Journal of Technology Management & Innovation
E-ISSN: 0718-2724
editor@jotmi.org
Universidad Alberto Hurtado
Chile

de Oliveira Moraes, Renato; Barbin Laurindo, Fernando José
Performance Evaluation of IT Projects - The Shenhar and Dvir Model
Journal of Technology Management & Innovation, vol. 8, núm. 3, 2013, pp. 15-24
Universidad Alberto Hurtado
Santiago, Chile

Journal of Technology Management & Innovation

Special Issue on Selected Papers from ALTEC 2011.
Selected February 11, 2013

J. Technol. Manag. Innov. 2013, Volume 8, Special Issue ALTEC.

Performance Evaluation of IT Projects - The Shenhar and Dvir Model

Renato de Oliveira Moraes[1], Fernando José Barbin Laurindo[2]

Abstract

This paper presents a scale for the ex-post evaluation of IT projects based on the definition of multidimensional performance of projects proposed by Shenhar and Dvir (2009). From the five dimensions proposed by these authors, a questionnaire was designed to assess the importance of various performance criteria in the ex-post evaluation of projects and IT in different organizations. The responses to the questions in the questionnaires were analyzed using factor analysis and Cronbach's alpha, which measures the scale's internal reliability.

The scales presented in this article are consistent with the evaluation criteria of the model ex-post evaluation of IT projects presented by Moraes and Laurindo (2010), and they are articulated with assessment procedures described by these authors. Accordingly, this paper contributes to the construction of a set of references for an ex-post evaluation of IT projects.

Keywords: performance of IT projects; performance scale; management of IT projects.

Universidade de São Paulo (USP). Departamento de Engenharia de Produção. Avenida Prof. Luciano Gualberto, Travessa 3 N°380.
E-mail: [1]remo@usp.br, [2]fjblau@usp.br

ISSN: 0718-2724. (http://www.jotmi.org)

Introduction

The success rate of IT projects, according to the Standish Group's CHAOS Report, is approximately 16%, while approximately 31% of projects are abandoned or canceled and other projects are completed without achieving their original goals with respect to cost, time and/or technical performance. Although the most common causes are known, organizations that wish to increase their success rate regarding such projects must clearly identify the factors that most affect their IT projects. An ex-post evaluation of projects, however, is an alternative to this identification.

This paper presents a scale for the ex-post evaluation of IT projects based on the definition of the multidimensional performance of projects proposed by Shenhar and Dvir (2009). From the five dimensions proposed by these authors, a questionnaire was designed to assess the importance of various performance criteria in an ex-post evaluation of projects and IT in different organizations. The responses to questions on the questionnaires were analyzed using factor analysis and Cronbach's alpha, which measures the internal reliability of a scale.

The scales presented in this article are consistent with the evaluation criteria of the model ex-post evaluation of IT projects presented by Moraes and Laurindo (2010), and they are articulated with assessment procedures described by these authors. Accordingly, this paper contributes to the construction of a set of references for the ex-post evaluation of IT projects.

Theoretical Review

An incomplete vision of project performance is directly related to fulfilling the original goals of time, cost and quality. Therefore, the work of Baker, Murphy and Fisher (1983), which showed that broader performance criteria are used by professionals, plays an important role in various projects. They proposed the concept of perceived success when they observed in their study that projects that did not meet their original goals of cost, schedule and quality were not necessarily perceived as failed projects by the people involved in the development of the projects. Thus, a project's success is linked to the perception of those involved (stakeholders) regarding the performance of the project.

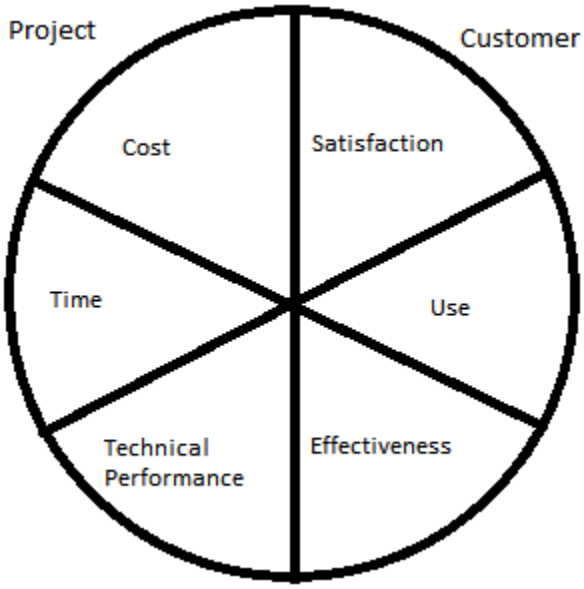


Figure 1 – Model of Project of Success. Adapted from Pinto and Slevin (1986)

Internal factors	External factors
Cost - degree of compliance with the project's initial budget Deadline – degree to which initially established deadlines are met Technical performance - degree to which the project meets implicit and explicit technical specifications	Use - project is used according to its original proposal Satisfaction - satisfaction with the process by which the project is being or was conducted Effectiveness - project will directly benefit its users

Table 1: Dimensions of success Pinto and Slevin (1986).

Pinto and Slevin (1986) provide a definition of project performance that considers both internal factors, which include cost, time and quality (compliance with technical specifications), and external factors, which include use, satisfaction and effectiveness.

While the internal factors are more closely related to and controlled by the manager and are thus not directly affected by the customers and users, the external factors, in contrast, are more directly related to customer behavior (Figure 1).

Table 1 provides a breakdown of the internal and external factors with examples of evaluation criteria.

The authors emphasize that the relative importance of each of the two factors (internal and external) varies with time. While internal factors, which are more subject to influence and control from the project team, are more important in the early stages of the project, while external factors, which are more specific to customer perception, assume greater importance from the time of implementation (Figure 2).

Lim and Mohamed (1999) also recognize the importance of the perception of success, noting that the perception of success is not necessarily the same for all actors involved in a project. For example, these authors separate vision performance into two categories: macro and micro. From the macro perspective, the success of the project can only be obtained in its operational phase, that is, the use of the product as generated by the project. Thus, success depends primarily on users. From the micro perspective, the success of the project depends on the tasks and milestones. Thus, this division – micro and macro – results in the evaluations of process and product, respectively, which is a view of product and process that is shared by other authors.

Cooke-Davis (2000) addresses two separate concepts. The first concept, the project's success, is measured by the degree of achievement of the project's overall objectives. For example, one project aims to generate, through the launch of a more modern product, increased market share, or to develop expertise in specific technologies, among other goals. The second concept is the successful management of the project, for which measurement is based on indicators of meeting deadlines, budgets and quality standards established for the project.

Baccarini (1999) also uses two distinct concepts of performance: success of project management (process view) and product success (product view). The success of the process is linked to the classical aspects of performance (time, cost and quality technical specifications), stakeholder satisfaction and development, and quality management process. This view leads to the following performance criteria:

• anticipate project requirements, meet project needs, use resources efficiently;
• communicate effectively and resolve of cases in a timely manner;
• establish effective coordination of and relationships between stakeholders, engage in teamwork and in participatory and consensual decision making;
• minimize scope changes and eliminate disturbances in the organization (related to work process and culture);
• complete project with no post-closing problems and identify and solve problems during project execution.

The success of the product is evaluated using the following criteria:
• achieves organizational objectives according to strategic buyer / project sponsor;

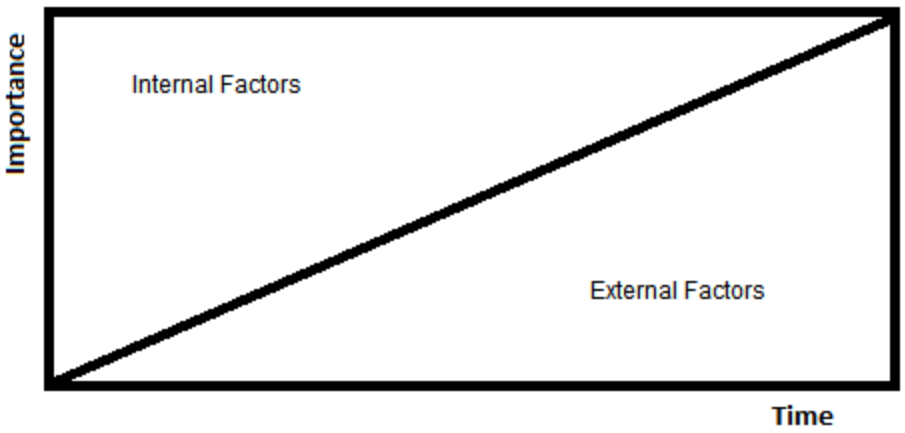


Figure 2 - Importance of factors of performance over time. Adapted from Pinto and Slevin (1986)

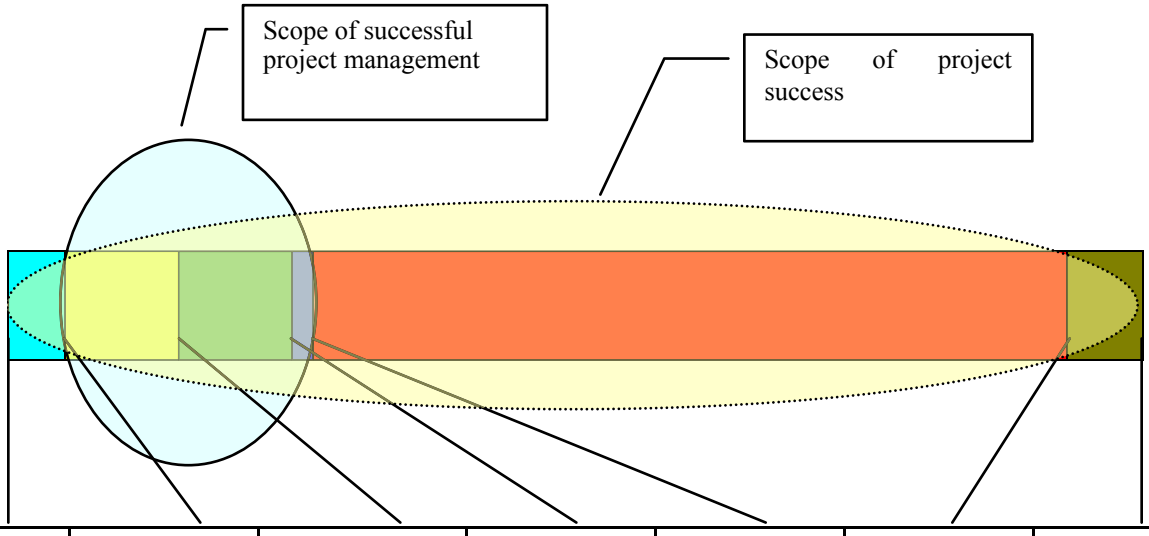
• meets needs and purposes of users purposes and is appropriate for use;
• meets needs of other stakeholders of the project product.

While recognizing the importance of the last successful product, Baccarini (1999) notes that the success of project management (process) tends to influence (positively) the success of the product. He notes that as the performance evaluation depends on who conducts the evaluation as well as on the time of evaluation, it is important to establish a priori the success criteria that will be used to assess a particular project.

Bjeirmi and Munns (1997) also separate the concepts of successful project management of project success; however, their concepts are not complementary. Successful project management is only part of the success of the project, as illustrated in Figure 3, and the project team is involved only at stages 2, 3 and 4 of the project, while customers will be interested in all stages 1 through 6. Accordingly, the team will naturally be more attentive to the successful completion of stage 4 as it terminates its involvement in the project. Customers (or users), however, will be interested in the final results, which are not apparent until the last stage. The authors suggest that the performance evaluation can, accordingly, be completed using three distinct optical factors:

1. Implementation: considers stages 2 through 4 and is focused on technical project management and implementation.
2. Perceived values: considers the users who will interact during the use of the product as well as during the design stage.
3. Customer satisfaction: considers the closure of the project when the client can examine all the influences and can assess compliance with the overall objectives and benefits.

Wateridge (1995) examined over 100 projects to determine the success criteria and constraints used in the design of information technology (IT). The work involved contact with project managers, sponsors, users, systems analysts and support staff, and it required him to submit the views of the contacts on the success of the IT projects. While the author claims to have found broad consensus among stakeholders of IT projects, there is some disagreement regarding the inclusion of meeting deadlines and budgets within the definition of success criteria. The author noted a variation in the criteria used in the performances among projects considered to be successful and those considered to be unsuccessful. For projects deemed to be successful, meeting the established quality specifications and achieving commercial success were considered to be more important by project managers, while with respect to project failures, compliance schedules and budgets were the most cited factors that contributed to a lack of success. Users, in general, are more concerned with ensuring a project's end result.



Phase	1-Design	2-Planning	3-Production	4-Delivery	5- Use	6-Disposal
Concerned Parties	Customers users third parties*	Customers project team third parties *	Customers project team manufacturer third parties *	Customers project team manufacturer third parties *	Customers users third parties *	Customers third parties *

(*) Third parties include local and national authorities, media, environmental groups, general public, etc.
Figure 3 - Scope of project success and success of project management. Adapted from Munns and Bjeirmi (1997)

It is interesting to note the consistency of this result with that of Baker, Murphy and Fisher (1983), who also found that the factors that affect the perception of success are not (exactly) the same as those that affect the perception of failure. Wateridge (1995) also emphasizes the importance of establishing a priori criteria for evaluating performance among project stakeholders. He recalls that a manager is only able to treat adequately the constraints of project success when a consensus exists among stakeholders on the success criteria applied to the project.

This same discussion is revisited in a later work, whereby Wateridge (1998) identified a set of performance criteria often used in IT projects (Table 2). In that study, the criteria used to evaluate the performance of projects suffered slight modifications (Table 3 and Table 4)
The concept of success used by Dvir et al. (1998) has two dimensions: benefits perceived by consumers and fulfillment of project goals (design). These dimensions also suggest a division of the concept of success, as the benefits perceived by consumers can only be evaluated after the implementation of the product design, unlike compliance with the specifications, which can be evaluated during development and project completion.

In contrast, Shenhar et al. (2001) do not recognize the existence of two distinct concepts of success – success and the success of product design – and instead defend the premise that the relative importance of the dimensions of project success change over time. They identify the following dimensions of success:
• Project efficiency (meeting deadlines and budgets);
• Impact on consumer (customer satisfaction and product quality);
• Success of the business (revenue generation, profit share and other benefits derived by the mother organization);
• Preparation for the future (developing organizational infrastructure and / or technology for the future).

However, the proposal of these authors also recognizes that the evaluation of each dimension cannot be conducted simultaneously, as each dimension has a different background (Figure 4).

The relative importance of each dimension varies with time and with the technological uncertainty. In the very short term, project efficiency is the most important dimension and is also the only dimension that can be measured with reliable accuracy. Using the developed product becomes pos-

Project Types	Perception of Users	Perception of Project Managers		
	Criteria for success	%	Criteria for success	%
All projects	Meet requirements of users	96	Meet requirements of users	82
	Contribute to user satisfaction s	71	Enforce budget	72
	Enforce budget	67	Meet deadlines	69
Successful Projects	Meet requirements of users	96	Meet requirements of users	86
	Contribute to user satisfaction	71	Achieve Commercial Success	71
	Enforce budget	71	Comply with quality goals	67
Failed projects	Meet requirements of users	100	Enforce budget	83
	Achieve purpose	100	Meet deadlines	78
	Contribute to user satisfaction	97	Meet requirements of users	78

Table 2: Three key success criteria (frequency of citation) as perceived by users and project managers. Adapted from Wateridge (1995)

Meets requirements of users Accomplishes purpose Meets deadlines Complies with schedules Contributes to user satisfaction Contributes to quality goals	

Table 3: Criteria used in projects by professional IT development as observed by Wateridge (1998)

Project Types	Perceptions of Users	Perceptions of Project Managers		
	Criteria for success	%	Criteria for success	%
All projects	Meet requirements of users	96	Meet requirements of users	81
	Achieve user satisfaction	69	Comply with budget	71
	Meet purpose	65	Meet deadlines	71
	Comply with budget	62	Achieve commercial success	60
	Meet deadlines	58	Meet purpose	60
Successful Projects	Meet requirements of users	96	Meet requirements of users	86
	Achieve user satisfaction	71	Achieve commercial success	71
	Comply with budget	71	Achieve quality goals	67
	Meet deadlines	67	Comply with budget	62
	Meet purpose	57	Achieve purpose	62
Failed projects	Meet requirements of users	100	Comply with budget	83
	Achieve purpose	100	Meet deadlines	78
	Contribute to user satisfaction	67	Meet requirements of users	78
	Contribute to team satisfaction	67	Contribute to commercial success	61
	Contribute to commercial success	67	Contribute to meeting quality goals	56

Table 4: Top five success criteria (frequency of citation). Adapted from Wateridge (1998)

Criteria	All	Users	Managers
Achieves Commercial success	48	38	60
Meets requirements of users	87	96	81
Complies with schedules	64	62	71
Contributes to user satisfaction	49	69	35
Achieves purpose	71	65	60
Meets deadlines	67	58	71
Contributes to S sponsors satisfaction	28	15	27
Contributes to meeting quality goals	49	38	58
Contributes to Team satisfaction	26	31	27
Others	7	12	8

Table 5: Criteria for success as cited by users and project managers. Adapted from Wateridge (1998)

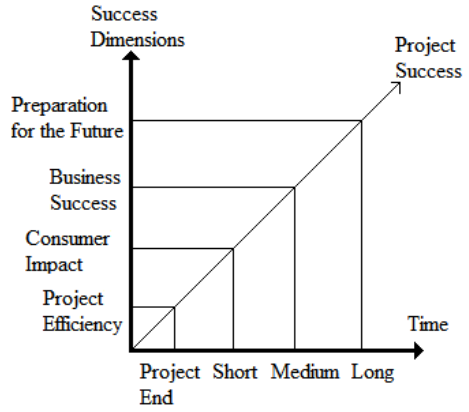


Figure 4 – Success dimensions versus term. Adapted from Shenhar et al. (2001)

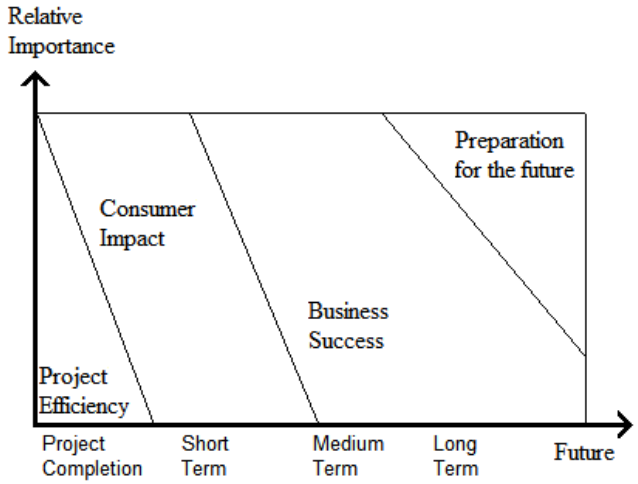


Figure 5 – Relative importance of success dimensions versus time. Adapted from Shenhar et al. (2001)

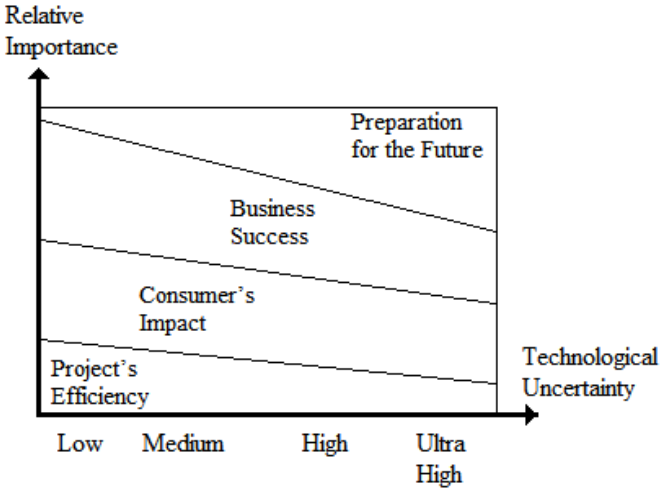


Figure 6– Relative importance of success dimensions versus technological uncertainty. Adapted from Shenhar et al. (2001)

Dimension of success	Measures / used variables
Project Efficiency	Meets goal deadline Meets Budgets
Consumer Impact	Contributes to functional performance Complies with technical specifications Meets customer needs Resolves customer issues Used by customer Contributes to Customer Satisfaction
Business success	Enhances Commercial Success Creates or increases market share
Preparing for the future	Creates a new market Creates a new product line Develops a new technology

Table 6: Dimensions of the success of projects, according to Shenhar et al.

sible, as does the relevant evaluation of other dimensions (Figures 4 through 6).

In projects with low technological uncertainty, project expectations are more strongly linked to marginal contributions in the development, and efficiency is an important factor. For example, when conducting a product update, the interest is in keeping the product in accordance with the specifications of the market, and this approach is not expected to change the life cycle of the product. When working with a high degree of both innovation and technological uncertainty, organizations become more tolerant toward low levels of project efficiency because there is an expectation that the project can eventually generate internal competence in new and emerging technology.

As noted by the authors previously discussed herein, a variation exists in terms of performance indicators, though there is a certain convergence in relation to the dimensions of project performance. A striking difference between the proposals relates to the discussion on how various concepts are related to performance. While some researchers (LIM and Mohamed, 1999; Cooke-Davies, 2000; Baccarini, 1999; Munns, 1997) refer to two distinct concepts - successful project management (focus on process development) and project success (focus on product of resulting project) - others (SHENHAR et al. 2001; Baker Et Al. 1,983; Pinto and Slevin, 1988) suggest that there is a single element with multidimensional characteristics, in which the relevance of each dimension varies with time.

The present work considers a different premise - a unique concept of performance - because the authors believe that this unique concept provides a more interesting temporal perspective regarding project performance.

Performance dimension	Performance Criteria
Project Efficiency	Meets schedules
	Meets budgets
Impact on Customer	Meets appropriate level of functional performance
	Meets technical specifications
	Meets customer needs
	Resolves customer issues
	Used by the customer
	Achieves Customer Satisfaction
Impact on Team	Achieves Team Satisfaction
	Develops Team morale
	Develops Skills
	Enhances Growth of team members
	Contributes to retention of team members
Commercial success	Increases sales
	Increases profits
	Contributes to Market Share
	Contributes to ROI and ROE
	Contributes to Cash Flow
	Improves Quality of Service
	Reduces cycle time
	Meets regulatory approval
Preparing for the Future	Creates new market
	Creates new product line
	Develops new technology
	Develops new core competency
	Contributes to new organizational capacity

Table 7 - Performance criteria of the data collection instrument

Method

From the literature review, a questionnaire was designed to collect data separated into 4 parts:

- Identification of the interviewee
- Identification and characterization of the company
- Characterization of the type of project
- Assessment of the importance of the criteria for evaluating performance

The closed question questionnaire was answered by 37 professionals working on various IT projects. The data were subjected to factor analysis, and the reliability of the scales was assessed by Cronbach's alpha value. Table 2 shows the performance evaluation criteria present in the data collection instrument. The respondent assessed the importance of each criterion in the ex-post evaluation of project performance of the organization (irrelevant, unimportant, medium importance, very important, or essential)

Results

In all, 37 valid questionnaires were obtained. The respondents included managers and project team leaders (22%) and professional development leaders (78%) whose experience in developing information systems ranged from 2 to 15 years. For each of the five dimensions of performance, we performed a factor analysis and determined that the sample size fit the recommendation of Hair et al. (2004) in at least five observations for each variable used in the analysis.

In each factor analysis, a single factor with an eigenvalue greater than 1 was extracted. The higher quality of the service criterion dimension Commercial Success was deleted because this variable was extracted at below 0.5, which increased the explained variation and the value of Cronbach's alpha for this scale. Table 8 presents a summary of the observed results.

In a broad sense, the results suggest that the variables used generate good scale performance of the dimensions of the Shenhar and Dvir model. The sampling adequacy measure (Kaiser-Meyer-Olkin (KMO)) for the first dimension is low because this dimension has only two variables. However, in this dimension, the variation of the variables extracted and the value of Cronbach's alpha can be considered good, according to Hair et al. (2005).

The results strongly suggest that this model can be used in ex-post evaluations of the performance of IT projects, which is consistent with the findings of Moraes (2004), Moraes and Laurindo (2010)

Final Remarks

This paper evaluated the use of the Shenhar and Dvir model (2009) for evaluating the performance of IT projects. Data collected through a closed questionnaire indicated that the variables of the performance dimensions of this model allow for the construction of scales with high internal reliability. Previous works (MORAES, 2004; Moraes And Laurindo, 2010) noted the appropriateness of the first two dimensions of performance -– project efficiency and impact on the customer - in assessing the performance of IT projects. It is worth noting that the characteristics of the ex-post evaluation process result in the perception of the project performance to be affected by the time of the evaluation. Thus, the relative dimensions of the performance model of Shenhar and Dvir, and therefore the scales of each of these dimensions, are important at different time points. In general, these scales help professionals to develop evaluation procedures that go beyond ex-post evaluations in which it is only possible to evaluate the efficiency of the project based on cost and timeliness of the project's completion.

As the sampling procedure was not probabilistic, it is expected that other studies, possibly with larger samples, can confirm the findings presented herein.

Performance Dimensions	Number of Variables	KMO	Extracted Variance	Cronbach's Alpha
Project efficiency	2	0.500	77.6%	0.711
Impact on customer	6	0.902	75.2%	0.929
Impact on team	5	0.847	80.4%	0.937
Commercial success	7	0.900	72.4%	0.933
Preparing for the future	5	0.795	84.0%	0.952

Table 8 - Summary of test results

References

BACCARINI, David. The Logical Framework Method for Defining Project Success IN: International Journal of Project Management vol. 30, no. 4, pp 25-32, 1999.

BAKER, Bruce N., Murphy, David C. E Fisher, Dalmar Factors Affecting Project Success In Cleland, D. I. E King, W. R. Project Management Handbook. New York : Van Nostrand Reinhold, 1988.

COOKE-DAVIES, T. The real success factors on projects. In International Journal of Project Management vol. 20, pp. 185-190, 2000

DVIR, D. et all. In search of project classification: a non-universal approach to project success factors. IN Research Policy , no. 27, pp. 915-935, 1998

HAIR, J. F. et all. Multivariate Data Analysis. Prentice Hall, 2005

LIM, C. S. & Mohamed, M. Z. Criteria of project success: an exploratory re-examination. IN International Journal of Project Management vol. 17, no. 4, pp. 243-248, 1999

MORAES, R. O. Condicionantes de desempenho dos projetos de software e a influência da maturidade em gestão de projetos. Tese de Doutorado. Faculdade de Economia, Administração e Contabilidade da Universidade de São Paulo. 2004

MORAES, R. O. ; Laurindo, F. J. B. . Avaliação de resultados de projetos de TI. IN: Anais do XXX Encontro Nacional de Engenharia de Produção. São Carlos, 2010

MUNNS, A. K. & Bjeirmi, B. F. The role of project management in achieving project success. IN: International Journal of Project Management vol 14 no. 2 pp. 81-87, 1997.

PINTO, J. K. & Slevin, D. P. Critical Success Factors Across the Project Life Cycle IN: International Journal of Project Management , 1986

SHENHAR, A. et all Project success: a multidimensional strategic concept. IN Long Range Planning, no. 34, pp. 699-725, 2001

SHENHAR, A. & Dvir, D. Reinventando Gerenciamento de Projetos. São Paulo: M.Books, 2009

WATERIDGE, John. IT project: a basis for success. IN International Journal of Project Management vol. 13, no. 3, pp. 169-172, 1995