USE OF SUSTAINABILITY INDICATORS IN THE MANAGEMENT OF INFORMATION TECHNOLOGY PROJECTS

USO DE INDICADORES DE SUSTENTABILIDADE NA GESTÃO DE PROJETOS DE TECNOLOGIA DA INFORMAÇÃO

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ABSTRACT

Purpose - To understand the relationship between sustainability indicators and information technology projects.

Design/methodology/approach – This is an exploratory study with a qualitative approach of multiple cases involving service providers in the information technology sector.

Findings – It was found that companies use sustainability indicators at an organizational level for management of information technology projects, but no specific sustainability indicator was present in none of the cases. Thus, the use of sustainability indicators depends on the nature of the information technology project.

Research limitations/implications - This study is limited to the identification of sustainability indicators in information technology companies.

Originality/value - Although this study points to the effectiveness of the use of sustainability indicators in projects, there is still a gap for performing new studies on information technology projects with the objective of increasing the companies' economic performance.

Keywords - Sustainability indicators, information technology, project management.

RESUMO

Objetivo – O objetivo deste estudo é compreender a relação entre indicadores de sustentabilidade e projetos do segmento de Tecnologia da Informação.

Metodologia - A pesquisa caracteriza-se como exploratória com abordagem qualitativa realizada por meio de um estudo de caso múltiplo realizado em prestadores de serviços da área de Tecnologia da Informação.

Resultados – A pesquisa concluiu que as organizações não possuem a aplicação de indicadores de sustentabilidade em nível organizacional na gestão de projetos de Tecnologia da Informação, porém, nenhum dos casos abordados apresenta a presença de indicadores específicos para projetos de Tecnologia da Informação. Assim, a utilização de indicadores de sustentabilidade está sujeita à natureza envolvida no projeto de tecnologia da informação.

Limitações/implicações da pesquisa - O estudo se limita à identificação de indicadores de sustentabilidade em empresas de tecnologia da informação.

Originalidade - Embora pesquisas apontem para a eficácia da utilização de indicadores de sustentabilidade em projetos, ainda existe uma lacuna para a realização de novos estudos em projetos de tecnologia da informação, com o objetivo de aumentar seu desempenho econômico.

Palavras-Chave - Indicadores de sustentabilidade, tecnologia da informação, gestão de projetos.

1 INTRODUCTION

Some studies seek to understand the complexity of projects in information technology (IT) from a project management perspective through the so-called condition of success. Examples include the studies by Baker, Murphy and Fischer (1983) and Yeo (2002). These authors sought to identify the main factors and determine the management practices that intensify or reduce the likelihood of impacts on IT projects. However, these studies did not address whether there are certain conditions related to the organization's information or business processes.

Studies on the use of sustainable indicators in IT projects (Dyllick & Hockerts, 2002, Buson et al. , 2009; Ghose, Hasan & Spedding, 2009; Watson, Boudreau & Chen, 2010; Silvius & Schipper, 2014; Sánchez, 2015; Kivilä, Martinsuo & Vuorinen, 2017; Mavi & Standing, 2018) established that these indicators are used as a technological strategy (Boudreau, Chen & Huber, 2008; Marcelino-Sádaba, González-Jaen & Pérez-Ezcurdia, 2015; Aarseth et al., 2017) in order to obtain increased performance and economic control of the project results (Barbieri et al., 2010; Carvalho & Rabechini Jr., 2011; Martens & Carvalho, 2017).

To ensure this alignment with the dimensions of sustainability (i.e., economic, social, and environmental), the companies are adopting strategies to maintain the balance between all their interest groups. Elkington (1998) defines that, for a project to be sustainable, it must be ecologically correct, economically viable and socially fair resulting in a set of dimensions called tripod of sustainability, commonly known as TBL (triple bottom line).

The application of sustainable development principles to the IT area through existing indicators in the dimensions of TBL contributes to the increase of competitiveness, control and performance of the companies (Barbieri et al., 2010). This scenario is also addressed by D'Souza et al. (2006), who maintain that establishing variables for determination of sustainability indicators can encourage the companies to increase their competitive performance and identify possible flaws in the organizational management process (Carvalho & Rabechini, 2011). In fact, according to Veiga (2010), an increase in a company's performance can occur through the use of sustainability indicators. The establishment of a set of indicators, controlled by means of a measurement process, is the basis for formulating procedures to compose what is normally called "sustainable practices within organizations".

In this context, companies using some form of measurement of sustainability indicators in the management of their IT projects are still quite restricted (El-Haram et al., 2007). In a survey applied to 101 companies regarding the use of sustainability indicators, it was found that only 28% of them used some of these concepts in order to minimize the risks in the control of their projects. Thus, sustainability is increasingly perceived as a necessary tool for understanding the economic reasons related to the establishment of management and control of projects (Thomson, Elharam & Emmanuel, 2011). The companies inserted in this context seek, through the use of measurements of these sustainability variables in their projects, reduce the economic impacts and increase their performance in accordance with baselines previously defined in the projects (Thimóteo, 2013; Silvius, 2017). In view of these considerations, the research question guiding the present study is the following: **how IT companies relate sustainability indicators to the processes of management of information technology projects?** This work is based on a multiple case study with the participation of three IT service providers. From our results, it was possible to identify sustainability indicators present in each dimension and its respective relationships with IT projects.

2 LITERATURE REVIEW

In this section, the concepts on sustainability indicators, sustainability, and the relationship with the project management and sustainability indicators inserted in the management of IT projects are briefly presented.

2.1 Sustainability Indicators

The use of sustainability indicators by companies in their project management practices has become necessary in recent years. The essence of the term "sustainability" is associated with the concept of something sustainable, that is, which can be sustained and maintained in the long term. This theme has been observed and applied by many companies. According to Sánchez (2015), such organizations rely on the foundations of triple bottom line (TBL) and started to adopt sustainability practices in internal ventures to improve their performance, including economically.

Corroborating this idea, the Global Reporting Initiative (GRI) presents a set of sustainability guidelines and indicators disseminated worldwide, acting as a tool to support companies in their social, environmental, and economic performance. Such guidelines contribute to the determination of indicators, risks and respective impacts within the companies. Studies by Silvius and Schipper (2014), de Azevedo (2006), Krajnc and Glavic (2003), Araújo et al. (2006), and DJSI (2019) confirm the indicators proposed by the GRI (2019), which are in harmony with the TBL definitions and are organized as follows: (1) economic, (2) environmental and (3) social, with each indicator being related to the company's performance.

The economic performance indicator refers to the economic dimension of sustainability in relation to the possible impacts on the conditions of the project sponsors and on the company's economic system. The environmental performance indicator refers to the use of natural inputs and the compliance associated with the production process in relation to the impacts caused by the company on the environment.

The sustainability indicators shown in Table 1 were compared and grouped according to the categories suggested by Silvius and Schipper (2014), whose survey is specifically focused on indicators of project management sustainability. These indicators will serve as a basis for future application to case studies in order to identify their presence in companies developing IT projects.

Table 1. Sustainability Indicators

Silvius and Schipper (2014)	Azevedo (2006)	Krajnc and Glavic (2003)	Araújo *et al.* (2006)	DJSI (2019)
Economic Indicators				
Return on Investment	Annual production	Value added in GDP	Competitive advantage	Corporate governance
Diversity in Design	Total annual sales volume	Investments in sustainable development	Quality and cost	Investor relations
Direct financial benefits	Exports	Environmental liability costs	Focus	Strategic planning
Net present value	Billing	Number of customer complaints	Market	Measurement system / scorecards
		Investments in ethics activity	Results	Risk and crisis management
		Number of sustainable environmental reports	Business Strategy	Codes of conduct
Environmental Indicators				
Local procurement	Internal environmental project programs	Energy consumption	Clean technologies	Environmental policy and management
Digital communication	Environmental compliance	Material consumption	Recycling	Environmental performance
Travels	Environmental management system	Water consumption	Sustainable use of	Advanced environmental management system
Transport	Environmental education projects	Production	Natural resources	Product leadership
Energy used	Reduced material consumption	Solid waste	Legal Compliance	Climate strategy
CO2-emission*		Liquid waste	Use of eco-friendly products	
Recycling		Gas emission	Environmental impacts	
Disposal				
Resource reuse				
Waste				
Social Indicators				
Direct employment	Direct jobs generated	Number of employees	Assuming social responsibility	Labor practices indicators
Labor / management relations	Employees' dependents	Turnover	Supporting community growth	Human capital development
Health and safety	Admissions in the period	Index of workers satisfied with their work	Commitment to HR development	Attracting and retaining talents.
Training and education	Female, black and handicapped workers in the company.	Percentage of promotions	Promotion and participation in social projects	Knowledge management / organizational learning
Organizational learning	Management positions held by female, black and handicapped workers.	Time on sick leave		Standards for suppliers
Diversity and equal opportunities	Shutdown index	Fraction of charitable contributions		Involvement of stakeholders
No discrimination	Level of training	Number of social projects		Corporate citizenship and philanthropy
Resource reuse				
Waste				

Source: prepared by the authors based on Silvius and Schipper (2014), Azevedo (2006), Krajnc and Glavic (2003), Araújo et al. (2006) and DJSI (2019).

2.2 Sustainability and Project Management

For Shenhar and Dvir (2010), the dimensions of sustainability have different roles in business practices. While the social and environmental dimensions must be related to the efficiency factors of the projects, the economic dimensions are seen by the authors as of great importance due to the fact that they remunerate the resources of the investors. Given the need and the imminent contributions of the use of sustainability in the project management, Carvalho and Rabechini Jr. (2011) assure that such a practice should seek to understand the different project stakeholders and the trade-offs involved. Rodrigues et al. (2005) point out that the use of sustainability in projects is associated with adequate and qualified management in order to meet the business strategy and the interests of the parties involved in the project. In this sense, several studies demonstrate that sustainable factors are aimed at serving the project stakeholders (Fiksel, Mcdaniel & Mendenhall, 1999; Veleva & Ellenbecker, 2001; Labuschagne, Brent & Van Erck, 2005; Savitz, 2006; Buson et al., 2009; Ethos, 2019).

2.3 Sustainability Indicators Included in IT Project Management

In the view of Pressman and Maxim (2016), projects in the IT area have a short life cycle and may undergo changes, error corrections and eventual maintenance. The result of employing project management techniques is to produce software using the organization's resources properly and quickly, always considering scope, deadline and cost restrictions (TAO, 2008). The discussion about IT projects is highlighted by Kerzner (2000), who points out that these projects cause changes in companies and, for this reason, they can generate some type of internal resistance. In this sense, the author places the project manager as the main character to overcome such a resistance, and he or she must be equipped with techniques and processes to achieve the project's objectives. In view of the process of IT project management, the project's life cycle should be adjusted so that its requirements could start together with the company's strategic needs and end when these are met and validated by the user, which would serve as a support for the manager and make the project successful (Forsberg, Mooz & Cotterman, 2005).

According to Mintzberg (1995), companies aim to reduce costs and seek to increase the performance of their projects. Thus, it can be understood that companies apply sustainable concepts to their projects in order to increase their performance. Based on the development cycle of IT projects, Keeling (2010) defines that companies can adopt a strategy to promote a greater contribution to their projects over time, which may be related to the use of sustainability indicators. In fact, according to Silvius, Schipper and Nedeski (2013), the relationship between practices of IT project management and sustainability indicators is increasingly attracting new academic research and being used by professionals. For the companies, such a relationship can result in increased performance (Ika, Diallo &Thuillier, 2012; Veiga, 2010).

3 METHODOLOGY

This section describes the methodological aspects used to carry out the present study.

3.1 Methodological Approach

This study is structured from the perspective of an exploratory and qualitative approach as

it is not focused on quantifying research data, but on addressing particularities and the quality of how these data are portrayed by characterizing them as well as the research facts (Minayo, 1994).

3.2 Research Method

According to Patton (2002), among the methods of qualitative research, the case study aims to systematically group rigorous and succinct information on a particular phenomenon to be studied. The composition of a case study occurs through systematic planning of the research, data collection and analysis process. It is considered by Llewellyn and Northcott (2007) as a procedure which seeks to highlight the contextual understanding of the phenomenon and centralize the understanding of the execution of the research within a real context (Eisenhardt, 1989).

With the objective of increasing the rigor of the research, Yin (2017) and Gummesson (2007) suggest that the researcher should use multiple cases in order to allow generalization of the study and understanding of the data, which improves the quality and success of the research. Given this context, it was decided to carry out this study by using a multiple case study method as there is little or no control over the phenomena (Yin, 2017). In addition, according to Eisenhardview (1989), a multiple case study is more consistent and more powerful than a single case study as its results allow the understanding of an auxiliary theory.

3.3 Research Protocol

Martins (2008) describes the research protocol as a set of procedures to apply the study to another case with the same denotations as the first study. Research protocol is an activity of crucial importance for carrying out a study because, according to Voss, Tsikriktsis and Frohlich (2002), a scientific research must have specific rules in its conduction. These rules must be used in procedures such as data collection and data analysis, including during semi-structured interviews with a question script.

The sustainability indicators identified by Silvius (2012), which are directly associated with the three TBL dimensions (i.e. economic, environmental and social), can be used as a basis to identify which indicators are present in other studies. Therefore, we will rely on sustainability indicators (Azevedo, 2006; Krajnc & Glavic, 2003; Araújo et al., 2006; DJSI, 2015) in order to establish a cohesive list of indicators present in all studies. These indicators will be validated in the future against their existence in project sustainability metrics (Fiksel; Mcdaniel; Mendenhall, 1999; Veleva; Ellenbecker, 2001; Labuschagne; Brent; Van erck, 2005; Savitz, 2006; Buson et al., 2009; Ethos, 2012). Some of the sustainability indicators defined by Silvius (2012) will be adopted for categorization of indicators, as shown in Table 2.

Table 2. Category of sustainability indicators

Economic	Environmental	Social
ROI – Return on investment	Transport	Labor practices
Business agility	Energy	Human rights
	Waste	Company and clients
	Materials and Resources;	Ethical behavior

Source: Compiled by the authors.

The indicators were selected and grouped according to their presence in at least three of the five studies to maintain their coherence and presence among the studies addressed, which

are listed in Table 1. Along with these indicators, some sub-classifications were added to support the researcher and facilitate the identification of the place where these sustainability indicators are present in the study cases. Sub-classifications are the following:

(i) **Present**: explicit or stated identification of the use of sustainability indicators in IT projects;

(ii) **Other Nature**: identification of sustainability indicators, but not directly related to IT projects already existing in the company´s metrics;

(iii) **Institutional**: indicators existing in the company, but not applicable at the project level, be they IT or of any other nature. Despite not being necessarily indicators, they bring a discourse of sustainability in the company, but without a specific purpose of measurement.

Table 3 shows how this study addresses the intersection between sustainability indicators and projects in the companies studied here.

Table 3. Sustainability indicators used in the research

Dimension	Indicators	Present	Other nature	Institutional
Economic	ROI – Return on investment			
	Net present value			
	Strategic planning			
Environmental	Transport			
	Energy consumption			
	Waste			
	Reuse of materials and resources			
Social	Relations with the community			
	Labor practices			
	Ethical behaviors			

Source: Compiled by the authors

To support the researcher in conducting a multiple case study and ensure the quality and integrity of the research (Yin, 2017), this study was based on the research protocol shown in Table 4 below:

Table 4. Research Protocol

Questions	Reference
How do you describe the procedures that your company employs in relation to sustainability practices and indicators?	Shenhar and Dvir (2010) Atkinson (1999) Elattar (2009)
What are factors are used to measure the economic performance of projects?	Singh et al. (2012)
How is the incorporation of sustainability aspects into organizational processes to seek corporate sustainability?	Labuschagne, Brent and Van Erck (2005) Carvalho and Rabechini Jr. (2011)
What are the main difficulties encountered in using sustainability variables and indicators in projects?	Rics (2004) Presley et al. (2007) Sarkis, Meade and Presley (2012)
Regarding the cost trade-off versus benefit, how does the company evaluate the impacts of continuous cost on the decision-making process?	Buson (2009) Buson et al. (2009)
How is the project's contribution to return on investment, competitiveness and market performance of the company measured?	Munns and Bjeimi (1996)
How do risk management practices consider elements of sustainability in projects?	Carvalho and Rabechini Jr. (2011)
How is the use of sustainability indicators disseminated in GP practices to improved the results?	Singh et al. (2012) Labuschagne, Brent and Van Erck (2005) Carvalho and Rabechini Jr (2011) Silvius, Schipper and Nedeski (2013)
How does the company measure the success of a project according to the use of sustainability indicators?	Mir and Pinnington (2014) Carvalho and Rabechini Jr (2015)
Are the sustainability practices currently adopted in the company and applied to IT projects?	Sánchez (2015) Carvalho and Rabechini Jr (2015)
Are there specific sustainability indicators for IT projects, be they development or infrastructure projects?	Sánchez (2015) Ika, Diallo and Thuillier (2012) Veiga (2010)
Are the existing indicators for measuring the company's economic sustainability performance being currently applied to IT projects?	Sánchez (2015)

Source: Compiled by the authors

The purpose of the research protocol was to identify the companies' perception and planning regarding sustainability indicators in IT projects. With the research protocol in hand, the next step was to select the cases to be studied.

3.4 Case Selection

The scope of this study includes companies who provide IT services by developing systems and who use, at some level, organizational or project management sustainability indicators for monitoring and controlling their projects. The companies were selected at random and for convenience and after validating their participation by means of initial questions. The questions were e-mailed by using the tool SurveyMonkey during the period from 20 December 2018 to 15 January 2019. The initial selection was based on electronic addresses and the questionnaires were elaborated by groups of managers or chief officers of IT projects, with these groups being open or closed to members of the LinkedIn network.

Thirty-four companies answered the questionnaire from a total of 458 e-mails, representing 7.5% of respondents. Of these respondents, only 12 companies met the necessary criteria for inclusion in the case study as they had explicitly stated that they measured sustainability indicators in their technology projects. Invitation letters were sent to the 12 companies to participate in the case study. After some attempts to establish contact with all of them, nine declined to participate in the case study during the interview scheduling phase.

3.5 Data Collection

Considering the objective of this study, analysis of documents and semi-structured interviews were used as data collection instruments. IT project documents used to control and measure the results were analysed in order to find the main characteristics of the application of sustainability indicators for project management.

In addition to the document analysis technique, semi-structured interviews were also conducted to identify whether the companies were using sustainability indicators to measure their projects, including IT ones, in terms of project life cycle and management.

The interviews were conducted in person and remotely by using video and voice communication software, with the content being recorded with the interviewee's permission. However, the disclosure of the companies' names was not allowed due to confidentiality of information, need for permission from various departments and multidisciplinary nature of the subject under analysis.

The interviews took place in the period from 01 March 2019 to 01 April 2019 with three managers of three companies in the field of technology provision and services, specifically in the area of software development, who had formally established sustainability indicators at the organizational level in their projects. Each of the managers is responsible for the project portfolio in their companies and uses some type of sustainability indicator to measure the project's performance, thus justifying the conduction of a solo interview per company.

3.6 Data Analysis

For Vergara (2006), data analysis can be done through coding and structured data presentation. From the process of observation and analysis of documents, it was possible to identify whether the individuals had knowledge on sustainability indicators in IT projects within their routine work and whether they knew that these indicators were being used. The techniques adopted for project management were identified and then grouped. The objective was to verify in which phases of the project the company used these practices and their main contributions to the company (Gil, 2002).

For Rubin and Rubin (2011), the information resulting from the interviews helps to identify how a certain research factor occurs in the study scenario. In our study, this information describes how the companies use their sustainability indicators in IT projects. The interview information was recorded and transcribed for analysis of the content.

The resulting data were treated and analysed based on Bardin (1977), that is, by using the content analysis technique. According to the author, content analysis consists of systematization, explanation and expression of the message into categories. It is worth mentioning that the categories were previously selected from a literature review, which justifies the origin of the messages in the validation process.

In the present study, a critical and reflective reading of the sources of evidence (i.e. identification and documents) was carried out. Next, the data were tabulated and categorized according to the study and research purposes, as shown in Table 3. The categories were used to analyze the results of the evidence sources based on the frequency of the evidence in the categories (Bengtsson, 2016).

Data analysis was performed considering who provided the information, in which context and which effects were intended. In this way, the meanings of the answers were grouped before being categorized. From this categorization, the categories were crossed with each other to show the use of sustainability indicators by the companies in their IT projects.

3.7 Case Studies

Company E1 is a Spanish-Portuguese organization leading the market of customer relation-ship management (CRM) and inserted in the business process outsourcing (BPO). The management of IT projects is segmented by the type of activity, in which new and innovative clients are managed by dynamic approaches, whereas more conservative clients or low-complexity projects are managed by traditional methods. Since 2009, the company has been effectively using sustainability indicators to measure its activities, including publicizing its intentions, practices and results regarding sustain-able actions in the Global Reporting Initiative (GRI). In 2011, the company joined the United Nations Global Compact initiatives.

Company E2 is a world leader in the provision of communication technologies, including applications and services. It offers services, software and infrastructure for telecommunications op-erators and other industries. As a company with an innovative profile and complex projects, its IT projects are managed through a hybrid management framework. The annual Sustainability and Cor-porate Responsibility report, called Technology for Good, is listed on the NASDAQ OMX (Stockholm) and NASDAQ (New York) stock exchanges.

Company E3 is the leading telecommunications provider in Latin America. It has the largest and most modern telephone service network, in addition to being considered the most technolog-ically efficient company in the telecommunications sector. The relationship between sustainability and projects in the IT area generates national and international recognition and one of the results of this recognition is that the Brazilian Ministry of Justice qualified the company as a Civil Society Organization of Public Interest (OSCIP).

4 RESULTS

This section presents the results of the case study regarding the three companies de-scribed above. The sustainability indicators identified in the interviews and the analysis of the companies' documents were categorized and recorded according to the indicators selected for carrying out this study (See Table 3 in the Methodology section).

4.1 Company 1 (E1)

4.2.1 Indicators Used by Company E1 regarding the Economic Dimension of the Sustainability

With regard to the economic indicators, it was possible to identify that company E1 uses in its projects the return on investment as a sustainability indicator, as highlighted in the inter-viewee's speech:

> "[...] we can say that they are measured based on three major factors: ROI [return on investment], reduced consumption of direct and indirect resources and the cost-benefit ratio of each project".

ROI is considered as the most used practice by the company E1 regarding the percep-tion of the economic dimension of sustainability. When analysing the documents on the projects completed in the last five years, one can see that approximately 90% of the company's projects used ROI to measure their financial performance. This practice is in line with that proposed by Munns and Bjeimi (1996), who claim that ROI is considered an evaluation criterion to measure the success of a project. Similarly, Shenhar and Dvir (2010) point out that profitability and increased revenues can also contribute to measuring a project's success, including in the sustainable sphere.

4.1.1.2 Indicators Used by Company E1 regarding the Environmental Dimension of Sustainability

By analysing the preliminary documents and the final scope of the projects, it was possible to identify the sustainability indicator for the reuse of materials and resources by the company, which is highlighted in the words of interviewee A:

> "In our concept, looking for ways to reuse resources and incorporate new technologies to reduce the impact on the environment is extremely important and permeates all areas of the company. This precaution is taken from the planning phase to the execution of the project, whether it be the creation of a new call center or the development of applications to support operations".

Another sustainability indicator identified in the interview was energy consumption, which is shown in the speech of interviewee A:

> "[...] the environmental part is taken into account in installations of major operations and that involves a large structure to be assembled, analyzing the consumption of energy, people and infrastructure".

This discourse is in line with what was established by Shenhar and Dvir (2010), who state that environmental sustainability can be measured through the long-term effects associated with projects regarding the preparation and use of infrastructure.

4.1.1.3 Indicators Used by Company E1 regarding the Social Dimension of Sustainability

In its projects, the company uses sustainability indicators for community relations and labor practices. The use of the relationship with the community indicator is presented in the interviewee´s speech:

> "When we open service centers in areas lacking adequate training, we are investing in the development of the community where we will operate, since the impact is always high and recruitment and training help both the community and the company to have a lower labor cost".

For this to happen, the company signed a global agreement with the United Nations Children Fund (UNICEF) and established a joint commitment aimed at promoting values, rights and social transformation. The interviewee's speech shows the use of the labor practices indicator:

> "We have an agreement signed with UNICEF globally in which large-scale projects that require a high volume of labor are implemented, such as a service center in a low-income area, so that the social work can benefit the region as little as possible and financial resources be turned over to the community. [...] The development of labor is also part of this agreement for the development of the region".

In this scenario and in parallel with the practices of the company E1, it is worth mentioning Shenhar and Dvir (2010) as they establish that the team involved in the execution of the projects can be affected by the results, both positively and negatively, which in a way can mark the professional career of each individual.

4.1.1.4 Sustainability Indicators and Their Use in IT Projects

In the company E1, of the three dimensions of sustainability, only the economic one is

applied to IT projects in the area of development and maintenance of software. This is observed in the speech of interviewee A:

> "[...] we do not have specific indicators for software development project; generally, when they are included in larger projects they end up entering the "batch" of the measurements, but nothing specific".

The company's projects are measured strictly according to their ROI. Based on both the speech of the interviewee and evaluation of the manager's practices, it was notable that the software development projects are meant to meet delivery deadlines and have a low cost. Thus, it was identified that there is no regulation in the company guiding the sustainable process index in their IT projects.

4.1.1.5 Final Thoughts on Company E1

It can be seen that the company carries out management practices in the three dimensions of sustainability. However, based on the interview transcript, questionnaire analysis and documentary analysis, it is clear that the economic criterion has a significantly greater weight than the other indicators, being present in the vast majority of the projects, whether for application development or implementation of large customer service centers. These two types of projects are the main ones existing in the company and the entire analysis was carried out with one of the project managers in the company's IT area, with no evidence of other types of projects being implemented.

The indicators present in the social and environmental dimensions only appeared during the analyses on the implementation of large and long-term projects, such as the establishment of call centers, for example. In these cases, the concern with meeting and measuring the sustainability indicators is very present not only at the project level, but also institutionally due to the observance of environmental impacts. Therefore, adjustments may be needed to comply with the environmental legislation and be in line with the agreements between company and international institutions for reinvestment in social development of the communities involved.

Although some sustainability indicators are part of the discourse proposed by the company, there is no clear evidence that they are used at the project level. In this case, they will be classified as institutional indicators. In some cases, it was possible to associate these indicators at both levels and therefore received a dual classification. In the case of company E1, the following indicators were classified as institutional: ROI, energy consumption, waste, reuse of materials and resources, relationship with the community, and labor practices.

4.1.2 COMPANY 2 (E2)

4.1.2.1 Indicators Used by Company E2 regarding the Economic Dimension of Sustainability

The economic sustainability indicators used by company E2 in their projects are the return on investment (ROI) and strategic planning. With regard to the ROI indicator, the company presented a report with the main practices used for the economic dimension and it was possible to observe that ROI is used in 100% of the projects. By using this practice, the company can measure the economic performance of the project portfolio and, in a classic way, perform the planning and financial control of the projects. This is observed in the speech of interviewee B:

> "There is no project that does not have financial validation and return on investment measurement".

As Munns and Bjeimi (1996) recall, the result is part of the executive analysis to measure the success of a project. Sustainability is considered by the company as a competitive differential, which is highlighted in the speech of interviewee B:

> "We are the giant that we are today because we are being differentiated by competitiveness with other companies".

This relationship is seen by the company as the culmination of a sustainable relationship with customers. The strengthening of this relationship is aimed to create value for the company and stakeholders. With this partnership, the company aims to find the most sustainable and responsible way to carry out its activities as if it was harvesting the fruits. In this context, it is possible to observe the use of strategic planning as a sustainability indicator in the speech of interviewee B:

> "For most of our customers, the generation of value in a responsible and sustainable way guarantees the level of satisfaction of customers and investors, thus being part of our strategic planning".

The company's relationship with stakeholders reinforces what was pointed out by Ika, Diallo and Thuillier (2012) because, according to the authors, the performance of the projects is associated with adherence to them and related to the expectations of the stakeholders, allowing the sustainability to be measured by project contributions after withdrawal of stakeholders.

4.1.2.2 Indicators Used by Company E2 regarding the Environmental Dimension of Sustainability

With regard to the environmental indicators, the company has a well-defined and clear position as it discloses its planning and environmental goals in an annual Sustainability and Corporate Responsibility report, called Technology for Good, published on the New York Stock Exchange and Swedish Stock Exchange with the aim of presenting the company's vision of the transformative power of the information and communication technology. By analysing this report, it was possible to identify the use of sustainability indicators for reuse of materials and resources and energy consumption in their projects. These indicators can also be seen in the speech of interviewee B:

> "As suppliers of a large number of high-tech products and services, we are committed to seeking environmentally friendly solutions to generate the least possible impact from the reuse of materials and savings in energy."

and

> "We are always open to new technologies, as long as they guarantee at least the quality we have today. If these technologies promote less impact and guarantee this quality, so this is what we are constantly looking for".

4.1.2.3 Indicators Used by Company E2 regarding the Social Dimension of Sustainability

The first sustainability indicator identified in the projects of company E2 was the relationship with the community, as interviewee B reported:

> "Due to our size, we seek to contribute to society in order to connect people and facilitate access to information".

To highlight this figure, 40% of the current telecommunications traffic in Brazil is in the hands of company E2. In terms of the ethical behavior indicator, the company is associated with the United Nations Human Rights and is committed to human rights throughout its operations. To support the implementation of these principles, the company launched a two-year business apprenticeship program, as highlighted in the speech of interviewee B:

> "It is part of the company DNA to create non-technological projects to support people who would do not have access to the latest technology. [...] And we do that in very low-income countries in order to reconnect people who without any pretension to profit and only to help these people".

The company's internal policy for hiring human resources in new operations prioritizes the selection of candidates who live close to the major operating centers. This company's action was identified from the analysis of the internal documents shown by interviewee B, thus characterizing the use of sustainability indicators in its projects through labor practices.

4.1.2.4 Sustainability Indicators and Their Use in IT Projects

The company has a research and development center, which is responsible for creating and maintaining the technologies adopted by the company. In the field of product and solution development, investments in R&D translate into increasingly sustainable products with very high energy efficiency (i.e. reduced consumption) and less visual impact. In the classification of projects, the most important ones are indicated and have their results monitored by committees. In the pre-project phase, the committee's evaluations follow an analysis flow and pre-determined levels of approval. In the execution phase, as mentioned before, the projects are monitored by using a dashboard of the main indicators, thus being regularly observed and evaluated. The company's practices are globally performed with agile project management and quick decision-making processes. Due to its sustainable global practices, it is worth noting that the company does not use a specific indicator for IT.

4.1.2.5 Final Thoughts on Company E2

The company has a high degree of commitment to the application of sustainability indicators in all dimensions. In this sense, it is important to note that formulation and consent occur at strategic and managerial levels and the guidelines are disseminated to other levels of the company in the form of rules for the quality of both service and products. Based on data analysis, one can see that all the projects use economic indicators, meaning that managers are constantly submitted to validations, audits and presentation of financial results. In terms of social and environmental care, everyone undergoes validation for sustainability from pre-sale to post-service so that the complete cycle of the project is monitored and measured throughout its development. Therefore, it is possible to guarantee that the company's criteria are being adequately met and in accordance with the

established quality standards for customer service.

A high degree of maturity and adequacy in relation to the sustainability issues is observed in the IT projects of the company. Although they do not have specific indicators for development of new applications, they are measured in a more generic context during the product development phase as these indicators will only be active from the software developed to meet the expected functionalities.

4.1.3 Company 3 (E3)

4.1.3.1 Indicators Used by Company E3 regarding the Economic Dimension of the Sustainability

Among the practices used for the economic dimension of sustainability, [...] "the return on investment is a mandatory item in all projects and I extract it automatically through the project monitoring systems". According to the interviewee C, it is possible to notice that the company uses the return on investment in the cost-benefit analysis of their projects. The return on investment indicator and the cost-benefit ratio are used in all projects of company E3. Such practices are used to measure the economic performance and possible success of the projects, as highlighted in the speech of interviewee C:

"For us, a successful project is a project that makes a profit".

Just to have an idea of the representativeness of this indicator, in 2015 the company had an increase by 3.8% in the economic performance compared to the previous year, in addition to a reduction in the operating costs by 3.9%. With regard to profitability, the company had a profit margin of 31.5%, the best in the telecommunications market. In relation to costs, these were below the company's target and even below inflation, that is, a reduction by 2.1% in costs versus 6.4% of the Broad Consumer Price Index (IPCA). Such indicators can be used to measure the success of a project (Munns & Bjeimi, 1996).

4.1.3.2 Indicators Used by Company E3 regarding the Environmental Dimension of Sustainability

The company has a worldwide policy for its sustainability practices and indicators. The goals are specific to the region where the company operates and are disclosed in their annual report. In the company's conception, the use of IT can effectively contribute to the reduction of energy consumption and inputs associated with the projects. In the medium term, the company's goal is to develop projects with energy efficiency in all areas, including projects associated with IT:

"Although we are a company with most services in agreements with our partners, we must keep the chain as a whole with the same objective, and always innovating to improve the service, from the infrastructure to people management".

Analysis of the project documents, mainly in its initial phase, showed that the risk matrix of the company's projects involves the sustainability indicator of energy consumption. This indicator is directly related to the projects for new operating sites as well as to project costs, having a direct relationship with the realization or not of the project.

4.1.3.3 Indicators Used by Company E3 regarding the Social Dimension of Sustainability

With regard to sustainability, the company has its activities focused on customers, employees and suppliers involved in the service chain. With the customers, the company seeks a direct relationship associated with service channels and market studies. The objective is always to establish the quality of the services provided, that is, from planning services to mapping after-sales. The development of social actions is part of the planning and a form of retribution to society, as highlighted in the statement of interviewee C:

> "We have actions from customers and suppliers, including internal ones, to establish a better relationship with the entire production chain, from suppliers to our employees ".

This speech shows that the company E3 uses the indicator of sustainability in its projects as an indicator os sustentability.

4.1.3.4 Sustainability Indicators and their Use in IT Projects

In the view of interviewee C, IT projects are generally high-cost and the cost-benefit analysis is difficult to be used by the managers: "In the vast majority, the ROI is applied because it is not uncommon to withdraw resources in the middle of the project to put them in other areas, which complicates measuring the cost-benefit ratio". Interviewee C stressed in the speech that, due to changes in priorities and the specific need of each client in the project, measuring the efficiency of the projects is an arduous task. What most hurts IT projects is the constant change of priorities, which significantly impacts the economic indicators of the project.

4.1.3.5 Final Considerations on Company E3

With regard to the economic dimension, analysis clearly shows that ROI is the main economic indicator and which has being systemically established so that the absence of this indicator in the projects is not possible. The cost-benefit ratio could be additionally applied in rare cases, but the issue of constant changes in the resources for projects undermines the accuracy of the values obtained.

With regard to the environmental indicators, the central issue refers to the development of technologies and systems with the purpose of reducing the energy use and of reusing it so that one can achieve operational effectiveness through actions related to energy efficiency. Furthermore, a major concern of the company is the relationship with the different parts of its service chain, that is, from the suppliers to the final customer. What is sought through this dimension is to establish a direct relationship with those involved in the service chain, thus allowing actions to be known according to their perceptions.

5 DISCUSSION AND ANALYSIS

In the case of sustainability indicators in the economic dimension, it was possible to observe the presence of return on investment (ROI) as an indicator of effective results in all cases involving IT projects. It should be noted that although all the three companies provide IT services with focus on different areas, all of them use ROI as the basis of economic indicator. It is noteworthy that

this indicator is defined at the institutional level and possibly used as a criterion for allowing an easier measurement as other indicators are more sensitive to changes. In fact, the turnover of resources during the execution of the projects, as mentioned by the companies, might affect the accuracy of the results. With regard to the environmental dimension, all the companies have a more or less comprehensive approach to issues related to the efficient use and consumption of energy, whether this dimension involves the development of new applications for better use of this resource or the acquisition of new technologies for a more intelligent way to reuse it.

In this topic, it is observed that the companies that provide IT services have a closer connection with devices for the use of applications, as is the case of companies E1 and E2, who reported to have more concerns than company E3. This is due to the nature of the different projects between them and to the presence of development and implementation of new technologies directly related to the functioning of internal and external devices in the regions where they are installed, as in the cases E1 and E2. Company E3, however, focuses on providing services rather than developing new products with technology as product development is usually part of its supply chain. Interestingly, there is a point of convergence between the companies: the reuse of materials. However, it should be emphasized that the reuse of resources is only present in cases where the material has some direct connection with products used internally and from the area of technology.

Finally, the social dimension is concerned with the relationship with the community, although it is worth mentioning that the project's nature directly impacts the intensity and direction of these actions. In the case of E1, this indicator is only considered in large projects, such as the creation of a call center in a needy location. In this case, during the definition of a project, this type of community action is mandatory due to the major changes that will occur. However, in the case of the development of smaller projects, it is not part of the indicators used by company E1 for its IT projects. On the other hand, companies E2 and E3 develop actions focused on society on a constant basis, even if they do not have a direct relationship with the development of projects.

6 FINAL RECOMENDATIONS

In the first stage, the central question of this study is answered: companies use sustainability indicators in the management processes of information technology projects at some organizational level and which are not only aligned with IT projects. However, such indicators are not used specifically for IT as they come from the organizational level and are applied to all projects of the companies. Corroborating this result, it is possible to state that there are sustainability indicators in companies to a greater or lesser extent within IT projects, depending on their nature. However, even if these are not linked to information technology projects, they are disseminated concurrently through organizational practices. Thus, it can be assumed that existence, validation and measurement of these indicators contribute to the institutional results.

It is almost unanimously agreed that economic indicators, with emphasis on return on investment (ROI), are present in all IT projects regardless of the nature of the service provision. In this sense, it is possible to identify aspects that are replicable at several layers of the project and at the institutional level, independent of the nature of the projects, in order to measure whether return on investment is suitable to the organizational goals.

However, it cannot be confirmed that the use of sustainability indicators is related to a better or worse economic performance of IT projects (Veiga, 2010; Mintzberg, 1995) because only the application of ROI does not show economic improvement linked to sustainability indicators. In addi-

tion, these indicators are vastly generalized and commonly applied to project management practices (PMI, 2017). Thus, it is necessary to expand the study to validate whether there is a subset of specific and targeted indicators for the IT area that could add greater benefits to the economic performance of projects and be generalizable to IT project applications of different nature.

The use of social and environmental sustainability indicators in complex and large-scale projects, as exemplified in this study with the implementation of a call center, is a situation in which the company provides technology services by applying several indicators to issues inherent to installations and training. However, issues such as applications are measured in a secondary way and only in the economic dimension, since the project's main objective is to bring technology in the form of a package of solutions, which makes measurements of individualized aspects difficult because the IT projects are multidisciplinary and may involve several other projects simultaneously.

The present study contributes to the academic environment by relating areas of sustainability to the IT project management, with the main objective of identifying the existence of sustainability indicators within the project management practices in information technology companies. More specifically, it was sought to relate indicators to IT projects and to determine whether they are commonly applied to service providers in information technology. Even though the themes of sustainability and IT project management are widely disseminated, both in the academic and professional fields, the intersection of both has been little studied. Moreover, in the professional field the theme has low applicability in the system development. Thus, the application of generic indicators brings little significance to the validation of their real contributions. In this sense, the study suggests the development of specific indicators for IT project management to allow a more effective and targeted measurement and to complement the current knowledge, which possibly would bring more applicable statistics to the market.

The present study is limited to the identification of sustainability indicators in information technology companies. Another limitation is the strategy selected for the study, that is, it is a case study because of the low number of companies to be analysed. Even though the companies have great representativeness and international scope, the recommendations cannot be generalized as they use sustainability indicators differently in their IT projects, no matter how much the companies operate and belong to the same area. It is suggested that further studies with a more comprehensive range of IT companies should be conducted to deepen the results obtained in this research so that the already identified sustainability indicators can be empirically validated, thus allowing a certain degree of generalization and applicability to business development software companies.

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3. Development of theoretical propositions (theoretical work)	√	√	√	√
4. Theoretical foundation / Literature review	√	√		
5. Definition of methodological procedures	√		√	√
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