IS quality), there is a general feeling that cost reduction and risk reduction are the real drivers. Executives often hope outsourcing will offer improved performance, lower cost and higher flexibility. From an economic point of view outsourcing can be seen as a transformation of fixed costs into variable ones and, if the contract has been properly managed, into foreseeable costs (Alner (2001)) that may be lower due to economies of scale and scope. But Gonzalez et al. (2005) also cite the elimination of a function that becomes problematic or complicated for top management and risk reduction. The question remains whether outsourcing reduces the risk. There is some research evidence that outsourcing when compared to in-house sourcing, is risky (Earl (1996)),

possibly due to the fact that outsourced projects pose greater challenges in terms of team communication and coordination (Wallace (2004)).

Of course, IT management is well aware of these problems. A myriad of alternative evaluation methods has been developed with a varying degree of success. Mercken (1979) discussed 17 IT evaluation techniques, Berghout and Renkema (1997) listed 60 IT evaluation techniques and at this moment at least 200 techniques are documented (mostly composite techniques). There is certainly no shortage of evaluation methodologies. Yet, some companies treat IT investments like any other investment project, while other companies do not formally evaluate IT investments at all. Those who treat them in a special way, generally use a combination of methods (Arribas and Inchusta (1999)).

We believe the worst “solution” is to avoid evaluation. It is a fact of life that in many cases IT management tries to *manage* the risks associated with the project but also tries to *blur* the exact nature of the business benefits to be expected from the project and the exact magnitude of the uncertainty surrounding the project. A *qualitative* instead of quantitative *business case* is developed in order to avoid being committed to a set of very precise (but in all likelihood very difficult to achieve) targets. Due to the complexity of the determination of costs and benefits and the difficulty to predict the future success of new technology or new business models and the competitive reaction, top management is asked to commit to those strategic projects as an act of faith. Gut feeling (sometimes termed ‘vision’, or ‘strategic insight’), replaces quantitative analysis (Bannister and Remenyi (2000)). Although, from an ex post view, many excellent IT investment decisions have been made this way, gut feeling is a bit unsatisfactory. Though instinct is not something to be condemned, and the value of intuition in solving complex problems is widely accepted, the process is difficult to communicate and explain. Without formal evaluation, it is difficult to enlist the stakeholders. Evaluation processes play an important role in getting internal and external stakeholders committed to the system. The evaluation processes enhance the absorptive capacity of the organization and reduce resistance to change. The popular term “project justification” instead of “project evaluation” highlights another characteristic of evaluation processes. In a lot of cases the purpose of the evaluation is not to choose in a perfect positivist view the best solution out of a limited list of alternatives, but rather to *justify* a project that has already, on the basis of gut feeling, been defined as highly likely to be the best choice. This justification is not (or ought not to be) a formal ritual, but serves the purpose of translating ‘the vision’ into concrete benefits and get the commitment of the stakeholders. Evaluation and selection processes precede adoption and use. So even if the decision is based on gut feeling, formal evaluation still is very useful. A qualitative vagueness will hamper this objective. Without a clear understanding of the business benefits aimed for, and the exact nature of the uncertainty and risk, with on the positive side also the inherent flexibility, surrounding the project, it will be difficult to:

- manage the benefits (they don't come automatically, and if they are not explicitly stated, it will be hard to optimize their achievement, and difficult to fight resistance to change which may lead to uncommitted stakeholders, which in turn is one of the biggest obstacles to IT success);
- manage an IT development crisis (detection of crisis indications, runaway projects, recovery management and possibly the decision to abandon the project, use of the built-in flexibility to redirect the project; options thinking).

For both problems, corporate culture and corporate politics are extremely relevant. It is not our purpose to design a new evaluation methodology, but to discuss the consequences of inadequate ex ante evaluation. First, we will briefly discuss the main classes of evaluation methodologies, and then we will discuss the issues of benefits management and uncertainty.

## II. EVALUATION METHODOLOGIES

A review of the IT evaluation literature shows that different thoughts exist on the way IT creates values to firms (Hu and Quan (2005)). The *microeconomics-based view* searches to show whether IT investments create excess return over other types of capital investment or other production factors. It can be used as an ex post justification on firm level. The *process-based view* (Barua et al. (1995)) is based on the idea that IT investments can create value by improving operational efficiency which can lead to better firm-level performance. It postulates that the impact of IT investments on firm performance is the result among three processes: the IT conversion process in which IT investments become IT assets, the IT use process in which IT assets create impacts and the competitive process in which IT impacts are converted into firm performance (Hu and Quan (2005), Tiernan and Peppard (2004)). The final result is measured in pure economic terms, but the intermediate results can be measured by other metrics. The *resource-based view* investigates whether IT investments improve firm performance by creating sustainable competitive advantage via unique, immobile, and path-dependent strategic resources and capabilities (Bharadway (2000)). The *real-option view* postulates that IT investments can create value by offering options and flexibility to firms in a highly uncertain competitive environment (Dos Santos (1991)). To these views we add what we will call the *pragmatic-justification view*, which aims at justifying the IT investment decision by a mixture of value concepts and taking into account the organizational decision context where rationality is bounded by political factors.

### A. The microeconomics-based view and the process-based view

Nobel prize winner Solow's famous saying "you can see the computer age everywhere but not in the productivity statistics" (1987) has sparked numerous studies, with very mixed results. Although this kind of high level ex post evaluation of the effect of IT expenditures on productivity is not the subject of this paper, it would be wrong to ignore the matter. Though there is research evidence that the paradox is not true any more, and was perhaps only there due to a faulty research design in the first place, it is still influencing the way some executives view IT: despite huge investments, the benefits are unclear. Another detrimental use of this paradox is to simply dismiss the evaluation question: "IT has not provided a measurable value (productivity or profit) to the business world, but you cannot live without it, so you should try to minimize the effort and the risk". From a pragmatic point of view, it would be very unlikely that executives, over the past fifty years, would have invested a huge and growing amount of money in IT projects if they had not a strong feeling that this investment made a positive contribution to the company. Measuring the effects of IT investments is complicated. Input as well as output is not that easy to determine. On the input side, many productivity studies only take into account hardware investments. The IT benefits are often not clearly defined. If productivity or profitability is used as an indicator, it is clear that IT only has an indirect effect on them (process-based view). It is perfectly possible that an IT project was a complete success, but did not yield a bottom line effect due to external influences. If e.g. the X banking corporation merges with the Y banking corporation, it is very likely that even very successful IT projects will be disposed off because the new entity will define a new IT architecture. Mergers often lead to a massive destruction of IT investments. Given the bad track record of IT projects, it is also obvious that there will be a significant difference if only successful projects (usable systems actually used as intended) are included or all projects.

#### 1. The original productivity paradox

Early studies found that investment in IT did not bring about productivity growth or yielded only a very low increase (Brynjolfsson (1993)). Later studies do show a positive and significant relationship. One thing is clear: difference in methodology leads to a significant difference in research outcome. There is a great variety in the way output and input is measured, in the level of the analysis (project, firm, industry, national economy), in the time lag allowed for the investment to have any effect, and in taking into account mitigating factors. 'Productivity' is measured in various ways. Measuring output is not a trivial task. Oz (2005) argues that it is almost impossible to measure productivity gains in the service industry, yet this industry is a major IT user. But even for tangible products, the output will not be homogenous over time, due to quality improvements, changing product specifications or better service aspects. In the automotive industry e.g. the

complexity of a '2005 model' car can hardly be compared to its '1975 model' equivalent. The input side is also complicated. In many studies 'investment in IT' is defined as investment in hardware (as those figures are readily available in the USA) though it is well-known that hardware is only a small and shrinking fraction of IT costs, while the capacity delivered is expanding at a rapid pace. In those studies where the total IT budget is used to overcome the hardware-problem, it is noted that it is very hard to obtain reliable IT budgets because often the IT cost is not clearly separated from other costs. Time lags between investment and benefit (due to development, learning, organizational restructuring, adjustment), mismanagement, and external factors such as mergers, redistribution (other firms or stakeholders receive the benefit) complicate the problem. Some studies have used a single production function to try to find a direct correlation between IT spending and firm performance. This microeconomic view of IT value is that IT can be treated as an input in the production function of a firm and that there is a substitution effect between IT and other production factors. Though the adequacy of this methodology is a subject of debate, it offers some valuable insights. Brynjolfsson and Hitt (1996) used Cobb-Douglas production functions and found that the IT hardware spending yielded a very high marginal product. Though these findings were confirmed by many similar studies, at firm level, at industry-specific level (Menon et al. (2000)) and at country level (Tam (1998)), they were challenged because of the fact that hardware spending is only a small fraction of the IT effort. Production functions based on total IT costs confirmed the positive relationship. Shu and Strassmann (2005) estimated a Cobb-Douglas production function on the basis of panel data (hardware and IT-labor cost) for the banking industry and found that information spending has the highest marginal product among all input variables. Hu and Quan (2005) evaluated the productivity impact with a causal analysis model and confirmed that there is a causal relationship between IT investments and productivity at the industry level.

## 2. The financial performance approach

Strassmann (1997) finds, on the basis of a large number of cases, the absence of any positive correlation between profitability of firms and IT spending, and postulates that this relation has not changed for more than 20 years. From this he concludes that it is not how much is spent on IT but how IT assets are managed that makes the difference, which is confirmed by the process view of value and by many executives (Hopper (1991)). The lack of relation between financial performance and IT investments can be due to several factors: time lags, difficulties in measuring IT effort, external factors and IT management problems. In an attempt to deal with the last problem, Stratopoulos and Dehning (2000) investigated whether companies which are particularly successful in IT, perform financially significantly better than less IT successful firms. On the basis of a quasi-experimental approach, comparing

successful users of IT (selected on the basis of an expert opinion on IT-success) to a matched control group, they find that successful users of IT financially outperform the control group. So there is some evidence that for successful users there is a positive relationship between the intensity of IT investments and firm performance.

### 3. The firm value approach

The financial performance (profitability) is essentially a short term indicator. The firm value (shareholder value) is a more long term indicator, which is preferable for investment decisions. Management's first priority should be to maximize value for shareholders. IT projects can have multiple effects on firm value. The firm value approach forces the IT managers to think in terms of competitive advantage (magnitude and duration) and risk and its effect on firm value (Dehning et al. (2005)). Several research studies, employing event study methodology to measure the effect of IT investment announcements on firm value, yield mixed results and illustrate the complexity of relations. Dos Santos et al. (1993) finds a significant positive reaction for firms that made innovative IT investment announcements but an insignificant negative reaction for firms that made non-innovative IT investment announcements. Im et al. (2001) find that small firms experience a significantly positive reaction but larger firms a negative but insignificant reaction. Chatterjee et al. (2002) find that IT infrastructure investments have higher positive abnormal returns than application investments. Subramani and Walden (2001) give evidence that the market values investments in electronic commerce. Ferguson et al. (2005) find that on average, noninnovative electronic commerce investments are perceived as more valuable to the firm than innovative investments. They postulate that this is due to the fact that innovative electronic commerce projects are most likely seen by the capital market as easily replicable, and consequently have little, if any, competitive advantage period. Noninnovative investments are seen as being compatible with a firm's information technology capabilities, a view consistent with the resource-based view of the firm. Dehning et al. (2005) developed a theoretical firm value model that incorporates the multiple effects that IT investments have on firm value. Overall, there is evidence that IT investments have a positive impact on firm value.

### 4. The process-based view

The process-based view studies the process of value creation. In contrast to the productivity view discussed above, that is based on a black box approach (compare input to output), the process-based view tries to understand the way the value is created. Lee (2001) shows the indirect and complex causal relationship between the use of IT and profit using time lags and instrumental



variables. For ERP systems e.g., Poston and Grabski (2001) found a significant improvement in firm performance 3 years after the ERP system implementation. Activity-based costing (ABC), originally designed for the allocation of costs after an investment is made, was shown to be of use for investment justification to get a clear picture of the process of value creation (Peacock and Tanniru (2005)).

### *B. The resource-based view and the real-option view*

These views are an extension of the process-based view and they value the flexibility and strategic influence of IT investments. The resource-based view implies that competitive advantage can be sustained by investing in inimitable idiosyncratic competencies (Peppard and Ward (2004)). Central to the resource-based view is the fact that resources, per se, do not create value; value is created by an organization's ability to utilize and mobilize those resources (Peppard and Ward (2004)). The resource-based view for IT is the successor of previous, more limited partial approaches, e.g. the Strategic Alignment Model (validated by Avison et al. (2004)) and strategic fit models (Porter (1985), Jiang and Klein (1999b)). The option-view is based on the real-options approach and values the inherent flexibility of many IT projects. These views can be used for ex ante evaluation on project level.

#### 1. The resource-based view and composite scorecards

Typical for resource-based view approaches to the economic evaluation of IT is the use of all kinds of composite scorecards. A well known example is Information Economics (Parker and Benson (1988)). Information Economics, in essence, uses a process of assigning point-rating scores to assess the investment benefits and strategic relevance of IT technology (both for the business domain and the technology domain), together with a measure of risk. These scores are attributed in a subjective-expert way (averages of scores of several experts).

The comprehensive approaches often make use of scoring and weighting to derive a single result. Weighting and scoring is conceptually a dangerous process. Scores on a nominal scale are treated as values on a ratio scale (which is clearly wrong) and scores belonging to completely different domains are added as if they were interchangeable. The advantage of this approach is that many evaluation aspects can be dealt with and be translated into a single overall score. It is however doubtful whether the single score objective is yielding the right information. We believe it is better to confront the decision makers with the detailed scores instead of the overall score. A format based on the Balanced Scorecard (Kaplan and Norton (1992)) is preferable to evaluate the project on each of the four perspectives (financial,

customer, internal, innovation) by means of specific IT-related metrics (Milis and Mercken (2004)).

## 2. The real-option view

The use of real-option models to evaluate IT investments has attracted a lot of attention (Dos Santos (1991), Kumar (1996), Kumar (2002)). An option is the right to do something, without the obligation to do it. The standard financial call option for shares e.g. gives the holder of the option the right to buy the share at the end of the option period (European-type call option) for a predetermined price (the strike price). If the market price at that moment is higher than the strike price, he will honor the option. If the market price at that moment is lower, he will not use his right. The positive outcome can be very high, while the gross negative outcome is limited to 0 (the net outcome is minus the premium he had to pay for the option). It is interesting to note that uncertainty has a positive value. Suppose for example that the current price of the stock is € 100, the strike price € 101 and the price at the end of the period could be just one of two values: € 98 or € 102. If the price is € 98 the call option will be worthless, and the investor will have lost the premium; in the other case he will have gained € 102 - € 101 = € 1 gross, minus the premium. Higher uncertainty means that the difference between the down and up price will increase. Suppose that the price at the end of the period could be just one of two values: € 51 or € 151. If the price is € 51 the call option will be worthless, and the investor will have lost the premium; in the other case he will have gained € 151 - € 101 = € 50 gross, minus the premium. So the downside is the same (it is capped to the loss of the premium) but the upside has increased a lot. The value of the option (which can e.g. be computed by means of the binomial model or the Black-Scholes model) will be higher for the second case than for the first case. As Fichman et al. (2005) postulate “although most managers can understand why increased uncertainty expands the value of a stock option, the same principle applied to IT investments with embedded options strikes many as counterintuitive”. Of course this is not only the case for IT investments, but for all real investments. Although option models have been around for some time to evaluate real investment projects, they still are not very popular. This is a pity because real-option thinking yields a unique insight into the value of flexibility. Many investments in real assets (buildings, equipment but also information systems) have option like characteristics. In the general investment evaluation literature, the real option model has been welcomed as an extension of the classic Net Present Value approach to deal in a superior way with uncertainty and to free the Net Present Value approach from its typical inflexibility and from the misuse of an arbitrarily high risk-adjusted rate of discount (Mercken (2004)). Option valuation uses a risk-neutral approach and the cash flows are discounted at the risk-free interest rate. The classic rigid NPV approach systematically undervalues investment projects with flexibility options. But more important

than the technique is the fact that thinking in terms of options stresses the importance of dealing with uncertainty in an open way. With the classic NPV approach the project promoters will try to blur the uncertainty: more uncertainty means more risk, thus a higher rate of discount. They will also be forced to make all kinds of estimates of a probabilistic nature (determine the possible outcomes and their likelihood). If the option-view is used, there is no need to estimate the likelihood of the outcomes, nor to assess the overall risk level of the project in order to choose the right rate of discount... There is no need to blur the uncertainty, as that uncertainty has a positive value. Balasubramanian et al. (2000) stress that the true value of the real options approach is in how it informs the management process of IT investments. This is confirmed by Fichman et al. (2005).

Many IT investment projects have some built in flexibility (scale up, scale down, stop, redirect, postpone, speed up,...) that can be used to greatly enhance the proceeds of the project: avoid pitfalls and capitalize on favorable circumstances. Since the early days of computing IT management has tried to contain the risks by means of a number of option-like elements: large projects will be preceded by a consulting project (go/no go/redirect), start with a pilot (proceed/stop/redirect), while the speed of the rollout will surely be adapted to the circumstances (speed up, postpone, cancel). The consulting project, the pilot, etc. are all examples of real options. Even within those phases, other flexibility options are present: if prototyping is used, it will e.g. be possible to postpone difficult technological decisions to a point in time where better information will be available. Kumar (2002) and Fichman et al. (2005) show how options thinking can help to enhance project management. Kim and Sanders (2002) discuss how option valuation can be used to take into account the impact of strategic actions and competitor reactions, thus making a bridge between IT competitive analysis and IT investment valuation. Campbell (2002) studied the quantification of the waiting period (delay) that will maximize the value of the IT project by means of real options. Singh et al. (2004) used real options to evaluate the application service provider (ASP) model.

### *C. The pragmatic-justification view*

The pragmatic-justification view uses a wider definition of value and takes into account the organizational and political context, with the need to conform to social norms of acceptable behavior and legitimacy. IT evaluation is seen as a multidimensional problem: multiple objectives and multiple points of measurement (Mercken (1977)). System success criteria include: system quality, user information satisfaction, quality of decision making, IS usage, productivity, strategic fit, flexibility. User perceptions are particularly prominent. IS effectiveness is a multidimensional concept (DeLone and McLean (1992)). Saarinen (1996) proposes four dimensions of system success: satisfaction with the system development process; satisfaction with

system use; satisfaction with system quality and finally impact of IS on the organization (benefits of the investment). Jian and Klein (1999) show on the basis of a survey that the involvement of users is critical for more than one form of satisfaction. In a paper dealing with the evaluation of executive information systems Poon and Wagner (2001) suggest five evaluation criteria for EIS, but we believe this can be generalized to other types of information systems:

- the system is made available and users are given access to the system;
- the system is used by the intended users;
- users are satisfied with the system;
- the system has positive impact on the users and the organization;
- the system tends to spread (diffusion).

The pragmatic approach also acknowledges the fact that an evaluation is not a strictly objective, rational, positivist endeavor, but also encompasses elements of a social and political process of commitment and justification with substantial ceremonial aspects (Tingling and Parent (2004)).

### III. BENEFITS MANAGEMENT

#### *A. Relevance of benefits management*

Without a good benefits management plan, it is likely that top management will consider IT investments as ‘acts of faith’ what will contribute to an alienation of IT. It will also be difficult to get the commitment of sponsors and future users. IT projects are implemented to provide benefits to the organization (Bennington and Baccarini (2004), Ward et al. (1996)). In one of the earliest discussions of this issue, Matlin (1979) stresses the importance of benefit calculation. Many executives have been disappointed with the *real* benefits delivered. Systems are usually developed with high expectations, yet often end in failure. Lin and Pervan (2003) state “while pre-investment appraisal and post-implementation review of IS/IT projects are important for evaluation purposes, they are insufficient in terms of ensuring that the benefits required are realized and delivered to the organization”. Without an effective active benefits management strategy in place, the desired performance improvements may not materialize and thus IT may be deemed an investment sinkhole (Love et al. (2005)). Evaluations are not neutral. They are meant to prove the value added of the project and to get people committed. As Wilson and Howcroft (2005) rightfully state, “evaluations are important resources for supporters of an information system to enroll new users and consolidate support from those already enrolled”. This is confirmed by Irani (2002). Without evaluations, it will be harder to convince those involved. User

participation is no guarantee for success. Even with intensive and well-designed user participation it still is possible that the system will eventually fail to be used due to user resistance if the benefits promised do not materialize. Howcroft and Wilson (2002) give evidence that the dual nature of the role of the systems developer, due to the antagonistic relations between end-users (employees) and sponsors of the system (managers) relate to the problem of benefits definition. It is striking that according to Ward et al. (1996) only 10% of organizations has a defined process for managing the benefits of IT projects. Bennington and Baccarine (2004) find that in Australia, a significant majority of the respondents' organizations do not have a formal benefits management methodology. Tiernan and Peppard (2004) stress that this is illustrative for the way IT projects are handled by executives: "The majority are under the illusion that once the technology has been implemented, everything necessary has been done for the benefits to begin to flow. This thinking is reflected in the practice of creating elaborate plans to implement the technology while the achievement of business benefits (...) receives little or no planning". Neglecting benefits management is one of the key reasons for many failures. Although the famous contribution of Carr (2003, 'IT doesn't matter') in the Harvard Business Review caused a lot of controversy, most researchers will agree with the central theme: not the technology itself is the differentiator, but the way the organization uses it. If the IT department develops a technically perfect system that is not strategically aligned or is only marginally used by frustrated users, it can hardly be expected that this will yield an adequate return. In a conceptual analysis Mata et al. (1995) concluded that only IT *management skills* are likely to be a source of sustained competitive advantage.

#### B. *Benefits management methodology*

There is no lack of benefit management methodologies. Common steps are: benefits identification; benefits realization planning (prior to the project being approved for implementation); benefits monitoring and benefits realization (review of what was, and what was not achieved) (Bennington and Baccarini (2004)).

Identifying and measuring benefits is the most difficult issue in evaluating IS/IT. Benefits without clearly defined Key Performance Indicators (KPI) are of little value. KPIs identify the project's benefits to measure, and when and where to measure them. The stakeholders will be able to assess at all times whether the project is likely to achieve the targets. The KPIs make the project team and the stakeholders accountable for the required input and for the results. There is some indication that benefit oriented KPIs are not used enough. A survey of Australian IT managers revealed that only 48% of the respondents assigned KPIs to project benefits (Bennington and Baccarini (2004)). Without KPIs, benefits managements is futile. Securing the users' full participation is essential for the success of the project and it is

obvious that this will be easier if the benefits for the users (or other stakeholders) are clearly stated. Managing the congruence between stakeholders' expectations and project goals is very important. Stakeholders who fear their interests will be negatively influenced by the new system can hardly be expected to be enthusiastically committed to the system. It is very likely they will form coalitions to oppose the project. Users may be reluctant to cooperate during the requirements analysis phase (sometimes feeding contradictory information) or unwilling to use the new system at all. Committed users are essential to convince other stakeholders (e.g. suppliers for an e-procurement system, Pan (2005)). Benefits identification helps to avoid misalignment between executives and IT management. Khandelwal (2001) confirms empirically an important cause for misalignment: CEOs regard information technology critical for the success of their enterprises and are looking to the IT function to help them manage the external forces impacting their enterprises while IT managers are focusing attention on technological issues.

Benefits monitoring compares results (benefits) to the plan and assesses the relevance of internal or external changes. Benefits monitoring helps to correct for the focus of many project leaders to deliverables (rather than benefits) and to the continuity of the project, even when there are indications that the target benefits will not be realized and the costs will likely be greater than the benefits. Benefits monitoring can also be linked to enhancing the absorptive capacity of the organization. Absorptive capacity is the organization's ability to recognize the value of new information, assimilate it, and apply it to commercial ends (Cohen and Levinthal (1990)). Building absorptive capacity is best envisioned as building overlapping and shared knowledge structures within the organization (Harrington and Guimaraes (2005)). Benefits monitoring helps to create a permanent dialogue between the technology domain and the business domain.

### *C. Benefits management and CSF for system success*

On the basis of the literature, the following critical success factors for system success were identified:

- committed (time and effort) and informed (realistic understanding of capabilities and limitations) sponsor;
- carefully defined information and system requirements;
- clear link to business objectives and clear benefits in using the technology:
  - key performance indicators;
  - key business opportunity is focused;
- management of user relations:
  - positive user attitude;

- organizational absorptive capacity (political resistance is a common factor of implementation failure as information systems can alter information flow and shift the power relationships);
- management of system evolution and spread:
  - evolutionary development methodology (prototyping);
  - user involvement and acceptance of evolutionary changes.

The link with benefits management is obvious. Clearly, executives will have a strong bottom-line orientation, and very limited time to hunt for benefits. Thus a system that can clearly demonstrate benefits, by being linked to business objectives, will have a strong selling point toward user acceptance (Poon and Wagner (2001)).

#### IV. RISK, UNCERTAINTY AND RUNAWAY PROJECTS

##### A. *Effort overrun*

According to an extensive survey of over 13.000 IT projects, only 34% of them are completed on time and within budget; the average IT project exceeds its allocated financial resources by 43% and its original time schedule by 82% (cited by Iacovou and Dexter (2004)). According to another survey, carried out by the Standish group ([www.standishgroup.com](http://www.standishgroup.com)), the average software project cost overrun is as high as 189% of the original estimate, and only 17% of the projects are completed on-time, on-budget and within specification. The Genesys consulting group, cited by Stratopoulos and Dehning (2000), reports that over 80% of IT projects fail to deliver their anticipated benefits. Another Standish Groups' survey, cited by Jiang (1999), shows that 52,7% of software projects miss their budgeted targets and 31,1% of all projects are cancelled. Executive information systems, which have always been high-risk systems, offering usually only one change to successfully implement them in the organization, have an estimated failure rate of 70% (Poon and Wagner (2001)). Other research sources report that 20% of IT spending is wasted and 30-40% of IT projects realize no benefits whatsoever, however measured (Remenyi et al. (1995)).

Large effort overruns may be attributed to lack of executive support and user involvement (unwilling, inexperienced, ill defined), inexperienced project managers, personnel turnover, unclear business objectives and requirements, scope creep, casual project management, ineffective use of methodologies, project size, insufficient resources, and use of unreliable estimates (Iacovou and Dexter (2004), Jiang and Klein (1999)). Many of these factors are directly connected to the evaluation issue. Executive support and user involvement (according to the literature probably the most important predictor for systems success (Jiang and Klein (1999))) are easier to achieve if

the business benefit is clearly stated, while the unreliable effort estimates (unrealistic low overoptimistic estimates) are at the heart of the evaluation matter. Why are effort estimates so often overoptimistic? Expert estimation of software development effort follows a process that is, to some degree, non-explicit and non-recoverable (Jorgensen and Sjoberg (2004)). Possible causes for expert estimates of efforts that are, on average, too low are:

- an inherent over-optimism when estimating effort in situations with high-uncertainty (does not take into account the fact that in general the likelihood of negative events is higher than that of positive events) (Asher (1993));
- a lack of separation of bid (“price-to-win”) and realistic effort usage when competing to get a project;
- too enthusiastic (champion);
- impact of the customer’s expectations regarding effort or cost usage (Jorgensen and Sjoberg (2004)).

Lovallo and Kahneman (2003) indicate that delusional over optimism is a general factor (for all kinds of investment projects, not just IT projects) that leads to situations where initiatives are pursued that are unlikely to come in on budget and on time, which often results in runaways and escalation of commitment to these initiatives. Several studies indicate that the overstatement of benefits to gain IT project approval is widespread. Bennington and Baccarine (2004) find that 88% of the respondents indicated that benefits were often overstated. The situation is aggravated by the fact that in cases in which the estimates of effort are too high, the remaining effort is used to improve the delivered product in stead of cutting the development time (a variant of Parkinson’s law). ‘This means that much of the apparent bias of the estimate is caused by different project behavior when the estimates are too low compared with when they are too high’ (Jorgensen and Sjoberg (2004)).

#### *B. De-escalation of commitment, recovery management and the abandonment decision*

A major problem with runaway projects is that the executives involved (sponsors as well as development team and users) try to postpone breaking the bad news and avoid an abandonment decision. Generally, runaway projects stem from the behavior of escalating commitment to a failing course of action (Pan et al. (2004)). Iacovou and Dexter (2004) state: “Team members and managers tend to mask the problems hoping to overcome them without scrutiny of executives and other stakeholders. (...) Moreover, overcommitted managers are unlikely to accept such bad news. (...) The tendency to cover up and deny early indications of project troubles compounds the problems and delays their resolution”. Drummond (1996) states “where investments fail to



work out as envisaged, (...) decision-makers are believed to compound the problem by persisting irrationally". To overcome this problem, the role of the project sponsor is very important. The project champion's commitment is a critical success factor in IT project development, but an overcommitted champion is a problem if things go wrong. He may lead the organization in a devastating escalation. Therefore, it has been proposed to have also an "exit champion", someone who regularly reviews the situation to determine whether there still is a sound business case for it. While there is some truth in this suggestion, we believe the loss of credibility of the project champion will be harmful for the organization. A better way is to convince the project champion to be realistic, and to make him responsible for the redirection or eventually the abandonment of the project. The provision of psychological safety for project members has been identified as one of the key factors for successful de-escalation (Pan et. al (2004)), and this is also the case for the project champion. Large effort overruns have significant negative effects, including dissatisfied and alienated users and sponsors, decrease and or delay of the target business benefit, low quality profile and frustrated software developers. The low quality profile can be the consequence of a software organization that reduces poorly specified quality attributes of the software in order not to experience huge losses (and e.g. cuts the testing effort). The loss of credibility of all those involved can be dramatic. Acajou and Dexter (2004) give cases where the IT department was completely eliminated following a failed implementation, or the executive sponsor was fired. Effort estimates that are much too low may imply that the customer does not have a sufficiently large budget to complete the project properly, leading to abandonment.

So, the first thing to investigate when there are large overruns, is whether the original estimates were realistic. As Iacovou and Dexter (2004) put it: "well-executed projects may simply be labeled as runaways because their initial cost and time estimates were unrealistically low or because of inadequate allocation of resources". An improved, realistic estimate is needed for at least two purposes. On the one hand, it relieves the development team of the blame not being able to live up to normal expectations, and it makes the situation clear to everybody involved, with a redirected and realistic business case. On the other hand, an improved estimate can lead to a situation where the estimated costs are larger than the estimated benefits. In that case, the project has to be treated in an analogous way as a real runaway, and abandonment should be considered. For real runaways, full recovery management is needed to contain the losses and to save the project, or to abandon it. One of the most important elements is that the business case has to be re-estimated. Resources already spent on the project are sunk costs and should not be considered, but it is clear that the reestimated benefits (due to the delay) should be greater than the estimated costs to complete the project. Again, it is clear that this decision is dependent on the availability of a clear idea of what the target business benefit is. Without clear indication of the value of the target benefit, it is impossible to decide on a rational basis.

Abandonment (the termination of all activity on the project prior to full implementation, Ewusi-Mensah (1997)) is one of the most difficult management issues in connection with projects that are in trouble, taking into account that a significant number of escalated projects will eventually fail (Keil (1995)). Project abandonment can be a very sensible exit strategy, but de-escalation of commitment to those projects is often a painful process. "Generally, runaway projects stem from the behavior of escalating commitment to a failing course of action" (Pan et al. (2004)). A strongly held conviction and the refusal to let inevitable setbacks undermine it are reasons why bad projects are so difficult to terminate (Royer (2003)). Pan (2005) made a stakeholder analysis of an abandonment case and confirms Ewusi-Mensah' (1997) finding that the lack of general agreement on a well-articulated set of project goals and objectives is a major contributing factor to project abandonment.

### *C. Hedging risk in IT projects*

As was discussed above, uncertainty has a positive value when one looks at it from the option point of view. But option thinking (flexibility) makes it also possible to hedge risk in IT projects. Kumar (2002) discusses how to do this. Commitment may e.g. be deferred by using methodologies that permit delay of critical design decisions, by investing in software tools that speed up later stages of the project, or by deferring project start in anticipation of new technology.

## V. CONCLUSIONS

The economic evaluation of IT investments still is a difficult problem. IT is considered to be a strategic necessity that is difficult to manage. The success of many IT projects is a complex mixture of financial, technical, organizational and social effects, both within the organization and external: competitive reactions, influence on the value system, technology acceptance behavior. For many organizations IT investments represent substantial and growing amounts, while the benefits are uncertain. However difficult ex ante evaluation may be, the worst alternative is to abdicate. Evaluation processes serve an important role in turning sponsors and users into committed stakeholders. Without a clear benefits management plan and a shared notion of value it will be difficult to make sure the business benefits aimed at will really be achieved, and it will be equally difficult to avoid runaway projects.

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