VALUE-BASED SOFTWARE PROJECT MANAGEMENT
A Business Perspective on Software Projects

Anderson Itaborahy, Káthia Marçal de Oliveira and Rildo Ribeiro dos Santos
PGCTI, Universidade Católica de Brasília, SGAN 916, Módulo B, Brasilia (DF) - Brasil

Keywords: Project Management, Value-Based Software Engineering, IT Business Value.

Abstract: When an organisation decides to invest in a software project it expects to get some value in return. Thus, decisions in software project management should be based on this expected value by trying to understand and influence its driver factors. However, despite the significant progress software engineering and project management has experienced in recent years, both disciplines work in a 'value neutral' context, by which is meant focusing on technical correctness and adherence to plans. This paper intends to contribute to a view of software project management based on business value by identifying value determinant factors in a software project and proposing some tools for recording and monitoring them. The proposed approach will be tested in a real project, in order to evaluate its applicability and usefulness in decision-making.

1 INTRODUCTION

In the last few decades software project management has undergone rapid development, mainly as a response to the increasing complexity of such projects and their business impacts.

However, a number of studies underscore the fact that projects continue being managed in a value-neutral context. In other words, technical accuracy and compliance to the plans are prioritised and quality is treated as an end in itself, while an explicit concern for impacts on business is overlooked (Favaro, 1996; Boehm e Sullivan, 1999; Boehm, 2006; Biffl *et al*, 2006).

Based on that criticism, Biffl *et al* (2006) propose a 'Value-Based Software Engineering'. Such proposal seeks to integrate the idea of value into software engineering practice, with a focus on value for stakeholders. As such, the critical factors for success would lie within the domain of project value rather than in technical issues.

The management of a project, then, should be based on the value that the organisation investing in it expects to get. But how might this be done? How can a project be managend based on its business returns? More specifically, how might the drivers of project value be identified and monitored, so that they may be acted upon?

Accordingly, this article will present an approach to software project management based on business value. To achieve this objective, the determinant factors of project value and the questions of how these might be recorded and monitored will be investigated.The approach was tested in a real business context in order to verify its applicability and usefulness in the decision-making process.

2 BUSINESS VALUE IN SOFTWARE PROJECTS

According to Maximiano (2000), project management essentially means the process of decision-making in relation to the use of resources. These decisions are based on data gathered through processes of monitoring and control. With some minor differences, these processes are described by PMBOK (2004) and CMMI (2001), among others. Table 1 summarises the information contained in these models.

Table 1: Project Data.

Information	Description
Delivery	Delivery acceptance
Scope	Scope stability
Chronogram	Project evolution
Cost	Project evolution
Quality	Compliance to standards
Team	Competence for the task
Resources	Sufficiency and Availability
Commitments	Reliability of commitments
Documentation	Sufficiency and compliance to standards
Involvement	Stakeholders' involvement
Risks	Threats to planned results

Itaborahy A., Marçal de Oliveira K. and Ribeiro dos Santos R. (2008).
VALUE-BASED SOFTWARE PROJECT MANAGEMENT - A Business Perspective on Software Projects.
In *Proceedings of the Tenth International Conference on Enterprise Information Systems - DISI*, pages 218-225
DOI: 10.5220/0001694502180225

These data constitute what might be called a project's internal scenario, which excludes consideration of both business environment and strategy. As such, they are an insufficient basis for decisions aimed at achieving a project's business value.

In order to identify the relevant data, then, it is necessary to understand how a project might produce value.

Marshall, McKay and Prananto (2004), expanding a previous work by Soh and Markus (1995), argues for a Process Theory approach for value generation by information technology.

From this perspective, IT investment represents a necessary but not a sufficient factor for the generation of value. The latter, in the form of business performance gains, is the outcome of a chain of processes, each one necessary, but insufficient by itself to guarantee the final result, as follows:

- Through the **alignment** process, strategic objectives will determine what IT investment is required. That involves identifying opportunities and threats, understanding strategy and the opportunities for using IT to implement it.
- The determined investments will then generate IT assets through a **conversion** process. This contains the design of IT strategies and the choice of those organisational structures able to realize them appropriately.
- Depending on how it is used, IT assets will impact the organisation. The process of **use** involves both redesign (in terms of organisational processes and structures) and redefinition of roles in order to adjust them to the IT-induced changes.
- Finally, the impacts resulting from the use of the assets created by IT investment may lead to performance gains, depending on the process of **competition**, in which the organisation is situated. The said process entails the nature of competition within the industry, competitors' behaviour, and general economic conditions.

These authors argue that, for the production of value, each of these processes must unfold appropriately. If any one fails, no value is generated. By the same token, no one process can guarantee success by itself.

Thorp (1999) also tackles this question, with a focus on what he calls 'The Information Paradox'. This is indicated by the absence of any clear correlation between IT investment and gains in organisational performance. According to this author the paradox results from a mistaken approach in which an IT project is seen as isolated from its organisational context.

Like Marshall, McKay and Prananto (2004), Thorp (1999) claims that IT is incapable of generating value by itself. Rather, it must be suitably integrated with other organisational elements thereby forming what the author calls a 'Results Chain'.

The focus of Thorp's approach (1999) is that a project should be managed in tandem with all changes in business processes that it provokes, rather than in isolation. Other initiatives complementary to the IT project will be required if the expected benefits are to materialise. These may take the form of training programmes, alterations in organisational structure, marketing initiatives and so on.

As a tool for assessing project development, Thorp (1999) proposes a set of key questions that can be interpreted as follows:

- **Is the right thing being done?** The aim of this question is to ensure that project and an organisation's business goals are aligned.
- **Is the project in the right way?** Here the objective is the integration of project with organisational processes and structures
- **Is the project being well-done?** This question concerns the presence of adequate staff capacity, competence, resources and infrastructure to advance a specific project.
- **Can benefits be achieved?** The focus here is on the external context and conditions in which project aims may be realised.

In both Process Theory and the Results Chain, organisational strategy is a key issue in project success. For value to be produced, alignment with strategy is of central importance. It is therefore essential to understand the processes of developing strategy and those elements which define it.

According to Ansoff and McDonnel (1993), organisational strategy is a function of the Strategic Business Area, the SBA, which means a segment of the business environment in which action or intention to act occurs.

Porter (1979) claims that 'the essence of strategy is dealing with competition', which in turn is defined by the relations among a set of forces such as substitute products, customers and suppliers, and competitors, both new and old.

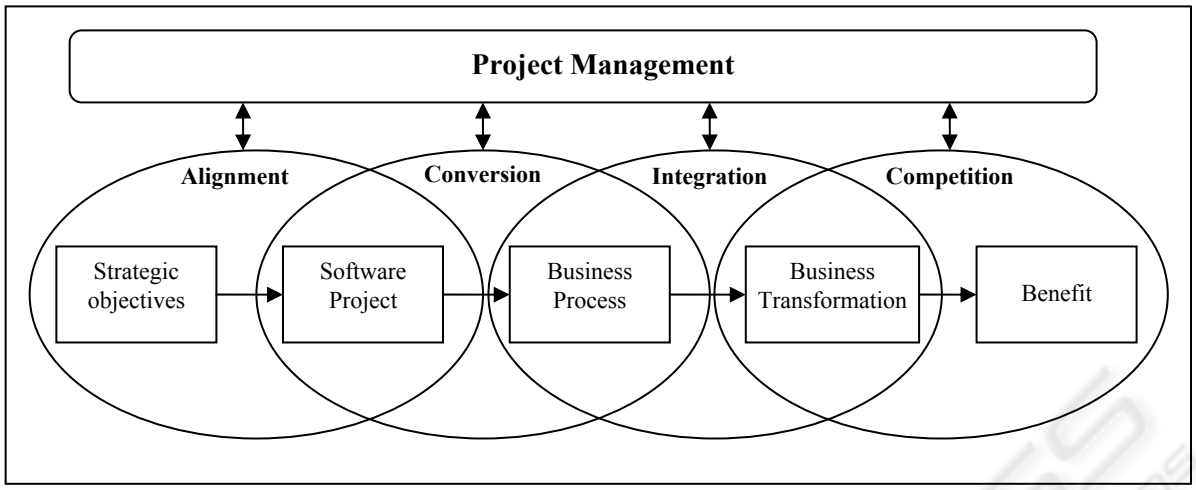

Figure 1: Software Project value generation process chain.

Such an arrangement of forces determines the attractiveness of the SBA, which represents the potentials of profitability, growth, and turbulence in the environment.

Based on the attractiveness of the SBA, a company will define its interest in acting there or not and, if deciding to act, defines its strategy so as to respond to competition and build an advantageous position.

Many companies have regular strategic planning events, usually annually, in which they (among other things) define the IT projects needed to achieve stated objectives. However, the more difficult working environments become, the more likely a project will undergo contextual changes.

To deal with that turbulence (ever more present in current business contexts), Ansoff and McDonnel (1993) suggest continual analysis of strategic questions, in which an evaluation team must monitor the situation in order to identify both opportunities and hazards. This activity supports the decisions of those responsible for the administration of the organisation.

3 VALUE-BASED PROJECT MANAGEMENT

The previous section presented a process view of how IT leads to the generation of value. This perspective encompasses diverse aspects of the value-generating mechanism and highlights a fundamental point: simply investing in IT is not enough to achieve business value. Rather, IT investment – as in the case of a software project – will generate value through transforming organisational processes based on previously-defined strategic objectives.

On the basis of this premise, we propose a reinterpretation of the model for value creation developed by Marshall, McKay and Prananto (2004), backed up with Thorp's (1999) proposal of a Results Chain. This new reading is shown in Figure 1.

The first process in the chain is that of **alignment**, in which a company's strategic goals define those software projects to be carried out.

The second process is that of **conversion**, in which software projects generate IT assets. Mooney, Gurbaxani and Kraemer (1996) claim that the results of IT investment can be verified by the modifications introduced into organisational processes. As such, our revised model will view the IT assets generated by IT projects as new or modified business processes.

The third process relates to the **use** of the processes created or modified by the IT project. Projects may be of different types and produce differing effects in an organisation. This is what Venkatraman (1994) calls 'business transformation'. Modified processes, when utilised, will produce such transformations.

Moreover, a software project is, in Thorp's (1999) view, part of a larger system, and is dependent on complementary initiatives that will prepare organisational elements and processes for their new capabilities. It is thus appropriate to refer to the process of use as a process of **integration**, thereby reinforcing the claim that value is produced through the integration of IT and business processes.

The fourth process relates to **competition**, and concerns those factors external to the business environment that influence the possibility of an organisation benefiting from its projects. Such

environments correspond to what Ansoff and McDonnel (1993) term Strategic Business Area, or SBA.

As defined by Soh and Markus (1995), the end result of the chain of value will be gains in business performance. In this revised model, 'gain' means the benefits an organisation hopes to achieve from a project, whatever its nature.

Project management will be continually collecting information related to each process and making decisions that will affect their evolution.

In addition to the elements in the chain of processes, the value of a project is affected by the time required to reach the benefits, by the costs incurred, and by the risk that it may not be realised.

Therefore, even when the processes of alignment, conversion, integration and competition are delivered adequately, if results take to long to arrive, if costs become excessive, of if the chances of failure are high, then the organisation may opt to abandon the project.

Each of the elements in Figure 1, although insufficient in themselves, is a determining factor of project value. Likewise, time, costs and risks will impact value. The set of factors determining the project value is then as described in Table 2.

Table 2: Determinant factors of value in a Software Project.

Factor	Description
Strategic Objective	Objective motivating the project
Business Process	Process to be modified by the project
Business Transformation	How project results will affect business
Benefits	Expected performance gains
Conversion Process	Corresponding to the execution of a software project in itself, in the domain of traditional Software Engineering.
Integration Process	Organisational initiatives complementary to the project.
Competition Process	Market contexts in which a project will produce results.
Time	The timescale in which an organisation hopes project results will enhance business performance.
Costs	Refers to the 'price' an organisation is prepared to pay for benefits.
Risks	Refers to factors that might hinder or diminish expected benefits

Alignment was not included in this list, as it would already have occurred when a project is begun and, thus, will not be directly monitored, although, it is fundamental to know the strategic objectives behind a project, if it remains valid and if alignment is maintained.

Taken as a whole, these factors indicate the potential of a project to generate the value that justified its undertaking by an organisation.

In traditional software project management decision-making would be based on monitoring and control processes that produce the information shown in Table 1. The data there mainly concerns the conversion process, and does not consider the other factors identified in Table 2.

The software project management approach proposed here extends the data input by recording and monitoring these other value determinant factors.

Figure 2 illustrates the proposed approach by representing traditional data in white and newer inputs in the darker tone.

While standard project information remains indispensable, the new additions include the organisation's expectations of value creation by a project, the state of organisational elements, and the market context within which results will have to be produced.

This conjoined information may form the basis for assessing potential project value. This assists the decision-making which will, in turn, impact a project by defining resource allocation and further development.

To structure the approach, certain artefacts were defined to integrate the determinant factors of project value and implement the additional data. These artefacts are presented and explained below:

- The **Value Model** corresponds to the organisation's description of what it expects in terms of project value, and characterises its basic determinant factors: the strategic objective, the business process to be modified, the intended business transformation and an indicator of success, which provides the subjective component of the benefit.
- The **Complementary Initiatives** describes the integration process by monitoring initiatives related to preparing organisational elements for the changes brought by the project.
- The **Market Scenario** refers to the competitive context of the SBA in which a company intends to get business benefits.
- The **Project Scenario** describes the conversion process, and brings on the standard data

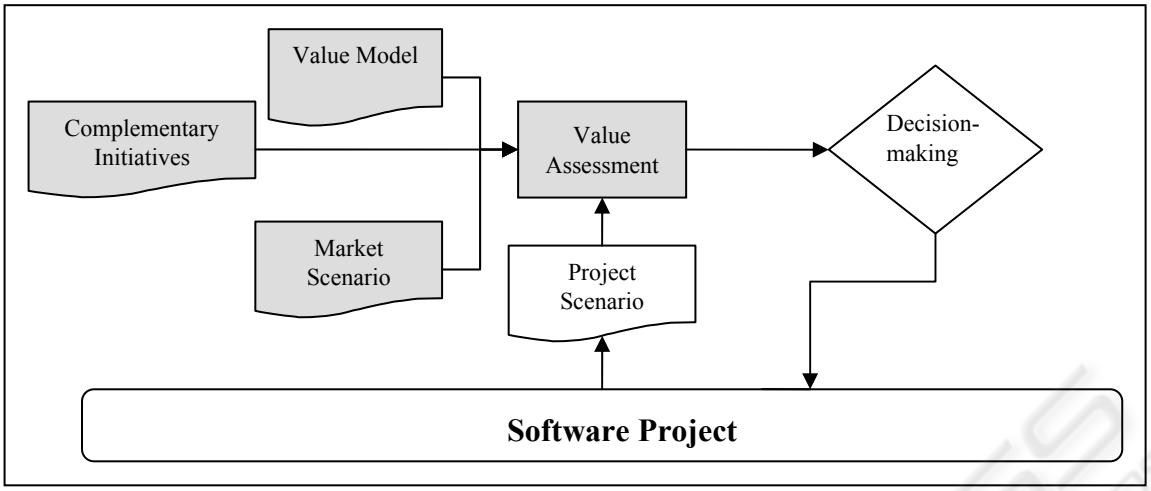

Figure 2: Software Project management based on business value.

concerning traditional software engineering (as described in Table 1).

The above artefacts encompass the range of determinant factors of project value presented in Table 2 and will support the assessment of potential project value.

This assessment must be undertaken by a specialised team, with good knowledge of the company's business strategy, its particular 'culture' and its projects.

An interesting alternative would be to delegate this task to a Project Management Office - or PMO – given that these structures have assumed growing importance in the alignment between business and IT.

Considering value as a subjective and contextual concept (Soh and Markus, 1995; ITGI, 2006), it's not possible to represent it in a completely quantitative way. In order to minimise the level of subjectivity in the assessment process, a specific artefact was designed. This takes the form of a structured set of affirmations. The design of this artefact is based on the processes in the value creation chain described in Figure 2 and on Thorp's (1999) key-questions as described in Section 2.

Potential value assessment will be carried out in relation to the dimensions of alignment, conversion, integration, competition, time, cost and risks. Table 3 shows the items associated with each of these dimensions.

For each item (presented as a statement) assessors must indicate its level of agreement on a six level scale ranging from disagreement to agreement.

For the dimensions of alignment, conversion, integration and competition groups of five statements are presented; the fifth in each group (highlighted in Table 3) summarises a dimension's general assessment.

When proceeding to evaluation, assessors will use the information previously recorded in the artefacts in order to measure the extent to which it agrees with each statement. It should be remembered that the first four statements will form the basis of the fifth one.

In the cases of time, cost and risks, only one statement is required.

Each statement will score an agreement level from 0 (disagreement) to 5 (agreement). The score for the main statement in each group represents the overall assessment for the specific dimension.

The final evaluation of the seven dimensions can be translated into a diagram, as in Figure 3. It is also possible to record on the diagram different evaluations, performed in different moments of project life-cycle, thus showing the evolution of potential project value.

Table 3: Assessment artefact for potential project value.

Dimension	Statement
Alignment	The strategic business objective remains valid
	Using a software solution is opportune
	Project benefits for the company are clear
	The project is of central importance for reaching the objective
	The project conforms with business objectives
Conversion	Actors with necessary capabilities are available
	Necessary resources are available
	Project plans are consistent
	Project execution is going to plan
	The project will deliver expected results

Table 3: Assessment artefact for potential project value (cont.).

Dimension	Statement
Integration	Additional initiatives are developing appropriately
	Organisational elements are being coordinated
	The business is capable of adapting to necessary changes
	The project is adhering to organisational architecture
	Project and organisational elements are integrated
Competition	The market scenario is favourable to the project
	Estimates of benefits are consistent
	Project sponsorship is consistent
	Results are protected from uncontrollable external factors
	It will be possible to harvest the beneficial results from the project
Time	**Schedule will be met**
Costs	**Project execution will not exceed predefined limits**
Risks	**The risk of not obtaining benefits is low**

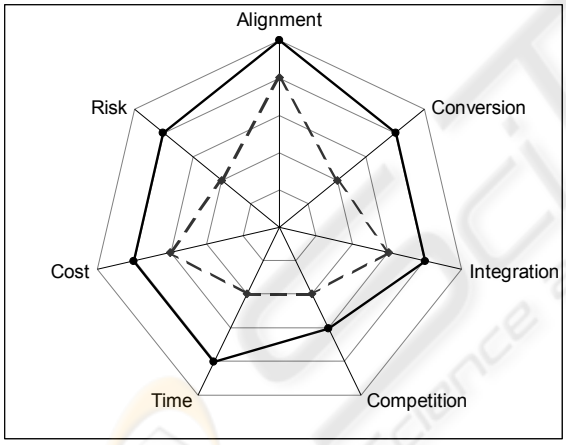

Figure 3: Sample project value assessment diagram.

4 PRACTICAL APPLICATION

The approach described in this paper was put into practice in an actual project for a large enterprise. Although software development is not the company's principal activity, software is used heavily in its business, what demands many projects, involving its own staff, as well as external providers.

In order to apply the approach within tight time limits, an already completed project was chosen. The data necessary for completing the artefacts was obtained from project records and in interviews with the actors involved, especially business managers.

The organisation's PMO staff led the application of the approach, as they have knowledge of the project, strategies and the company's document database.

The chosen project aimed to design a new product, novel both within the company and for the market, and it had generated high expectations of possible benefits. Successful implementation of the product would depend strongly on a robust and consistent information system that could put the product business rules into practice.

The project was not challenging in terms of technology, as there were available staff with experience of this type of application. The greatest difficulty was establishing business rules, as there were still a number of concerns for both a section of the market and for regulatory agencies.

Assessment was carried out at three specific points. The first occurred soon after the project had been approved, the second midway through, and the third shortly before completion.

In a 'live' context such assessments would be planned during the initial planning of the project, according to its specific characteristics or company policy. For example, assessments might be set on a monthly basis, shortly after relevant deliveries, or before the injection of major investment.

The diagram in Figure 4 presents the results of evaluations of potential project value in the case study in three different moments. The most external black line indicates the first moment, the dotted line the second and the grey inner line the third.

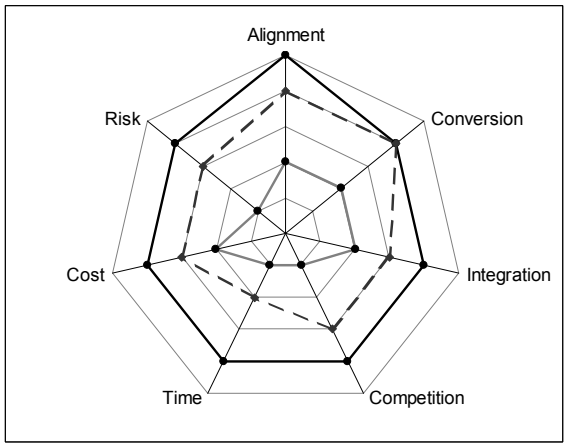

Figure 4: Potential project value evolution.

The first assessment indicated high potential project value, with a high degree of alignment and good perspectives in all dimensions.

At the second moment deterioration in value was already noticeable. The project was encountering problems in stabilising the business model, although the dimension of conversion remained under control.

In the final assessment, potential value had vanished, and had even corrupted conversion.

During its actual working life, the project had appeared technically consistent. Consequently, the organisation maintained investment and continued development, trying to keep adherence to established plans. Had a management approach based on value been utilised, the losses in the project's potential value could have been identified earlier. This in turn would have led to decisions concerning the rearrangement and optimisation of available resources.

5 RELATED WORK

Two important approaches are in the same line of this article. The first one is the aforementioned Value-Based Software Engineering (Biffl *et al,* 2006) that proposes the inclusion of value considerations among the basic principles of software engineering.

This paper aims to contribute to the VBSE effort by investigating the value generation mechanism in software projects and proposing a method to record and analyse it, which is part of the VBSE agenda as proposed by Boehm (2006b).

The second one is the ValIT Initiative (ITGI, 2006). ValIT is intended to respond to the need for organisations to optimize the realization of value from IT investments. A significant part of ValIT principles is based on Thorp (1999), which is also an important reference for this paper. One of the main objectives of ValIT is to continuously evaluate the business value potential of an IT investment in order to optimize the organisation's portfolio. To achieve this go, ValIT defines a set of processes and related practices.

The instruments proposed herein implement a way to support the ValIT practices, especially those related to evaluating, recording and managing value in software-enabled business investments.

6 CONCLUSIONS

This article has aimed to present a management approach to software projects based on business value. A literature review identified the key determinant factors of project value from a business perspective.

The value determinant factors were grouped together and mapped onto a set of artefacts that could be used to record and monitor their status in a project. The data obtained would be the input necessary for the evaluation of project value, a process that might be undertaken at various moments according to prior planning.

The evaluation of potential project value would be a key input for decision-making, since it complements the technical information produced from traditional processes of monitoring and control.

The set of artefacts and monitoring mechanisms described here could underpin a project management approach based on business value.

In order to assess the applicability of the approach and its usefulness in real situations, a trial run was conducted using an actual project as its basis.

Although the practical application did not enjoy sufficient quantitative data to conclude its superiority as a way of assessing project value, it did indicate that the approach is viable and may be a useful tool in decision-making.

Future studies could widen the scope of practical application and extend the experimental results. For example, they might employ the approach in relation to a range of actual projects during their life-cycle. This would provide the quantitative data needed for more definitive conclusions.

The initial step in this study – the establishment of parameters for recording and monitoring project value – also suggests other possibilities. For example, defining the software process to be used in a project could be based on determinants of value.

It also seems possible that there is a correlation between the factors identified, as they do not vary in a fully independent way. For example, variations in the conversion process might affect timescale, just as competition affects levels of risk. The investigation of such relationships represents another fruitful area for future study.

Another issue for further studies is the relative weight of each value factor. Probably they differ for different business areas. In this case, some customization will be necessary, but the basic model remains valid.

By offering an applicable approach to software project management based on business value, this work has contributed to the business and academic communities by providing the following:

- a discussion of how a software project generates value for business, yet enabling a more wide-ranging view of this issue;

- the identification of a matrix of factors that influences a software project value and can be used for its continuous monitoring;
- artefacts that can be used by organisations to record and monitor the development of potential value in their projects.

On the basis of the research conducted for this study, it may be seen that, although software engineering has advanced rapidly in terms of tools and solutions, many of the most critical remaining questions are clearly located on the frontier between IT and business, especially in the creation of a shared vision of value.

REFERENCES

Ansoff, I., & McDonnel, E. (1993). *Implantando a administração estratégica.* São Paulo, SP: Atlas.

Biffl, S. *et al* (Eds) (2006). *Value-based software engineering*. Berlin: Springer Verlag.

Boehm, B. (2006). Some future trends and implications for systems and software engineering processes. *Systems Engineering, Vol. 09, Is. 1*, 1-19.

Boehm, B. (2006b) Value-Based Software Engineering: Overview and Agenda. In: S. Biffl *et al* (Eds.) *Value-Based Software Engineering***.** (pp. 109-132). Berlim: Springer-Verlag.

Boehm, B.; & Sullivan, K. (1999). Software Economics: a Roadmap. *Information and Software Technology***,** *41,* 937-946.

CMMI (2001). *Capability Maturity Model Integration, version 1.1 – CMMI for Systems Engineering, Software Engineering and Integrated Product and Process Development (CMMI SE/SW/IPPD v1.1)*. Pittsburg, PA: Software Engineering Institute - Carnegie Melon University.

Favaro, J. (1996). When the pursuit of quality destroys value. *IEEE Software*, *Vol. 13, Is. 3*, 93-95.

ITGI (2006). *Enterprise value governance of IT investments: The Val IT framework.* Rolling Meadows, IL: IT Governance Institute.

Maximiano, A. (2002). *Administração de projetos: como transformar idéias em resultados. (2ª. Edição)*. São Paulo, SP: Atlas.

Marshall, P., McKay, J., & Prananto, A. (2004). A process model of business value creation from IT investments. *Proceedings of the 15th Australasian Conference on Information Systems.* 81-92.

Mooney, J., Gurbaxani, V., & Kraemer, K. (1996). A Process Oriented Framework for Assessing the Business Value of Information Technology**.** *The DATA BASE for Advances in Information System, Vol. 27, Is. 2*, 68-81.

PMBOK (2004). *A Guide to the Project Management Body of Knowledge (PMBOK), 3rd Ed.. Newton Square, PA:* Project Management Institute-PMI.

Porter, M. (1979). How Competition Shapes Strategy. *Harvard Business Review, March-April*, 9-18.

Soh, C., & Markus, M. (1995). How IT Creates Business Value: A Process Theory Synthesis. *Proceedings of the 16th International Conference on Information Systems*, 29-41.

Thorp, J. (1999). *The Information Paradox***:** *Realizing the Business Benefits of Information Technology*. Toronto, ON: MacGraw-Hill.

Venkatraman, N. (1994). IT-Enabled Business Transformation: From Automation to Business Scope Redefinition. *Sloan Management Review*, *Vol. 32 Is. 2,* 73-87.