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Прочитайте статью[1] и сделайте её критический анализ на русском языке.

1. Introduction

Project management is designed to ensure the success of a project is a subjective concept that depends on the perspective of the individual who is evaluating that success *(Carvalho, 2014).*

Traditionally, compliance with cost, schedule, and quality/ has been used as a criterion to measure project success *(Barclay & Osei-Bryson, 2010).* These dimensions, known as the «iron triangle», though often criticized, are still considered the gold standard for measuring project success *(Papke-Shields et al., 2010)*. Accordingly, a focus on these factors suggests that project management is expected to be more concerned with organizational efficiency than with organizational effectiveness.

To better understand the causes of project failure, researchers explored a number of project management dimensions, including how projects are conducted and the internal and external contexts in which projects are executed *(Papke-Shields et al., 2010)*. Over the last three decades, many authors have used different lines of research to identify the variables or conditions that lead to successful projects. Among these lines of research, the greatest number of publications is related to critical success factors *(Fortune & White, 2006)* and project management maturity models *(Berssaneti et al., 2012; Jiang et al., 2004)*. The current business environment shares the general assumption that the adoption of project management methodologies and the achievement of maturity in this field result in improvement of both organizational performance and project performance.

Although businesses have been engaged in project management for more than half a century, its contribution to performance is still not acknowledged outside the group of professionals who believe in project management *(Aubry & Hobbs, 2010)*. Some empirical studies support the general view *(Besner & Hobbs, 2013; Kerzner, 2006)* and highlight the challenges associated with the implementation of project management methodologies *(Ala-Risku & Kärkkäinen, 2006)*. However, scholars argue that the contribution of project management methodologies to enhancing performance is a controversial subject that requires in-depth research *(Aubry & Hobbs, 2010).*

There is a lack of empirical and structured researches *(Grant & Pennypacker, 2006)* to address the relationship between project management and performance. This paper aims to fill the research gaps and to answer the research question «what are the variables that influence project success»?

[1] Подготовлена на основе: Berssaneti F.T., Carvalho M.M. (2015) Identification of variables that impact project success in Brazilian companies // *International Journal of Project Management*, Vol. 33(3), pp. 638-649.

2. Literature review

2.1. Project success

The goal of project management is to ensure the success of the project. Success, as a subjective term, is dependent on the perspective of those who are measuring it *(Jha & Iyer, 2006)*. According to *Barclay and Osei-Bryson (2010)*, a key challenge of a projects often includes the lack of clearly defined objectives and the mismatched stakeholders' expectations. Moreover, the success criteria can vary from project to project as they are dependent on the context and on the perspectives of the various stakeholders, according to *Toor and Ogunlana (2010)*.

Factors such as time, cost, and quality are traditionally used as criteria for measuring project success (*Pinto & Slevin, 1987; Papke-Shields et al., 2010)* and the «iron triangle» *(Meredith & Mantel, 2000; Pinto & Slevin, 1987)*. However, there is no consensus regarding the success criteria among researchers *(Jha & Iyer, 2006)* because there are many variables that can affect success, such as the context of the internal organization and the external environment in which a project is performed, and can influence both the outcome and the success of a project *(Papke-Shields et al., 2010)*. In addition, over the years, the three criteria (time, cost, quality), often called the basic or traditional criteria, have been criticized because they seem inadequate. Some authors consider them excessive, while others consider them incomplete *(Yu et al., 2005)*. Accordingly, several efforts have been made to overcome the inadequacies. These attempts can be grouped into two different approaches: (1) adding more dimensions to the traditional criteria (iron triangle), exploring the variables that can impact success; and (2) reducing various criteria to a single evaluation criterion, the financial criterion *(Yu et al., 2005)*. The second approach considers that time and quality are project cost variables *(Yu et al., 2005)*. This study is aligned with approach 01, exploring variables that impact project success.

Because of the complexity of the project success concept discussed above and the lack of consensus among authors in the field, the traditional dimensions of the «iron triangle», albeit criticized, are still considered central to the measurement of project success *(Papke-Shields et al., 2010)*. *Agarwal and Rathod (2006)* stated that cost, time and quality (functionality) are still important criteria for evaluating the performance of projects from the professional's point of view, and these criteria have been used in several studies, both alone and in combination with other measures.

The present research used the basic dimensions, denoted as efficiency by *Shenhar and Dvir (2007)*. Project performance was evaluated according to the planned budget, the schedule, the technical specifications (product/service requirements), and the ability to meet the customer service requirements. Note that the quality dimension was subdivided into two criteria: meeting technical specifications and meeting customer demands. Projects were considered successful when all four dependent variables of the conceptual model proposed and stated above as basic dimensions were met. Partial success was considered when only one, two, or three of the basic dimensions were met.

2.2. Critical success factors — CSFs

Many authors have published lists of factors, sometimes relating them to specific problem areas and activities, sometimes highlighting their applicability to all projects types, and in some cases, changing the concept and referring to them as «Critical Failure Factors» *(Fortune & White, 2006)*. These authors presented a list of twenty-seven critical factors, in which the most cited was top management support, cited by 39 references (62%). In any organization, top management is primarily responsible for providing the necessary support and resources required for the project *(Rauniar & Rawski, 2012)*. A lack of engagement by the top management and a

lack of attention from the organization during the early stage of the project are linked to poor performance *(Sosa et al., 2007)*.

Zwikael (2008) suggested that effective executive involvement can significantly improve project success. However, the literature does not provide organizations with a clear list of effective top management support practices to facilitate or to achieve this type of support. As a result of his research, *Zwikael (2008)* identified a short list of critical processes and best practices that most contribute to effective top management support and, hence, to project success.

The above discussion suggests the following hypothesis:

H01

There exists a relationship between top management support and the performance (success) of executed projects.

Another critical success factor often cited in the literature corresponds to the existence of a dedicated project manager *(Fortune & White, 2006; Pinto & Mantel, 1990)*. *Archibald (1976)*, for example, considers the project manager the link responsible for integrating the entire project. *Nguyen et al. (2004)* identified five critical success factors, among which are included a competent project manager and the availability of resources. The leadership literature states that the project manager provides the team with the proper direction and goals, provides motivational support, and helps to resolve any interpersonal and organizational issues *(Rauniar & Rawski, 2012)*. In another research, *Qureshi et al. (2009)* posited that project management leadership has a significant impact on project management performance.

The above discussion leads us to propose the following hypothesis:

H02

There exists a relationship between the presence of a dedicated project manager and the performance (success) of executed projects.

In conclusion, in this research, the two critical success factors highlighted by the literature are used in the conceptual model (see Fig. 1), as follows: (a) top management support; and (b) a project manager dedicated to the project. These two critical success factors were selected based on the feasibility of verification and checking by survey respondents and because they are most often cited in the literature related to CSFs.

2.3. Project management maturity models

Project management maturity of a company is a measure of its efficiency in completing the project *(Kerzner, 2001)*. The emergence of project management maturity models is a recent phenomenon, which dates back approximately a decade and a half. The literature has focused its attention on the methods used to conduct a maturity assessment based on the potential value of project management maturity models *(Grant & Pennypacker, 2006)*.

Among the project management maturity models, three models can be highlighted: Capability Maturity Model Integration (CMMI), the Organizational Project Management Maturity Model (OPM3) *(Project Management Institute, 2008)* and the Kerzner Project Management Maturity Model (PMMM) *(Kerzner, 2001)*.

CMMI, based on concepts of maturity levels or stages and on structural requirements for key process areas, execute a series of practices, both specific and general, that are inherent to each of the five maturity Levels: (1) initial, (2) managed, (3) defined, (4) quantitatively managed, and (5) optimized).

Organizational Project Management Maturity Model (OPM3) was established to develop a maturity model certified according to PMI standards. Additionally, the OPM3 program helps organizations develop the ability to support macro company processes in managing all projects and relating these projects to corporate strategy.

The Project Management Maturity Model (PMMM) is composed of five levels: Level 1 – Common Language; Level 2 – Common Processes; Level 3 – Singular Methodology; Level 4 – Benchmarking; and Level 5 – Continuous Improvement. As in Software Engineering Institute models, each level represents a different degree of project management maturity. Maturity Level 2, for example, represents the transition from immaturity (Levels 1 and 2) to maturity (Level 3) *(Kerzner, 2001)*. According to *Carvalho et al. (2008)*, despite the similar structure, the CMMI and PMMM have different focuses, as the CMMI is more specific to the software engineering context, and different terminology, which could lead to misunderstandings when both models are being implemented in the same organization.

Level 2 represents the transition from immaturity to maturity. The PMMM Level 2 has the following main characteristics: recognition of benefits from project management, organizational support at all levels, recognition of the need for processes/methodologies, recognition of the need for cost control, and development of a project management training curriculum. The PMMM Level 2 can be deployed in five life cycle phases as follows: (1) embryonic, (2) executive management acceptance; (3) line management acceptance, (4) growth, and (5) maturity *(Kerzner, 2001)*.

Although companies with more mature project management practices could be expected to have better project performances, the findings are, in fact, conflicting *(Yazici, 2009)*. In recent decades, some studies have been published which evaluated the relationship between project management maturity and project success. However, there is limited evidence on the existence of a relationship between maturity and success, and to date, this relationship has not been confirmed. Accordingly, these studies demonstrate the need for further research regarding the relationship between project management maturity and project success.

Dion (1993) mentioned that organizations that adopt the CMM model tend to demonstrate higher quality software development, a faster development cycle and greater productivity. *Herbsleb and Goldenson (1996)* found evidence that process maturity of software development is associated with better organizational performance.

Jiang et al. (2004) identified a statistically significant relationship between project success and maturity levels of software development.

The previous discussion suggests the following hypothesis:

H03

There exists a relationship between organizational maturity in project management and the performance (success) of executed projects.

2.3.1. Comparative analysis of the maturity models

For assessing project management maturity, the Kerzner maturity model was selected. The PMMM, Maturity Level 2 – Common Processes, mark the transition within an organization, from immaturity stages (Levels 1 and 2) to maturity (Levels 3, 4 and 5), according to *Kerzner (2001)*.

2.4. Research conceptual model

For answering the research question, a set of hypotheses arose as a result of the theoretical discussion. Three variables that can impact project success were considered: top management support, dedicated project manager and organizational project management maturity. The main effect of these three variables was analyzed, besides the effect of the interaction among them. Project success, the dependent variable, is considered according to the iron triangle perspective. Fig. 1 shows the research conceptual model and hypotheses.

The research hypotheses are the following:

H01. There exists a relationship between top management support and the performance (success) of executed projects.

H02. There exists a relationship between the presence of a dedicated project manager and the performance (success) of executed projects.

H03. There exists a relationship between organizational maturity in project management and the performance (success) of executed projects.

H04. There exists a combination of the variables of top management support and a dedicated project manager that explains the success of executed projects.

H05. There exists a combination of the variables of organizational maturity in project management and a dedicated project manager that explains the success of executed projects.

H06. There exists a combination of the variables of organizational maturity in project management and top management support that explains the success of executed projects.

H07. There exists a combination of the variables of top management support, a dedicated project manager, and organizational maturity in project management that explains the success of executed projects.

3. Research methods

3.1. Unit of analysis selection

The unit of analysis is the project. The sample is composed of people who have responded to the questionnaire on behalf of their companies. These individuals are part of institutes and associations dedicated to studying project management, and are from project-oriented companies.

We obtained an effective return of 336 questionnaires, a sample that is larger than that calculated by the software G*Power 3.0 *(Faul et al., 2007)* when considering the level of statistical significance (α) at 5% and the level of power required at 80% *(Hair et al., 2005)*, which results in a sample of 153 respondents.

3.2. Research instrument

The research instruments were designed based on the literature review, deployed into 4 sections as follows (see Table 1):

Table 1 Research instruments

Section 1	Characterization of the interviewee (participation in projects, responsibility in projects etc); characterization of the Company (number of employees, revenue estimates, number of ongoing projects etc.)
Section 2	Evaluation of organizational maturity in project management using Kerzner's (2001) PMMM Level 2 assessment – life cycle phases: transition, within an organization, from immaturity (Levels 1 and 2) to maturity (Levels 3, 4 and 5). [For a company to be eligible for maturity Level 3, it is necessary to have high scores (six or greater) in all five life cycle phases. In this case, the company may be considered mature]
Section 3	Observation of critical success factors (existence of an exclusively dedicated project manager and if the estimated resources of the project were made available by the top management)
Section 4	Analysis of the project performance: to draw a relationship between critical success factors and project management maturity

3.3. Conceptual model

In the present research, there are four dependent variables, all of which were analyzed separately. Tables 2 and 3 identify the dependent, independent and/or moderating variables of the conceptual model.

Table 2 Evaluation of project success – dependent variables

Dependent variable	
D1	Compliance with project budget (cost)
D2	Compliance with original project timetable (schedule)
D3	Delivery of product/service requirements as planned
D4	Customer service requirements (needs)

Table 3 Input variables of the conceptual model

Input variable	Variable category	Construct
V01 – Top management support	Independent and/or moderating	Critical success factor
V02 – Dedicated project manager	Independent and/or moderating	
V03 – Project management maturity	Independent	Project management maturity models

A moderating variable is a factor, phenomenon or property that also impacts the dependent variable, but to a lesser extent, thus influencing the relationship between the independent and the dependent variables *(Marconi & Lakatos, 2003)*. The two critical success factors selected are the two possible moderating variables used to evaluate their influence on generating lower costs, meeting deadlines and improving the quality of the projects. Therefore, these two CSFs were considered independent variables for verifying hypotheses H01, H02 and H04, while they were considered moderating variables for verifying hypotheses H05, H06 and H07.

To verify hypotheses H01, H02 and H03, chi-squared independency tests were performed using as a benchmark a p-value lower than or equal to 0.05 (descriptive level) of the maximum likelihood test, from Minitab v.16.

To verify hypotheses H04, H05, H06 and H07, binary logistic regressions were tested also using as a benchmark a p-value lower than or equal to 0.05. The binary logistic regression analysis applied in this study corresponds to a multivariate statistical technique used for explaining a dependent variable with binary outcomes (success or failure). According to *Hosmer and Lemeshow (2001)*, the logistic equation corresponds to a probability distribution restricted between 0 and 1, as seen in Eq. (1):

$$P\ (\text{success}) = \frac{1}{1+e^{-\alpha}} \qquad (1)$$

Where:

$\alpha\ \beta 0 + \beta 1X1 + \beta 2X2 + \ldots + \beta iXi$

βi – constants

Xi – independent or moderating variables

4. Results

For evaluating which organizations can be classified as mature with respect to project management, the data from the project management maturity (Level 2) questionnaire were verified for each of the five stages of the Level 2 life cycle of the PMMM. Table 4 presents, for each one of the five stages, the number of companies with scores equal to or greater than six,

from the perspective of the survey participants.

Table 4 Results per PMMM life cycle phase

Life cycle PMMM Level 2	Companies with a score equal to or greater than 6	Mean	Standard deviation	Median
Embryonic	98	1.62	5.67	2.00
Executive management acceptance	59	0.61	5.24	1.00
Line management acceptance	71	1.28	4.86	2.00
Growth	72	0.66	5.40	1.00
Maturity	58	−0.74	5.88	−1.00

When analyzing Table 4 (distribution of companies according to Level 2 life cycle), in which a given company can have a score equal to or above six in one of the stages of Level 2 of the PMMM, great variability of the data can be observed. We note that out of the 336 questionnaires only 32 (or 9.5%) evaluated their companies with scores equal to or above six in all stages of the life cycle, the case necessary for a company to be considered mature *(Kerzner, 2001)*. The results have shown that there is a great opportunity to improve project management practices in the evaluated companies, given that less than 10% of the sample has evaluated their company as meeting the requirements necessary to be assessed as mature with respect to project management. This result corroborates those obtained by *Yazici (2009)* and *Berssaneti et al. (2012)*, who have also found that only a small portion of their samples qualify as mature regarding their project management practices.

To verify the hypotheses in the research, the hypotheses have been broken into four sub-hypotheses that aim to verify the relationship between the input variables of the conceptual model and each of the four dependent variables in the model. Based on the results in Table 5, we can infer that H01b and H01c are true. Hence, there is a relationship between top management support and meeting the project timetable and also between top management support and product/service requirement delivery. These results support the critical success factor most often cited in the literature – top management support *(Fortune & White, 2006)*.

Table 5 Specific hypotheses deployed from hypotheses H01, H02 and H03

Hypothesis		a – budget (cost)	b – schedule (time)	c – project requirements	d – customer demands
H01	Chi-square test $\chi 2$ p-Value	Fail to support 1.147 0.284	**Support** **8.39** **0.004**	**Support** **4.796** **0.029**	Fail to support 3.187 0.074
H02	Chi-square test $\chi 2$ p-Value	Fail to support 0.966 0.326	**Support** **4.161** **0.041**	Fail to support 1.775 0.183	Fail to support 0.000 0.983
H03	Chi-square test $\chi 2$ p-Value	**Support** **6.326** **0.012**	**Support** **5.296** **0.021**	**Support** **6.392** **0.011**	Fail to support 0.435 0.509

H02 is also partially true as a relationship between the existence of a dedicated project manager and meeting the timeline was found. The result indicates the importance of a dedicated

project manager in meeting timelines, thus contributing to studies such as *Qureshi et al. (2009)*.

With respect to hypothesis H03, three sub-hypotheses were confirmed. This result corroborates the findings of *Berssaneti et al. (2012)*, who conducted a similar study on the technology sector in which they identified a relationship between project management maturity and meeting stakeholders' demands. The result also supports the studies by *Jiang et al. (2004)*, which confirm the hypothesis that project management maturity is positively related to improved project performance. Furthermore, according to H04, H05, H06 and H07, the presence of more than one variable, when present and combined, provides an explanation for the success of the projects. To perform the binary logistic regression analysis, these hypotheses have been further broken down into four specific hypotheses (Table 6).

At this level, only hypothesis H06 was partially confirmed, thus resulting in a regression equation for variable D3 – product/service requirements delivery as planned.

Table 6 Specific hypotheses deployed from hypotheses H04, H05, H06 and H07

Hypothesis	a – budget (cost)	b – schedule (time)	c – project requirements	d – customer demands
H04 - Binary logistic regression	Fail to support	Fail to support	Fail to support	Fail to support
Constant	p-Value = 0.004	p-Value = 0.361	p-Value = 0.022	p-Value = 0.001
Top management support	p-Value = 0.327	p-Value = 0.007	p-Value = 0.038	p-Value = 0.067
Project manager	p-Value = 0.382	p-Value = 0.087	p-Value = 0.283	p-Value = 0.837
H05 - Binary logistic regression	Fail to support	Fail to support	Fail to support	Fail to support
Constant	p-Value = 0.000	p-Value = 0.245	p-Value = 0.000	p-Value = 0.000
Maturity	p-Value = 0.045	p-Value = 0.049	p-Value = 0.047	p-Value = 0.521
Project manager	p-Value = 0.432	p-Value = 0.067	p-Value = 0.265	p-Value = 0.964
H06 - Binary logistic regression	Fail to support	Fail to support	**Support**	Fail to support
Constant	p-Value = 0.000	p-Value = 0.715	**p-Value = 0.004**	p-Value = 0.000
Maturity	p-Value = 0.043	p-Value = 0.045	**p-Value = 0.046**	p-Value = 0.584
Top management support	p-Value = 0.330	p-Value = 0.005	**p-Value = 0.035**	p-Value = 0.074
H07 - Binary logistic regression	Fail to support	Fail to support	Fail to support	Fail to support
Constant	p-Value = 0.006	p-Value = 0.3	p-Value = 0.033	p-Value = 0.001
Maturity	p-Value = 0.047	p-Value = 0.059	p-Value = 0.052	p-Value = 0.57
Project manager	p-Value = 0.049	p-Value = 0.126	p-Value = 0.379	p-Value = 0.797
Top management support	p-Value = 0.370	p-Value = 0.009	p-Value = 0.047	p-Value = 0.071

In Table 7, we present the β coefficients of Eq. (1), p-value – and «Odds Ratio Exp(B)», which allows us to determine how the probability of a given event increases in the presence of a single variable when compared to its non-existence.

Table 7 Input variables of the model

Dependent variable	Independent variable	Coefficient	Standard error	p-Value	Odds Ratio Exp(B)
D3 – delivery of the product/service requirements of the project as planned	Constant	β0 = 0.724260	0.248697	0.004	
	V03 – project management maturity	β3 = 1.48368	0.744685	0.046	4.41
	V01 – top management support	β1 = 0.621888	0.295039	0.035	1.86

When analyzing data from Table 7, we can conclude that variables V03 and V01 influence the delivery of product/service requirements as planned. Therefore, they should be included in the model. We then obtain Eq. (2):

$$\mathbf{P(D3)} = \frac{1}{1+e^{-(0.724260+1.48368V03+0.621888V01)}} \quad (2)$$

By substituting values in Eq. (2), that is, V03 = 1 (presence of variable) and V01 = 1 (presence of variable), the probability that the project delivers product/service requirements as planned is 94.43%.

Independent variable V03 and moderating variable V01 positively influence the probability that product/service requirement delivery as planned will be met. In the presence of variable V03 (project management maturity), the probability of product/service requirement delivery as planned increases by 4.41 times (Odds Ratio Exp(B)), and in the presence of moderating variable V01 (top management support), it increases by 1.86 times (Odds Ratio Exp(B)).

5. Conclusions

The research hypotheses presented herein provides a means for correlating the organizational project management maturity with project success, as well as two critical success factors (top management support and the presence of a dedicated project manager). However, the impact is not significant in all dimensions of project success.

Other moderating and control variables should be explored in the future, such as the project complexity, sector, project life cycle phases and company size. Finally, this study also demonstrates that the time vertices of iron triangle are more sensitive to the studied variables than the others. Thus, it is important to investigate if there are tradeoffs among the project success dimensions, because this study demonstrates that the studied variables impact each success dimension in different ways.

Вопросы для размышления

1. Систематизируйте, каким образом авторы статьи анализируют эволюцию отношения к проблеме влияния зрелости проектного управления на успех их реализации?
2. Какая из моделей оценки зрелости проектного управления была использована в исследовании? На Ваш взгляд, почему авторы выбрали именно такую модель? Целесообразно ли было использовать другие популярные модели? Обоснуйте Вашу точку зрения.
3. Прокомментируйте выдвинутые авторами гипотезы и выразите Ваше отношение к ним.
4. В чём состоит проблема исследования, какова его цель и методология? Подтвердились ли поставленные авторами гипотезы?
5. С помощью какого статистического метода (методов) была протестирована концептуальная модель исследования? Какую роль в оценке модели играют показатели p-value, бэта-коэффициент, Odds Ratio Exp(B)?
6. На основании результатов исследования, прокомментируйте, какие факторы, относящиеся к зрелости проектного управления (исходя из материалов статьи), являются определяющими для успеха проекта и почему?
7. Какие факторы успеха, на Ваш взгляд, не учли авторы, но, по Вашему мнению, эти факторы следовало бы учесть?