



The challenge of introducing sustainability into project management function: multiple-case studies



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ABSTRACT

Project management field management has neglected sustainability issues. This research investigates how companies are introducing sustainability into project management. Moreover, it aims to investigate how sustainability can impact project success. A multiple-case studies approach was conducted in four companies from Brazil and USA, from different sectors. Data were gathered from multiple sources including semi-structured interviews with project and sustainability managers, and online questionnaires were applied to project team members. The results suggest that firms are concerned about sustainability in project management; however there is a gap between the perception of importance and the actual use in practice. Finally, companies from the public sector are more concerned about the social dimension than the others.

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1. Introduction

Project management can be a means to positively influence the integration of sustainability dimensions in projects (Bocchini et al., 2014), which has aroused the interest of professionals and academics in the discussion of sustainability in the context of project management (Silvius et al., 2013). The concept of sustainability is linked to economic, environmental and social dimensions and their interrelations, forming the Triple-Bottom Line – TBL (Elkington, 1998), which should also be integrated into the project management function (Singh et al., 2012; Labuschagne et al., 2005; Carvalho and Rabechini, 2011; Silvius et al., 2013).

However, according to Sánchez (2015), social and environmental dimensions of sustainability are difficult to incorporate in programs and projects, obviously sustainability is a major challenge, especially in large projects (Thamhain, 2014), and much more research is needed to develop tools, techniques and methodologies (Singh et al., 2012) that are simple to apply in the context of the project management function routine, in order to integrate sustainability into project management (Silvius et al., 2013; Cole, 2005; Carvalho and Rabechini, 2015).

Given the still exploratory characteristic of the subject and the need to understand how organizations are working on sustainability in project management, this research aims to investigate how companies are introducing sustainability into the project management function. Additionally, it aims to understand how the efforts of sustainability can impact project success. The methodological approach adopted is the multiple-case studies, with multi-sectoral and cross-country character.

Following this introduction, this study is divided into four sections. In Section 2, the literature review of this study is presented. In Section 3, the methodological approach is addressed. Section 4 presents the cases studied, as well as the research results. Finally, in Section 5 the final considerations of this study are presented.

2. Literature review

2.1. Sustainability

In order to clearly address the concept of sustainability, it is necessary to understand what Sustainable Development (SD) means. As the document “Our Common Future” (Brundtland Report) states, the concept of SD is the development that meets the needs of the present without compromising the needs of future generations (WCED, 1987). A broader concept of SD is based on the integration of three dimensions: economic, environmental and social, constituting the sustainability known as Triple-Bottom Line

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(TBL), and which became widely known (Elkington, 1998), but these ideas were also inspired, for example on authors like Sachs (1993), that formulated the concept of ecodevelopment, and on the Natural Resource Based View presented by Hart (1995). In addition to that, a lot of international events were developed for clearing the sustainability concept, as for example, “Bellagio Principles” that worked on the development of sustainability indicators to achieve progress in sustainability (Hardi and Zdan, 1997), “The future we want” that met the commitment of countries for the sustainable development (Brasil, 2013), among others.

Similar to that, there is an increasing interest in Corporate Responsibility (CR) including corporate financial responsibility, corporate environmental responsibility and corporate social responsibility (WBCSD, 2006). Furthermore, Baumgartner and Ebner (2010) show the concept of Corporate Sustainability (CS) relating to actions related to the business environment, and it means that SD when incorporated by the organization is called CS and it contains, like sustainable development, all three pillars or dimensions: economic, ecological and social.

Looking at the three dimensions of sustainability and first at economic dimension, Shenhar and Dvir (2007) argue that the economic dimension is considered paramount for developing businesses, but these authors say, at the same time, that the others dimensions (environmental and social) are equally important and companies need to put effort to work on projects in order to integrate variables related to the three dimensions of sustainability.

The environmental dimension has been developed in management theory since the 1990s, when the Natural Resource Based View presented by Hart (1995), including pollution prevention, product stewardship, and sustainable development strategies. As suggested by Hart (1995), management theory has ignored the constraints imposed by the environment and a similar statement can be applied concerning sustainability in project management. In other words, Hart (1995), when said, at that time, which the environmental impacts associated with business activities also have multiplied, as for example, air and water pollution, toxic emissions, chemical spills, and industrial accidents have created regional environmental and public health crises for thousands of communities around the world.

Furthermore, explaining the social dimension of sustainability, it is possible to find many corporate models of sustainability (see for example www.gri.com, www3.ethos.org.br) that show a large number of variables composing the social dimension of sustainability. When the focus is project management, there are proposals that explore the relationships between project management and sustainability and most studies work on defining a process or sustainable project management methodology (Sánchez, 2015). For example, Gareis et al. (2009, 2013), that developed a model to discuss relationships between sustainable development and project management. However, the integration of sustainability issues in project management is until a lack of research (Singh et al., 2012; Labuschagne et al., 2005; Carvalho and Rabechini, 2011; Martens, 2015; Silvius et al., 2013). In the next section, sustainability will be discussed at the project management function.

2.2. Sustainability and project management

Sustainability is a participatory process that creates and develops a vision of community that respects and makes prudent use of natural resources, seeking to ensure, as far as possible, that the present generations achieve a high degree of economic security and can attain democracy and popular participation in the control of their communities while maintaining the integrity of the ecological systems and of life (Gladwin et al., 1995). As the project activities, especially complex projects involving large amount of resources

and interfering with the daily life of the surrounding communities, the issue of sustainability is urgent.

A significant number of companies are adopting project management techniques (Berssaneti and Carvalho, 2015), investing resources and efforts in the implementation of project management. There are several reference guides in the project management area, such as the Guide of the Project Management Body of Knowledge (PMBOK) given by the Project Management Institute (PMI, 2013), which is structured into ten areas of knowledge, yet showing no special attention to the area of sustainability. Other guides of important organizations can be highlighted, such as the International Project Management Association (IPMA, 2013), the Australian Institute of Project Management (AIPM, 2013), the Association for Project Management (APM, 2013), the Projects in Controlled Environments – PRINCE2 (PRINCE2, 2013) and the ENAA Model Form – International Contract for Process Plant Construction (ENAA, 2013), and also devote no special attention to the issue of sustainability.

In order to address sustainable issues into Project Management a clear understanding of the various details involved in a project and their interactions is required (Sánchez, 2015), but Sustainability (in the economic, environmental and social dimension) needs to be inserted into and worked within the project management function, and remains as a gap in the literature and in practice (Brones et al., 2014; Carvalho and Rabechini, 2015; Marcelino-Sádaba et al., 2015). It involves the organizational processes and the organizations' management level, thereby contributing to improve the results (Singh et al., 2012; Labuschagne et al., 2005; Carvalho and Rabechini, 2011; Silvius et al., 2013). In order to analyze sustainability in project management, it is necessary to understand the tension between the different groups of stakeholders and trade-offs involved (Carvalho and Rabechini, 2011). Based on the theoretical review of several studies that seek to integrate sustainability into project management, the main variables related to the themes were identified in the three dimensions of TBL. The literature review of sustainability into project management is summarized in Table 1.

2.3. Success in projects and sustainability

In order to work on success, it is important to distinguish between success in project management and success in projects. The success in projects refers to meeting the initial objective and other benefits planned for the organization as a whole, while success in project management is mainly associated with the success of the direct action of the project manager, applying the tools of the discipline, and it is also associated to the triple restriction of any project, consisting of scope, time and cost (Wit, 1988).

In the traditional role, the metrics used to evaluate project success include: scope, time and cost (Adnan et al., 2013; Larson and Gobeli, 1989; Berssaneti and Carvalho, 2015); however, with the evolution of the literature, other successful dimensions were incorporated. Shenhar and Dvir (2007), Shenhar (2011) and Shenhar et al. (2001) present success evaluation criteria in five dimensions: (1) the efficiency is related to cost, time and scope; (2) the impact on client considering criteria such as meeting product function and technical specifications, satisfying the needs and improving the quality of life of the customer, solving the customer's problems, use of the product by the customer and customer satisfaction; (3) the impact on team verifying how the project affects the team members, marking the event in the professional life of the persons positively or negatively, depending on the development and result of the project; (4) the business success analyzing the direct consequences from the development of the project, observing factors such as increase in sales, revenue and profitability

Table 1

Research framework for sustainability in project management and project success.

Sustainability in project management (SPM)	
Economic dimension (ECD)	
Financial and economic performance (EC01)	Wang et al. (2014); Silvius et al. (2013); Liu et al. (2013); Jones et al. (2013); Macaskill and Guthrie (2013); Sarkis et al. (2012); Carvalho and Rabechini (2011); Corder et al. (2010); Fernández-Sánchez and Rodríguez-López (2010); Ustinovichius et al. (2010); Araújo (2010); Gareis et al. (2013); Xing et al. (2009); Buson et al. (2009); Leurs et al. (2008); Fellows and Liu (2008); Mulder and Brent (2006); VDI (2006); Pulaski and Horman (2005); Labuschagne et al. (2005); Azapagic (2004); Ustinovichius and Kochin (2003); Spangenberg et al. (2002); ICHEME (2002); Veleva and Ellenbecker (2001); Bernhardt et al. (2000); Fiksel et al. (1999)
Financial benefits from good social and environmental practices (EC02)	
Cost management (EC03)	
Customer relationship management (EC04)	
Participation and involvement of stakeholders (EC05)	
Business ethics (EC06)	
Innovation management (EC07)	
Organizational culture management (EC08)	
Environmental dimension (END)	
Natural resources (EN01)	Shenhar (2011); Shenhar and Dvir (2007); Shenhar et al. (2001); Kerzner (2001); Munns and Bjeirmi (1996); Bryde (2003); Carvalho and Rabechini (2015); Ika et al. (2012); Almahmoud et al. (2012); Elattar (2009); Chan and Chan (2004); Lim and Mohamed (1999); Atkinson (1999); Kumaraswamy and Thorpe (1996); Kometa et al. (1995)
Water (EN02)	
Energy (EN03)	
Air (AM04)	
Eco-efficiency (EN05)	
Management of environmental impacts (EN06)	
Environmental policy management (EN07)	
Environmental commitment and responsibility (EN08)	
Social dimension (SOD)	
Labor practices management (SO01)	
Relations with the local community (SO02)	
Management of human rights (SO03)	
Stakeholder engagement (SO04)	
Relations with society (SO05)	
Responsibility for products and services (SO06)	
Relations with suppliers and contractors (SO07)	
Project success (PS)	
Efficiency dimension (PSE)	
Meeting the cost (PSE 01)	
Meeting the time (PSE 02)	
Meeting the scope (PSE 03)	
Impact on customer dimension (PSIC)	
Meeting product function and technical specifications (PSIC 01)	
Satisfying the customer's needs and solving the customer's problems (PSIC 02)	
Use of the product by the customer and improvement of the customer's quality of life (PSIC 03)	
Impact on team dimension (PSIT)	
Impact on the professional life of the team members (PSIT 01)	
Improvement of learning and growth (PSIE 02)	
Greater satisfaction and productivity of the team (PSIT 03)	
Business success dimension (PSBS)	
Increase in sales and market share (PSBS 01)	
Increase in profitability (PSBS 02)	
Return on investment, competitiveness, and market performance (PSBS 03)	
Preparation for the future dimension (PSPF)	
Creation of new markets (PSPF 01)	
Creation of new products (PSPF 02)	
Creation of new technologies (PSPF 03)	
Sustainability dimension (PSS)	
Perpetuation of the economic benefits of the project (PSS 01)	
Perpetuation of the environmental benefits of the project (PSS 02)	
Perpetuation of the social benefits of the project (PSS 03)	

Codes were developed for all topics in order to use them during the research.

as well as return on investment, competitiveness and market performance (Munns and Bjeirmi, 1996); (5) the preparation for the future analyzing the long-term effects made possible by the project, referring to the preparation of the company's infrastructure for the future and the creation of new opportunities, the project's ability to contribute to the continuous improvement of the company (Bryde, 2003), and, in addition to creating new markets, products and technologies. These dimensions were used recently in quantitative studies relating project management performance and project success (Mir and Pinnington, 2014; Carvalho and Rabechini, 2015).

The success of the project is characterized by ambiguity; however, according to Ika et al. (2012), there is consensus that the criteria for success in developing international projects include the relevance, efficiency, effectiveness, impact and sustainability. Relevance refers to the extent that the project meets the project stakeholders' expectations. Efficiency refers to the extent to which the project uses the least costly resources to achieve the desired results. Efficacy refers to the extent to which the project meets its goals. The impact refers to the positive and negative variations produced by the project, directly or indirectly, intentionally or not.

Finally, sustainability refers to the fact that the benefits from the project should continue after the investors have withdrawn from the project, therefore not explicitly aligned with the concept of TBL.

The dimension of success related to the TBL is not so consolidated. Some works suggest that sustainability is a new dimension of success (Carvalho and Rabechini, 2015) aligned with the TBL, including social and environment aspects in this dimension. In previous studies, this idea of the criterion of sustainability was already in the works, as in the study of Atkinson (1999), which exposes the social and environmental impact in addition to the economic impact. Elattar (2009) argues that the success criteria are linked to the nonexistence of lawsuits and to the social acceptability of the project. Similarly, Chan and Chan (2004) in studies of success in projects in the construction sector elected, among others, environmental performance as a criterion of success in projects. In addition to these criteria, Kometa et al. (1995), Kumaraswamy and Thorpe (1996), Lim and Mohamed (1999) and Almahmoud et al. (2012) point health and safety as a criterion for success in projects.

The mentioned five dimensions of project success proposed by Shenhar and Dvir (2007) (efficiency, impact on clients, impact on team, direct business and success, and preparation for the future) are well accepted in project management research with recent applications on Carvalho and Rabechini (2015) and Voss and Kock (2013). In this study we integrated a sixth dimension of project success now called “sustainability” that is related to perpetuation of the economic, environmental and social benefits of the projects. Table 1 summarizes the discussion regarding success in the context of this study. However, there is a lack of empirical studies applying this new dimension of success as suggested by these authors.

3. Research methods

This exploratory research employs a qualitative approach, because the objective is to obtain information about the perspectives of the individuals, as well as to interpret the environment in which the problem occurs (Bryman, 1989). For this purpose, the multiple-case studies approach (Yin, 2014; Voss et al., 2002; Eisenhardt and Graebner, 2007; Eisenhardt, 1989) was used.

3.1. Selection of cases

In this study, we adopted the theoretical sampling as suggested by Eisenhardt and Graebner (2007), that is, the cases were selected for their particular richness concerning the theme of sustainability in project management and for the ease of accessing the key internal stakeholders and organizational documents. Furthermore, it was a prerequisite for choosing the organizations that they employed project management and sustainability to conduct their projects. Finally, the selected cases must have a Project Management Office (PMO) and also an organizational Sustainability area.

In this study, four case studies were carried out, and according to Yin (2014) and Eisenhardt (1989), it is appropriate to consider from four to ten cases. In order to explore the industry-level, the cases are from different industrial sectors as suggested by Eisenhardt and Graebner (2007), as detailed in Table 2. To study the country-level, the cases were performed in Brazil and one in the United States, to serve as “polar type”. Moreover, Carvalho et al. (2015) suggest that country and sector are relevant contingent variables, stating that these variables have significant effect on project success and must be investigated in research related to project success. Considering these arguments we selected cases from different countries and sectors, limited to the availability of the cases were willing to be interviewed.

The research protocol demanded that at least two people were interviewed per each organization. Interviewees should include

two different profiles: one more aligned with project activities and the other more aligned with the sustainability activities in the organization. A total of ten executives were interviewed, whose profiles are summarized in Table 2. In addition, 23 project team members of these organizations responded to a questionnaire made available online.

3.2. Data collection and analysis

The approach of multiple-case study combined several methods of data collection, and the evidences were of qualitative and quantitative nature, which can be used to describe, test and create a theory (Eisenhardt, 1989). Among these methods, semi-structured interviews were conducted with the responsible for project management and for sustainability, 23 questionnaires were applied to project team members, and on-site observations were performed in addition to analysis of websites of the organizations targeted by the study. According to Yin (2014), the evidences resulting from multiple-case studies are considered more convincing and the global result of the study is more robust.

Carvalho (2014) suggests that the first stage of the development of the theoretical framework is critical. In this study, the literature review, whose summary was presented in Section 2, was guided by the topics sustainability and project management, as well as by the topic of projects success. With the respective literature review, it was possible to build the research framework presented in Table 1, whose coding and content analysis was performed using the Sphinx software (www.sphinxbrasil.com). Table 1 shows the synthesis of this stage of the research.

From this stage, the research instruments were developed. For the in-depth interviews, a guideline based on predominantly open questions was developed. Not only were the issues raised in Table 1 explored, but also the relation between them, that is, how sustainability in project management can affect success. According to Brown and Eisenhardt (1998), multiple cases enable exploring this type of relation. All the interviews were recorded, transcribed and validated. The analysis of the interviews was conducted through the interpretation and content analysis of the discourses collected and recorded in the interviews with managers presented in Table 2, using the same content analysis technique and the same encoding used in the literature review.

A second research instrument was developed, with predominantly closed questions. The preferences scale adopted is ranging from 1 (equal importance) to 9 (absolute importance), following the so-called “psychological threshold”, in which humans can judge a maximum of 7 ± 2 (Saaty, 1991). The instrument was applied online (made available on web link) to project team members. The questions addressed the variables of sustainability in project management and project success, presented in Table 1. A total of 23 people in the four organizations responded the questionnaire, according to the profile in Table 3. The data from the questionnaires were analyzed using the statistical software Minitab17 (www.minitab.com) by means of descriptive statistics.

The technique of using multiple data collection sources, and the interaction with constructs found in the literature, allowed to achieving greater constructive validity of the research (Eisenhardt, 1989). The qualitative and quantitative evidences in this qualitative study (multiple-case studies) provided the chance of increasing the internal and external validity of this research (Creswell and Clark, 2006). The qualitative and quantitative data obtained in this study were treated and analyzed using the Sphinx software (www.sphinxbrasil.com) and Minitab17 (www.minitab.com), using descriptive statistics, and the content analysis technique was used as well (Krippendorff, 1980). These two software were used because they were available at that time.

Table 2
Characterization of the interviewees.

ID	Country of the case	Size (employees)	Type of business	Code of the interviewee	Position
Org_A	USA	Large (4523 all divisions; 3249 case studied)	Public sector (Management and Civil Construction of roads, bridges and tunnels)	Org_A1	Project director
Org_B	Brazil	Large (1800)	Chemical (planning of new industrial plants)	Org_A2	Sustainability manager
Org_C	Brazil	Large (160,000 global; 20,000 automotive global; 1300 case studied)	Automotive (components for the industry)	Org_B1	Project coordinator/PMO
Org_D	Brazil	Large (9477)	Public sector (projects of engineering and architecture of subway transportation)	Org_B2	Sustainability manager
				Org_C1	Director of improvement projects
				Org_C2	Sustainability Coordinator
				Org_C3	Manager of projects and programs
				Org_D1	Manager of systems and sustainability
				Org_D2	Coordinator of systems of environmental studies and management
				Org_D3	Manager of the department of control of projects and constructions

Large size according to Sebrae (2014).

Table 3
Characterization of the questionnaire respondents.

Organization	Position	Respondent
Org_A	Project directors and managers	4
Org_B	Project managers and coordinators, sustainability manager and project team members	6
Org_C	Project director, managers and coordinators, sustainability coordinator, managers and coordinators of management areas and project team members	12
Org_D	Project manager	1

4. Discussion of the results

4.1. Cases characterization

For this multiple-case study four organizations were used. The identification of the organizations and members involved was kept secret due to formal request from the board of directors of the respective companies. To meet this demand of confidentiality, the case studies were identified like Org_A (organization A), Org_B (organization B), Org_C (organization C) and Org_D (organization D). Additional information can be gathered in Tables 2 and 3.

4.2. Analysis of sustainability in project management and its relation to success: interviews

As for project management, we emphasize that all the investigated organizations use project management tools and have a strong appeal for sustainability in their processes and projects. The use of specific techniques for project management appears clearly in the discourses. For example, in Org_A, the interviewee 2 argues that his company has a clear set of project processes and it must be made (Table 4).

In the organization Org_B, project management practices are applied, but the organization is in the process of improvement and expansion of project management processes. Both evidences appear in the discourse of the organization B interviewee Org_B1 when he talks about applying the PMI (Project Management Institute) techniques, but his organization is still structuring the PMO (Project Management Office) (Table 4).

For Org_C, the systematic project management has been applied globally for many years, from the enterprise located in the United States to the business units spread around the world, and this is pointed out in the Org_C1 interviewee discourse relating to the use of a methodology consolidated of project management (Table 4).

For Org_D, project management occurs in two ways. In the first one, the sectors of projects of operation of ready works have ISO9001 certification, and thus they are audited by item 7.3 of this standard. In the second one, the management of expansion

projects, that is, new projects, is outside the scope of certification, using specific tools of project management to do so. Currently, this project management department is implementing methodologies according to the PMI model. These directions are evidenced in the discourse of the interviewees Org_D1, Org_D2 and Org_D3 (Table 4).

With regard to sustainability, all four organizations studied show enthusiasm about the sustainability issue and accordingly perceive an increase in the value of its operations when sustainability (TBL) is incorporated into the activities and projects. For Org_A, sustainability is seen as a path of no return where, in addition to actions in practice, sustainability can be understood as a new way of thinking. This understanding can be observed by Org_A1 (Table 5).

In the same line of demonstration of the importance of sustainability for the organization and for the projects, the Org_B interviewee argues that sustainability is a corporate role in the organization as a whole, and that the same has the autonomy and the duty of incorporating sustainability practices into the project management routine, as observed in the excerpt of his/her discourse of Org_B2 (Table 5).

In this context, in the words of the Org_C interviewee is evident the importance of using the term sustainability in the organization's quality policy, and that it is assessed by a structured strategic indicator and broken down into tactical and operational indicator, which can be observed in the discourse of the interviewee Org_C1 (Table 5). In his discourse is highlighted the mission of the company relating project management and product for reaching 98% of recycling rate.

Organization D has an important characteristic that is different from the other companies studied. Org_D also has a department of systems of management and sustainability implemented and managed by competent people. The difference is that in most processes sustainability is transversal, and it is managed by integrated management systems (ISO9001, ISO14001 and OHSAS18001) and sustainability, however the project management (mainly planning and expansion of projects in operation) is outside the scope of the certifications, and the inclusion of sustainability

Table 4
Statements of the interviewees related to project management.

Project management	
Org_A	[...] there is a clear set of project processes [...] for each stage along the way you know who is responsible ... in the highways division for each step, what are the steps that must be made [...]. (Org_A2)
Org_B	[...] for larger projects involving a greater investment value, we follow the entire flow of the methodology "XX", which then has various stages of [...] study of value and gates [...], the methodology "XX" and the calculation of the investment return by the "XY" are always done granted for complex projects [...]. (Org_B1) [...] we try to apply the PMI techniques, but we are still structuring the PMO, and I can not say that we apply 100% of these tools. We use more the aspects that are the control of the budget, cost, schedule and scope [...]. (Org_B1)
Org_C	[...] the company has a project management methodology consolidated for over 22 years, by the way it is academic reference in the books of Kerzner [...]. (Org_C1)
Org_D	[...] several units of our organization with scopes covering more than 80% of all activities have quality management system (ISO9001) and environmental management system (ISO14001). The occupational health and safety management system (OHSAS18001) is implemented in all of our organizational units. (Org_D2) [...] we have a methodology that is under development, the schedule spans 2.4 years already. The development is slow, but it is the way we chose, a path that has no chance of going back. (Org_D3) [...] The expansion area is working in fact with the project management, and we think it makes little sense to implement simultaneously the system based on quality standards and in project management rules [...]. In some areas it even occurred, but using two methodologies ultimately generates an improvement of entropy that is not needed. (Org_D1)

Source: research data.

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Table 5
Statements of the interviewees related to sustainability.

Sustainability	
Org_A	[...] Sustainability is a different way of thinking and different attitudes in projects, and we are trying this to change ... and we are opening our doors and saying to look at what we are doing, and if this is an opportunity for us to be more environmentally healthy, then this is what we want [...]. (Org_A1)
Org_B	[...] we interfere with the adoption of management criteria [...], in particular the processes that establish requirements for quality, health and safety, environment, responsibility and others. We work to systematize it in work practices [...]. (Org_B2)
Org_C	[...] the company's mission is clear, a safer, more comfortable and sustainable product. It is in the mission of our division, and why is it in the mission? Because the product that is related to the project management is a product with recycling rate that reaches 98% [...]. (Org_C1)
Org_D	[...] actually this ends up happening by a matrix process, we have working groups to deal with themes related to sustainability and that we coordinate, where strategies that can be oriented to projects are defined. (Org_D1) [...]. It is been in our mission for several past reviews already this issue of sustainability and, therefore, for being in the mission this is eventually discussed and permeate the organization. (Org_D1) [...] we walk along with the project area, supporting intern needs, legal requirements, and environmental agency requirements [...], as I said there is a whole path that starts back there, there is EIA-RIMA (study of environmental impact and the respective report), we make plans and dream that it will improve a lot more [...]. (Org_D2)

Source: research data.

requirements occurs isolatedly and specifically in the new projects through specific sectors, including the integrated management systems and sustainability. This fact can be observed in the discourse of the Org_D1 interviewee (Table 5). The discourse of Org_D2 also complements this idea of supporting internal needs like studies of environmental impacts and their respective reports.

When the interviewees were asked about use of structured methodologies for sustainability and which was the vision or approach applied to the projects, it is observed in the interviewees'

discourses that insights of approaches and indicators of different models of corporate nature are collected, but not specifically of sustainability models studied and specific to projects. This can be observed in the words of the Org_A2 interviewee (Table 6).

Organization Org_B seeks requirements in various national and international models, according to the discourse of the Org_B2 interviewee (Table 6), for example, indicators come from GRI (www.gri.com), quality and environmental standards (www.iso.org) and New York Stock Exchange requirements (www.nyse.com/index).

Table 6
Statements of the interviewees related to sustainability in project management.

Sustainability in project management (structured methodologies for sustainability)	
Org_A	[...] we have standards that we have identified internally through green policies ... we are working with the divisions to identify specific ways to implement these principles [...]. We also began a system for the assessment of sustainability of transportation projects. (Org_A2)
Org_B	[...], and we also have here the GRI, which is the basis of our sustainability reports [...], and these indicators are part of our day to day management [...]. (Org_B2) [...] our integrated system has several references of the market, ISO9001, ISO14001 and others that we said, but we are signatories to the responsible action program of Abiquim, which is already a reference in sustainability. [...] we adopted the index "XYZ" of the stock market and we also meet the New York Stock Exchange requirements. (Org_B2)
Org_C	[...] when we talk about sustainability, we cannot help but talk about the economic part that is key in business, but recycling is key ..., and meeting the community needs and the requirements of the country are also key [...]. It is much broader than the economic aspect and is a consequence of the strategy [...]. (Org_C1)
Org_D	[...] we are investing in the issue of projects, a more recent approach, in order to make projects that are more sustainable. If you look at the newer stations, you can see a number of initiatives, such as natural lighting, natural ventilation [...]. (Org_D2) [...]. The area of sustainability is another area for promoting sustainability initiatives. [...] we do accountability using the GRI model, which is more structured. (Org_D1)

Source: research data.

The organization Org_C has a very strong environmental focus, as evidenced in the discourse of Org_C1 interviewee pointing out that recycling is a fundamental key (Table 6). Organization D uses the integrated management system (quality, environmental and safety and occupational health) as a basis for the development of sustainability practices in the certified processes. The project management area is not in the scope of certification, receiving separate initiatives and at times when these plans are needed. As a whole, Org_D uses global insights to leverage sustainability issues, such as the GRI (www.gri.com). These evidences and discourses to exemplify these statements can be seen in Table 6.

As well as sustainability in project management, the theme relating sustainability in project management to project success was targeted in the interviews. As a governmental organization, Org_A stands out as an example of the application of sustainability initiatives in the development and management of its projects, and understands that this system is fundamental to achieve success in its projects. In fact, it understands that in the light of the government, success is to be in harmony with the environment and the welfare of the community. This understanding can be observed in the discourses of both interviewees of the organization A, Org_A1 and Org_A2 (Table 7).

For the Org_B, it is observed that there is no convergence in the discourses. According to the responsible for corporate sustainability, project success will not happen without the inclusion of sustainability variables into projects, as illustrated by the discourse of the Org_B2 interviewee (Table 7). On the other hand, the one responsible specifically for project management (which acts within a project methodology with several phases, each one with a different responsible) does not believe in the positive relationship of sustainability in project management and project success, but he believes in the relationship with the organization's performance as a whole, because the interviewee Org_B1 sees these sustainability variables as project requirements (Table 7). Maybe as an explanation, due to the fact that the corporative division of sustainability is planning and carrying out these activities in parallel to projects, the project managers do not end up participating and understanding the importance of this relationship.

As an organization with industrial focus, Org_C operates amid very complex projects that can cause a process highly polluting. Any failure in their projects can put the society in front of the plant

entrance hall, protesting against problems and facts that can generate and cause severe environmental consequences and actions on the community, as well as poisoning to the own workforce. Thus, Org_C does not hesitate to confirm the relation between the themes SPM and PS, and argues for benefits from these practices instituted some years ago and improved daily through local actions and via corporate holding. On the other hand, the Org_C1 interviewee comments that the measures of success in projects are primarily focused on the dimension of efficiency (Shenhar and Dvir, 2007) and as stated in the mission, topics related to sustainability (accidents, linking environmental and social) (Ika et al., 2012; Atkinson, 1999; Elattar, 2009; Chan and Chan, 2004; Kometa et al., 1995; Kumaraswamy and Thorpe, 1996; Lim and Mohamed, 1999; Almahmoud et al., 2012). Thus, the discourses presenting such statements are highlighted by Org_C1, Org_C2 and Org_C3 as well (Table 7).

Finally, for Org_D, this relationship is clearly perceived. According to the Org_D2 interviewee's testimony, it is possible to observe the gains obtained in projects by including sustainability variables into the development of projects (Table 7). According to the Org_D3 interviewee, the contribution of sustainability in project management to project success is also clearly identified, and he says that the enterprise can not exist without this relation because it affect cost, scope and schedule of the projects and organization goals.

Based on the interviews, the cross-analysis of the four cases was conducted, which is synthesized in Table 8.

With this synthesis it is possible to make some considerations. It is evident that the four organizations apply sustainability variables to conduct their projects. The organizations Org_A and Org_D operate with a strong social focus, while Org_B and Org_C focus on applying economic variables to the projects. Perhaps this can be explained by the fact that the organizations Org_B and Org_C have roots in private organizations aiming at financial results related, specifically, to project cost and schedule. On the other hand, organization Org_C has a strong environmental concern.

The use of sustainability variables from models of a strategic nature like GRI, and not specific to projects is also perceived as a reality in the organizations studied, confirming in practice the research gaps regarding the need for new methodologies of SPM (Labuschagne et al., 2005; Carvalho and Rabechini, 2011). On the

Table 7
Statements of the interviewees showing the relation between sustainability in project management and project success.

Relation between sustainability in project management and project success	
Org_A	[...] yes, I would say that I think this is the kind of approach that the community residents really, that our customers really want and appreciate. (Org_A2) [...] I think there is a relation. I think that the way to successful projects can be difficult, right? Because when you are trying components of sustainability in any project, you challenge the dialogue, since the communities are not used to doing so. (Org_A1)
Org_B	[...] I have no doubt! I believe that if we had not, if there was not such a balance, effectively we would not have a sustainable business [...], it would not be viable, without a doubt! I will give you an example: "XX" monthly ... I am required to pass them a series of environmental indicators [...], socioenvironmental indicators [...]. (Org_B2) [...] it collaborates in fact to indicators of the company, of performance, not to project indicators. The project indicators that collaborate to us are meeting the project management practices and the reference norms in engineering, so not meeting them means doing something of poor quality, which can lead to accident or something [...]. When you speak of meeting the legislation, related to municipality things and government in general, our actions are related to the company's performance indicators, directly to the company's image. We do not have how to relate sustainability factors and project success, specifically to projects implemented, we do not have this kind of indicator. (Org_B1)
Org_C	[...] I think so, that it is related, perhaps it is not the most important. (Org_C2) [...] there is a complete relation, no doubt! We measured these of the mission ..., we do not measure all of Shenhar model [...], I think there is a lack of maturity in the project management. You see here an extreme concern with efficiency in projects, the iron triangle in projects, time, cost and scope [...]. (Org_C1) [...], but especially when talking about the social part, operator, company employee, then there is a strong point of impact [...], if we do not look into it we will have mainly financial problems [...]. (Org_C3)
Org_D	[...] regardless, it is already a bit on the concept of our project engineering and architecture to seek more sustainable ways, [...] even because it is the company's mission. (Org_D2) [...] not only it helps as I would say that the enterprise doesn't even exist [...], if we don't work with it, we will be wasting too much, effort, [...] and we will not get ahead at certain points [...]. I have no doubt that it affects success. It affects from the start in the triple constraint, scope, schedule and cost [...], so it is very immediate and it has to be considered [...]. (Org_D3)

Source: research data.

Table 8
Cross-analysis of the cases.

	Org_A	Org_B	Org_C	Org_D
ECD	**** Use of own indicators;	***** Use of GRI, Abiquim and New York Stock Exchange indicators, and certifications;	***** Use of GRI indicators, certifications;	*** Use of GRI indicators, certifications; No concern with cost, time; Concern with scope;
END	***** Use of own indicators and American standards; Focus on carbon emissions;	***** Use of GRI, Abiquim and New York Stock Exchange indicators, and certifications;	***** Use of GRI indicators, certifications; Focus on recycling for use as inputs;	***** Use of GRI indicators, certifications; Concerns with innovations;
SOD	***** Use of own indicators; Focus on customer's welfare;	***** Use of GRI, Abiquim and New York Stock Exchange indicators, and certifications;	***** Use of GRI indicators, certifications;	***** Use of GRI indicators, certifications; Focus on the social and on customers;
PM structure	**** Own method focusing on the knowledge of the managers;	***** Own method, migrating to PMI techniques;	***** Own method referenced by Kerzner	***** Operation: use of item 7.3 of certified ISO9001 Expansion: own method, migrating to PMI techniques
S structure	***** Own method; Corporate function; Force to influence projects;	***** Own method; Corporate function; Based on the certifications ISO9001, ISO14001, SA8000, OHSAS18000;	***** Own method; Corporate function; Based on the certifications ISO9001, ISO14001, SA8000, OHSAS18000;	***** Own method; Corporate function; Based on the certifications ISO9001, ISO14001, SA8000, OHSAS18000; New projects based on support groups;
Relation between SPM and PS	***** Confirmed; Path with no return; Direct actions; Influence on the result;	**** Confirmed; Direct actions; Influence on the result;	***** Confirmed; Direct actions; Project managers mistake project indicators with strategic indicators; Influence on the result;	***** Confirmed; Support actions; Influence on the result;
SPM use versus importance	**** Integrated to meet governmental requirements; Possibility of increasing federal financial incentives;	***** Integrated to meet certifications requirements; Possibility of increasing the result;	***** Integrated to meet certifications requirements; Possibility of increasing the result;	***** Sustainability reports; Possibility of increasing the result;
Link of the S sector with PM	***** Strongly integrated and developed;	***** Strongly integrated and developed;	***** Not directly integrated;	***** Not directly integrated;
Impact of SPM on PS dimensions	**** Integrated and impacting;	**** Integrated and impacting;	**** Integrated and impacting;	**** Integrated and impacting;

Org_A

ECD ****

END *****

SOD *****

Impact *****

SPM

PS

PSE ***

PSIC *****

PSIT ****

PSBS ***

PSPF ***

PSS *****

Org_B

ECD *****

END *****

SOD *****

Impact *****

SPM

PS

PSE *****

PSIC ****

PSIT ****

PSBS ***

PSPF ***

PSS *****

Org_C

ECD *****

END *****

SOD ****

Impact *****

SPM

PS

PSE *****

PSIC ****

PSIT ****

PSBS ****

PSPF ****

PSS *****

Org_D

ECD ***

END *****

SOD *****

Impact *****

SPM

PS

PSE ***

PSIC *****

PSIT ****

PSBS ****

PSPF ****

PSS *****

Very weak*; weak*; regular***; strong****; very strong*****; sustainability (S); project management (PM); sustainability in project management (SPM); project success (PS).

other hand, companies are adopting their own project management methodologies but with evidence of migration to world-renowned management techniques, such as the PMI bodies.

It is also observed that the certification standards of integrated management systems (ISO9001, ISO14001, OHSAS18001, SA8000, among others), even in large companies, are references, because they provide minimum requirements to start the integration of sustainability variables into project management routines.

Concerning the contribution of SPM to PS, this relationship is evidenced by analyzing the discourses and actions of the companies investigated in practice and in their sustainability reports. In addition, the new dimension of success called sustainability is also incorporated in PS analysis, due to the fact that the companies interviewed actually believe in the economic, environmental and social benefits obtained from sustainability in project management, which can be observed in the fact that these organizations have

included the term sustainability as a strategic commitment, in addition to the annual publication of sustainability reports.

4.3. Importance and utilization of SPM variables: questionnaires

The results of the online questionnaire (available on web link) tabulated from the 23 respondents suggest that the three sustainability dimensions (TBL) show up significantly on the use and importance given to SPM variables. The values were calculated, taking into account answers to individual questions related to each one of the variables of the research framework (Table 1) in their dimension and finally within their construct (SPM and PS).

It can be observed that the values of the calculated medians show that more than half of the respondents answered in Likert 1–9 scale, values above 7, considering application and importance of SPM variables. Similarly, analyzing mode values, most answers were positioned above 6 (EC08), also for both criteria, application and importance of SPM variables. It can be inferred, given the results obtained, that the components of the project teams of the organizations studied while applying the SPM concepts show a high level of understanding and importance concerning the increase in the implementation of the SPM actions.

In this study (Table 9), even with regular standard deviation values, the average results show that the four companies studied strongly apply the economic dimension (75.60%) and the social dimension (74.67%), but the environmental dimension (77.17%) of sustainability is highlighted in their projects. These results contradict Labuschagne et al. (2005), who pointed out answers in his studies showing emphasis on economic sustainability compared to the others: environmental and social. Observing the mean degree of importance in relation to the degree of use of SPM variables, it is observed an improvement in the mean values for the variables that are part of the ECD (78.20%), END (79.77%) and SOD (76.95%).

Considering that the set of answers points to a greater value for the importance of SPM variables than for the use of variables in this context, it indicates that there may be, in the mid and long term, an improvement in the level of integration of sustainability practices into project management in new projects and in projects under development. It is observed, therefore, that this study confirms the results obtained by Labuschagne et al. (2005) and Singh et al. (2012), in which the social dimension is the least used and valued in projects, but now at levels much closer to the economic and social dimension. Perhaps these results are explained by the fact that the Org_A and Org_D have very strong social focus.

Briefly, the qualitative results from the triangulation of the interviews with the results of the questionnaires directly linked to the research framework of this study suggest that the four organizations investigated show strong evidence for the use of project management tools, as well as use in good level of sustainability variables in project development, with special attention to actions related to material recycling to reduce the use of

natural resources and concern for the welfare of consumers of the projects and others involved. Another finding refers to the degree of importance given to the variables of the research framework, where the results suggest that future increases related to integration of sustainability into projects can be prospected, which shows the trend of improvement of projects in the mid and long term. In the next section, aspects of the research framework will be addressed.

4.4. Discussion concerning the research framework

Based on the research framework defined in Table 1 and used as assertive to collect data through a questionnaire, two empirical scenarios concerning the perception of importance and the current use were investigated as a synthesis of this multiple-case study. Analyzing the responses of the online questionnaires and answered by managers of these organizations, the results presented in Tables 9 and 10 were developed, which are the basis for the scenarios presented, referring to the degree of use and the degree of importance of sustainability variables in project management and its relation to project success.

The first scenario observed is linked to the degree of use of variables and constructs of sustainability in project management, as well as the degree at which sustainability (TBL) in project management is related to the achievement of project success. Thus, in Fig. 1, there is a representation of the research framework of the first scenario, using the positive relation arising from the results of the application of the questionnaire. The percentages for use and importance were calculated by equation (1).

$$\text{Average Use or Importance} = \frac{\sum_{i=1}^6 PS_{\text{dimension}}}{6} \quad (1)$$

It is observed that in the scenario of Fig. 1, with values of the use of SPM, there is a strong relation between the main constructs of the framework, i.e., the SPM promoting PS on the order of 69.57%. It is also possible to analyze, for PS, that most of the individual medians are above 5 (except for PSPF 01 with 4), representing that more than half of the respondents rated above this value (5), as well as the mode values were satisfactory, where most constructs showed values above 7, except for PSBS and PSPF with mode 1 for some variables.

Similarly, data related to PSBS (59.1) and PSPF (53.95) appear to receive regular contribution, and corroborate the argument of Shenhar and Dvir (2007), when they say that these two dimensions are not strongly applied to measure project success in the short term and that appear more clearly in the long term, and when there is a proper measurement of the projects for this purpose. In addition to that, the new dimension of success called “sustainability” appears strongly applied and influenced in the framework (median 7), showing that, according to Ika et al. (2012), Atkinson (1999), Elattar (2009), Chan and Chan (2004), Carvalho and Rabechini,

Table 9

Results from the combined evaluation of the dimensions of sustainability in project management of the four organizations studied.

	SPM dimension	Mean (1–9)	Mean %	Median	Mode	Standard deviation
Use	ECD	6.80	75.60	7.63	8.13	1.99
	END	6.95	77.17	7.63	9.00	2.38
	SOD	6.72	74.67	7.43	8.57	2.19
	Use SPM	6.82	75.81			2.19
Importance	ECD	7.040	78.200	7.630	8.130	1.900
	END	7.180	79.770	7.750	9.000	2.120
	SOD	6.930	76.950	7.570	8.140	1.820
	Importance SPM	7.05	78.31			1.95

Source: research data (extracted from Minitab17).

Table 10
Results from the cross evaluation of the project success dimensions.

	PS dimension	Mean (1–9)	Mean (%)	Median	Mode	Standard deviation
Use	PSE	6.77	75.2	7	9	1.89
	PSIC	7.26	80.52	7.33	9	1.66
	PSIT	7.06	78.42	5	8	1.54
	PSBS	5.32	59.1	5.67	6	2.80
	PSPF	4.86	53.95	5	3	2.89
	PSS	6.32	70.21	7	8	2.24
Use PS _{Total} Importance		6.26	69.57			2.17
	PSE	7.58	84.22	9	9	7.33
	PSIC	7.59	84.38	7.67	9	1.54
	PSIT	7.36	81.8	7.67	7	1.48
	PSBS	5.77	64.09	6.67	6	2.82
	PSPF	5.16	57.33	5.67	3	2.55
Importance PS _{Total}	PSS	6.77	75.2	7	8	1.99
		6.71	74.50			2.95

The highlighted entries mean the lowest score for use and importance.
Source: research data (extracted from Minitab17).

2015) and Almahmoud et al. (2012), this dimension can be incorporated into PS measurement models.

The other success dimensions PSE, PSIC and PSIT, also appear being affected by sustainability. Confirming the arguments of several authors such as Shenhar and Dvir (2007), Shenhar (2011) and Shenhar et al. (2001), the PSE is one of the most used and influenced by sustainability dimensions, however, PSIC and PSIT dimensions are evidenced as highly influenced by sustainability when variables of sustainability are inserted into project management. Observing the sustainability dimensions (TBL), it can be inferred that both dimensions in this first scenario are presented with strong relationship with respect to the use of the same by the companies studied and thus strongly contributing (69.57%) to the achievement of PS. To explain this fact, we can highlight Porter and Linde (1995), who claim that the economic dimension is important, but not enough, and we must also work on projects with initiatives in the environmental and social dimension.

Furthermore, for example, we can remember Hart (1995), when said, at that time, which the environmental impacts associated with business activities also have multiplied around the world. Thus, the results of our work can be linked to Hart's considerations and it can be considered an academic and practical contribution for sustainability and project management field, being reference to basis for

new studies, but, obviously, these results can be adapted and used by practitioners right now.

The second scenario (also Fig. 1) refers to the degree of importance of SPM dimensions and the degree of importance of each PS dimension in the research framework. In this scenario, a slight increase (69.57–74.50%) of the SPM contribution to PS is observed. This value is also interesting in that more than half of the respondents suggest a median equivalent to 5; furthermore, the PSPF and PSBS mode values follow the same lines of the framework of Fig. 1 when looking at the degree of use, being less affected by SPM.

Thus, the research results that show the use and importance of sustainable practice affecting success in projects in the studied firms have strong practical implications, corroborating with the debate between managers and scholars concerning the relative importance of internal firm capabilities to create a sustainable competitive advantage, particularly at project management level.

It is also noteworthy that the business success construct (PSBS) obtained an increase compared to the model related to the use in which the variables PSBS 01 (Increase in sales and market share), PSBS 02 (Increase in profitability) and PSBS 03 (Return on investment, competitiveness and market performance), appear to be affected by sustainability, but are still confused with indicators and success measuring for the organization and not for projects, which can be related to the Org_B1 interviewee when he points out: “[...] it actually contributes to indicators of performance, not to project indicators”. This finding is consistent with Shenhar and Dvir (2007), showing that respondents of companies see the importance and possibility of transferring indicators considered strategic to the project management sphere.

As in the first scenario, related to the use of SPM and its contribution to PS, and now looking at the importance of SPM variables to contribute with PS, the PSPF construct appears being moderately affected by sustainability, corroborating Shenhar and Dvir (2007), who argue that this dimension may appear more clearly in the mid and long term. However, according to Elkington (1998), leading sustainability actions in companies will require drastic changes in the economic, environmental and social dimensions of sustainability, and the real challenge is to conduct managers, project managers and companies to embrace this new and paramount challenge. Our results advance and contribute to improve actions of SPM and to reduce the research gap, however companies that hope take in account this challenge will need to undertake on actions of sustainability for obtaining better results or success at project management and strategic level as well. Following, the final considerations of the study will be presented.

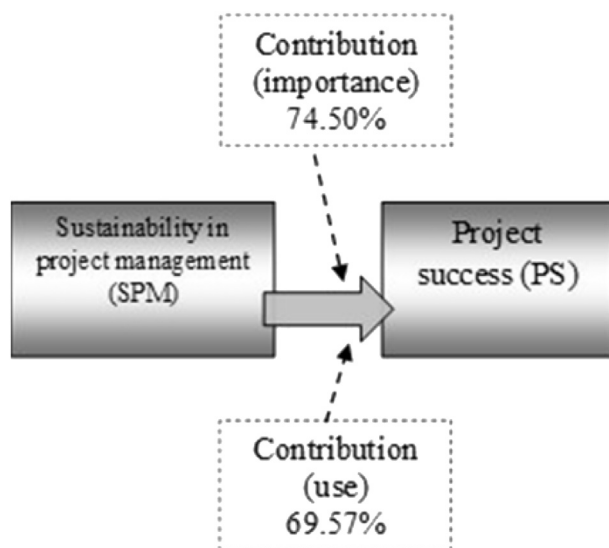


Fig. 1. Results of the research framework for the use and importance of SPM variables and the contribution to PS.

5. Final considerations

The discussion of the central concepts of the research (sustainability in project management and project success) showed that in fact these issues have been presented as important topics and deserve attention of practitioners and researchers of both subjects. Motivated by this need, this study aimed to investigate how companies are introducing sustainability into the project management function and understand how the efforts of sustainability can impact project success through multiple-case studies in four organizations.

The results of multiple-case studies pointed out the use of standard project management methodologies, the use of sustainability in the phases of initiation, planning, development, control and closing of projects, as well as concerns and constant improvements in these areas were observed. It is noteworthy that when analyzing the importance given to these factors like sustainability and project management, a slight increase in project success is observed, showing interest and awareness of the organizations aimed at enhancing these technologies. Similarly, the two scenarios presented, concerning the perception of importance and the current use or application analyzed showed relation between sustainability in project management and project success in the light of use and importance, as well as it is perceived the real impact of SPM on PS. However, there is a gap between the perception of importance and the actual use of sustainability in project management in practices.

For the development of the multiple cases, it was considered that the number of interviewees and respondents of the questionnaire, in addition to other data collection sources, was sufficient to provide a considerable internal validity to the study. However, a suggestion is made to expand the case studies, as well as to study particular business niches in order to understand their strategies regarding these issues. One limitation of the study is the choice for the four cases due to accessibility and convenience, since it is the least severe type of sampling.

The subjective form of performance and conduct of the researchers concerning the processing of data and analysis of the results can be considered another limitation of this study. In order to minimize this limitation, we used standard techniques of content analysis, statistical software to perform descriptive statistics, as a means to mathematically rationalize the relation between SPM and PS.

Moreover, the discussion is not exhausted in this study, which is a contribution to the academia, especially for the development of the research framework on the constructs and variables of sustainability in project management, as well as the presentation of evidence regarding the relation of these issues with project success. It is suggested that researches employing surveys could also be the subject of future studies. Thus, it is evident the need to continue the efforts initiated in this study in order to align the concepts of sustainability in project management to further understand its relation with the achievement of success in projects. As a practical contribution, these results can be used as a reference for other organizations, offering a direction to strategies, as well as an initial path for the development of indicators related to sustainability in project management and measures of success in projects.

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References

- Adnan, H., Hashim, N., Marhani, M.A., Asri, M., Johari, Y., 2013. Project management success for contractors. *World Acad. Sci. Eng. Technol.* 74, 425–429.
- AIPM. Australian Institute of Project Management, 2013. Retrieved from: <http://www.aipm.com.au/> (accessed 15.09.13.).
- Almahmoud, E.S., Doloi, H.K., Panuwatwanich, K., 2012. Linking project health to project performance indicators: multiple case studies of construction projects in Saudi Arabia. *Int. J. Proj. Manag.* 30 (3), 296–307.
- APM. Association for Project Management, 2013. Retrieved from: <http://www.apm.org.uk/BOK6> (accessed 15.09.13.).
- Araújo, J.B., 2010. Desenvolvimento de método de avaliação de desempenho do processo de manufatura considerando parâmetros de sustentabilidade (Tese de Doutorado). Escola de Engenharia de São Carlos da Universidade de São Paulo, São Carlos, 176 pp.
- Atkinson, R., 1999. Project management: cost, time and quality, two best guesses and a phenomenon, it is time to accept other success criteria. *Int. J. Proj. Manag.* 17 (6), 337–342.
- Azapagic, A., 2004. Developing a framework for sustainable development indicators for the mining and minerals industry. *J. Clean. Prod.* 12, 639–662.
- Baumgartner, R.J., Ebner, D., 2010. Corporate sustainability strategies: sustainability profiles and maturity levels. *Sustain. Dev.* 18, 76–89.
- Bernhardi, L., Beroggi, G.E.G., Moens, M.R., 2000. Sustainable water management through flexible method management. *Water Resour. Manag.* 14 (16), 473–495.
- Berssaneti, F.T., Carvalho, M.M., 2015. Identification of variables that impact project success in Brazilian companies. *Int. J. Proj. Manag.* 33 (3), 638–649.
- Brones, F.A., Carvalho, M.M., Zancul, E.S., 2014. Ecodesign in project management: a missing link for the integration of sustainability in product development? *J. Clean. Prod.* 80 (1), 106–118.
- Brown, S.L., Eisenhardt, K.M., 1998. Competing on the Edge – Strategy as Structured Chaos. Harvard Business School Press, Boston, MA.
- Bocchini, P., Frangopol, D.M., Ummenhofer, T., Zinke, T., 2014. Resilience and sustainability of civil infrastructure: toward a unified approach. *J. Infrastruct. Syst.* 20, 1–16.
- Brasil, 2013. Rio +20. Retrieved from: http://www.rio20.gov.br/sobre_a_rio_mais_20 (accessed 27.03.13.).
- Bryde, D.J., 2003. Modeling project management performance. *Int. J. Qual. Reliab. Manag.* 20 (2), 229–254.
- Bryman, A., 1989. *Research Methods and Organization Studies*. Unwin Hyman, London.
- Buson, M.A., Laurenti, R., Rozenfeld, H., Forcellini, F.A., 2009. Uma proposta de avaliação da sustentabilidade de projetos na fase de planejamento com base nos princípios lean: um estudo de caso no segmento de eletrônicos. In: 7^o CBGDP. São José dos Campos.
- Carvalho, M.M., 2014. An investigation of the role of communication in IT projects. *Int. J. Oper. Prod. Manag.* 34 (1), 36–64.
- Carvalho, M.M., Rabechini Jr., R., 2011. *Fundamentos em Gestão de Projetos: Construindo competências para gerenciar projetos: teoria e casos*, 3^a ed. Atlas, São Paulo, 422 pp.
- Carvalho, M.M., Rabechini Jr., R., 2015. Impact of risk management on project performance: the importance of soft skills. *Int. J. Prod. Res.* 53 (2), 321–340.
- Carvalho, M.M., Patah, L.A., Bido, D.S., 2015. Project management and its effects on project success: cross-country and cross-industry comparisons. *Int. J. Proj. Manag.* 33 (7), 1509–1522.
- Chan, A., Chan, A., 2004. Key performance indicators for measuring construction success. *Benchmarking Int. J.* 11 (2), 203–221.
- Cole, R., 2005. Building environmental assessment methods: redefining intentions and roles. *Build. Res. Inf.* 33 (5), 455–467.
- Corder, G.D., Mclellan, B.C., Green, S., 2010. Incorporating sustainable development principles into minerals processing design and operation: SUSOP[®]. *Miner. Eng.* 23 (3), 175–181.
- Creswell, J.W., Clark, V.L., 2006. *Designing and Conducting Mixed Method Research*. Sage, London.
- Eisenhardt, K.M., 1989. Building theories from case study research. *Acad. Manag. Rev.* 14 (4), 532–550.
- Eisenhardt, K.M., Graebner, M.E., 2007. Theory building from cases: opportunities and challenges. *Acad. Manag. J.* 50 (1), 25–32.
- Elattar, S., 2009. Towards developing an improved methodology for evaluating performance and achieving success in construction projects. *Sci. Res. Essays* 4 (6), 549–555.
- Elkington, J., 1998. *Cannibals with Forks: the Triple-Bottom Line of 21st Century Business*. New Society Publishers, Canada.
- ENAA. Engineering Advancement Association of Japan, 2013. Retrieved from: <http://www.enaajp.jp/EN/activities/model.html> (accessed 15.05.14.).
- Fellows, R., Liu, A., 2008. Impact of participants' values on construction sustainability. *Proc. ICE Eng. Sustain.* 161 (4), 219–227.
- Fernández-Sánchez, G., Rodríguez-López, F., 2010. A methodology to identify sustainability indicators in construction project management—application to infrastructure projects in Spain. *Ecol. Indic.* 10 (6), 1193–1201.
- Fiksel, J., McDaniel, J., Mendenhall, C., 1999. *Measuring Progress towards Sustainability Principles, Process and Best Practices*. Battelle Memorial Institute, Ohio.
- Gareis, R., Huemann, M., Martinuzzi, A., 2009. Relating sustainable development and project management. In: *IRNOP IX*, Berlin, pp. 1–25. Retrieved from: <http://pt.scribd.com/doc/106456206/Gareis-Irnop-2009> (accessed 11.01.13.).

- Gareis, R., Huemann, M., Martinuzzi, A., 2013. Project Management and Sustainable Development Principles. Project Management Institute Inc., Pennsylvania.
- Gladwin, T.N., Kennelly, J.J., Krause, T.S., Kennelly, J., 1995. Shifting paradigms for sustainable development: implications for management theory and research. *Acad. Manag. J.* 20 (4), 874–907.
- Hardi, P., Zdan, T., 1997. Assessing Sustainable Development: Principles in Practice. International Institute for Sustainable Development, Canada.
- Hart, S.L., 1995. A natural-resource-based view of the firm. *Acad. Manag. Rev.* 20 (4), 986–1014.
- ICHEME. Institution of Chemical Engineers, 2002. The sustainability metrics: sustainable development progress metrics recommended for use in the process industries. Retrieved from: www.icheme.org (accessed 21.11.13.).
- Ika, L.A., Diallo, A., Thuillier, D., 2012. Critical success factors for World Bank projects: an empirical investigation. *Int. J. Proj. Manag.* 30 (1), 105–116.
- IPMA. International Project Management Association, 2013. Retrieved from: <http://ipma.ch/resources/ipma-publications/ipma-competence-baseline/> (accessed 11.08.13.).
- Jones, S., Tefe, M., Appiah-Opoku, S., 2013. Proposed framework for sustainability screening of urban transport projects in developing countries: a case study of Accra, Ghana. *Transp. Res. Part A* 49, 21–34.
- Kerzner, H., 2001. Project Management – a Systems Approach to Planning, Scheduling, and Controlling. John Wiley & Sons, New York.
- Kometa, S., Olomolaiye, P., Harris, F., 1995. An evaluation of clients' needs and responsibilities in the construction process. *Eng. Constr. Archit. Manag.* 2 (1), 57–76.
- Krippendorff, K., 1980. Content Analysis: an Introduction to its Methodology. Sage Publications, Newbury Park, California.
- Kumaraswamy, M., Thorpe, A., 1996. Systematizing construction project evaluations. *J. Manag. Eng.* 12 (1), 34–39.
- Labuschagne, C., Brent, A.C., Van Erck, R.P.G., 2005. Assessing the sustainability performances of industries. *J. Clean. Prod.* 13 (4), 373–385.
- Larson, E.W., Gobeli, D.H., 1989. Significance of project management structure on development success. *IEEE Trans. Eng. Manag.* 36 (2), 119–125.
- Leurs, M.T.W., Mur-Veeman, I.M., Van Der Sar, R., Schaalma, H.P., Vries, N.K., 2008. Diagnosis of sustainable collaboration in health promotion – a case study. *BMC Public Health* 8. Retrieved from: <http://www.biomedcentral.com/1471-2458/8/382> (accessed 20.03.12.).
- Lim, C., Mohamed, M., 1999. Criteria of project success: an exploratory re-examination. *Int. J. Proj. Manag.* 17 (4), 243–248.
- Liu, J., Zuo, J., Sun, Z., Zillante, G., Chen, X., 2013. Sustainability in hydropower development: a case study. *Renew. Sustain. Energy Rev.* 19 (2013), 230–237.
- Macaskill, K., Guthrie, P., 2013. Risk-based approaches to sustainability in civil engineering. *Eng. Sustain.* 166 (ES4), 181–190.
- Marcelino-Sádaba, S., González-Jaen, L.F., Pérez-Ezcurdia, A., 2015. Using project management as a way to sustainability. From a comprehensive review to a framework definition. *J. Clean. Prod.* 99 (15), 1–16.
- Martens, M.L., 2015. Sustainability in Project Management and its Relation with Project Success: Proposition of a Conceptual and Empirical Model. Thesis (Doctorate). Polytechnic School of the University of São Paulo, São Paulo, Brazil, 284 pp.
- Mir, F.A., Pinnington, A.H., 2014. Exploring the value of project management: linking project management performance and project success. *Int. J. Proj. Manag.* 32, 202–217.
- Mulder, J., Brent, A.C., 2006. Selection of sustainable rural agriculture projects in South Africa: case studies in the LandCare programme. *Eng. Technol.* 28 (2), 55–84.
- Munns, A.K., Bjeirmi, B.F., 1996. The role of project management in achieving project success. *Int. J. Proj. Manag.* 14 (2), 81–87.
- PMI. Project Management Institute, 2013. A Guide to the Project Management Body of Knowledge (PMBOK® Guide). Published by, fifth ed. Project Management Institute, Inc., Pennsylvania, USA.
- Porter, M.E., Linde, C., 1995. Green and competitive: ending the stalemate. *Harvard Bus. Rev.* 75 (5 – September–October), 120–134.
- PRINCE2, 2013. PRINCE2® – Projects in Controlled Environments. Retrieved from: <http://www.prince-officialsite.com/home/home.aspx> (accessed 11.08.13.).
- Pulaski, M.H., Horman, M.J., 2005. Continuous value enhancement process. *J. Constr. Eng. Manag.* 131 (12), 1274–1282.
- Saaty, T.L., 1991. Método de análise hierárquica. McGraw-Hill, São Paulo.
- Sachs, I., 1993. Estratégias de transição para o século XXI: desenvolvimento e meio ambiente. Studio Nobel e Fundação de Desenvolvimento Administrativo, São Paulo.
- Sánchez, M.A., 2015. Integrating sustainability issues into project management. *J. Clean. Prod.* 96, 319–330.
- Sarkis, J., Meade, L.M., Presley, A.R., 2012. Incorporating sustainability into contractor evaluation and team formation in the built environment. *J. Clean. Prod.* 31, 40–53.
- Sebrae, 2014. Serviço Brasileiro de Apoio às Micro e Pequenas Empresas. Retrieved from: <http://www.sebrae-sc.com.br/leis/default.asp?vcdtexto=4154> (accessed 21.10.13.).
- Shenhar, A., 2011. Meeting time, cost, and moneymaking goals with strategic project Leadership®, why is project management weak? The art and science of project management. In: PMI Global Congress Proceeding.
- Shenhar, A., Dvir, D., 2007. Reinventing Project Management: the Diamond Approach to Successful Growth and Innovation. Harvard Business School Press.
- Shenhar, A., Dvir, D., Levy, O., Maltz, A.C., 2001. Project success: a multidimensional strategic concept. *Long Range Plan.* 34, 699–725.
- Silvius, A.J.G., Schipper, R., Nedeski, S., 2013. Sustainability in project management: reality bites. *PM World J.* 2 (2), 1–14.
- Singh, R.K., Murty, H.R., Gupta, S.K., Dikshit, A.K., 2012. An overview of sustainability assessment methodologies. *Ecol. Indic.* 15 (1), 281–299.
- Spangenberg, J.H., Pfahl, S., Deller, K., 2002. Towards indicators for institutional sustainability: lessons from an analysis of Agenda 21. *Ecol. Indic.* 2 (12), 61–77.
- Thamhain, H.J., 2014. Managing Technology-based Projects: Tools, Techniques, People and Processes. John Wiley & Sons, Inc., New Jersey.
- Ustinovichius, L., et al., 2010. Feasibility of verbal analysis application to solving the problems of investment in construction. *Autom. Constr.* 19 (3), 375–384.
- Ustinovichius, L., Kochin, D., 2003. Verbal analysis of the investment risk in construction. *J. Bus. Econ. Manag.* 4 (4), 228–234.
- Veleva, V., Ellenbecker, M., 2001. Indicators of sustainable production: framework and methodology. *J. Clean. Prod.* 9, 519–549.
- VDI. Verein Deutscher Ingenieure, 2006. VDI 4070: Nachhaltiges Wirtschaften in kleinen und mittelständischen Unternehmen: Anleitung zum Nachhaltigen Wirtschaften. Beuth Verlag, Berlin.
- Voss, M., Kock, A., 2013. Impact of relationship value on project portfolio success: investigating the moderating effects of portfolio characteristics and external turbulence. *Int. J. Proj. Manag.* 31, 847–861.
- Voss, C., Tsikriktsis, N., Frohlich, M., 2002. Case research in operations management. *Int. J. Oper. Prod. Manag.* 22 (2), 195–219.
- Wang, N., Wei, K., Sun, H., 2014. Whole life project management approach to sustainability. *J. Manag. Eng.* 30 (April), 246–255.
- WBCSD. The World Business Council for Sustainable Development, 2006. Corporate Social Responsibility: Meeting Changing Expectations. Retrieved from: <http://www.wbcsd.org/pages/edocument/edocumentdetails.aspx?id=82&nosearchcontextkey=true> (accessed 11.08.13.).
- WCED. World Commission on Environment and Development, 1987. Our Common Future. Oxford University Press, Oxford, England.
- Wit, A., 1988. Measurement of project success. *Proj. Manag.* 6 (3), 164–170.
- Xing, Y., Horner, R.M.W., El-Haram, M.A., Bebbington, J., 2009. A framework model for assessing sustainability impacts of urban development. *Account. Forum* 33 (3), 209–224.
- Yin, R.K., 2014. Case Study Research: Design and Methods, 5th ed. Sage Publications Inc, California.