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A Comprehensive Approach for Selecting IT Projects: A Brazilian Case Study

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INTRODUCTION

This paper intends to analyze, through a case study, the selection of IT projects by a portfolio approach, considering the different types of IT projects, their costs, the impacts of these projects on the Critical Success Factors of the enterprise and the related risks. So, it encompasses both efficiency (resources use) and effectiveness (achieving positive results to the organization).

The role of Information Technology (IT) in organizations can vary from a simple administrative support till a strategic position (Henderson & Venkatraman, 1993; McFarlan, 1984). The strategic function of IT has achieved an important status in the leading companies in the increasingly competitive markets (Porter, 2001). Two basic points can be used for understanding IT: the acquisition of a competitive advantage at the value chain and the creation and enhancement of core competencies (Porter & Millar, 1985; Duhan et al, 2001). On the other hand, there is still an important discussion about the difficulties of finding evidence of returns over the investments in IT, called the 'productivity paradox'. Although there are different explanations for this fact, there is a general consensus about the relevant increase in IT investments in the last decades (Brynjolfsson, 1993; Brynjolfsson & Hitt, 1998).

The decisions about which information systems (IS) projects should be implemented are frequently determinant of business performance and are able not only of changing the competitive positioning of the companies but also can modify the competitive structure of the industry, like it happened in financial and airlines industries (Laurindo et al, 2002).

Meanwhile, the evaluation of IT projects efficiency (regarding cost, time frames and quality) is a rather controversial issue, due to the uncertainty and the complexity inherent to these projects. Meeting project efficiency goals involves balancing scope expectations and the available resources. Thus, IT project management addresses the full range of concepts, tools and techniques to improve project performance and organizational effectiveness and efficiency (Carvalho et al., 2003; Laurindo et al., 2003).

The strategic impacts of IT applications and their effects on enterprises and industries was analyzed by McFarlan (1984) through the Strategic Grid that allows the visualization of the relationship between IT strategy and business strategy. McFarlan (1981) also analyzed the selection of projects of new IT applications considering the risks associated with each project and also the risks of the projects portfolio. Jiang & Klein (1999) studied the selection of IT projects taking into consideration the different possibilities of the Strategic Grid.

Thus, this paper intends to investigate IT projects portfolio management, considering the linkage among them and the strategic goals of the organization, the related risks and the appropriate use of resources.

The strategic impact of IT applications and their effects on the organization and in the role industry were analyzed by McFarlan (1984) through the Strategic Grid that allows understanding the relationship between IT and business strategies. McFarlan (1981) also studied the selection of new IT applications projects considering the risks of each project and the risk of a project portfolio. Jiang & Klein (1999a) studied the IT projects selection practices of firms classified in different possibilities of the Strategic Grid.

In order to investigate these concepts, the adopted methodological approach was case study (Yin, 1991; Claver et al., 2000). The theoretical background includes concepts of projects portfolio management (especially IT projects, McFarlan, 1981), Critical Success Factors (Rockart, 1979), strategic impacts of IT (McFArlan, 1984), taxonomies of IT applications (Farbey *et al.*, 1995) and project risks (Archibald, 1976;Jiang *Et Al.*, 1996; Jiang & Klein, 1999b).

The case selection criteria were: the existence of an expressive and diversified mix of IS projects and the presence of a formal project management process in IT area. The selected enterprise is one of the most important in the building materials industry in Brazil and adopts the differentiation competitive strategy approach. Information was gathered through semi-structured interviews performed with many players from different hierarchical levels, considering IT and different user areas.

Preliminary results indicate the need for tools that make easier the understanding and dissemination of projects portfolio management. This paper intends to contribute with a systematic and broad approach for selecting IT projects, bringing new alternatives and insights for the discussion of this issue that is increasingly more important for organizations competitiveness.

INFORMATION TECHNOLGY PROJECTS AND STRATEGY

As IT applications evolved, the range of possibilities was amplified, and a list of new possible alternatives of IT applications became possible. Thus, uncertainties arose about the decisions of selecting projects that should be developed and implemented (Laurindo et al, 2001).

One of the first proposals to solve the problem of choosing and prioritize IT projects was the Critical Success Factors (CSF) method developed by Rockart (1979) and it is still widespread used nowadays. This method aimed especially management and executive information systems and it was based on the definition by top executives of their current needs, expressed by the CSF. Rockart defines CSF as the areas where satisfactory results 'ensure successful competitive performance for the organization'. This author states that CSF prime sources are structure of industry, competitive strategy, industry position, geographic location, environment and temporal factors. Although prima-

rily conceived for information systems design, this method had an important impact on managerial and strategic planning practices. It is usual to define CSF for different functions of the company, like marketing CSF, manufacturing CSF, projects CSF, among others.

Porter (1979, 1996) emphasizes the importance of positioning a firm in its industry, in order to achieve a sustainable competitive advantage through the choice of one of three generic strategies: cost leadership, differentiation and focus. The competitiveness of an industry results from five forces: clients, suppliers, substitutes, new entrants and present competitors.

McFarlan (1981) analyzed the selection of projects of new IT applications considering the risks associated with each project and also the risks of the projects portfolio. These risks encompasses costs, time, technical performance, overestimation of IS benefits and incompatibility of hardware and/or software for the IS. The same McFarlan (1984) proposed the Strategic Grid that allows the visualization of the relationship between IT strategy and business strategy. This model analyses the impacts of IT existent applications (present) and of applications portfolio (future), defining four boxes, each one representing one possible role for IT in the enterprise: 'Support', 'Factory', 'Turnaround' and 'Strategic'.

- 'Support': IT has little influence in present and future company strategies.
- 'Factory': existent IT applications are important for company's operations success, but there is no new strategic IT application planned for the future.
- 'Turnaround ': IT is changing from one situation of little importance ('support' box) to a more important situation in business strategy.
- 'Strategic': IT is very important in business strategy in the present and new planned applications will maintain this strategic importance of IT in the future.

In order to assess these strategic impacts of IT, McFarlan proposed the analysis of the effects of IT applications on the five competitive forces (Porter, 1979):

Jiang & Klein (1999) studied the selection of IT projects taking into consideration the four different possibilities of the Strategic Grid. Enterprises classified in the 'strategic' and 'turnaround' categories usually are more prone to assume risks and have more rigorous controls for IT projects. The enterprises classified as 'support' consider costs as the primary criterion for selecting and conducting IT projects.

The selection of IT projects should consider both efficiency (use of resources) and effectiveness (achieving positive results for the organization) issues, and also analyze their risks. These criteria are very important in the highly competitive market of the globalize economy. In this paper, IT projects are considered like research & development (R&D) projects, using the idea of portfolio management. This approach allows managers to have a broad view of alternatives of projects that could maximize results of the whole portfolio (McFarlan, 1981; Carvalho et al., 2003).

The uncertainties can be found in different ways during the development of a Project. In this paper, it will be considered the uncertainties related to the achievement of expected results in terms of cost, time, quality of the final product of the project and impacts on the organization.

According to Archibald (1976), project uncertainties diminish as the project development advances.

Among many different taxonomies about IT applications, Farbey et al. (1995) proposed to classify them in eight different types: mandatory changes, automation, direct value added systems, management information systems (MIS) and decision support systems (DSS), infrastructure, inter-organizational systems, strategic systems, business transformation.

Taking these concepts in consideration, the portfolio approach adopted in this paper is based on the following concepts: Critical Success Factors (CSF), strategic positioning, uncertainties, type of project (in terms of complexity and experience with technology), time and budget (Archibald, 1976; Rockart, 1979; Farbey et al., 1995).

CASE STUDY

As mentioned in introduction, the adopted methodological approach was case study (Yin, 1991; Claver et al., 2000).

The selected enterprise, hereafter COMPANY 'A', is one of the most important in the building materials industry in Brazil (revenue about US$ 400 millions per year and 6,000 employees). It is organized in four different business units, with very different operative characteristics and geographically dispersed. Information was gathered through semi-structured interviews performed with many players from different hierarchical levels, considering IT and different user areas. Companies of building materials industry in Brazilian have been adopting different competitive strategies in order to face the growing market share of lower cost foreign competitors. Two major competitive approaches have been detected: the first one is the cost leadership strategy, and the second one is the differentiation approach (Porter, 2001). Along the years, COMPANY 'A' has kept leadership in its market through differentiation strategy (Porter, 1979), since its products are well known by their superior quality and design. Another important differentiation factor is the technical assistance, providing repair services and allowing customers to buy replacing parts easily.

In COMPANY 'A', according to its IT and business executives of the corporation and of business units, Critical Success Factors (CSF) were: *(1) new products design and time-to-market, (2) process and final product quality, (3) product quality image, (4) after sale services, (5) costs, (6) flexible and large product mix, (7) products delivery lead-times*.

In the 1990's, COMPANY 'A' had undergone changes in guidelines and the top management body. The new leadership starts a centralization process due to a cost reduction policy in management areas, with a dramatic reduction in the number of employees in the corporate IT area (from 200 employees in 1990 to about 40 in 2002). The range of attributions of the IT teams of the business units was reduced to user support and follows patterns and priorities defined by corporate IT. The culture of the company favors internal development, but this behavior is slowly changing. Some software packages have been acquired to complement specific points of the internally built IS architecture. The corporate IT does not have systematic approaches to plan and control costs and resource requirements, nor to evaluate applications performance. There is also no systematic or formal process to 'ex-ante' evaluation of IT projects, neither to evaluate the results of the decisions about IT projects backlog.

The criteria adopted by the CIO for selecting IT projects to be developed are: fixing 'bugs', modifications required by legal reasons, corporate projects (directly determination of the CEO), business unit projects (at least one of each business unit). There are also 'technologic projects' whose initiative is from IT area. The purpose of these projects is mainly build or enhance infrastructure.

There is no formal forum or process to allow CIO or other IT managers to participate directly in the discussions about the business strategy of the company.

A proposed method for selecting IT projects

The main points of the analysis of the case previously presented were discussed with the CIO and other IT and business managers Based on this discussion and in a portfolio approach, a new method for selecting IT projects were proposed and tested in COMPANY 'A'.

The first point was the need to classify the different kind of IT applications. Since the eight different types of IT projects presented in Farbey et al. (1995) taxonomy were considered too complex by the IT managers of the studied company, a new classification was proposed, considering four different types of IT projects, as follows:

- *Mandatory* – projects in which there is no 'not to do' option. For instance, that was the case of many applications related with the Y2K problem, since companies were obliged to modify there IS in order to avoid serious problems. Modifications in legislation can have the same effect of inevitability of IS projects.
- *Infrastructure* – in these projects usually there is few significant immediate benefits, but they enable new and important opportu

nities. Examples of this category are the implementation of a new corporate database, a new local or wide area network, the implementation of intranets or a new organizational structure.

- *Incremental* – projects that encompass well know technologies and/or business process, whose impacts can be previously imag ined. They promote incremental gains in efficiency and/or in effectiveness.
- *Exploratory* – projects linked to new technologies (considering the companies knowledge), to new business strategy or to new organizational structures or processes. Intrinsically, these projects present great uncertainty. However, if they are successful, they can bring high gains (in efficiency and/or in effectiveness) to the organization.

The development lead-time is the time from the formal beginning of the project until this project generates the expected benefits. The planed budget is related to the amount of investments necessary to the generation of these benefits.

In the proposed method there is no heuristic involved, but it emphasize the need for a overall evaluation of the projects of the backlog, considering this different kind of projects, the need for strategic alignment (Henderson & Venkatraman, 1993). Although this method enables participation of many project stakeholders, it is based on subjective judgments by the managers. However, it leads these managers to ponder on projects scope and on the benefits to the organization in a more comprehensive and qualitative way.

Managers (both from IT and business) must seek for a project portfolio aiming the best possible trade-off with many criteria that sometimes are mutually conflictive. This process leads to an evaluation of the importance of different effective contributions that IT area can bring to entire organization.

The proposed method intends to interconnect the concepts previously presented. The first step in this method is the list the projects that are candidates to be part of the IT portfolio. The scope of these projects can vary from maintenance of existing systems or hardware substitution until strategic new IS. Projects already in development should not be interrupted.

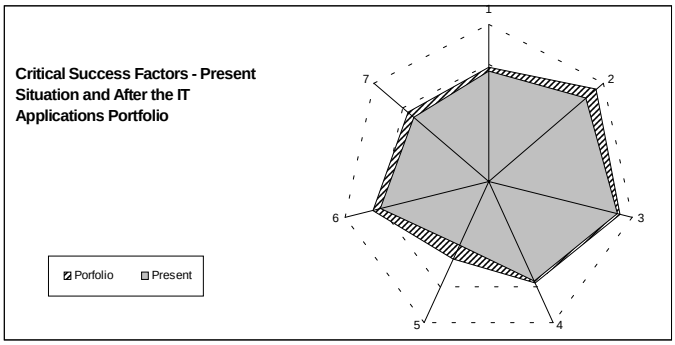
This first list of IT projects, with the estimative of success and classification for each project is shown in Table 1. The description of each project is omitted due to confidentiality reasons. IT managers subjectively estimated both costs and success probability. Success probabilities of each project were subjectively estimated by IT managers, based on their experience and also on the organization, personal and project characteristics. Since this was a new practice in the studied organization, the accuracy of these estimates was not evaluated until now.

First, it is necessary to estimate contribution (in terms of the increment of achievement, in a % basis, of the CSF) of each project to

Table 1: COMPANY 'A' IT projects information

Project	EstimateCost	Success Probability (Uncertainty)	Type
A	USD 210.000	90%	Incremental
B	USD 320.000	75%	Incremental
C	USD 360.000	50%	Incremental
D	USD 250.000	90%	Incremental
E	USD 250.000	85%	Incremental
F	USD 280.000	60%	Exploratory
G	USD 250.000	85%	Mandatory
H	USD 180.000	50%	Exploratory
I	USD 210.000	40%	Exploratory
J	USD 320.000	60%	Exploratory
K	USD 360.000	75%	Incremental
L	USD 280.000	70%	Incremental
M	USD 140.000	95%	Infrastructure
N	USD 70.000	97%	Infrastructure
O	USD 30.000	92%	Infrastructure
P	USD 100.000	93%	Infrastructure
Q	USD 70.000	98%	Infrastructure
R	USD 250.000	70%	Infrastructure

Figure 1: Effectiveness gain with one IT portfolio, according to the CSF



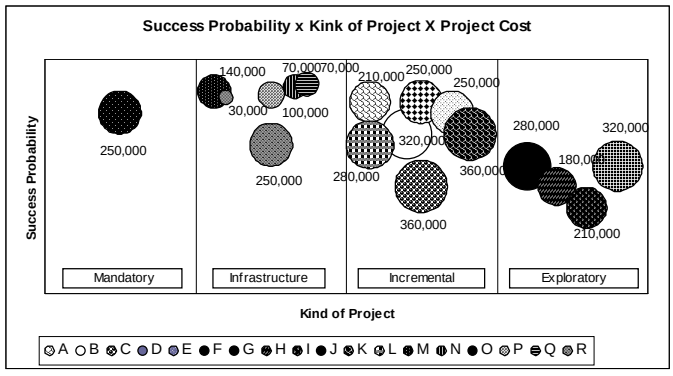
each CSF; these estimates were also made by IT managers. It must be noted that each project can contribute with more than one CSF. CSF (2) *process and final product quality* and CSF (5) *costs*, seem to be the most impacted by the list of IT projects. This fact agrees with the traditional managerial practices of the company. But, this graphic does not show properly the combined effects of IT projects on CSF. To understand these combined effects, the next step was to evaluate the overall effect of each possible portfolio.

The portfolio with the greatest overall contribution would the candidate to be chosen. Figure 1 presents the result of an IT projects portfolio including all the projects of the list of Table 1. The small area surrounding the great central polygon represents the effectiveness gains with this specific portfolio.

Another important aspect to be considered in order to select the projects portfolio is the level of uncertainty involved that is impacted both by the characteristics of the project and its budget. Uncertainties can be overcome by greater resources availability, i.e., by a greater budget (for instance, if you hire more analysts, the uncertainty concerned with time can be reduced). The success probability (that is related to the uncertainties) of the projects were related with the classification presented above; so, each project was properly classified and their uncertainties were estimated, as already mentioned. The area of the circle representative of each project indicates the respective estimate of the necessary investment (Figure 2).

This graphic allows investigating investments that are undermined by great uncertainty. One important question would be: is it worthwhile to expend scarce resources in projects with great uncertainty? Projects 'K' an 'I, whose respectively investments are US$360 million and US$210 million can be examples of this situation. On the other hand, if these projects were considered important according to other criteria, they should receive more resources or their scope should be re-discussed in order to achieve the desired results. In the same way, mandatory projects should not present great uncertainty because their failure would bring considerable troubles. The trade-offs involved in this process reflect industry structure and internal competences.

Figure 2: Uncertainties of IT projects, classified in four different types



CONCLUSION

The case study showed some of the problems faced by IT managers in their search for the best allocation of resources among several projects. It led to the proposed method that is comprehensive (encompass effectiveness, efficiency and risk issues) and presents potential to be enhanced and used in organizations. One of the points to be better analyzed is the classification of IT applications, since the taxonomy adopted reflects the specific situation of the studied company and the points of view of their IT and business managers. The efficiency and effectiveness of management of the on going projects was not analyzed neither was the ex-post evaluation; these two aspects should be better studied. Some difficulties in the use of the method were caused by the fact that it was its first version and the managers that participate in the process did not have familiarity with some of the concepts used.

Since there are many objectives that must be satisfied in the process of selecting an IT project portfolio, some techniques would be very useful, like the *Analytic Hierarchy Process – AHP* or *Fuzzy Sets* (Shimizu et al., 2001). They could be used, for instance, to evaluate and prioritise effects of IT on the CSF.

One important detected benefit of the method was the help to the managers to systematise their ideas and also it allowed their reflection about the process and the impacts of selecting IT projects. It also led IT and business professionals to work together and consequently better understand each other needs and insights, which enabled to improve the much desired strategic alignment.

Finally, this paper can be the starting point for further researches aiming the deepening of the studies about the points mentioned above.

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