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How to evaluate sustainability in projects? On the pursuit of KPIs
Iolanda Raquel da Silva Rocha

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Prof. José Ângelo Pinto

" How wonderful it is that nobody need wait a single moment before starting to improve the world "

Anne Frank in *The Diary of Anne Frank*

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ESCOLA SUPERIOR DE TECNOLOGIA DE GESTÃO

Abstract

Escola Superior de Tecnologia e Gestão
Instituto Politécnico do Porto

Master in Project Management

How to evaluate sustainability in projects? On the pursuit of KPIs

by Iolanda Raquel SILVA ROCHA

The concept of sustainability has evolved through times, in parallel with its importance. Indeed, nowadays, there is a urgency of change towards a sustainable development. Such urgency puts pressure on the organizations to adapt and incorporate the sustainable principles on their business strategies. On the other hand, there has been a projectification of the society, which revealed projects as the main way to implement those strategies and reach the objectives for the sustainable development. Hence, project management, and in particular, the incorporation of project management methods and metrics to evaluate the sustainability in projects, become essential to achieve an effective and measurable implementation of sustainability. Following these two trends, this work aims to focus on the sustainability evaluation of projects through the search of performance indicators to be integrated in the process of project management. In order to do that, a systematic review was performed and a survey-questionnaire was applied to managers of projects. This methodology allowed to collect a total of 748 KPIs, 730 from the literature review and 18 from the surveys applied. Those KPIs were then analysed in terms of activity sector, sustainability dimension and SDG. Furthermore, the survey allowed to have some clues on how, when and why KPIs are being applied into management and project management practices. This dissertation represents the first study that collects an extensive list of KPIs, transversal to several sectors and linked to sustainability. The work performed also allowed to reflect on the use of indicators and reinforce their importance in project management practice. The discipline of sustainable project management is emerging and necessary if we are to achieve sustainability, or even to go further and start to have a regeneration perspective, where we actually contribute positively to

society and the planet. This will require an interdisciplinary and integrative approach to tackle the complex sustainability and regeneration problems we have now and will have in the future.

ESCOLA SUPERIOR DE TECNOLOGIA DE GESTÃO

Resumo

Escola Superior de Tecnologia e Gestão
Instituto Politécnico do Porto

Mestrado em Gestão de Projetos

Como avaliar a sustentabilidade dos projetos? Na busca de KPIs

por Iolanda Raquel SILVA ROCHA

O conceito de sustentabilidade evoluiu ao longo dos tempos, em paralelo com a sua importância. De facto, hoje em dia, existe uma urgência de mudança no sentido de um desenvolvimento sustentável. Tal urgência pressiona as organizações a adaptarem-se e a incorporarem os princípios sustentáveis nas suas estratégias empresariais. Por outro lado, houve uma projectificação da sociedade, que revelou os projectos como a principal forma de implementar essas estratégias e alcançar os objectivos do desenvolvimento sustentável. Assim, a gestão de projectos, e em particular a incorporação de métodos e métricas de gestão de projectos para avaliar a sustentabilidade nos projectos, tornam-se essenciais para alcançar uma implementação eficaz e mensurável da sustentabilidade. Seguindo estas duas tendências, este trabalho visa centrar-se na avaliação da sustentabilidade dos projectos através da procura de indicadores de desempenho a serem integrados no processo de gestão de projectos. Para o efeito, foi efectuada uma revisão sistemática e aplicado um questionário de inquérito aos gestores de projectos. Esta metodologia permitiu recolher um total de 748 KPIs, 730 da revisão bibliográfica e 18 dos inquéritos aplicados. Estes KPIs foram então analisados em termos de sector de actividade, dimensão de sustentabilidade e SDG. Além disso, o inquérito permitiu ter algumas pistas sobre como, quando e porquê os KPIs estão a ser aplicados nas práticas de gestão e gestão de projectos. Esta dissertação representa o primeiro estudo que recolhe uma extensa lista de KPIs, transversal a vários sectores e ligada à sustentabilidade. O trabalho realizado permitiu também reflectir sobre a utilização de indicadores e reforçar a sua importância nas práticas de gestão de projectos. A disciplina de gestão sustentável de projectos é emergente e necessária para alcançarmos a sustentabilidade ou, mesmo, para irmos mais longe

e começarmos a ter uma perspectiva de regeneração, onde realmente contribuimos positivamente para a sociedade e para o planeta. Tal exigirá uma abordagem interdisciplinar e integradora para enfrentar os complexos problemas de sustentabilidade e regeneração que temos agora e que irão surgir no futuro.

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Glossary

BCSD	Business Council for Sustainable Development
CSR	Corporate Social Responsability
EU	European Union
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GPM	Green Project Management
ISO	International Standards Organization
KPI	Key Performance Indicator
PMI	Project Management Institute
SDG	Sustainable Development Goal
SPM	Sustainable Project Management
TBL	Tripple Bottom Line
UK	United Kingdom
UN	United Nations

Chapter 1

Introduction

Sustainability has increasingly emerged as a priority issue on political agendas, applicable regulations, investment funds and on opinion of society that puts pressure on institutions and companies by choosing those that demonstrate to be more sustainable (Marlin&Marlin, 2003). With the progressive projectification of society, projects and, implicitly, project management emerges as a strategic way for entities to incorporate and implement sustainability (Cerne&Jansson, 2019; Gareis et al., 2010). In the field of projects, sustainability has emerged in an integrative perspective of extending the iron triangle (time, cost, scope and quality) to a more integrative fashion, having a constant monitoring of environmental and social impacts of project processes and products (GPM Global, 2019). Thus, similar to what is currently done for the financial component, it is necessary to develop and incorporate metrics and indicators in the evaluation and monitoring of the project that reveal its environmental and social performance (Albuoul, 2017; Kerzner, 2011; Kivilä et al., 2017; Zdan, 2010). The literature review suggest that these metrics and indicators are still in an embryonic stage and that, on the other hand, in most cases, they have not been taken into consideration in the process of project management (e.g., in the monitoring and control of the project), but only from an organizational strategic point of view. Furthermore, it reveals the lack of studies collecting indicators. The development of this work arises to try to fill some lack of indicators applied to the three sustainability dimensions and SDGs for several sectors, with a brief discussion on their importance in the integration of project management.

The dissertation is organized in five main chapters: Literature review (2), Objectives and Methodology (3), Results (4), Discussion of results (5), Conclusions (6). In the Chapter 2, several themes are addressed to support and justify all the work performed in this

thesis: the evolution of sustainability (2.1), the need for action (2.2), sustainability dimensions and SDGs (2.3), sustainability in the organizations (2.4), sustainability in project and in project management (2.5), and sustainability evaluation (2.6). In the Chapter 3, the general and specific objectives of this work will be defined, as well as all the methods used will be described. In Chapter 4 the results will be presented, namely the total number of KPIs obtained for each of the approaches used and their relationship with sustainability dimensions, SDGs and activity sector. In Chapter 5, the results will be discussed in the light of current literature and the global world context. Finally, in Chapter 6, the main conclusions will be draw and it will be presented potential future work.

Chapter 2

Literature Review

This section will present the main topics that support the dissertation thematic, starting by describing 2.1) the evolution of sustainability, 2.2) the need for action in the actual world context, 2.3) the sustainability dimensions and the Sustainable Development Goals (SDGs), 2.4) the sustainability in organizations, 2.5) the sustainability in projects and in project management, and 2.6) the evaluation of sustainability in projects.

2.1 The evolution of sustainability

The word 'Sustainability' comes from latin word '*Sustentare*', which means to hold, to support, to conserve and to care. The sustainability concept has been evolving through time. The first concerns regarding natural resources and its use date back to the early 18th century (Carlowitz, 1713). Malthus (1798), in 1798, despite not talking about sustainability as a whole, published his essay in which he set out his ideas and concerns about the growth of the planet's population and the fact that this growth was potentially exponential, while food production grew only arithmetically, which in the long term would cause a shortage of food and, as a consequence, hunger for a large part of the human population. These predictions, although they did not fully materialize, show a concern with the limits of the planet's resources, particularly in the capacity for food production. Only later, in the 20th century, did more attention and emphasis on sustainability appear again. By the 1960s and 1970s, organizations began to be aware of the impacts of their activities on the environment, due to pressure from local communities that began to suffer from the effects of pollution, and at this time legislation began to be implemented as a way to minimize the risks and impacts of industry (Vogel, 2005).

Still in the 1970s, Meadows and collaborators (1972), also called the Club of Rome, published a book called 'The Limits to Growth', based on the theories of Malthus, which again drew attention to the limits of the planet. In this book, they predicted that the growth of the human population and the world economy would lead to a breakdown in the capacity of the planet and its natural resources.

On the other hand, environmental disasters with major social consequences, from climate change, the ozone layer, the desertification, the famine crisis in Africa, to the pesticide dumping incidents in Bhopal (India) and the nuclear accident at Chernobyl in the former Soviet Union, led to the creation, in 1983, of the United Nations World Commission on Development and Environment, better known as the Brundtland Commission, named after former Norwegian Prime Minister Gro Harlem Brundtland's choice to head the Commission. It began to debate how, even with improved standards of living through industrialization, many countries were still dealing with extreme poverty. The results of economic development without taking into account the environment and social equity also began to be questioned, and it became clear that the strategy had to change, and a greater harmony had to exist between economic growth and prosperity and the environmental and social realm. Four years after the creation of the commission, the final report 'Our Common Future' (World Commission on Environment and Development, 1987) was released, which besides highlighting the negative environmental consequences of economic development and globalization, offers solutions to the problems arising from industrialization and population growth. In this report, they also defined the concept of sustainable development, which is still used today as a basis for defining strategies and improvement:

> "development that meets the needs of the present without compromising the ability of future generations to meet their own needs, ensuring a balance between economic growth, environmental care and social well-being," in Our Common Future, the so-called Brundtland Report

This evolution led in the late 1970s and early 1980s to the emergence of a culture of corporate responsibility, in which some organizations began to include sections on the environmental and social performance of the organization in their annual reports, thus recognizing that they have responsibility for the impacts that their activities may cause in these two dimensions (Robbins, 2001; Vogel, 2005). The factors that led to this change seem

to have been of various natures: (1) an increased awareness of the importance of reputation and how it can be damaged by poor social and environmental performance; (2) an increased demand for information about this performance by communities and consumers; (3) the growth of ethical or socially responsible investment in OECD countries (Marlin&Marlin, 2003).

Already in the 1990s, the International Institute for Sustainable Development, based on the Brundtland Report, proposed a definition applied to organizations, in which it refers to the role of stakeholders in promoting change and implementation for sustainable management in organizations: The adoption of business strategies and activities should meet the needs of organizations and their stakeholders today, while protecting and uplifting the human and natural resources that will be needed in the future (Deloitte, 1992).

In 1997, Elkington (1997) also reinterpreted the Brundtland Report and introduced the concept of the Triple Bottom Line (TBL), which contrasted with the well-known Iron Triangle proposed in the 1960s by Dr. Martin Barnes, whose mantra is 'on time, within budget, and according to spec'. According to the 3BL proposed by Elkington, companies would have to consider other bottom lines besides cost, time and scope for evaluating project performance, namely:

- Profit - the traditional measure of project financial performance and which answers the question: how responsible has the organization been in ensuring its competitive prosperity?
- People - a measure to account for the social side of the organization: how responsible has the organization been in impacting the quality of life of the individuals its activity affects?
- Planet - a measure to account for the environmental side of the organization: how environmentally responsible has the organization been in terms of its impact on natural ecosystems?

This concept allowed organizations to start thinking about how to incorporate sustainability into their activity and how to operationalize it taking into account the three pillars identified: economic sustainability, social sustainability and environmental sustainability. Elkington (1998) also reinforced the importance of creating partnerships and

close contact with the various stakeholders involved, as an essential way to achieve sustainability objectives. The TBL approach is one of the most used to address corporate sustainability, however it may overlook the corporate governance which is one of the crucial elements to achieve corporate sustainability (Al-Malkawi et al., 2014; Balachandran&Faff, 2015; Janssen et al., 2015). Through the years, academics and practitioners started to realize that having only in account the profit, people and planet dimensions was not enough, and added the corporate governance as key to enhance the long-term corporate value (Evans et al., 2007; Kolk, 2008). Hence, the quadruple bottom line (QBL) arose recently to define profit, people and planet in a purpose-driven way (Fig.2.1).

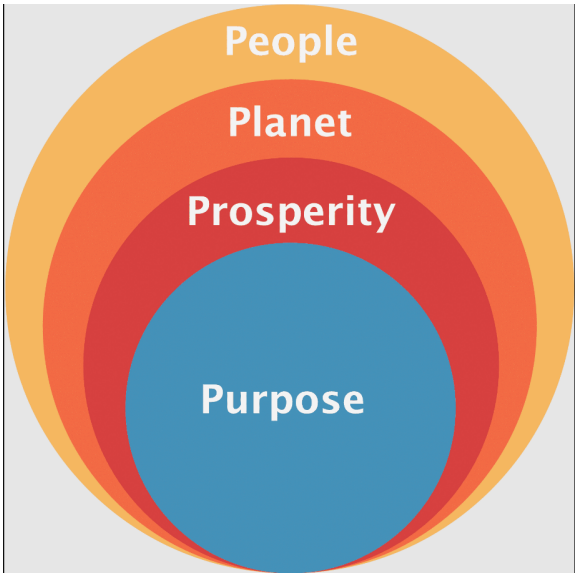


FIGURE 2.1: Quadruple bottom line. Source: GPM Website

In the context of organizations, the concepts of sustainable development and sustainability are beginning to be implemented in the context of Corporate Social Responsibility (CSR). Therefore, the International Standards Organization (ISO) 26000 ends up defining CSR as: the responsibility of an organization in the impact of its decisions and activities on society and the environment, through transparent and ethical behavior that contributes to sustainable development, that includes the welfare and health of society, takes into account the expectations of stakeholders, complies with the laws and standards in force, and is implemented in the organization and its relationships (International Organization for Standardization, 2010).

Sustainable development has been on the political agendas since 1972, with the first United Nations conference in Stockholm. In 1992, at the Earth Summit in Rio de Janeiro

(Brazil) came Agenda 21, an action plan to create a global partnership for sustainable development that seeks to improve the lives of human beings and protect the environment, and that more than 178 member countries adopted. Already in 2000, the United Nations organized the Millennium Summit, which resulted in the Millennium Declaration containing the 8 Millennium Development Goals (MDGs) to reduce extreme poverty by 2015. In 2002, there was a strengthening on Agenda 21 and the Millennium Declaration at the World Summit on Sustainable Development, organized in South Africa, resulting in a declaration with more emphasis on multilateral partnerships. At the United Nations Conference on Sustainable Development (Rio+20) in 2012, member states drafted and adopted 'The Future We Want' document, in which they decided to launch the process to develop a series of Sustainable Development Goals (SDGs) to address some of the shortcomings of the MDGs. In this document, they also established the UN High-level Political Forum on Sustainable Development and stated some measures for implementing sustainable development, particularly with regard to future financing. In 2015, the outcome of the working groups culminated in the adoption of the 2030 Agenda for Sustainable Development, which has at its core the 17 agreed SDGs. Today, the annual meeting of the High-level Political Forum on Sustainable Development serves as a United Nations platform for reviewing and monitoring the implementation of the SDGs (United Nations, 2020).

At the European level, in late 2019, the European Green Pact emerged as a roadmap for making the European Union's economy more sustainable. The actions in this roadmap aim to boost resource efficiency through the transition to a clean and circular economy, restore biodiversity, and reduce pollution. It also describes the necessary investments and available financing instruments and explains how to ensure a fair and inclusive transition. On the other hand, the EU aims to be climate neutral by 2050, so they have proposed a European Climate Act that turns political commitment into a legal obligation and an investment driver (Comissão Europeia, 2020b). Very recently, the EU Biodiversity Strategy 2030 was approved and released, which aims to protect and restore the natural resources of our planet (Comissão Europeia, 2020a).

Today, there is no doubt that the financial, social, and environmental sides are of extreme importance if humanity and the planet are not to be compromised in the future. The political agendas are moving in that direction, so organizations, and consequently their projects, will have to keep up. In fact, projects have been suggested as a mean to

achieve sustainable development.

As regards, in parallel with a worldwide view on the importance of sustainability, the perspective of the projectification of organizations, and even of society, has begun to appear.

The perspective of 'projectification' appeared in 1995 in a study about Renault and its transition from a highly bureaucratic format (classic functional) to a projectized format, more similar to what project management is today. Such a change led to profound and destabilizing effects on the permanent processes and logics of the organization, namely in task definition, hierarchical regulations, career management, and supplier relations (Midler, 1995). Midler also exposes how the time limit of a project poses challenges in permanent functions, such as bureaucracy. On the other hand, bureaucracy is pointed out as fundamental for a democratic society to function well and foster trust among its citizens (du Gay, 2000).

If we look at projectification in its most narrow sense, the focus is on how projects as a product and strategic unit influence organizational efficiency, innovation, and work patterns, drawing mostly on organizational theory, strategic management, and human resource management. However, if we look more broadly, projectification is more influenced by sociology and critical management studies, being especially focused on how the new knowledge-based and networking economy is understood as a threat or not to the fundamental hitherto taken for granted, due to its flexible and temporary nature (Boltanski&Chiapello, 2005).

Project management then emerges as the possibility to deal with the management of more complex tasks and objectives, as is the case of sustainable development. The idea is that sustainable development should be broken down into several projects, so that it can be managed using project management tools and techniques. However, some challenges to this trend arise, particularly in view of the different scales: a project is usually temporary and short, while sustainable development has a more permanent and long-term status. Flexibility in project-based organizations may be an advantage for addressing sustainability, but it can also represent a challenge, depending on the ability to manage change. The fact that the company constantly has to adjust to new knowledge, concepts and legislation makes it difficult to maintain focus. Another challenge that can arise is the coordination of resources between projects (cross-project), technical development, and learning, especially if the projects are not aligned with the business and organizational

strategies. Nevertheless, achieving sustainable development from projects has potential and is becoming a worldwide way of looking at the problem (Cerne&Jansson, 2019).

In 2009, it was founded a non-profit social enterprise called Green Project Management (GPM) organization, that advocates the integration of sustainability into the project management profession. This organization supports other organizations (companies and governments) to incorporate sustainability following methods based on principles and values that will have benefits for all the value chain. It also develops training, assessment, and certifications, based on the principles for sustainable development, which are recognized by IPMA. It represents the first and unique organization, so far, that formally and structurally integrates sustainability into project management practice. In 2013, GPM became the first PM organization to be a signatory of the UNGC (UN Global Compact) from the profession, taking part in UN Global Compact Leadership summits, championing initiatives such as Caring for Climate and attending to COP21 and COP22. It also advocated for project management in business forums, Business4Pease and the Anti-Corruption Call to Action. This present year (2022), this organization closed a partnership with PMI, which reveals that sustainability is becoming more than a trend in project management, and it is becoming a real need and a new competence to achieve as project managers. GPM turns out to be the reference to sustainable project management.

In summary, the concept of sustainability has evolved over time, as has its importance. Today, there is an urgency for transformation towards sustainable development, and this urgency is implicit in society's opinion, political agendas, applicable regulations and investment funds. This requires organizations to adapt and incorporate sustainability principles into their strategies. On the other hand, there has been a projectification of society, which leads to projects being seen as the main way to implement these strategies and achieve the goals for sustainable development. Thus, project management and, more specifically, the incorporation in project management of methods and metrics for the assessment of project sustainability becomes essential for the implementation to be effective and measurable.

2.2 Sustainability dimensions and Sustainable Development Goals

From the previous sections, it is possible to understand that sustainability is urgent and requires a more holistic approach that considers the environmental, social and economic

dimensions, and recognizes that only by considering these dimensions together can long-term prosperity be achieved. Thus, it is important to understand what each dimension incorporates in order to understand its relationship with the Sustainable Development Goals (SDGs) and to better gauge evaluation metrics.

The environmental dimension should conserve and manage natural resources, especially those that are non-renewable or that are fundamental to life support. To this end, actions should be implemented to minimize negative impacts on the atmosphere, water and soil, preserve biodiversity, protect and improve the quality of the environment, and promote responsible production and consumption.

The social dimension should respect human rights and equal opportunities for all individuals in society, promote a more just society, with social inclusion and equitable distribution of goods, with special focus on the elimination of poverty. The cultural diversity of local communities should also be recognized and respected, avoiding any form of exploitation. Policies should also promote decent working conditions and access to health care for all individuals equally.

The economic dimension is the one that causes less strangeness, because it is the usual way that organizations have to evaluate their performance. It refers to the efficiency of economic activity, which includes the viability of organizations and their activities in creating wealth and increasing economic performance.

The Sustainable Development Goals (SDGs) represent the global priorities for the United Nations' 2030 Agenda for Sustainable Development, signed by more than 190 countries in 2015 (Fig. 2.2). The SDGs succeed the Millennium Development Goals (MDGs), broadening the challenges to be addressed and encompassing a wider range of interrelated topics across the three dimensions: economic, social, and environmental. They define global priorities and aspirations for 2030 and require worldwide action by governments, businesses, and civil society to eradicate poverty and create a life of dignity and opportunity for all, within the limits of the planet (United Nations, 2015).

The 17 SDGs comprise 169 targets that seek to direct focus and guide strategies towards areas of utmost importance to humanity and the planet:

- People: End poverty and hunger, in all its forms and dimensions, to ensure that all human beings can reach their potential with dignity and equality in a healthy environment

FIGURE 2.2: Sustainable Development Goals (SDGs)

- Planet: Protect the planet from degradation, including through the promotion of sustainable production and consumption, better management of natural resources, and by putting climate change as a focus for action, so as to support the needs of the present without compromising future generations
- Prosperity: Ensuring that all human beings can lead prosperous lives and that economic, social, and technological progress occurs in harmony with nature
- Peace: Promote peaceful, just, and inclusive societies, free from fear and violence
- Partnership: Mobilize the means necessary to implement the Agenda through a revitalized Global Partnership for Sustainable Development, based on the spirit of global solidarity, addressing in particular the needs of the poorest and most vulnerable, and with the participation of all countries, all stakeholders, and all people.

2.3 The need for action

The need to implement sustainability measures has become increasingly urgent and essential due to several global factors.

The first factor is the climate change. It is unanimous and all scientific evidence proves the existence of this phenomenon. The warming of the Earth is unequivocal, and since the 1950s many of the changes observed are unequaled by any other period in history. Atmospheric and ocean temperatures have increased, glaciers and snow cover have been decreasing, and sea levels have been rising. Note that global warming refers to the average

warming of the entire Earth, and locally what we are seeing is an increase in the frequency of extreme weather events, such as more floods, colder winters, or hotter summers. The emission of greenhouse gases caused by human activities has been increasing since the industrial age, along with the large economic and population growth that has occurred (IPCC, 2014). The effects of climate change are varied and with potentially severe social and environmental impacts that put the system as we know it at risk (Fig. 2.3).

FIGURE 2.3: Some of the effects of climate change. Source: BCSD website

The second factor is the environmental degradation and loss of biodiversity (Fig. 2.4). Nature is being impacted in a way that has never been seen before, with the world's wildlife population declining by 60% in the last 40 years and with one million species at risk of extinction. This loss of biodiversity is a consequence of climate change (interconnected and mutually aggravating phenomena), the overuse of natural resources, and the impact of human development, globalization, and urbanization. Unlike climate change, whose acceptance began to gain some prominence some time ago, biodiversity loss has always remained somewhat on the sidelines, only very recently appearing in the EU Strategy as a focus (Comissão Europeia, 2020a). Biodiversity is, indeed, essential for life, and the entire planet, as well as the economy, depends on it. Ecosystems allow us to have food, health, medicines, materials, and well-being. Some species filter the air and water we need, help maintain a balance essential to our survival, convert waste into resources, pollinate and fertilize crops, among many other services they provide us with and that we benefit from without often realizing it (Balvanera et al., 2017). It is important to note that almost half of the world's GDP (about 40 billion euros) depends on nature and its

resources. The three largest economic sectors that depend on nature are Construction, Agriculture, and Food and Beverage, and together they generate more than 7 billion euros. Therefore, the benefits of biodiversity to the economy are many, such as increased annual profits for the marine industry from conserving marine stocks and savings to the insurance industry from reducing flood damage by protecting coastal wetlands. The economic and social costs of inaction on environmental and climate issues would be very large, leading to a reduction in average EU GDP of up to 2% and perhaps even more in some parts of the EU (World Economic Forum&PwC, 2020).

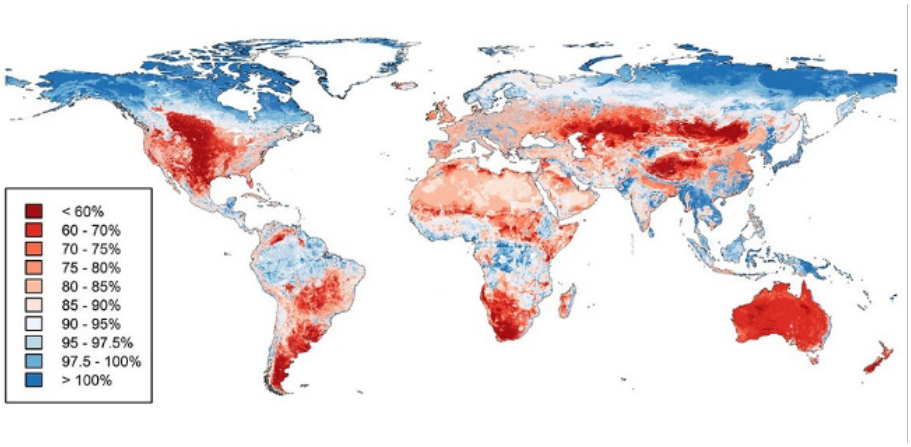


FIGURE 2.4: Biodiversity decline all over the world. Source: www.nhm.ac.uk

The third factor is over-consumption of natural resources. Today, we would need 1.81 planet Earths to sustain the life style we have (The World Counts, 2020). This means that we are over-exploiting natural resources and services in a rate that nature cannot regenerate and renew. As an example, one of the continuous demands is on energy. The rapid urbanization and migration from rural to urban areas, as well as industrialization has led to an increase in these needs. Much of this energy comes from non-renewable resources which could lead to a resource crisis, an increase in pollution levels and greenhouse gases (increasing climate change), if nothing is done to change (WWF, 2018). At least in Portugal, this trend seems to be changing, with most energy coming from renewable energies such as wind power, hydroelectric power, biomass, and photovoltaic. According to REN, by 2021, renewable energies supplied 59% of Portugal's electricity consumption. However, it is unquestionable that we still have a long way to go to reach responsible consumption.

The fourth factor is related to increasing poverty and inequality. There is growing inequality in developed and developing countries (Fig. 2.5). More than two-thirds of the

world's population live in countries where inequality is rising and the impact is felt at both a personal and national level. This can increase divisions and slow down economic and social development (Department of Economic and Social Affairs, 2020). This trend is mainly due to technological innovation, climate change, urbanization and international migration. Another report states that in the reality of 101 countries, at least 1.3 billion people are 'multidimensional' poor (poverty is not only a result of income, but also other indicators such as poor health, poor working conditions and threat of violence), with 886 million living in middle income countries (Alkire et al., 2019).

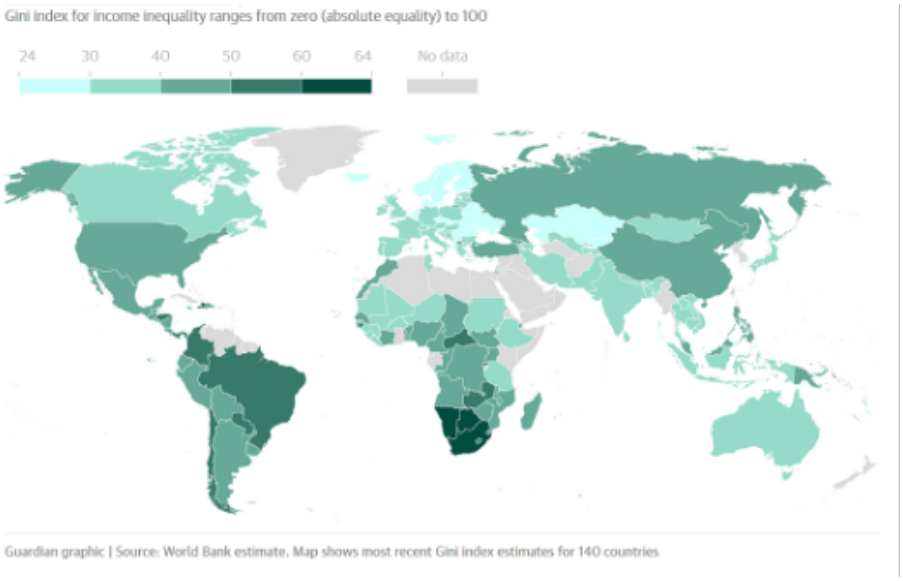


FIGURE 2.5: Map reflecting the inequality of incomes through the world regions. Source: www.theguardian.com/inequality

The fifth factor is the exponential population growth with projections estimating an increase from 7,6 billion to 10 billion by 2050 (Baillie&Zhang, 2018), with the recent news announcing the reach of 8 billion by November this year. This continuous exponential growth is unbearable in a finite planet with limited resources (Czech, 2013), and contributes for the worsening of many other factors here described (over-consumption of natural resources, climate change, major decline of biodiversity, poverty and inequality) and others such as ocean acidification, decline on potable water, disease outbreaks and pandemics, that interplay among them increasing the unsuitability of life on Earth for humans and all present biota (Lidicker, 2020; Ripple et al., 2017). This is a major highlight done by scientific community, yet society is still ignoring it due to several reasons, such as: i) economies are sustained by population growth, so policies are pro-child in most of the countries, ii) 'more people' as a concept has always been seen as a 'good thing', iii)

religious beliefs that are against the use of contraceptives of any kind, iv) there is a conflict of rights – the individual right of the individual to reproduce and the right of other species to continue to exist (Washington et al., 2020). Solutions, pointed as non-coercive, to stabilize populations have been proposed based on scientific evidence that they actually work to decelerate population growth. Some of them are: i) assure universal access to a range of safe and effective contraceptive options and family planning services for both sexes, ii) guarantee education through secondary school for all, with a particular focus on girls, iii) put prices on environmental costs and impacts, iv) adjust population aging rather than trying to delay it through governmental incentives or programs aimed at boosting childbearing, v) convince leaders to commit ending population growth through the exercise of human rights and human development(Engelman, 2011). To limit the human population growth is one the more important and key factors to achieve an ecologically and socially sustainable future, preventing the ecocide (ecological genocide) (Washington, 2019).

In AXA's latest report (Ipsos&Eurasia Group - Politics first, 2021), climate change appears as the most emerging risk identified by the experts (Fig. 2.6), reflecting its growing importance for organizations and their strategies. While natural resources and biodiversity risks were neglect on the last reports, in the latest these risks appear in 6th place (out of 10), which support the urgent need for action on these areas in order to compensate the complete unawareness of the previous years. Inequalities and poverty can be implicit in several identified risks, from geopolitical instability and social discontent and local conflicts, to financial stability risks. Geopolitical instability due to the war in Ukraine will definitely have a great impact at all three levels (financial, social and environment), with a special reflect on increasing the inequality, poverty, and other social problems, all over the world.

In addition to using experts, the AXA working group also conducted an online survey to assess the trend of concerns by the general population (Fig. 2.6). Pandemics and climate change appear as the processes of greatest concern, while geopolitical instability and chronic illnesses as the ones of least concern. When comparing the experts and the general population answer, we can see that most of the risks are identified by both communities although in a different degree of concern. Pandemics is clearly still the primary big concern for general population, which is completely justified by the still present Covid-19 effect on daily life for many people and reinforces the populations attitude for the prioritization of health risks over the environmental one. The experts can understand

Top 10 risks according to experts and to the general public in 2021

	Experts	General Population
1st	Climate change	Pandemics and infectious diseases
2nd	Cybersecurity risks	Climate change
3rd	Pandemics and infectious diseases	New security threats and terrorism
4th	Geopolitical instability	Cybersecurity risks
5th	Social discontent and local conflicts	Pollution
6th	Natural resources and biodiversity risks	Social discontent and local conflicts
7th	New security threats and terrorism	Natural resources and biodiversity risks
8th	Financial stability risks	Financial stability risks
9th	Macro-economic risks	Geopolitical instability
10th	Risks related to artifical intelligence and big data	Chronic illnesses

FIGURE 2.6: Top 10 risks according to experts and to the general public in 2021. Source: Ipsos & Eurasia Group - Politics first, 2021

that those two are correlated, and therefore, they prioritize climate change. Both communities differ in two risks: general population identified pollution and chronic illnesses; experts identified macro-economic risks and risks related to artificial intelligence and big data. These differences probably reflect the level of overall knowledge and how the risks are related to each other.

In summary, the recent past taught us that in a matter of weeks or even days the reality can change a lot, which reflects the need for organizations to adapt quickly and flexibly to this changing world, incorporating best practices and mitigation measures applied to sustainability and in a sustainable way.

2.4 Sustainability in the organizations

Sustainability is growing as a priority subject in political agendas, regulation, investment funds and in the society opinion, which puts pressure under organizations to have more sustainable practices (Marlin&Marlin, 2003; Toljaga-Nikolić et al., 2020). It became evident that the economic growth alone will not solve the complex social and environmental problems that society faces nowadays, and a change is needed (DesJardins, 1998).

The mutual dependence of organizations and society demonstrates that decisions should follow the principle of shared value, where choices benefit both sides. All stakeholders must be taken into account: suppliers, shareholders, customers, partners, activists, unions, employees, community members, and governments; and value must be generated for all, so organizations must not only take into account their financial performance and value delivery, but also their sustainable performance, in order to encompass maximum value for all stakeholders (Shaukat et al., 2016; Shaukat et al., 2021). Corporate sustainability is, thus, the ability of a company to manage its activity and create long-term value while creating social and environmental benefits for its stakeholders.

In the last 50 years, corporate sustainability has evolved and organizations are becoming aware of its importance and the need to move from a traditional financial system, to one in which there is an assessment of performance in the three dimensions of sustainability purposed by the TBL: financial, environmental and social, as previously mentioned (de Lange et al., 2012; Gladwin et al., 1995).

The Social and Ethical Responsibility of organizations has been the main way in which they try to implement the necessary sustainability measures. This has proven to be insufficient and performance metrics have been encouraged through monitoring and reporting of results (de Lange et al., 2012). One problem may be the organization incorporating these metrics and measures voluntarily and permanently, as one study seems to point out that the main driver promoting this change in companies is regulation/legislation (Dummett, 2008; Kim et al., 2017). However, in that same study, other drivers such as reputation protection and champion stance, may also contribute to this change. Dummet (2008) was also able to perceive that if organizations are involved in discussions about the regulation to be developed, they will be more willing to then implement it in the best way possible. Tulder and colleagues (2013) identified two basic attitudes from the organizations: i) "liability" – legal frameworks and the avoidance of legal claims are the main drivers to guide business behavior; ii) "responsibility" – corporate leadership understands that its

own responsibility to take initiatives to compensate corporate strategies. This has obvious implications on how these two different organizations will implement sustainability and how much they will be committed to achieve it in a long-term and not dependent of external pressures.

The 2019 BSR/Globe Scan 'State of Sustainable Business' report revealed that sustainability is a top-priority for corporate CEOs, being climate change the factor with higher concern (BSR/GlobeScan, 2019). This CEOs interest in sustainability is then considered as an important driver for sustainable efforts, potentially enabling the attitude shift needed towards owning responsibility of having sustainable businesses.

Although sustainability has somewhat a long history, its application on the core of organizations and businesses is still on the embryonic stage. The SDGs came to provide a stronger basis for the overall framework to guide, communicate and report on organizational strategies, goals and activities, which will allow organizations to capitalize on a number of benefits (Fig. 2.7), such as:

- Identify future business opportunities, in growing markets that could benefit from innovative solutions;
- Enhancing the value of corporate sustainability through economic incentives for more efficient resource use and internalization of externalities;
- Strengthen relationships with stakeholders and keep pace with the development of public policies, anticipating the management of legal and reputational risks;
- Stabilize societies and markets, safeguarding business success in thriving societies with regulated markets, transparent financial systems, and non-corrupt and efficiently managed institutions;
- Use the same language and a common purpose for more effective communication with stakeholders about their impacts and performance (BCSD, 2020b).

A 2017 report (Frost&Sullivan&Global Scan, 2017) revealed that in just over a year, many organizations have embraced the SDGs in their strategies, documenting how they are aligned with the organization's values and how they can lead the organization to achieve benefits. However, all leaders agree that they cannot make the change alone, and that governments and other multilateral institutions will have to serve as facilitators of partnerships and collaborations. Governments and multilateral institutions, on the other

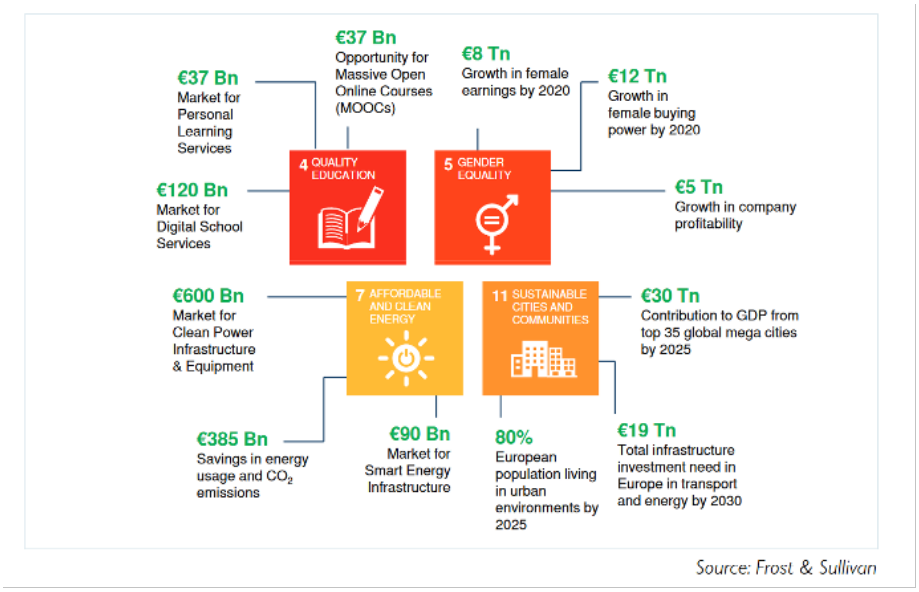


FIGURE 2.7: Business opportunities example for 4 selected SDGs, taking into account economic value

hand, should promote and educate the general public and companies about the SDGs, so that the whole society is aligned with the same purpose and companies can communicate their strategy more effectively. Additionally, governments, including more local ones, should share tools and resources that organizations can use to prioritize and operationalize the SDGs, as well as implement policies and regulations, and promote funding that directly links organizations to the SDGs. For their part, organizations will need to make the effort to communicate effectively internally to get the message of the SDGs, their benefits and rationale across.

In Portugal, the BCSD - Business Council for Sustainable Development (BCSD, 2020a) has as its main function the monitoring of organizations in their journey towards sustainable development, having on its website several resources and case studies that can be consulted. One of them is the so-called SDG Compass, which aims to guide companies on how they can align their strategy and measure and manage their contribution to the SDGs (GRI et al., 2020). In general, it guides companies through five steps, which broadly reflect how organizations should look at the SDGs and incorporate them into their strategies:

- Step 1: Understand the SDGs - companies are supported to become familiar and knowledgeable about the SDGs;

- Step 2: Set priorities - companies are encouraged to set their priorities based on an assessment of their current and possible positive and negative impacts on the SDGs along the entire value chain; it is expected that this will enable companies to identify business opportunities and reduce risks;
- Step 3: Set goals - goals are especially important in business success, so aligning company goals with the SDGs, sealing management's commitment to sustainable development, is essential;
- Step 5: Report and Communicate - companies should report on sustainable development through common indicators and shared sets of priorities, using these indicators to communicate with their stakeholders.

Recently, another initiative was created in Portugal, act4nature Portugal, which challenges companies to protect, promote and restore biodiversity. Biodiversity loss is a serious problem that has been overlooked by the main policies and agendas, and this has changed with the new strategy. Thus, this initiative intends that companies commit to biodiversity, integrating in their business models actions and solutions for the conservation of biological diversity, for its restoration, for the sustainable use of natural resources, and for a fair and equitable distribution of the benefits that result from this use. The adhesion of the companies to this initiative is based on the subscription of 10 common commitments of a set of individual SMART commitments, so that the companies can better integrate the various objectives.

The journey of organizations, in general, can be represented by a continuum, which leads to the maturity of the organization in implementing sustainability (Fig. 2.8). The exposure phase includes measures such as energy savings and the selection of sustainable projects. The integration phase begins to take a more holistic approach to sustainability, where the organization begins to understand how to integrate sustainability into the business strategy. The transformation phase culminates with sustainability as part of the organization's strategic vision, its integration into programs and projects, and as part of all decisions, processes, and success metrics (Kohl, 2016).

In short, the strategic alignment of the whole society, namely organizations, is indeed essential to achieve the SDGs in the long term. Article 67, agreed by all 193 UN member states, reinforces the importance that organizations have in solving today's challenges:

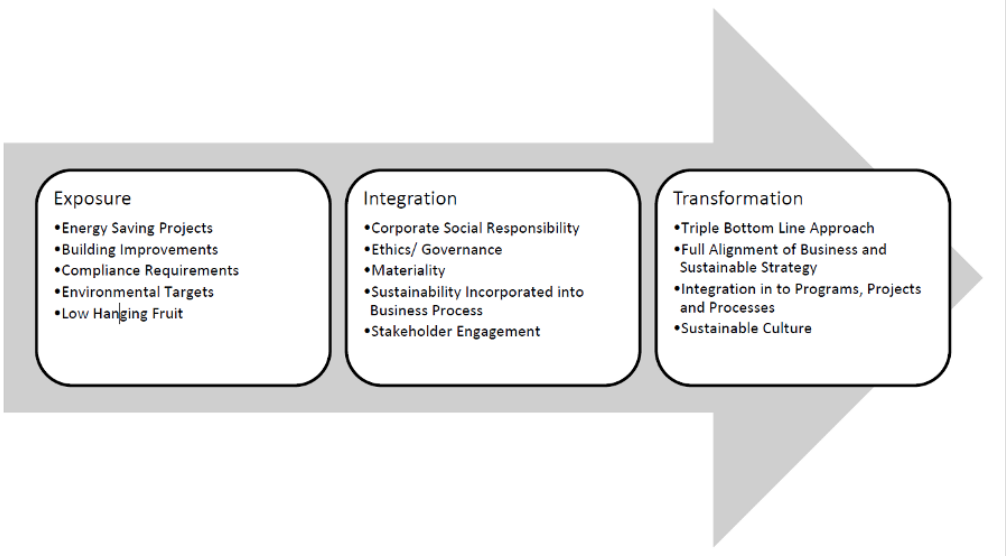


FIGURE 2.8: Example of a journey continuum for the sustainability achievement in organizations (Kohl, 2016)

"Private business activity, investment and innovation are among the most important drivers of productivity, inclusive economic growth and job creation. We recognize the diversity of the private sector, from micro-enterprises to cooperatives to multinationals. We urge businesses to apply their creativity and innovation to solve sustainable development challenges." in Agenda 2030

2.5 Sustainability in Projects and in Project Management

2.5.1 Sustainable Project Management as a discipline

Considering political agendas, investment decisions and the pressure for companies to change the way they are and carry out their activities, it can be observed that sustainability is something that has become a major focus in strategy definition, and that without its incorporation organizations may be doomed to failure, either by lack of investment or by a decrease in reputation.

As already mentioned, from an organizational point of view, sustainability involves adopting business strategies that meet the needs of the organization and its stakeholders today, while protecting the human and natural resources that will be needed in the future

(Deloitte, 1992). In parallel with the trend towards making organizations more sustainable, there has been an increasing trend towards the projectification of society, with economic activity increasingly determined by projects, which in turn is beginning to highlight the discipline of project management allied to sustainability - Sustainable Project Management - and how it can be the means to achieve sustainability in organizations.

Until recently, project management and projects were seen as an island in the middle of the organization, where the project has a beginning and an end, focusing on assessing risks that impact the project implementation itself and not on the risks it may have on external communities or even the organization's reputation. However, as mentioned in the previous sections, there is pressure to address sustainable development issues, and more and more businesses are or have global concerns in an ever-changing world. This implies that project management has to adapt, and projects have to be more oriented to the business and organizational contexts, and not only focused on the project itself.

Studies suggest that the incorporation of sustainability in project management can help deal with the complexity of projects, reduce crisis situations in the project, cancellations, and interruptions and, similarly to the benefits for organizations, it allows creating a competitive advantage and obtaining economic benefits (Gareis et al., 2010). Such benefits help to improve the project performance itself, since the reduction of risks by considering all the external environment to the project, ensures that the project manager and the organizations will be more prepared to deal with changes.

It is noticeable that sustainability, although it does not yet have a prominent place when compared to the Iron Triangle (time, cost, scope and quality), is already found in the codes of professional ethics and conduct (APM, 2020; IPMA, 2020; PMI, 2020) as something to be taken into account. In PMI's, for example, it reads 'As active professionals in the international project management community: We make decisions and act in the best interests of society, public safety and the environment', as a desirable standard in the Project Manager's conduct. However, the most widely used standards for project management have not yet put in a clear and integrative way the association between sustainability and project management (Eid, 2009; Gareis et al., 2010), and in fact in one of the most widely used worldwide such as the PMBOK has no emphasis on sustainability at all. IPMA, in its last version of Individual Competence Baseline version 4, refers the inclusion of the indicator "Identify and ensure that the project complies with relevant sustainability principles and objectives" and mentions that the project manager is

the responsible for assessing "the impact of the project on the environment and society". But only GPM has the sustainability on its standard core and even developed a methodology to fully integrate the different sustainability components into the project management practice (Carboni et al., 2018; GPM Global, 2019), however is still not very known and used by project management practitioners and discussed by academic researchers. Recently, an ERASMUS+ called ThinkTwice created a platform of best practices regarding the ecological sustainability in project management of European funded projects, that can provide some guidance on what to have in consideration regarding sustainability (https://thinktwice.management/).

One of the things that is maybe holding back the incorporation of sustainability into practice is the clash between the temporary nature of projects seems to be contradictory to the long-term orientation of sustainability (Fig. 2.9). Furthermore, sustainability takes into account the present generation and future generations, whereas project management usually takes into account the stakeholders most directly interested in the project. All of these differences add complexity to project management, yet the literature and the practice both suggest that projects can help organizations achieve long-term goals. The truth is that these differences seem to be changing over time, with an increasing tendency to consider projects as a way to align the strategic vision of the company, and therefore begin to take a view beyond execution.

Sustainable Development	Project Management
Long-term/ short-term oriented	Short-term oriented
Considers the interest of this generation and future generations	In the interest of sponsor/stakeholders
Life-cycle oriented	Deliverable/results oriented
People, planet, profit	Scope, time, budget
Increasing complexity	Reduced complexity

Source: Silvius & van der Brink (2012)

FIGURE 2.9: Difference between the concepts of sustainable development and project management

Another issue could be of the dichotomy that the Sustainable Project Management arises (Huemann&Silvius, 2017). A project can adopt sustainable metrics across phases and processes, regardless of the end product of the project and/or aim to deliver something sustainable, regardless of the processes and means to get to the product. The difficulty in defining a definition may be related to the complex and multidisciplinary nature of project management itself (Sabini et al., 2019). Silvius&Schipper (2014) tried to capture that complex essence through the following definition:

> "Sustainable Project Management is the planning, monitoring and controlling of project delivery and support processes, with consideration of the environmental, economical and social aspects of the life-cycle of the project's resources, processes, deliverables and effects, aimed at realising benefits for stakeholders, and performed in a transparent, fair and ethical way that includes proactive stakeholder participation".

However, this definition created a misunderstanding because it seemed to exclude projects that have a sustainable product/service as final deliverable. Huemann and Silvius (2017) then clarified the concept of SPM, having in account the final deliverable and the project management processes, proposing two new concepts that are now overall accepted by the academic community:

1. Sustainability by the project: projects that deliver a sustainable good or service;
2. Sustainability of the project: projects delivered following sustainable processes.

GPM definition is concordant with the previous one, but with a practical focus: sustainable project management is the application of methods, tools, and techniques, to achieve a stated objective while taking into account the project outcome's entire lifecycle to ensure a net positive environmental, social, and economic impact (GPM, 2022).

SPM is an emerging discipline and, as such, there is still a lack of theorization and methodologies to apply. Only 1% of the articles contextualize the work along theoretical lines, which is also a result of the applied nature of SPM, which ends up being practice-oriented. In general, the authors use a more qualitative analysis of a case study, which is expected when the research lines are new and the concepts are not yet very clear. In addition, the authors use the concept of sustainability in a more general way and give suggestions and recommendations that are also general and applicable to any kind of project and circumstances. The construction sector seems to be the most advanced in terms of incorporating the three dimensions of sustainability, while private and public services tend to focus on the social pillar (Sabini et al., 2019).

Sabini et al. (2019) conducted a literature review where he attempted to group the research conducted over the past 25 years into three main questions:

1. Why adopt sustainable business practices in projects? - The value that sustainability brings to Project Management and reasons for its integration in creating value for organizations and society. Many of the articles seem to address this issue as a way

to justify the discipline. Some of the reasons are related to a moral imperative, organizational resilience, the economic prosperity of the organization, and long-term performance; being the economic performance the most frequent referred. Nevertheless, it was also shown that there are organizations adopting SPM only for ethical reasons, not needing the economic reasons as a driver for change. On the other hand, public opinion nowadays carries a lot of weight and is tending to require more and more sustainable organizations, and therefore there are also inherent motivations of reputation maintenance. Some authors point out that the integration of sustainability in the organization, as well as in its products, services and projects, makes organizations even distinguish themselves from their competitors. In general, the authors recognize that, despite all the short- and long-term benefits, its full implementation requires reviewing and changing practices and values, as well as creating a system for evaluation and continuous improvement.

2. What is the impact of sustainability in project management practices? - clarification and definition of the characteristics of SPM, through the operationalization of concepts, processes and models integrated in SPM. From the analysis made by the authors, all researchers point out a significant impact on the tools, techniques and methodologies already established in the field of Project Management. They identify the three levels on which the impact occurs: micro, project and macro, see detailed description on each on Fig. 2.10.

3. How can sustainability be incorporated into project management? - description and suggestions on how sustainability can be achieved in a project, usually applied to a case study. This narrative is related to the analysis, description and recommendations of concrete and practical mechanisms for SPM implementation. The authors here decide to divide the various contributions by considering the different project phases (initiation, planning, execution, and closure) individually, the project cycle as a whole, and stakeholder management.

Table 8
Impact of sustainability on traditional PM (WHAT).

To what extent does sustainability affect PM practices (the 'what' question)?		
Micro-level (individual)	Decision making	• Consider individual decision-making processes of the project manager (Silvius et al., 2017). • Discuss key factors for sustainability in PM context, through a project manager lens (Martens and Carvalho, 2017).
	Competencies	• Understand what competencies a project manager needs to develop to achieve sustainability: systems thinking competencies, anticipatory competencies, normative competencies, strategic competencies, interpersonal competencies (Silvius, 2016). • Develop and implement curricula that equip graduates with new sustainable professional capacities (Gaziulusoy and Ryan, 2017).
	Intrinsic motivation	• The project manager should be intrinsically motivated to work on a sustainable project and achieve sustainable results (Goedknegt, 2012).
Project-level	Trade-offs in objectives	• Introduce a methodology to identify, classify and prioritise sustainability indicators based on risk management standards (Fernández-Sánchez and Rodríguez-López, 2010).
	Obstacles & Ambiguities	• SOCIAL – e.g. the difficulty of involving local communities in rural development projects (Pade-Khene et al., 2011). • COGNITIVE – e.g. ignorance of the sustainability concept among project stakeholders (Al-Saleh and Taleb, 2010). • FINANCIAL – e.g. green construction methods are costly to implement (Hwang and Tan, 2012); – e.g. specific modifications to conventional building practices to optimize the delivery of cost-efficient green building projects (Robichaud and Anantatmula, 2010). • AMBIGUITIES - Present an ontology, which combined with social and environmental requirements, can assist constructors and other stakeholders to gain a better understanding of sustainability issues (Edum-Fotwe and Price, 2009).
	Areas to be changed	• Propose and validate a model for Project Sustainability Management (Carvalho and Rabechini, 2017). • Identify Critical Success Factors (CSFs) to properly integrate sustainability into project management practices of construction projects in developing countries (Banihashemi et al., 2017). • Framework to guide integration of sustainability issues in value management (Abidin and Pasquire, 2007). • Analyse how various approaches to stakeholder management and sustainable development principles are included in PM standards (Eskerod and Huemann, 2013). • Consider sustainability as a key factor to be included in project planning and implementation (Ebbesen and Hope, 2013). • Analyse PM problems posed by sustainability indicators (Sánchez, 2015). • Present a 5-step framework for integrating sustainability in the innovation project portfolio management process in the field of product development (Brook and Pagnanelli, 2014). • Identify relevant dimensions of sustainability and areas of impact of sustainability on project management (Silvius and Schipper, 2014b). • Provide a framework for integrating sustainability into project baselines for consulting engineering projects (Talbot and Venkataraman, 2011)
	Assessments	• Identify control practices that organizations can use for SPM (Kivilä et al., 2017).
Macro-Level (entire project environment)	Long term considerations	• Show the level of integration between sustainability and project management through a literature review (Marcelino-Sádaba et al., 2015). • Suggests that sustainability should be considered a new school of thought project management discipline (Silvius, 2017). • Suggest a conceptual system to measure and control companies' behaviour to assess whether they are responding to stakeholder concerns effectively (Perrini and Tencati, 2006). • Policy framework to improve the contributions of projects to sustainable development (Gregersen et al., 1994).
	Systemic knowledge gaps	• Integrate, by identifying knowledge gaps, environmental dimension into the project management of new products to increase the effectiveness of eco-design (Brones et al., 2014). • Need to embed sustainability within value management practices in Gulf Cooperation Council countries (Al-Saleh and Taleb, 2010).

FIGURE 2.10: Impacts of the integration of sustainability in project management practices (Sabini et al, 2019)

Sabini and colleagues (2019) further identified the problems of the SPM discipline, namely:

1. Not having one definition of SPM can cause a lack of understanding among the project management community and researchers themselves, as well as make studies incomparable and make the SPM discipline very fragmented;

2. SPM has been seen as a new requirement to be integrated into project management as well as into existing frameworks. However, there is still a lack of critical thinking and problematization of the discipline, necessary for the development of the discipline and further integration into more robust frameworks. It is important to

understand if the suggested methodologies and best practices contribute to the constructive debate in the area or if they only represent a resolution of the difficulties encountered in practice. This, relates to the dichotomy presented earlier that between project management practices and project deliverables. Practices can be considered 'doing things right' (taking into account long-term goals and sustainability present), while deliverables represent 'doing the right thing'. The major challenge for SPM will be to be able to reconcile doing things right with doing what is right in order to achieve the ultimate goal of sustainable development;

3. There is a lack of connection between academia and the practical world of projects. While most of the literature has practical implications for managers, the real world of projects is moving faster, and implementing its own solutions and procedures.

Another review, by Armenia and colleagues (2019) reinforces that research and interest in this discipline has increased, but that most studies are isolated, which makes it difficult to define it. On the other hand, it confirms that there is a positive trend towards the integration of sustainability in project management, considering it a natural evolution of project management, although, again, they denote a difficulty in integrating the three pillars in a balanced way.

2.5.2 Role of the project manager

The Project Manager appears as one of the most influential roles in transforming projects and project management to a more sustainable perspective (Silvius et al., 2012), and thereby influencing change in the organization itself.

As mentioned earlier, according to the codes of ethics (e.g., PMI, 2020), the project manager will have to make decisions and take actions taking into account the interest of society, public health, and the environment, which makes sustainability already implicit in their responsibility, although most do not give it the emphasis intended with sustainable project management (Silvius et al., 2012).

Traditionally, the project manager is positioned in a more subordinate way to the project sponsor and manages projects taking into account scope, stakeholders, deliverables, budgets, risks and resources, over the stakeholders' requirements. However, a change in this view should occur so that the project manager can position himself as a partner of all stakeholders and thus take responsibility for guiding and implementing

sustainability in projects, project management and organizations (Tharp, 2012). In this new form, the sponsor is not the only responsible for the changes that projects may promote, being this shared with the project manager and other stakeholders.

In general, the sustainable project manager must recognize the negative and positive impacts of the project on society and the environment, and take responsibility for minimizing the negative impacts while promoting the positive impacts, such as ethics and transparency (Silvius&Schipper, 2014).

The implementation of sustainability requires new skills and behaviors within organizations, so there is a 'soft side' associated with sustainability (Brones et al., 2017). In a study on project managers' intention to steer their management towards a more sustainable way, the results reveal that this intention is influenced by a combination of 'hard' (e.g. opportunities derived from sustainability and expected benefits) and 'soft' (e.g. personal and moral convictions) factors (Silvius&de Graaf, 2019). More specifically, they identified four main factors that influence the project manager's intention to be sustainable and to present this perspective to project and organizational hierarchies: Personal Ability and Moral Guidance, Potential Benefits and Organizational Fit that influence positively, and Potential Risks that influence negatively. In another study, Silvius&Schipper (2020) refer that studying the human behavior of the project manager can complement SPM literature by providing an individual perspective to it. Doing so, these authors identified three main factors by which the project managers are influenced: i) intrinsic motivation – will to address sustainability that comes from the personal principles, ii) compliance – task-driven managers which are driven to comply with projects' assignment and the opinion of others; iii) pragmatism – not strongly self-motivated for sustainability but will address if they see the benefits of it.

When searching for the project managers perception of sustainability, Magano and colleagues (2021) found that, surprisingly, most of them are able to perceive the contribution of project management to a more sustainable society when linked to the project processes, but not so much how projects can play a role in changing organizations and society toward sustainability.

Another human-related factors that Sabini and Alderman (2021) found to be important to know, in order to achieve a better management of the inherent paradoxes created by SPM, are the potential tensions project managers are subject due to trade-off decisions on sustainability related objectives, such as diverse temporal dimensions of sustainable

objectives, the presence of organizational barriers or the lack of control. They conclude that addressing sustainability is "a balancing act between priorities and concerns of different stakeholders".

Project managers are well trained in the methodologies and techniques for project management, namely developing detailed project plans, managing complex projects, establishing metrics, performance, delivering projects on time and within budget, and communicating progress to various stakeholders. This firm project management framework, coupled with the ability to identify business benefits in projects, gives the project manager the credibility and competence to lead the change to sustainability (Kohl, 2016).

2.5.3 Proposed frameworks by the literature review

In this section, I will present four of the many frameworks found in the literature on how to incorporate sustainability into project management practices. I selected these based on the different inputs they give to the discipline.

Armenia and colleagues (2019) propose a conceptual framework, based on five dimensions – corporate policies and practices, resource management, life cycle orientation, stakeholders' engagement and organizational learning - that emerged from the review of the various articles analyzed, which somehow helps to direct the incorporation of sustainability in project management; being the most relevant dimension the Stakeholder Management (Fig. 2.11).

Larsson and Larsson (2020) proposed another framework in the scope of a Swedish project, and another dimension emerged, namely collaboration and its importance across all five suggested dimensions. The duration of collaboration will influence the capacity for organizational learning, as it facilitates the shift of focus from projects to processes, which promotes continuous improvement. The intensity of collaboration is important for joint problem solving and in planning. Deep and comprehensive collaboration is important for stakeholder management, revealing that the involvement of the lower levels of the organizational hierarchy that contribute to the production and implementation of the project and its deliverables is crucial for the implementation of sustainable project management practices. Another conclusion of this work is that the choice of procurement strategy and contract models can also affect the degree to which sustainability is considered.

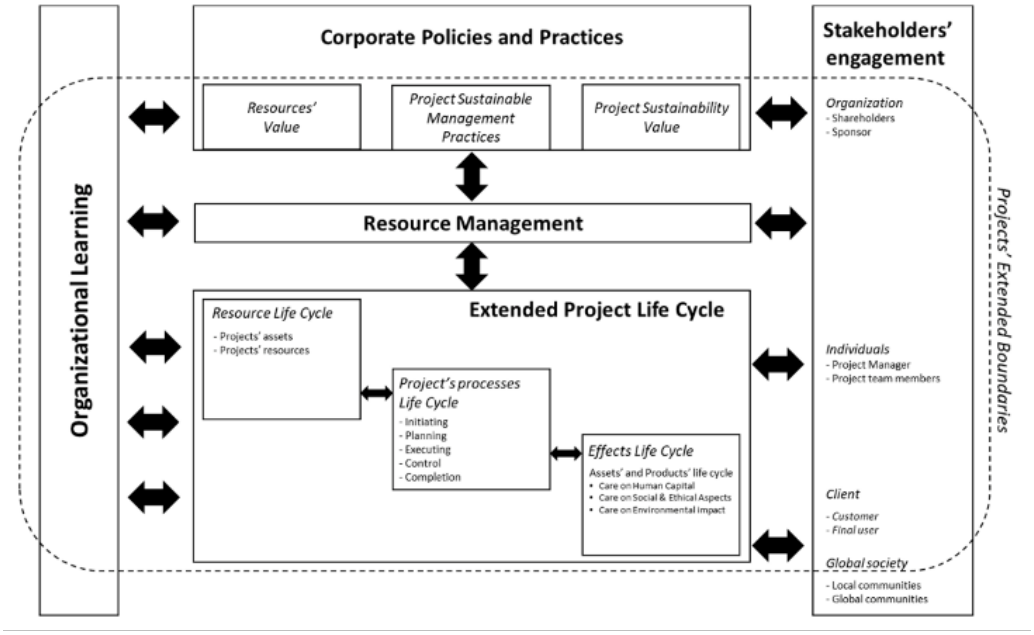


FIGURE 2.11: Proposed SPM framework by Armenia et al. (2019)

Most of the frameworks focus on the integration of sustainability principles and concepts, as the two presented ones, but there is still lacking the alignment between the project management and higher levels, such as portfolio management and organizational strategy (Silvius&Marnewick, 2021). The following frameworks try to address this issue on their proposed frameworks.

Sankaran and colleagues (2021) describe all the history of projects and project management from pre-history until the XXI century. Based on analyzing the history and the changes observed to adapt to new contexts, they argue that the SPM discipline has evolves as a transition innovation that can meet the challenges of sustainable development. Therefore, they purpose a framework to enable project management researchers and managers to achieve this transition. They suggest that an assessment sustainability principles and corporate social responsibility should be the first step. The second is to incorporate those into the governance of the project, promoting their embedding in the projects, roles and policies governing the projects. This is expected to thrive SPM all along the project execution, bringing the organizational, societal and ecological benefits at the end.

Silvius and Marnewick (2021), on the other hand, argue that linking the organizational strategy, project portfolio management and project management through sustainability implies more than adding a content dimension to it. Hence, they propose a framework based on three main dimensions – process, impact and competence – and that provides

guidance on how to deeper implement sustainability into organizational practices having in account the different levels (Fig. 2.12).

Interlinking dimensions		Interlinking practices On the level of organizational strategy	On the level of project portfolio management	On the level of project management
Impact	Economic impact	Recognition of material economic impacts, with specified goals for improving positive impacts while reducing negative impacts.	Alignment, prioritization, governance and evaluation of projects based on economic strategic goals.	Consideration of economic impacts in project business cases, plans and progress reports.
	Social impact	Recognition of material social impacts, with specified goals for improving positive impacts while reducing negative impacts.	Alignment, prioritization, governance and evaluation of projects based on social strategic goals.	Consideration of social impacts in project business cases, plans and progress reports.
	Environ-mental impact	Recognition of material environmental impacts, with specified goals for improving positive impacts while reducing negative impacts.	Alignment, prioritization, governance and evaluation of projects based on environmental strategic goals.	Consideration of environmental impacts in project business cases, plans and progress reports.
Process	Stakeholder orientation	Participation of key stakeholders in the development and governance of the organization's strategy	Participation of key stakeholders in prioritization, governance and evaluation of projects	Proactive and open engagement of all stakeholders and consideration of their interest.
	Transparen-cy	Periodic reporting of the organization's societal impacts, improvement strategies and performance progress.	Periodic reporting on the project portfolio's impacts, progress and performance.	Periodic reporting on projects' impacts, progress and performance.
	Ethical decision making	Consideration of ethical principles in decisions on organizational offerings, policies and practices.	Consideration of ethical principles in decisions on prioritization and selection of projects.	Consideration of ethical principles in decisions on planning, organization and execution of projects.
Compe-tence	Knowledge	Inclusion of expertise about social and environmental impacts of the organization in strategy development and governance.	Inclusion of expertise about social and environmental impacts of projects in the project portfolio management process.	Inclusion of expertise about social and environmental impacts of projects in the project management process.
	Technology	Organizational strategy includes actions and goals on the development of sustainable technologies.	Selection and prioritization of projects that develop sustainable technologies.	Consideration and application of sustainable technologies in and by projects.
	Attitude	Strategy is based on a precautionary approach to environmental and social challenges.	Reflection of a precautionary approach to environmental and social challenges in the evaluation and governance of projects.	Reflection of a precautionary approach to environmental and social challenges in the management and execution of projects.

FIGURE 2.12: Framework proposed by Silvius and Marnewick (2021)

2.5.4 Proposed framework based for practice implementation: P5 Standard and PRiSM

GPM proposes a standard called P5 Standard for Sustainable Development (GPM Global, 2019) and a methodology called PRiSM - Projects Integration Sustainable Methods (Carboni et al., 2018).

This organization realized the need for change and how projects are the way to implement that change. In a recent study where they interviewed various management-related professionals, from more administrative roles and project managers, to researchers and students of a project management (GPM Global, 2019), they realized that:

- 96% of executives believe that projects and project management are integral to achieving sustainable development, with 100% believing that project managers should realize the importance of sustainability in their project;
- 99% of project managers find the standard useful and 76% actively use it in their projects, namely as support for decision making (41%) and for training project managers and team members (32%);
- professionals linked to sustainability refer that the standard supports the link between the disciplines of sustainability and project management, and that it has allowed greater collaboration between professionals from both disciplines, with 50% using it for decision making and 30% for communicating results;
- 100% of the professionals linked to academia say that the standard is useful to their work and 82% say it has made positive contributions.

GPM intends with its standard to support the resolution of challenges in a world where volatility, uncertainty, complexity and ambiguity (VUCA) are the new norm, and sustainability is the order of the day. The primary objective of the P5 Standard is to identify potential sustainability impacts, whether negative or positive, that can then be analyzed and presented to management to support informed decisions and effective resource allocation.

The vision that the P5 Standard is intended to follow is as depicted in Fig. 2.13.

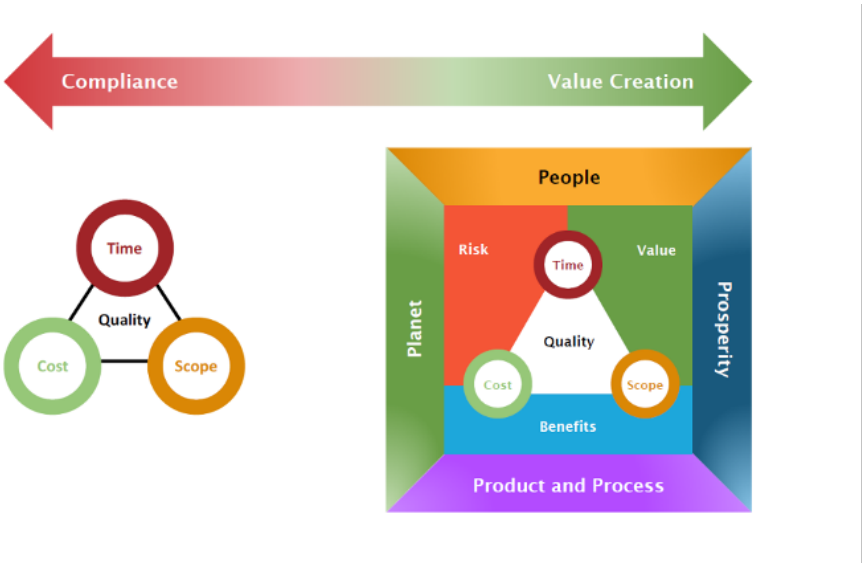


FIGURE 2.13: P5 Standard vision on the right, in contrast with the Iron Triangle on the left (GPM Global, 2019)

From this view, the standard presents a P5 ontology (Fig. 2.14). An ontology is a set of concepts and categories, in a given area, organized by their properties and relationships to each other. This ontology arrangement is intended to better manage complexity by organizing in a coherent way.

It is possible to observe that Product and Process are at the top and the dimensions of sustainability (People, Planet and Prosperity) are nested below these two dimensions of the project. Hence, the Product and Process areas relates to the impacts that project activities and outcomes may have on people, planet and prosperity as a result of decisions made about product characteristics and project management practices.

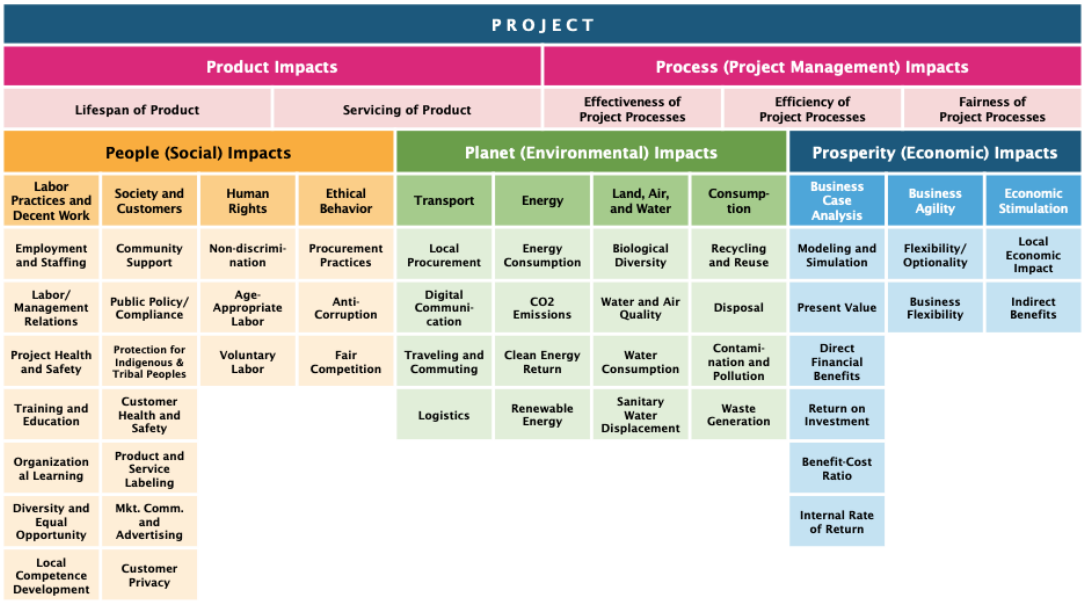


FIGURE 2.14: Standard ontology (GPM Global, 2019)

The P5 Standard is organized in a way that breaks down what each ontology block means, giving examples of how the project team should proceed, which benefits can be achieved, and how it relates to the SDGs. This allows project managers to have a clear view on how to put in practice the SDGs suggested by UN.

There are two distinctive processes when compared to other standards, namely the P5 Impact Analysis and Sustainability Management Plan.

The P5 Impact Analysis (P5IA) is used to define and prioritize sustainability impacts in order to improve expected project benefits, increase positive and reduce negative impacts on society, environment and project value, and contribute to the achievement of the

organization's sustainability objectives. The P5IA guides decision makers with information that can be turned into action to justify project changes in a socially, environmentally and economically responsible way.

The Sustainability Management Plan (SMP) describes how sustainability will be addressed during the project, and the SMP is a great help, as it identifies all the issues and problems to be taken into account. It is also a crucial document to have all project governance engaged with sustainability objectives.

Two additional advantages pointed to use this standard over other are to provide a solid and clear basis for sustainability reporting and communication and to provide useful information for lessons learned register about the efficiency of taken measures in response to impacts, sustainability problems that arose throughout the project and could not be solved, and areas to focus in future projects.

PRiSM is a project delivery method that is based on sustainability principles and incorporates tangible tools and methods to manage the balance between finite resources, social responsibility and the delivery of sustainable project outcomes (Fig. 2.15). It was developed to integrate project management processes and products with sustainability principles so that business objectives can be achieved without having negative social and environmental impacts, while ensuring that benefits are realized horizontally and vertically. As it is possible to observe in Fig.2.15, this methodology extends the typical project lifecycle with a five phased approach that incorporates pre-project planning, product/service adoption and integration as well as benefits realization, having project management processes tied to sustainability monitoring. This method is based on P5 Standard and derived from the UN Global Compact's Ten Principles, Earth Charter, and ISO:26000m Guidance on Corporate Social Responsibility, culminating in six main principles.

The Standard and methodology proposed by GPM are the most practical application that is currently available to project management professionals. As such, this dissertation will be based mainly taking them into account.

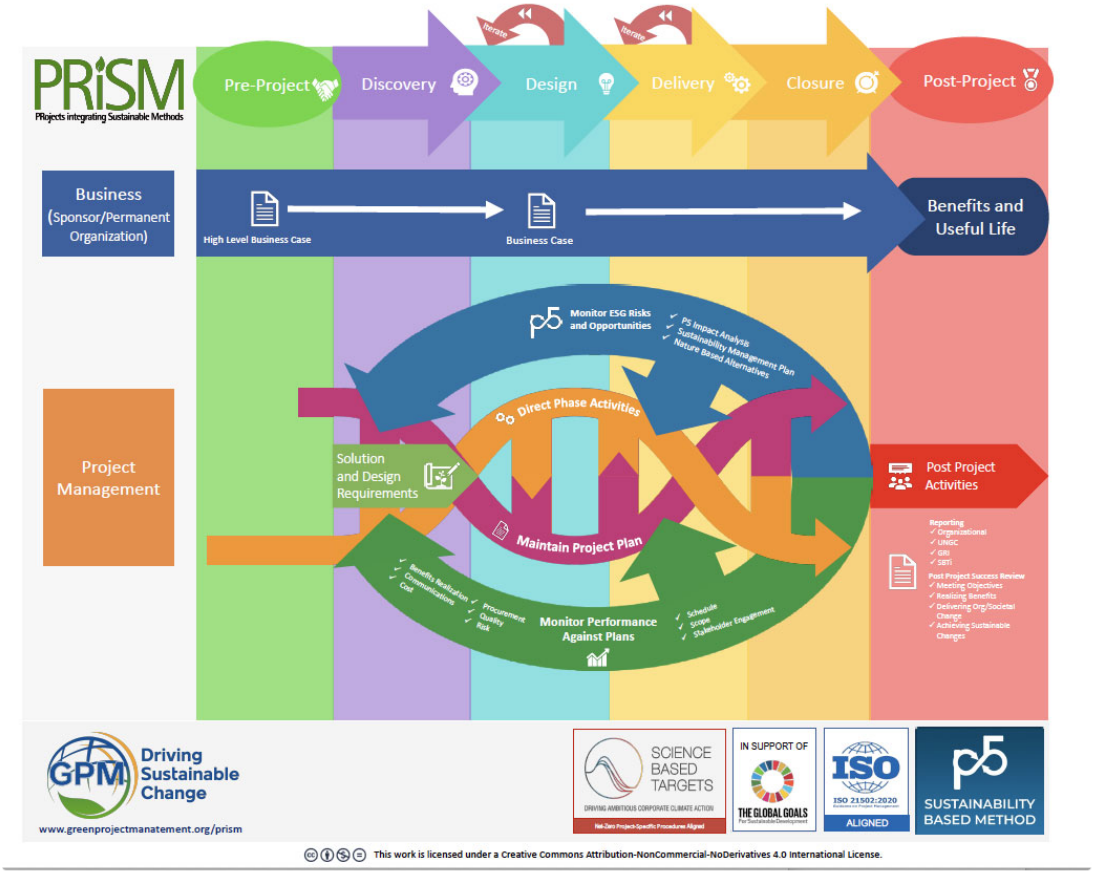


FIGURE 2.15: PRiSM methodology graphically represented.

2.5.5 Sustainability evaluation

"It is not possible to manage what you cannot control and you cannot control what you cannot measure!"

PETER DRUCKER

When it comes to project evaluation, it is still very much based on comparing the current state of work with the defined cost, time and scope baseline (e.g., PMI, 2017), taking into account measurable and tangible metrics or success factors. However, with the increasing complexity of projects, there is a need to adapt metrics and indicators (e.g. KPIs) to each project (Kerzner, 2011).

Metrics represent something measurable and lead to a more proactive, rather than reactive, project management, allowing the anticipation of problems, effective communication with stakeholders about project status, and should take into account the organization's business vision to ensure alignment with strategic objectives. Key Performance Indicators (KPIs) are a type of key metrics and represent critical performance indicators

that can and should contribute to increasing project performance and achieving project objectives. The main difference to metrics is that KPIs are more specific, allowing for better control over the project (Kerzner, 2011). Breaking down the meaning of KPI, we obtain the following: K = Key - key to achieving project success; P = Performance - a metric that is measurable, quantifiable, adjusted and controlled; I = Indicator - a representation of present and future performance. KPIs have five main objectives: motivate the team with concrete goals, communicate effectively with stakeholders about the interest and status of the project, ensure that the project is aligned with organizational goals, improve project performance, and capture lessons learned and best practices (Kerzner, 2011). Thus, KPIs should be involved in the project management process, from the planning phase where they are defined and during execution where they are monitored and controlled (Kivilä et al., 2017). The definition of KPIs should be done together with all stakeholders in order to promote project buy-in and ensure that all perspectives are covered. However, this makes their selection difficult, as each stakeholder will insist on their indicators in favor of the others, and therefore the project manager will play a key role in explaining the importance of the indicators and balancing the selected indicators.

In the case of sustainability, the definition of these metrics is still under development, since some technical and conceptual aspects are not yet fully clear, as perceived by the literature review here presented. However, for the incorporation to be effective, researchers and managers point out that tools and practices are needed for decision support that include sustainability criteria in project evaluation, project production and processes, and project selection (Madureira et al., 2022; Martens&Carvalho, 2016). To truly assess whether a project, and even an organization, is achieving sustainability objectives in all three dimensions, it is crucial to develop indicators that are systematically monitored, measured, quantified, and interpreted (Albuoul, 2017; Zdan, 2010). Without such indicators, there may be a risk that projects are only being sustainable in one part of their development and do not take the long term into account.

Studies proposing sustainability-related indicators and, specially, how to make their selection are starting to appear in abundance, with most of them focusing on the construction area. Ma and colleagues (2020) propose a way to make sustainable project selection taking into account multiple criteria. The authors argue that the best way to select the best project is through the use of Project Portfolio Selection (PPS), as it is an activity-based approach that supports the long-term mission of the organization and combines

the use of performance indicators (KPI) with a multi-criteria decision method (MCDM) to evaluate the project decision. Adabre and Chan (2019) advocate that product success can be influenced by project management and propose a framework where product success is integrated into project management success, which in turn is encompassed in the success of the project as a whole. To implement this framework, they suggest critical success criteria (which they assume to be synonymous with KPIs) for evaluating both project management performance and product success, mentioning the importance of integrating various types of indicators beyond those associated with time, cost, and scope, namely indicators related to safety, sustainable development, health, and others. Finally, they suggest that the indicators they list should be used to establish mathematical indices capable of measuring success in the various phases of the project. From a broader perspective and not so focused on sustainability, but that could perhaps be a way to integrate the inherent complexity, Grabis and colleagues (2019) suggest the implementation of a machine learning system that allows the evaluation of all parameters of the project life cycle, based on best practices, historical data and data from completed projects, suggesting that planning will be more accurate. Hristov and Chirico (2019), meanwhile, emphasize the role of the Sustainability Balanced Scorecard (SBSC) framework as the means of guiding organizations toward sustainability, considering value creation while taking into account respect for natural resources, and promoting the transition of the economy and society to a more sustainable path. The authors note that the SBSC would allow for the integration of the various dimensions of sustainability into organizations' strategies and translate those strategies into specific goals and KPIs that can then be used to monitor and control projects.

On the other hand, Kivilä and co-authors (2017) argue that an approach focused on only indicators can be problematic because performance indicators are usually late and may not cover all the value and benefits over the project life cycle. These authors, like Lam (2020) propose a more holistic view on integrating sustainability and indicators into project management to ensure that sustainability objectives are actually met. Kivilä and co-authors (2017) highlight that execution is the crucial phase to ensure that projects deliver sustainably, in which control modes (formal and informal control) and control mechanisms (rules, plans, budgets, schedules and social control) should be implemented. They then defend the idea of a control package, which includes performance indicators, incorporated in the monitoring and control of the project, with a unique configuration and

aligned with the project's sustainability objectives. Through the case study presented, they reveal that the contract model selected impacts the incorporation of sustainable practices, promoting contracts with incentives in all three dimensions of sustainability. Finally, they emphasize that coordinating and understanding the various stakeholders' views on the three dimensions is quite important, and the results suggest that the need to control the different dimensions is driven by different factors, such as regulation (environmental), publicity (social, environmental), and incentives (economic). In turn, Lam (2020) highlights that sustainable development in a project requires holistic thinking, decision-making, and innovative solutions that promote sustainability as a whole, focusing not only on pre-contract but also on post-contract. Thus, it states that not only the environmental, social and economic dimensions should be considered to evaluate the success of a project, but adds a functional dimension to sustainability. This functional dimension focuses on the impact of failure and responses, the level of service, and compliance with regulations and standards. It also states that the economic dimension can be assessed by cost-related KPIs, while the functional, environmental and social dimensions by quality-related KPIs.

When looking at the GPM reference guide (Carboni et al., 2018), it is possible to understand that KPIs are considered to be essential to accomplish the desired sustainable results and are outlined in P5 Impact Analysis. In that reference, GPM suggest some indicators, which for sustainability should follow the categories defined by P5 ontology.

Through these examples we can see that the identification and selection of KPIs is under constant development, with different authors proposing different methodologies, as well as different indicators, with no consensus yet. Stanitsas et al. (2021) highlighted the need for more studies collecting indicators, as no widely accepted strategy of achieving sustainability in projects has been discussed. The authors argue that one possible direction for future research, would be, indeed, to perform more studies on how to recover and reveal indicators that actually help achieving sustainability. These conclusions were done having in account construction projects, but certainly is possible to extrapolate them for most sectors, since constructions is one of the sectors with more published literature related to sustainability thematic. Hence, the work developed in this thesis follow the need for these indicators and try to fill some of the gap existing in the literature.

Chapter 3

Objectives and Methodology

3.1 Objectives

The literature review performed allowed us to realize the urgency of adapting project management practices having sustainability at its core. Something that is unanimous among researchers when it comes to its correct and effective implementation is that indicators and evaluation metrics are needed. However, the identification of these indicators is still confusing and somewhat disperse, and does not seem to reach practitioners. Hence, this dissertation aims to focus on the sustainability evaluation of projects through the search of performance indicators to be integrated in the process of project management and to create a database from which managers can choose indicators for their projects, depending on the sustainability focus they want and having a direct connection to SDGs.

Additionally, a second general aim is to understand how, when and why KPIs are being applied into management and project management.

In order to achieve those two general aims, the following specific objectives will be addressed:

1. Identify the indicators proposed in the literature;
2. Identify the indicators used in practice;
3. Compare the indicators from the literature with those used in practice;
4. Identify in which sectors those indicators are being implemented;
5. Identify at which level those indicators are being applied (organizational and/or project management);

6. Identify the main drivers to use indicators on all the three dimensions of sustainability;
7. Link each indicator with a sustainability dimension;
8. Link each indicator with a SDG;
9. Create a database with all indicators collected organized by sector, sustainability dimensions and SDGs.

3.2 Research methodology

In order to accomplish the objectives defined, the study will involve a systematic literature review and the application of surveys to project managers (Fig. 3.1).

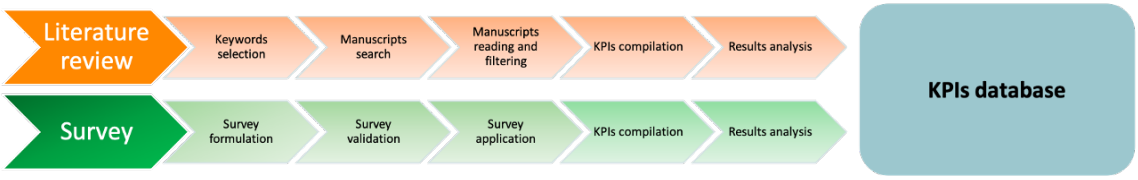


FIGURE 3.1: Summary of research methodology

The systematic literature review allows the selection process of studies related to the theme to be more rigorous and structured. On the other hand, it allows developing a knowledge base on the subject by accumulating information from different studies (Tranfield et al., 2003). The database used was the Web of Science (webofknowledge.com), since it is one of the most widely used databases for literature reviews (Li et al., 2018). The method used for the search was the advanced search mode in which independent searches are conducted with a group of keywords and then these independent searches are cross-referenced, thus obtaining the articles in common. Note that the search is based on finding the keywords defined in the title, abstract or keywords chosen by the authors. Only articles in English, Portuguese or Spanish were considered.

The independent searches were made on November 21st of 2021 and had as basis the following keywords:

1. sustainability OR sustainable OR "triple bottom line" OR "corporate social responsibility" OR csr OR "corporate environmental responsibility" OR cer
2. "kpi$" OR "key performance indicator$"

3. project management

4. sustainable project management OR green project management OR project sustainability management OR psm OR gpm

5. "project management"

These independent searches were then combined in the following combinations: (A) 1, 2 and 3; (B) 2 and 4; (C) 2 and 5. An additional criterion we also considered was that each article should have KPIs applied to, at least, one of the three sustainability dimensions.

A descriptive statistical analysis was performed using IBM SPSS Statistics for Mac, version 28.0. Descriptive statistics are used to describe, show or summarize data points in a constructive way such that enables researchers to detect patterns within the data (Kaur et al., 2018).

To reinforce our contribution to the literature and, at the same time, to approximate the work to project management practice, we also applied surveys to managers from diverse activity sectors and that are involved in projects and/or organizations with projects.

Surveys are a quantitative methodology that allows for the focused collection of a sample and uses statistical techniques to analyze results, which leads to more objective results and more secure conclusions about the topic being evaluated (Moser&Kalton, 2017). In this study, it was applied the survey by questionnaire, because it is the most adequate method to apply to a large number of people, enabling to infer general conclusions and to collect as many indicators as possible (Alves et al., 2021).

Before the questionnaire was applied to the participants, it was validated by three individuals connected to study area: one professional of project management, one professional linked to the sustainable project management and one academic related to project management and corporate social responsibility areas. They contributed with suggestions and correction that were incorporated in the final questionnaire (Appendix A).

The questionnaire was divided in four main parts:

1. Characterization of the organization where participant works: to collect data on sector, country, use of standard, project budget, size of project team, and proneness towards sustainability of the organization;

2. Knowledge about sustainability: to collect data about the level of knowledge on sustainability by the participant;

3. Sustainability evaluation: to collect data about if and how participants are evaluating sustainability on the three dimensions of sustainability;

4. Characterization of the participant: to collect data on demographic data, academic level, role on the organization and time at the organization.

The questionnaire was created in the GoogleForms platform and distributed online in social media (LinkedIn and Facebook) and via WhatsAPP in project management groups, from February 1st until August 31st. In this case, it is a random probability sample, since the selection was the result of chance (Coutinho, 2018). According to the same author and other authors within, the minimum number of questionnaires suitable for a significant statistical treatment is 30.

Descriptive statistics were also performed to analyze the data collected, using the IBM SPSS Statistics for Mac, version 28.0. Furthermore, two association tests were performed to understand what factors might contribute for the use of KPIs and to a greater knowledge regarding sustainability concepts. These association tests were done only for the whole dataset. An association test aims to test the significance of the relationship of two categorical variables and to test the strength of that association (Mishra et al., 2019).

The KPIs collected were then aggregated on a database composed by the following factors: sector, source (literature or questionnaire), sustainability dimension and SDG. A clean step over the KPIs was performed to avoid duplication (standardized KPIs). Hence, the database has the two datasets: non-standardized (not connected to SDG and sustainability dimensions) and standardized (connected to SDG and sustainability dimensions).

Chapter 4

Results

On this section we will present the main results obtained with the performed work. First, it will be presented the results of the systematic literature review. Second, it will be presented the results of the survey which will be divided in two sub-sections: a) Characterization of the sample, b) Survey results.

4.1 Literature review

From the 107 manuscripts collected, 85 were considered to read fully in the literature review after filtering with the criteria described in the Methodology section. After a more complete reading of those 85, only 51 had KPIs relevant for the study (Appendix B).

Within the 51 analyzed, the most represented type of manuscripts is Article (42), followed by Procceedings (7) and Reviews (2). Most of the manuscripts were applied to whole World (19) or Europe region (6), while there are case studies or application for a variety of countries: UK (3), Australia (2), Ireland (2), and the following all with one article: Africa, China, Czech Republic, Egypt, Indonesia, Latin America, Lybia, Malawi, Netherlands, Portugal, Qatar, Romania, Russia, Sweden, Switzerland, Turkey, USA and Vietnam.

As for the year of publication, there was a clear increase on the number of publications relating KPIs and sustainability since 2014, with a higher number in the last two years (Fig. 4.1).

As described in the methodology, the KPIs were standardized. A total of 903 KPIs were collected and then standardized into 730 KPIs (Table 4.1). The number of KPIs per sector is very similar between the two databases (non-standardized and standardized)

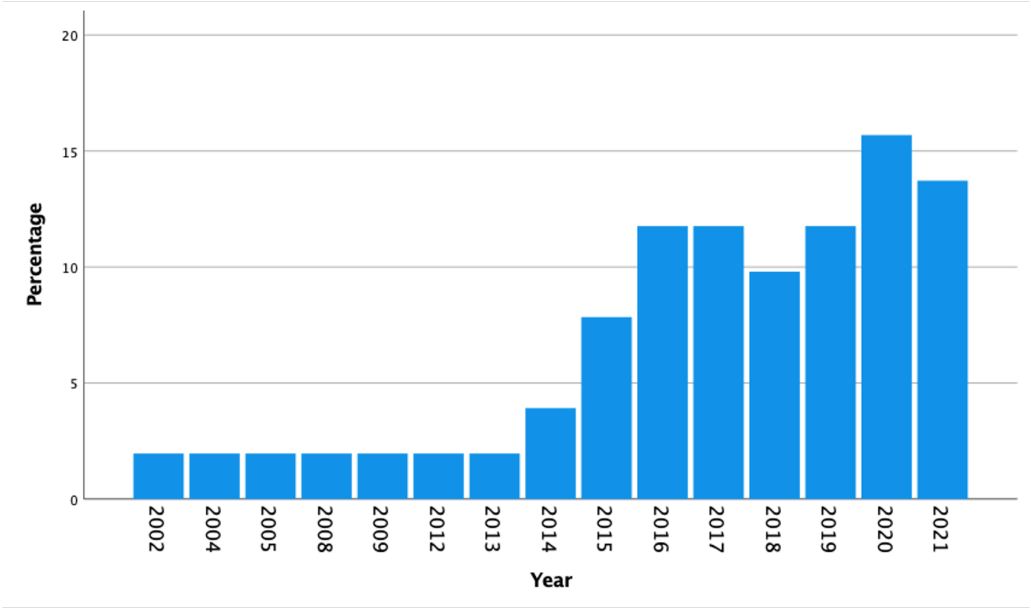


FIGURE 4.1: Distribution of manuscripts per year of publication

with Construction being the most represented sector, followed by Housing&Urbanism and Metallurgy. The less represented sectors, also in both datasets, are Academy, Aviation and Livestock. It is important to note that 57 out of 730 standardized KPIs have more than one sector in common.

TABLE 4.1: Number of KPIs by sector

Sector	**Total KPIs (non-standardized)**	**Total KPIs (standardized)**
Academy	5	5
Agriculture	28	28
Aviation	5	5
Brewery	24	19
Business/Management	77	57
Livestock	10	9
Construction	272	197
Elderly facilities	24	22
Fisheries	11	11
Housing&Urbanism	119	111
Infrastructure	48	32
Logistics	51	44
Mettalurgy	84	70
Mining	44	42
Oil and Gas	16	16
Simulation	15	15
Suppliers	25	25
Transport	24	24
Water	21	21

Considering the non-standardized KPIs, we assessed if the study presented the efficiency of a certain KPI and if that particular KPI was integrated in the project management process. As a result, we got a total of 500 KPIs (55.4%) with demonstrated efficiency and only 145 KPIs (16%) integrated in the project management process.

Regarding the standardized KPIs, we assessed its relation to the SDGs (Fig. 4.2) and to each sustainability component (Process, Product, People, Planet and Profitability) (Fig. 4.3). The most represented SDGs within the standardized KPIs are the 8 (Decent Work and Economic Growth), the 12 (Responsible Production and Consumption) and 11 (Sustainable Cities and Communities), while the less represented are 1 (No Poverty), 7 (Affordable and Clean Energy) and 10 (Reduced Inequalities).

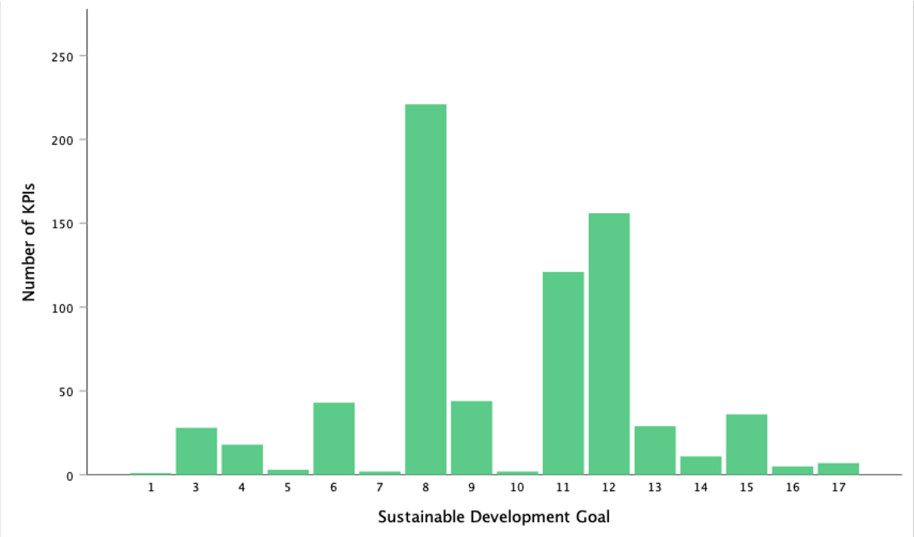


FIGURE 4.2: Number of KPIs by Sustainable Development Goal (SDG)

Looking to the distribution of KPIs by sustainability component, it is possible to observe that most KPIs address People dimension, followed by Planet and Prosperity dimensions (Fig. 4.3).

It is also possible to observe that KPIs related to the Prosperity dimension are mostly related with the SDG8 (Decent work and economic growth), while the ones directed to Planet dimension are more related to SDG12 (Responsible consumption and production). The KPIs for People dimension are more transversal, being mostly represented by SDG8 and SDG 11 (Sustainable cities and communities) (Fig. 4.4).

Relating the sector with the sustainable dimensions, it is possible to observe that the Construction sector leads the number of KPIs for all the three dimensions. The People dimension is also well represented in Housing and Urbanism, and Business/Management.

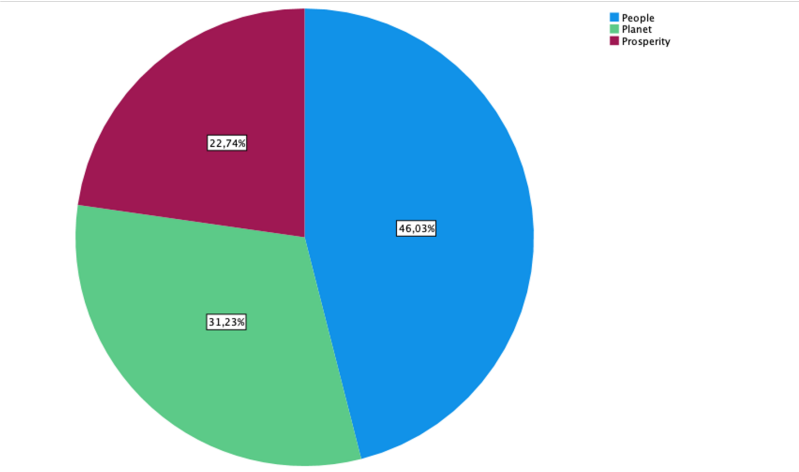


FIGURE 4.3: Percentage of KPIs by each sustainable component

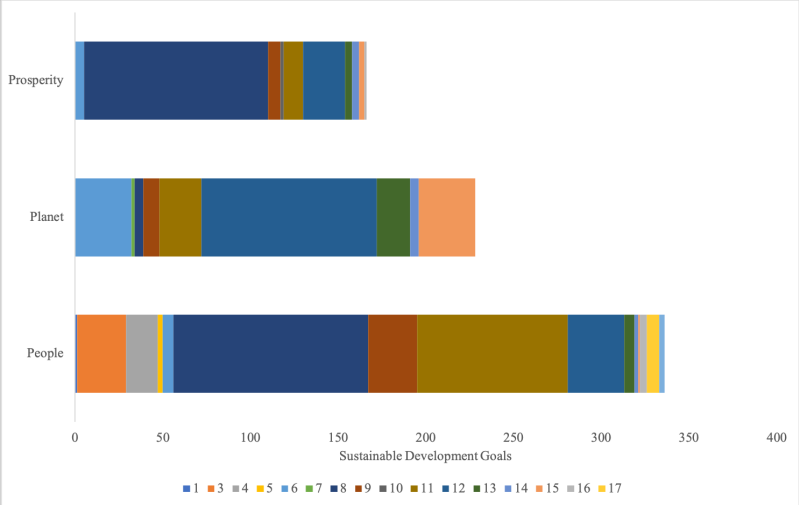


FIGURE 4.4: Distribution of KPIs on each sustainable component by SDG

For the Planet dimension there is also a high number of KPIs in Metallurgy, and Housing and Urbanism sectors. Finally, the Prosperity dimension has some medium number of KPIs in the sectors of Housing and Urbanism, Mining, Infrastructure and Business/Management (Table 4.2).

When linking the sectors to the SDGs (4.5, it is possible to observe that:

- SDG1: only addressed by Housing and Urbanism (1 KPI)
- SDG3: addressed mostly by Oil and Gas sector (13 KPIs) and Mining (6 KPIs)
- SDG4: addressed mostly by Academy (4 KPIs) and Business and Management (6 KPIs)
- SDG5: only addressed by Business and Management (2 KPIs) and Logistics (2 KPIs)

TABLE 4.2: Number of KPIs by sector for each sustainable component

Sector	People	Planet	Prosperity
Construction	97	72	42
Mettalurgy	2	63	7
Brewery	9	9	5
Housing and Urbanism	45	49	20
Infrastructure	19	13	16
Business/Management	46	12	16
Mining	19	4	22
Logistics	31	5	13
Transport	16	4	4
Academy	5	0	0
Agriculture	20	19	9
Water	0	1	0
Aviation	3	1	1
Livestock	1	3	5
Elderly facilities	15	5	4
Fisheries	1	3	7
Oil and Gas	16	0	0
Simulation	14	0	1
Suppliers	17	2	6

- SGG6: addressed mostly by Mettalurgy (20 KPIs) and Agriculture (17 KPIs)
- SDG7: addressed by Construction, Metallurgy, Brewery, Housing and Urbanism, and Transport
- SDG8: addressed by almost all sectors, but specially by Construction (79 KPIs), followed by Logistics (31 KPIs) and Business/Management (30 KPIs)
- SDG9: addressed mostly by Construction (15 KPIs)
- SDG10: addressed by Construction, Housing and Urbanism and Elderly Facilities
- SDG11: addressed mostly by Housing and Urbanism (47 KPIs) and Construction (35 KPIs)
- SDG12: addressed by almost all sectors, but particularly Construction (46 KPIs) and Metallurgy (44 KPIs)
- SDG13: addressed mostly by Housing and Urbanism (11 KPIs) and Construction (9KPIs)
- SDG14: addressed by Construction (1 KPI), Housing and Urbanism (2 KPIs), and Fisheries (8 KPIs)

- SDG15: addressed mostly by Construction (14 KPIs) and Housing and Urbanism (13)
- SDG16: addressed only by Housing and Urbanism, Infrastructure and Logistics
- SDG17: addressed only by Infrastructure (2 KPIs), Logistics (3 KPIs) and Suppliers (2 KPIs)

			Sustainable Devolpment Goals																
			1	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total
Sectors[a]	Construction	Count	0	4	2	0	3	1	79	15	1	35	46	9	1	14	0	0	210
	Mettalurgy	Count	0	0	0	0	20	1	1	0	0	0	44	6	0	0	0	0	72
	Brewery	Count	0	0	1	0	1	1	8	5	0	0	7	0	0	0	0	0	23
	Housing&Urbanism	Count	1	4	0	0	6	1	10	2	1	47	15	11	2	13	1	0	114
	Infrastructure	Count	0	2	0	0	1	0	20	3	0	8	3	3	0	4	1	2	47
	Business/Management	Count	0	2	6	2	1	0	30	6	0	8	8	5	0	2	3	0	73
	Mining	Count	0	6	1	0	0	0	18	4	0	1	15	0	0	0	0	0	45
	Logistics	Count	0	0	2	2	0	0	31	4	0	1	2	2	0	0	1	3	48
	Transport	Count	0	0	0	0	0	1	0	1	0	6	14	1	0	1	0	0	24
	Academy	Count	0	0	4	0	0	0	0	0	0	1	0	0	0	0	0	0	5
	Agriculture	Count	0	0	1	0	17	0	10	0	0	9	2	0	0	9	0	0	48
	Water	Count	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
	Aviation	Count	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	3
	Livestock	Count	0	0	0	0	0	0	6	0	0	0	3	0	0	0	0	0	9
	Elderly facilities	Count	0	1	1	0	0	0	5	0	1	15	1	0	0	0	0	0	24
	Fisheries	Count	0	0	0	0	0	0	3	0	0	0	0	0	8	0	0	0	11
	Oil and Gas	Count	0	13	1	0	0	0	2	0	0	0	0	0	0	0	0	0	16
	Simulation	Count	0	0	2	0	0	0	10	3	0	0	0	0	0	0	0	0	15
	Suppliers	Count	0	0	1	0	0	0	9	4	0	0	7	2	0	0	0	2	25
Total		Count	1	28	18	3	43	2	221	44	2	121	156	29	11	36	5	7	727

a. Grupo de dicotomia tabulado no valor 1.

FIGURE 4.5: Sector by Sustainable Development Goal

4.2 Survey

A total of 48 questionnaires were obtained, but only 38 were considered valid to proceed with the analysis due to compliance with selection criteria. Therefore, we respect the minimum number of samples for statistical analysis as suggested in Coutinho (2018).

4.2.1 Characterization of the sample

The characterization of the sample will comprise two main focuses: the participants and the organization where the participant works.

Beginning by the participants characterization, 63.2% are men and 34.2% are women. Relative to age, most of them have between 36 and 45 years old (44.7%), followed by the intervals between 56 and 65 years old (21%), 46 and 55 years old (15.8%), 26 and 35 years old (10.5%), more than 65 years old (5.3%) and 18 and 25 (2.6%).

Most of them live in Portugal (57.9%), followed by Angola (21%) and United Kingdom (13.1%) (Fig. 4.6).

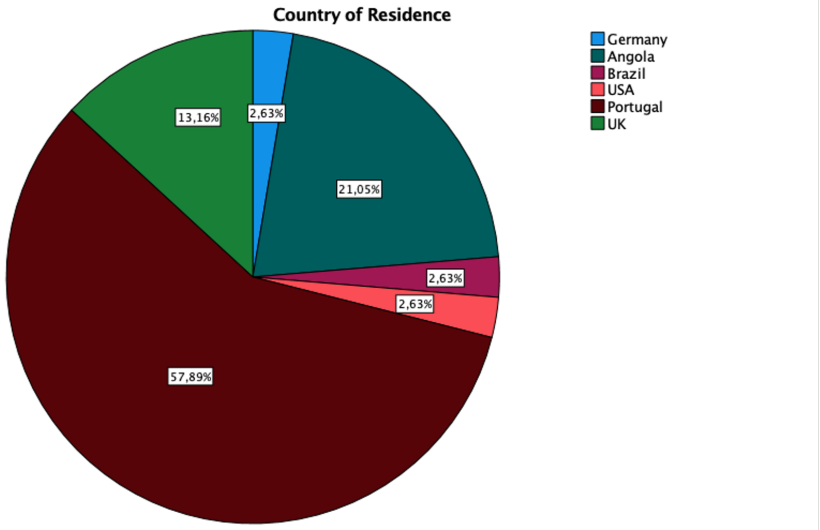


FIGURE 4.6: Residence country of the participants

Regarding academic degree, 39.5% of participants have a Bachelor, another 39.5% have a Masters, 10.5% has a post-Graduation, 5.3% PhD and 5.3% only have high school completed.

The main roles they have in the company is project manager (36.8%), manager (26.3%) and team leader (21%) (Fig. 4.7).

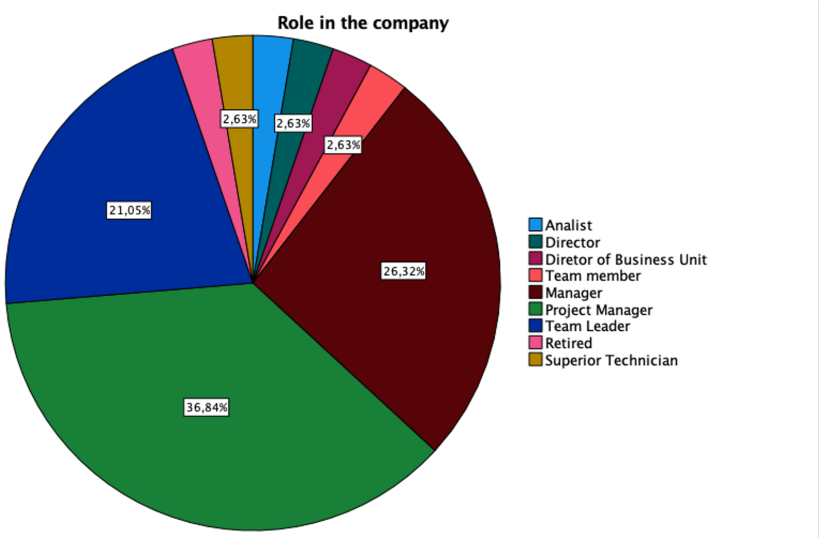


FIGURE 4.7: Role of the participant in the organization

Most of them are between 1 to 5 years in the organization where they are currently working (44.7%), 21% between 6 and 10 years, 15.8% between 11 and 20 years, 10.5% more than 20 years and 7.9% less than a year.

Now, for the organizations, it is possible to observe that most participants work on a diversity of sectors. The most represented sectors are Education (15.8%), Information and Communication Activities (13.2%) and Construction (10.5%) (Table 4.3).

TABLE 4.3: Number of participants by sector

Sector	Frequency	%
Education	6	15.8
Information and Communication activities	5	13.2
Construction	4	10.5
Public Administration and Defence	3	7.9
Extractive industry	3	7.9
Administration activities and support services	2	5.3
Human health and social support activities	2	5.3
Agriculture, animal production, forest, hunting, fishing	2	5.3
Water and waste management	2	5.3
Consultancy	2	5.3
Accomodation, restaurants and similars	1	2.6
Cooperatives	1	2.6
Car industry	1	2.6
Manufactoring	1	2.6
Informatics	1	2.6
Support services to industry	1	2.6
Transport and storage	1	2.6

Half of the organizations are based in Portugal, followed by Angola (18.4%) and United Kingdom (13.1%) (Fig. 4.8).

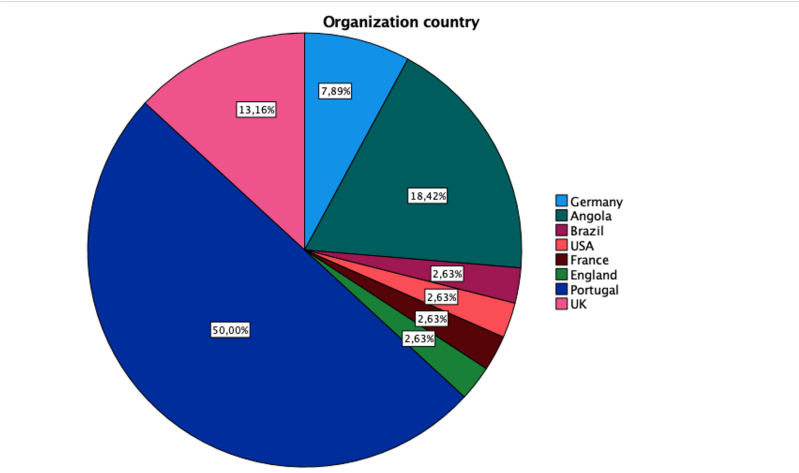


FIGURE 4.8: Country of the organization

Regarding the standard use, half of the organizations performs project management without any standard of reference, 34.2% uses PMBOK, 7.9% uses the combination of

PMBOK and PRINCE, 2.6% uses ICB4, 2.6% uses PRINCE and 2.6% uses a reference from Portuguese social security.

The average team dimension of the organizations' projects is mostly between 2 and 24 team members (Fig. 4.9). While the average budget is distributed mainly between three ranges - <100 000 euros, 100 000-200 000 euros and more than 1 million euros – with the two intervals in the middle less represented – 200 000-500 000 euros and 500 000-1 million euros.

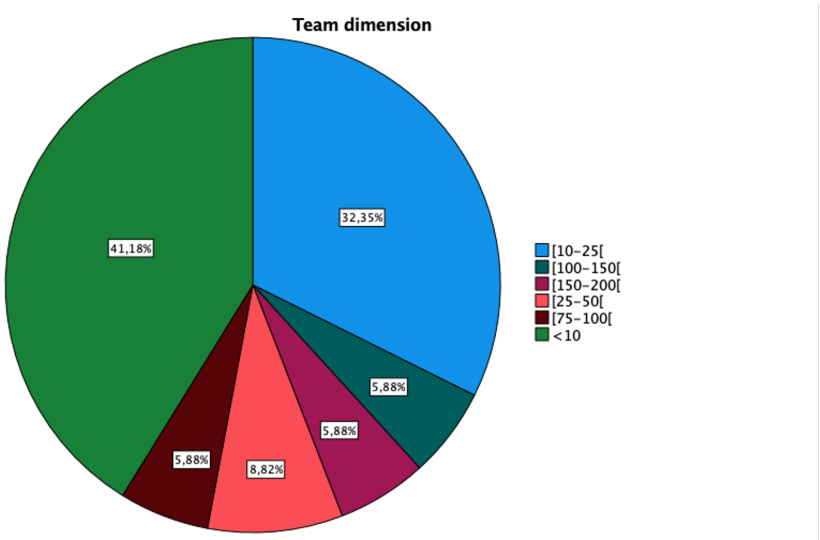


FIGURE 4.9: Project team dimension

The participants were also asked about the sustainability concerns of the organization in the three dimensions. Overall, there is a high concern regarding sustainability, with 89.5% of the organizations concerned about Prosperity, 81.6% concerned about Planet and 86.8% concerned about People.

4.2.2 Questionnaire results

The main objective of the survey was to collect KPIs to add to the final database, however, we decided to take advantage of it to understand better the knowledge of sustainability concepts by our participants, the awareness of project and process impact assessment, and how and why KPIs are being used and, in case of not use, what alternatives managers are using. Depending on if they use or not, the survey applied was different as possible to observe in Appendix A. Hence, this section is organized by presenting first the results regarding the knowledge, then the project and impact assessment awareness, the results of the group that uses KPIs and, finally, the results of the group not using KPIs.

Overall, the participants show a high level of knowledge for all the four concepts presented (Fig. 4.10), except for the Triple Bottom Line, in which 42.1% (16) of the participants never heard the term.

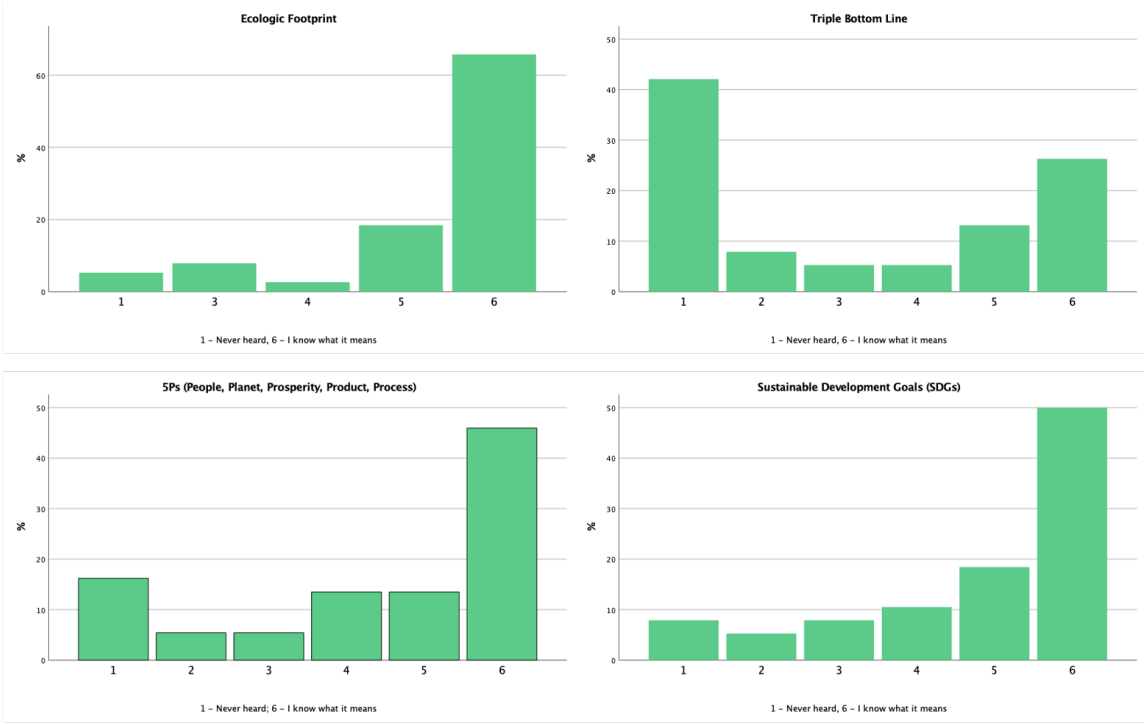


FIGURE 4.10: Graphical representation of the four knowledge concepts, based on the 6-point scale

One of the key perspectives of P5 Standard, represented on its ontology, is the evaluation of the potential impacts of the process and the product in the three sustainability dimensions (People, Planet and Prosperity). Hence, to understand if participants were aware and performing this assessment, we had two questions on the survey regarding this issue (Fig. 4.11). The results show that the majority of the participants are within the interval never to not-so-often (52.6%) for the Product impact assessment, however it also shows that 21.1% of the participants (8) do always the assessment. While for Process impact assessment, most of the participant do not perform the assessment so often (28.9% - 6) and 18.4% (7) do always perform process impact assessment.

Another unique characteristic of the P5 Standard is the link to SDGs, therefore it was also asked to participants about the consideration of SDGs on their management practices (Fig. 4.12). The majority of the participants are within the interval of not-so-often and the close-to-often (44.8% - 17) and 21.1% (8) always considerate SDGs on their management practices.

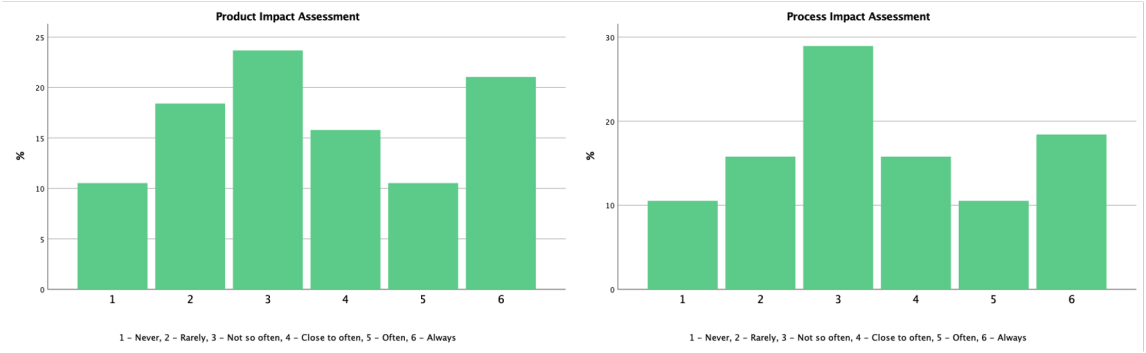


FIGURE 4.11: Graphical representation of the assessment of product and process impact, based on the 6-point scale

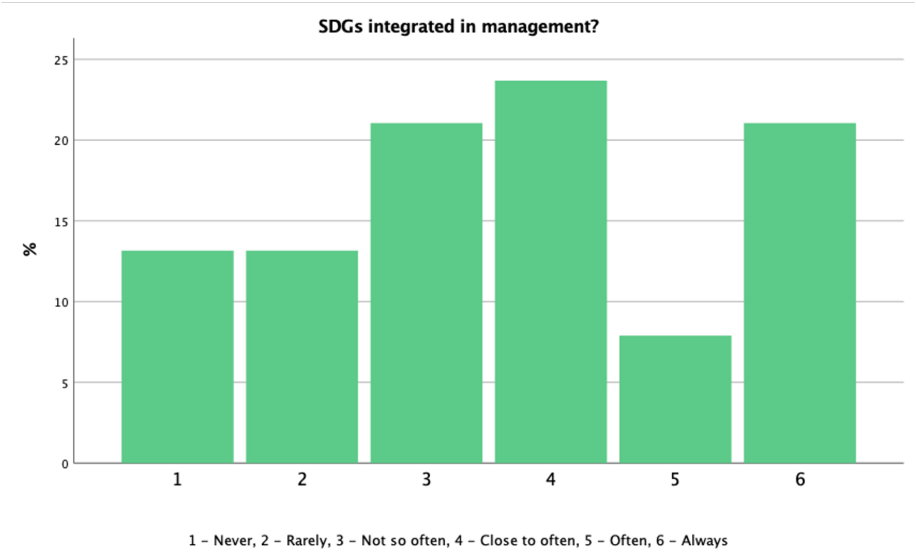


FIGURE 4.12: Graphical representation of the level of integration of SDGs, based on the 6-point scale

Only 39.5% (23 participants) affirmed to use KPIs for project evaluation. Of those, 93.3% said they use KPIs addressing Prosperity dimension, 60% addressing Planet dimension and 46.7% addressing People dimension. To understand the applicability of the use within management practices it was asked, in a scale from 1 (never) to 6 (always), how frequent they are applied. The results show that the Prosperity-related ones are almost always or always integrated, the People-related ones are never or rarely integrated, and in the Planet-related ones there is a duality between never-rarely and almost always-always (Fig. 4.13).

Going deeper on when KPIs are being defined, it is possible to understand that for all the three dimensions this definition is made mostly on the Initiation and Planning (Table 4.4). While for when they are being applied, a pattern was not found. Prosperity-related KPIs are mostly being applied in Monitor and Control, Planet-related KPIS in Planning,

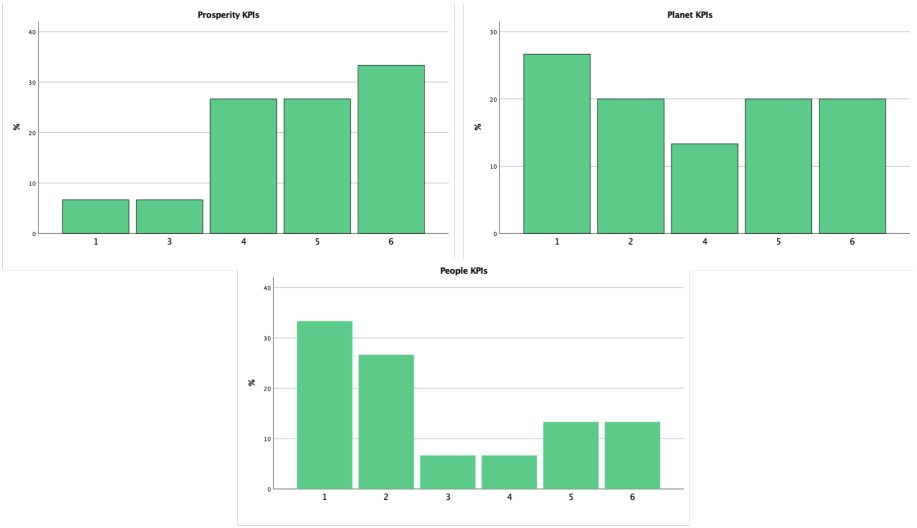


FIGURE 4.13: Graphical representation of the level of integration of sustainable KPIs by sustainability dimension, based on the 6-point scale

and People-related KPIs distributed equally between Planning, Monitor and Control, and Execution (Table 4.4).

When looking for the motives why they are being used, the results show that the highest motive for Prosperity-related KPIs is budget control, for Planet-related KPIs is ethical values, and for People-related KPIs are ethical values and reputation (Table 4.4). It is also possible to observe that regulation was not a motive pointed by any participant for People- and Planet-related KPIs.

TABLE 4.4: When and why participants use KPIs

N=14		**Prosperity**	**People**	**Planet**
Definition	Initiation	23.5% (8)	18.2% (4)	22.2% (4)
	Planning	29.4% (10)	18,2% (4)	22.2% (4)
	Monitor&Control	23.5% (8)	13.6% (3)	16.7% (3)
	Execution	14.7% (5)	9.1% (2)	5.6% (1)
	Closing	8.8% (3)	4.5% (1)	0%
Application	Initiation	14.6% (6)	8% (2)	0%
	Planning	19.5% (8)	16% (4)	23.8% (5)
	Monitor&Control	29.3% (12)	16% (4)	19% (4)
	Execution	19.5% (8)	16% (4)	19% (4)
	Closing	17.1% (7)	12% (3)	9.5% (2)
Motives	Budget Control	48% (12)	4.5% (1)	4.3% (1)
	Regulation	16% (4)	0%	0%
	Funding Source	20% (5)	13.6% (3)	13% (3)
	Ethical values	12% (3)	22.7% (5)	26.1% (6)
	Reputation	4% (1)	22.7% (5)	21.7% (5)

For the group of participants not using KPIs, we wanted to understand how they measure project performance and, if and how they have sustainability in consideration. Regarding EVM use for measuring the performance of the project, most of the participants rarely or not so often use it (Fig. 4.14). Only 8,7% (2) always use EVM.

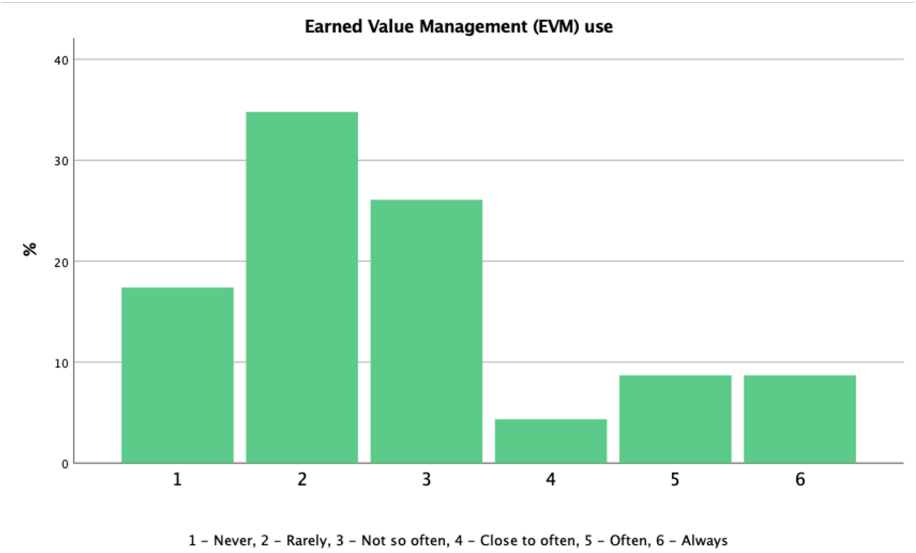


FIGURE 4.14: Graphical representation of the assessment of EVM use, based on the 6-point scale

Most of the participants rarely or not so frequently have budget and time allocated to dedicate to people- and planet- related considerations (Fig. 4.15). However, it is possible to observe that 26.1% (6) participants always allocate time and budget to address sustainability issues. When they have time and budget allocated, most of them have in account almost in frequent basis the direct or indirect impacts of their projects in Prosperity and People sustainability dimensions (Fig. 4.15). For the Planet dimension, the considerations of the impacts are more dispersed distributed over the scale, with 43.5% (10) rarely or not so often considering and the same amount almost frequently or always considering.

It was also asked if participants reported on the three sustainability dimensions: 39.1% (9) do report regarding People dimension, 26.1% (6) do it regarding Planet dimension and 47.8% (11) do it for Prosperity dimension.

For assessing possible factors related to use of KPIs, the binomial variable 'Use of KPIs' (yes/no) was compared with the variables Age, Academic degree, Role in the organization, Standard (yes/no) and Knowledge (averaged knowledge by participant). The results show a significant and moderate association between Use of KPIs and the Standard ($X= 8.922$, $p = 0.003$; Cramer's $V = 0.556$, $p = 0.011$), and between Use of KPIs and

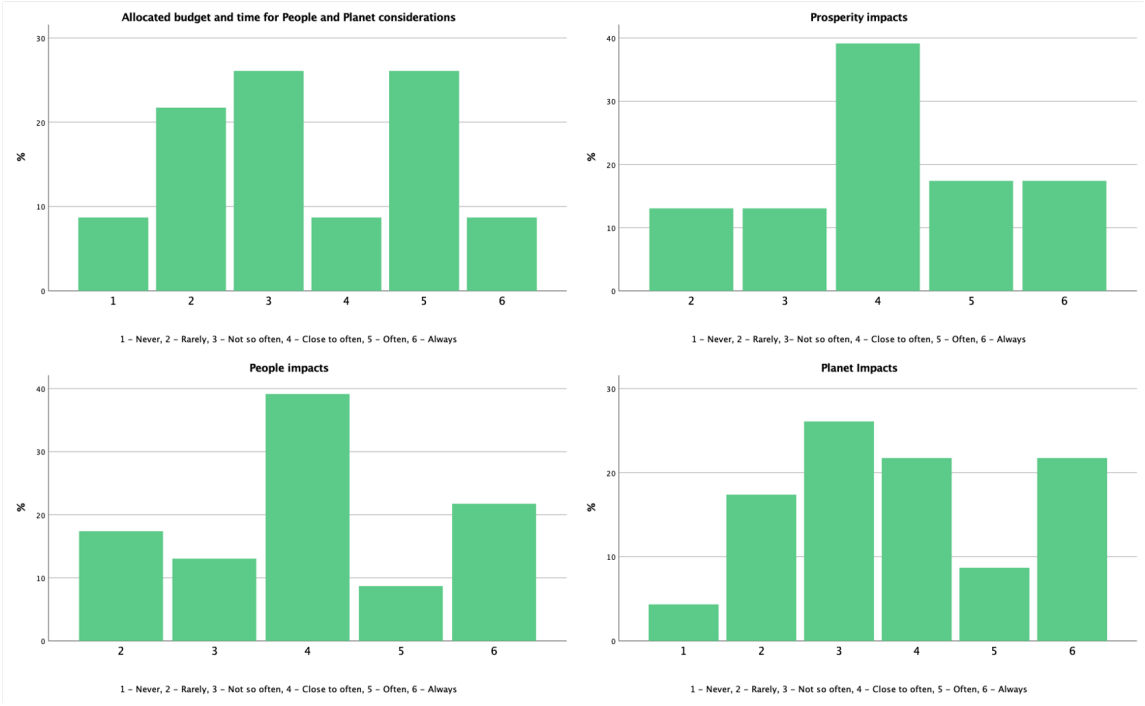


FIGURE 4.15: Graphical representation of the assessment of sustainability impacts by non-KPIs users, based on the 6-point scale

the Knowledge (X= 15.398, p = 0.041; Cramer's V = 0.637, p = 0.041) (Fig 4.16, Appendix C).

Use of KPIs * Standard[c]

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	8,922[a]	1	,003	,007	,003
Continuity Correction[b]	7,049	1	,008		
Likelihood Ratio	9,400	1	,002	,007	,003
Fisher's Exact Test				,007	,003
N of Valid Cases	38				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 7,50.
b. Computed only for a 2x2 table
c. For 2x2 crosstabulation, exact results are provided instead of Monte Carlo results.

Use of KPIs * Knowledge

	Value	df	Asymptotic Significance (Bilateral)	Sig. Monte Carlo (Bilateral) Significance	Confidence interval 95% Inferior Limit	Superior Limit
Pearson Chi-square	15,398[a]	9	,081	,041[b]	,037	,045
Likelihood Ratio	20,243	9	,016	,037[b]	,034	,041
Exact test of Fisher-Freeman-Halton	13,898			,041[b]	,037	,044
N of Valid Cases	38					

a. 18 células (90,0%) were expected to have a count less than 5. The minimum count expected is 0.39.
b. Based in 10000 sample tables with the seed 1090229469.

Symmetric Measures

		Value	Approximate Significance	Monte Carlo Significance Significance	99% Confidence Interval Lower Bound	Upper Bound
Nominal by Nominal	Phi	,485	,003	,007[c]	,005	,010
	Cramer's V	,485	,003	,007[c]	,005	,010
	Contingency Coefficient	,436	,003	,007[c]	,005	,010
N of Valid Cases		38				

c. Based on 10000 sampled tables with starting seed 334431365.

Use of KPIs * Knowledge

		Value	Approximated significance	Monte Carlo Significance Significance	Confidence Interval 95% Inferior Limit	Superior Limit
Nominal by Nominal	Fi	,637	,081	,041[c]	,037	,045
	Cramers' V	,637	,081	,041[c]	,037	,045
	Contingency Coefficient	,537	,081	,041[c]	,037	,045
N of Valid Cases		38				

c. Based in 10000 sample tables with the seed 1090229469.

FIGURE 4.16: Results of association tests between the variable 'Use of KPIs' and each of the variables Standard and Knowledge

The variable Knowledge (mode value of the four questions related to sustainability concepts) was compared with the variables Age, Academic degree, Role in the organization and Concern about sustainability dimension People and Concern about sustainability Planet. No significant associations were found (Appendix C).

Regarding the KPIs collected, a total of 55 were obtained, being 18 new to the database already created with the literature review collection. Most of them address Prosperity dimension (24), followed by Planet (16) and People (15) dimensions (Fig. 4.17).

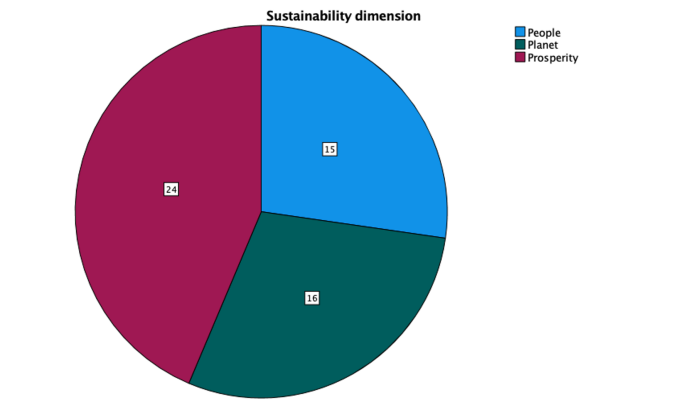


FIGURE 4.17: Number of KPIs for each sustainability dimension

The results also show that they address 9 SDGs, being mainly linked to SDG8 (decent work and economic growth) (Fig. 4.18).

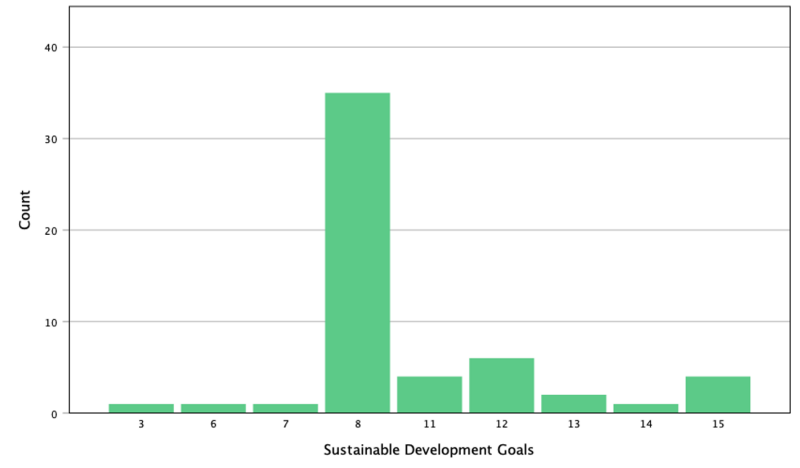


FIGURE 4.18: Number of KPIs for each Sustainable Development Goal

Chapter 5

Discussion

This dissertation allowed to collect a total of 748 KPIs, being 730 from the literature review and 18 from the surveys. Those KPIs address mostly the Construction, Housing and Urbanism and Metallurgy sectors; the SDGs 8 (decent work and economic growth), 11 (sustainable cities and communities) and 12 (responsible production and consumption); and the People sustainability dimension. The number of publications has been increasing, which reflects the growing interest on addressing sustainability issues in projects, namely through KPIs.

Regarding the sectors, the construction sector clearly leads the way towards the sustainability, having the higher number of KPIs covering all the three sustainability dimensions. It seems that researchers are aware of all the impacts this sector can have in all its fronts, for a number of reasons that were not assessed on this study. Nevertheless, a recent study pointed that even so, there is a lack of indicators to properly evaluate those impacts (Stanitsas et al., 2021). A lack that this dissertation tried to address, contributing with the aggregation of 186 KPIs.

There is no study that unifies the various possible variables to show which are the most polluting industries and sectors of the world. Nevertheless, based only in Greenhouse Gas (GHG) emissions, energy use on its different levels is responsible for 73.2% of the emission, agriculture for 18.4% of emissions and general industry and waste for 8% (Ritchie et al., 2020). Within energy use, industry is the biggest responsible with 24.2% of emission (7.2% of metallurgy sector, 10.6% of manufacturing and other industries such as textile, mining and construction), followed by use in buildings with 17.5% and transport with 16.2%. Food-related emissions are responsible for 31% of emissions, if all the production, supply and waste is having in account. The literature review performed to

collect KPIs allowed to cover most of these impactful sectors, and present KPIs for metallurgy, mining, transport, and housing and urbanism. This is indicative that, at least the researchers, are aware of these impacts on climate change, and that they are trying to address it, namely through the proposal of indicators for evaluating and monitoring sustainability. However, it is true that other elements besides GHG emissions are needed to be considered to better understand which industries are causing greater menace to environment and to humans. For example, for mining sector, besides the GHG emissions, for sure it has a great impact on local biodiversity and local communities because part of land will be destroyed and natural resources will be lost. Nonetheless, the indicators recovered have that in account and not only the GHG emissions, which reflects that researchers and managers are a having a perspective of the 'big picture', even if not completely integrating it on their practices.

Surprisingly, most of the KPIs obtained from the literature are related to People. It was expected that they would be more related to Prosperity due to the traditional way of evaluating and monitoring projects, based on project management standards such as PMBOK (PMI, 2017). On the other hand, in practice, the Prosperity-related factors are in higher number, reflecting exactly the traditional indicators to evaluate project performance. The reasons why managers and academics use KPIs for each dimension of sustainability may underlie this difference. The main reasons participants revealed to use Prosperity KPIs seem to be linked to, not only budget control, but algo funding sources and regulation. While the main reasons why they seem to use People and Planet KPIs are for ethical and reputational motives, reasons that are not as compelling as funding sources and regulation. Naturally, this is only a slight indication based on the answers to the survey, however since the sample size is small, no extrapolation and conclusions can be safely taken.

The SDGs most represented reflect a concern to help organizations be increasingly fair and decent at work (8), mindful of responsible consumption and production (12), while contributing to more sustainable cities and communities (11), at the same time that are able to maintain their economic growth (8). This representation is probably also related to the sectors most represented, namely construction, metallurgy, and housing and urbanism, since they are connected, for example, to high consumption and production of resources, to people-related impacts, to safety issues and to environmental impacts. The integration of SDGs on management practices, as advised by P5 Standard (GPM Global, 2019), seems to be partially taken into account, by looking at the surveys' results.

As for the KPIs in the literature, about half have their effectiveness tested with case studies or models (55.4%), but only 16% are integrated into project management processes or any connection to management in general. This can make the transition from academia to practice more difficult for managers and project managers, because it can be hard for managers to find the publications with relevant indicators. The diversity of methods and approaches to select indicators, as perceived in the literature review of this thesis, also adds a layer of complexity for this transition. GPM standard (GPM Global, 2019) and PRiSM methodology (Carboni et al., 2018) provide good guidance on how to integrate sustainability on project management processes, namely suggesting where to define KPIs, in which categories, putting in perspective within process and product impacts on the three sustainability dimensions. Nevertheless, it does not provide a detailed list of indicators nor suggest where managers can find them, and how to select them.

From the survey' results, it is possible to suggest that depending on the sustainability dimension they refer to, KPIs are applied differently. As expected, based on project management standards (e.g., PMBOK - PMI, 2017), KPIs of all the three sustainability dimensions are mostly defined in Initiation and Planning. As far as the application is concerned, the Prosperity- and People-related KPIs are mostly applied in Monitor and Control, and Execution, but the Planet-related KPIs are applied in the Planning. This can lead to situations where, indeed, KPIs are not enough to monitor and check if the medium-long term objectives aligned with sustainability are being addressed (Kivilä et al., 2017), because if they are used in Planning and in no other phase of the project, it is not possible to understand whether the project is being sustainable or not as whole. Even for Prosperity and People KPIs, the closure phase is missing. As suggested by several authors in the literature review and by GPM on its standard, sustainability requires a holistic view of the project and all the products and processes generated by it. Therefore, the application of KPIs should be done all along from Monitor and Control, Execution and Closure, to ensure that the sustainability targets are being met and to be able to adjust in case they are not (Kerzner, 2022; Mossalam&Arafa, 2019). Indicators have become essential, not only for evaluation, but also for communicating with stakeholders about the organization's sustainability goals (Kozlowski et al., 2015). Indeed, reporting has always been a way for organizations to document what was done regarding sustainability. Papoutsi and Sodhi (2020) show in their study that these reporting has been performed in an honest way for most of organizations. Yáñez and colleagues (2019) reiterates the

importance of reporting, claiming that it contributes not only to facilitate communication among stakeholders, but also to foster the integration of sustainability indicators into the overall management plan and to develop a more strategic and comprehensive view of the entire organization. Although the importance of reporting is widely recognized, the results from the survey show a tendency in the opposite direction with only 6 participants reporting on Planet sustainability dimension and 9 participants reporting People sustainability dimension. Those participants are the same that do not use indicators on their daily management, hence indicates that some projects are probably missing benefits opportunities on the medium-long term, since reporting and using indicators help to better define those opportunities and even to define new projects (Yáñez et al., 2019).

Sustainability requires the integration of the various levels (from the organizational to the project level), and for this, the project manager seems to have an increasingly relevant role (Mossalam&Arafa, 2019; Silvius, 2021). Indicators can be one of the ways this integration is done, since, as referred, they allow to follow sustainability target through all the project's lifecycle. The survey results suggest that the use of KPIs on project management is potentiated by the use of standard and the project manager knowledge regarding sustainability concepts. Hence, this arises the thematic that project manager skills need to developed in line with sustainable development (Crawford, 2005; Tam, 2010). As referred in the literature review, studies indicate that intrinsic motivation is the main driver to project management engage and incorporate sustainability in its practice. Training and education have been suggested has a way to stimulate this intrinsic motivation (Ahmad et al., 2012).

Recently, the general-secretary of the Business Council for Sustainable Development (BCSD) gave an interview warning that business schools are misaligned with reality and continue to teach 19th century science and train for 21st century companies (Silva et al., 2022). Part of the problem, according to him, seems to be because business schools continue to focus on purely analytical theories of economics, when sustainability also requires a human and ecological perspective, as well as a re-approximation of the human being to nature. Furthermore, he reflected on the need of interdisciplinary teams on both management schools and organizations to properly address sustainability. Given all the inherent complexities, the normal manager will probably not be able to take into account, for example environmental risks and impacts. There is a need of integration of biologists, engineers, designers, sociologists and other relevant disciplines, so that all the variables,

risks, impacts and perspectives are taken into account.

Chapter 6

Conclusion

This dissertation contributes for the advance of sustainable project management discipline. The main goal was to provide a final database with indicators that project managers can easily filter by the sustainability dimension or the SDG they want to address, removing part of the existing barrier between the researchers and the managers in practice. The database created allows, indeed, project managers to select KPIs according to the project's nature and the managers' interest. The work also allowed to reflect more on the use of indicators, reinforcing how they are important for the integration of sustainability in project management practices.

As any other dissertation, the study has some limitations. First, the sample size of filled surveys, which limits our ability to collect KPIs and to make inferences and extrapolations with the data collected. Second, the lack of access to some of the academic studies which could have relevant KPIs for the KPIs database. Third, not all KPIs found have the same level of information, namely metrics and/or formulas associated to each indicator, which can cause some difficulties on the application of those indicators due to its vague nature. Fourth, the systematic literature review was performed considering only one database (WebOfSience), hence some relevant KPIs can be missed. Finally, the fact that the connection of each KPI to a sustainability dimension and SDG was made only for one person (myself), which is not ideal having in account the subjectivity of the task.

As future work, a first task would be to increase the number of KPIs by searching literature on other databases and by increasing the number of filled surveys. Furthermore, the KPIs database information can be improved, by specifying SDG targets and not only the global SDG which is related to. Lastly, in order to serve all, academics and managers

in practice, it would be essential to publish it as an interactive database, where anyone can contribute and add new KPIs.

The sustainable project management is a complex new discipline that emerged within the project management community. A discipline that will require the integration of many other disciplines if we want to accomplish sustainability or even to move forward to regeneration (GPM Global, 2019). Indeed, regeneration should be our ultimate goal, since to simply sustain what we have now is not sustainable at all.

Appendix A

Questionnaire

Secção 2 de 10

Organização onde trabalha (Parte I)

Descrição (opcional)

Qual a atividade principal da sua organização? *

- [ ] Agricultura, produção animal, caça, floresta e pesca
- [ ] Indústrias extractivas
- [ ] Indústrias transformadoras
- [ ] Captação, tratamento e distribuição de água; saneamento, gestão de resíduos e despoluição
- [ ] Construção
- [ ] Comércio por grosso e a retalho
- [ ] Reparação de veículos automóveis e motociclos
- [ ] Transportes e armazenagem
- [ ] Alojamento, restauração e similares
- [ ] Actividades de informação e de comunicação
- [ ] Actividades imobiliárias
- [ ] Actividades administrativas e dos serviços de apoio
- [ ] Administração Pública e Defesa
- [ ] Educação
- [ ] Actividades de saúde humana e apoio social
- [ ] Actividades artísticas, de espectáculos, desportivas e recreativas
- [ ] Outra opção...

País da sede principal da organização onde trabalha *

Texto de resposta curta

A sua organização promove atividades ou desenvolve projetos que obrigam à constituição de equipas temporárias ou à gestão de subcontratações? *

- ○ Sim
- ○ Não
- ○ Não sei responder

Após a secção 2 Continuar para a secção seguinte

Secção 3 de 10

Organização onde trabalha (Parte II)

Descrição (opcional)

Qual o standard que serviu de base para a organização da gestão dos projetos? *

- ☐ Guia PMBOK®
- ☐ PRINCE®
- ☐ ICB4®
- ☐ GPM P5™
- ☐ Não foi utilizado nenhum standard ou referência
- ☐ Outra opção...

Qual a dimensão, em pessoas, de uma equipa para a atividade não recorrente ou projetos de maior impacto na sua organização no último ano (2021)? *

Texto de resposta curta

Qual o orçamento da atividade não recorrentes ou projeto de maior impacto na sua organização no último ano (2021)? *

Texto de resposta curta

Secção 3 de 10

Organização onde trabalha (Parte II)

Descrição (opcional)

Qual o standard que serviu de base para a organização da gestão dos projetos? *

- [ ] Guia PMBOK®
- [ ] PRINCE®
- [ ] ICB4®
- [ ] GPM P5™
- [ ] Não foi utilizado nenhum standard ou referência
- [ ] Outra opção...

Qual a dimensão, em pessoas, de uma equipa para a atividade não recorrente ou projetos de maior impacto na sua organização no último ano (2021)? *

Texto de resposta curta

Qual o orçamento da atividade não recorrentes ou projeto de maior impacto na sua organização no último ano (2021)? *

Texto de resposta curta

Sente que a sua organização se preocupa com questões de sustentabilidade financeira? *

- ( ) Sim
- ( ) Não

Sente que a sua organização se preocupa com questões de sustentabilidade ambiental? *

- ( ) Sim
- ( ) Não

Sente que a sua organização se preocupa com questões de sustentabilidade social? *

- ◯ Sim
- ◯ Não

Após a secção 3 Continuar para a secção seguinte

Secção 4 de 10

Conhecimentos sobre sustentabilidade

Descrição (opcional)

Já ouviu falar de pegada ecológica? *

	1	2	3	4	5	6	
Nunca ouvi falar	◯	◯	◯	◯	◯	◯	Sei o que significa

Já ouviu falar do termo 'triple bottom line'? *

	1	2	3	4	5	6	
Nunca ouvi falar	◯	◯	◯	◯	◯	◯	Sei o que significa

Já ouviu falar nos 5P's: Pessoas, Planeta, Prosperidade, Processos e Produtos (People, Planet, Prosperity, Process, and Products)? *

	1	2	3	4	5	6	
Nunca ouvi falar	◯	◯	◯	◯	◯	◯	Sei o que significa

Já ouviu falar dos Objetivos para o Desenvolvimento Sustentável (ODS)? *

	1	2	3	4	5	6	
Nunca ouvi falar	◯	◯	◯	◯	◯	◯	Sei o que são

Os ODS são tidos em consideração na gestão do dia-a-dia da organização? *

	1	2	3	4	5	6	
Nunca	○	○	○	○	○	○	Sempre

Após a secção 4 Continuar para a secção seguinte

Secção 5 de 10

Avaliação da sustentabilidade

Descrição (opcional)

Faz uma avaliação dos impactos sociais, ambientais e financeiros, dos produtos gerados pelo projetos ou atividades recorrentes? (Considerar os impactos durante a realização de atividades e após a sua conclusão) *

	1	2	3	4	5	6	
Nunca	○	○	○	○	○	○	Sempre

Faz uma avaliação dos impactos sociais, ambientais e financeiros, dos processos utilizado nos projetos ou atividades recorrentes? (Considerar os impactos durante a realização de atividades e após a sua conclusão) *

	1	2	3	4	5	6	
Nunca	○	○	○	○	○	○	Sempre

Utiliza KPIs para avaliação da sustentabilidade nos projetos ou atividades recorrentes? *

- ○ Sim
- ○ Não

Após a secção 5 Continuar para a secção seguinte

Secção 6 de 10

Avaliação da sustentabilidade

Descrição (opcional)

Utiliza o EVM (Earned Value Management) como principal forma de avaliar o desempenho do seu projeto ou atividade recorrente? *

	1	2	3	4	5	6	
Nunca	○	○	○	○	○	○	Sempre

Dedica orçamento e tempo para questões sociais e/ou ambientais? *

	1	2	3	4	5	6	
Nunca	○	○	○	○	○	○	Sempre

Tem em conta os impactos económicos, diretos ou indiretos, do projeto ou atividade recorrente? *

	1	2	3	4	5	6	
Nunca	○	○	○	○	○	○	Sempre

Tem em conta os impactos sociais, diretos ou indiretos, do projeto ou atividade recorrente? *

	1	2	3	4	5	6	
Nunca	○	○	○	○	○	○	Sempre

Tem em conta os impactos ambientais, diretos ou indiretos, do projeto ou atividade recorrente? *

	1	2	3	4	5	6	
Nunca	○	○	○	○	○	○	Sempre

Reporta sobre a sustentabilidade financeira nos seus relatórios de desempenho do projeto ou atividade recorrente? *

- ○ Sim
- ○ Não

Reporta sobre a sustentabilidade social nos seus relatórios de desempenho do projeto ou atividade recorrente? *

- ○ Sim
- ○ Não

Reporta sobre a sustentabilidade ambiental nos seus relatórios de desempenho do projeto ou atividade recorrente? *

- ○ Sim
- ○ Não

Após a secção 6 Ir para a secção 10 (Dados demográficos)

Secção 7 de 10

KPIs Financeiros

Os indicadores chave de desempenho (KPIs) financeiros são medidas de alto nível de lucros, receitas, despesas ou outros resultados financeiros que se concentram especificamente em relações derivadas dos dados - e quase sempre estão vinculados a um valor ou proporção financeira específica.

Alguns exemplos: Margem de lucro, Retorno sobre Vendas, Crescimento de Vendas, Índice de Fluxo de Caixa

Usa KPIs financeiros para medir a performance das suas atividades não recorrentes ou projetos a nível financeiro? *

- ○ Sim
- ○ Não

Aplica esses KPIs formalmente na gestão das suas atividades não recorrentes ou projetos? *

	1	2	3	4	5	6	
Nunca	○	○	○	○	○	○	Sempre

Em que grupo(s) de processos das suas atividades não recorrentes ou projetos os define? *

- [ ] Iniciação
- [ ] Planeamento
- [ ] Monitorização e Controlo
- [ ] Execução
- [ ] Fecho
- [ ] Não aplico

Em que grupo(s) de processos das suas atividades não recorrentes ou projetos os aplica? *

- [ ] Iniciação
- [ ] Planeamento
- [ ] Monitorização e Controlo
- [ ] Execução
- [ ] Fecho
- [ ] Não aplico

Indique, pelo menos, três KPIs financeiros que aplica nas suas atividades não recorrentes ou projetos *

Texto de resposta longa

Qual o motivo que o leva a usar KPIs financeiros? *

- [ ] Reputação
- [ ] Controlo de orçamentos
- [ ] Valores éticos
- [ ] Fontes de financiamento
- [ ] Regulamentação
- [ ] Não uso
- [ ] Outra opção...

Após a secção 7 Continuar para a secção seguinte

Secção 8 de 10

KPIs Ambientais

Os indicadores chave de desempenho (KPIs) ambiental são medidas quantitativas de alto nível que colocam valores no desempenho ambiental do projeto/actividade recorrente e/ou da organização.

Exemplos: Consumo de energia (kWh), Consumo de água (L), Quantidade total de resíduos produzidos (tonelada/m3), Área total de terreno aberto

Usa KPIs ambientais para medir a performance das suas atividades não recorrentes ou projetos a nível ambiental? *

- ( ) Sim
- ( ) Não

Aplica esses KPIs formalmente na gestão das suas atividades não recorrentes ou projetos? *

	1	2	3	4	5	6	
Nunca	( )	( )	( )	( )	( )	( )	Sempre

Em quegrupo(s) de processos das suas atividades não recorrentes ou projetos os define? *

- [ ] Iniciação
- [ ] Planeamento
- [ ] Monitorização e Controlo
- [ ] Execução
- [ ] Fecho
- [ ] Não aplico

Em que grupo(s) de processos das suas atividades não recorrentes ou projetos os aplica? *

- [ ] Iniciação
- [ ] Planeamento
- [ ] Monitorização e Controlo
- [ ] Execução
- [ ] Fecho
- [ ] Não aplico

Indique, pelo menos, três KPIs ambientais que aplica nas suas atividades não recorrentes ou projetos *

Texto de resposta longa

Qual o motivo que o leva a usar KPIs ambientais? *

- [ ] Reputação
- [ ] Controlo de orçamentos
- [ ] Valores éticos
- [ ] Fontes de financiamento
- [ ] Não uso

Secção 9 de 10

KPIs sociais

Os indicadores chave de desempenho (KPIs) social são medidas quantitativas de alto nível que colocam valores no desempenho social do projeto/actividade recorrente e/ou da organização.

Exemplos: Satisfação dos colaboradores (ex.: Percentagem de colaboradores que concordam com um dado número de afirmações), Número de lesões não-fatais e doentes, Percentagem de mulheres como vice-presidentes ou em cargos superiores, Total em doações monetárias a fundações e associaçóes sem fins lucrativos

Usa KPIs sociais para medir a performance das suas atividades não recorrentes ou projetos a nível ambiental? *

- ○ Sim
- ○ Não

Aplica esses KPIs formalmente na gestão nas suas atividades não recorrentes ou projetos? *

	1	2	3	4	5	6	
Nunca	○	○	○	○	○	○	Sempre

Em que grupo(s) de processos das suas atividades não recorrentes ou projetos os define? *

- ☐ Iniciação
- ☐ Planeamento
- ☐ Monitorização e Controlo
- ☐ Execução
- ☐ Fecho
- ☐ Não aplico

Em que grupo(s) de processos das suas atividades não recorrentes ou projetos os aplica? *

- [ ] Iniciação
- [ ] Planeamento
- [ ] Monitorização e Controlo
- [ ] Execução
- [ ] Fecho
- [ ] Não aplico

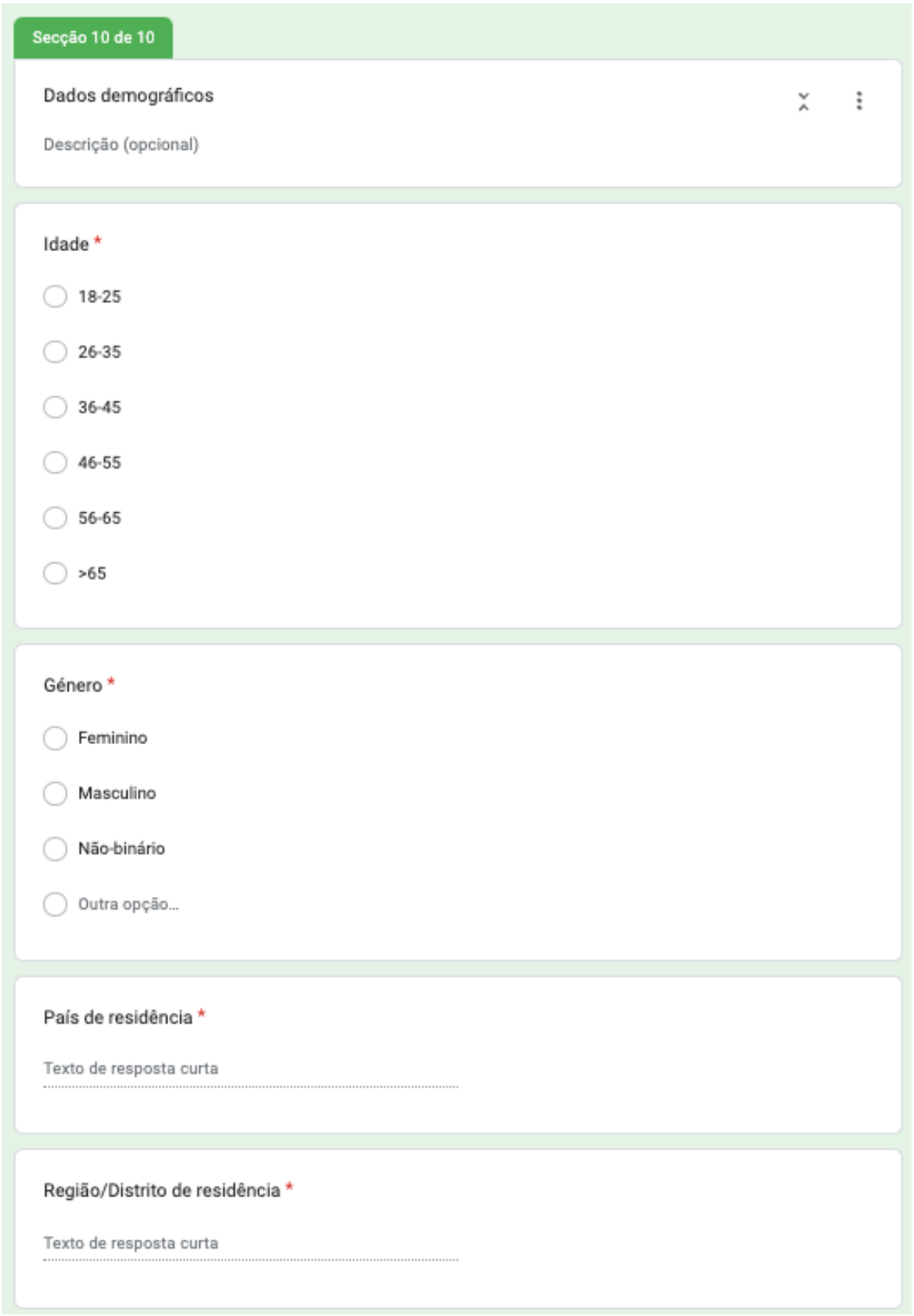
Indique, pelo menos, três KPIs sociais que mais aplica nas suas atividades não recorrentes ou projetos. *

Texto de resposta longa

Qual o motivo que o leva a usar KPIs sociais? *

- [ ] Reputação
- [ ] Controlo de orçamentos
- [ ] Valores éticos
- [ ] Fontes de financiamento
- [ ] Não uso
- [ ] Outra opção...

Após a secção 9 Continuar para a secção seguinte



Secção 10 de 10

Dados demográficos

Descrição (opcional)

Idade *

- 18-25
- 26-35
- 36-45
- 46-55
- 56-65
- >65

Género *

- Feminino
- Masculino
- Não-binário
- Outra opção...

País de residência *

Texto de resposta curta

Região/Distrito de residência *

Texto de resposta curta

Nível de escolaridade *

- ( ) Ensino Secundário
- ( ) Licenciatura
- ( ) Mestrado
- ( ) Doutoramento
- ( ) Pós-graduação

Qual a sua função na organização? *

- ( ) Administrativo
- ( ) Gestor
- ( ) Gestor de Projeto
- ( ) Líder de equipa
- ( ) Outra opção...

Há quanto tempo encontra-se a trabalhar na organização atual? *

- ( ) Menos de um ano
- ( ) 1-5 anos
- ( ) 6-10 anos
- ( ) 11-20 anos
- ( ) Mais de 20 anos

Se pretender, pode deixar aqui comentários, sugestões ou correções.

Texto de resposta longa

Appendix B

Systematic literature review – References

Adabre, M. A., & Chan, A. P. C. (2019). The ends required to justify the means for sustainable affordable housing: A review on critical success criteria. In Sustainable Development (Vol. 27, Issue 4, pp. 781–794). John Wiley and Sons Ltd. https://doi.org/10.1002/sd.1919

Akbari, S., Khanzadi, M., & Gholamian, M. R. (2018). Building a rough sets-based prediction model for classifying large-scale construction projects based on sustainable success index. Engineering, Construction and Architectural Management, 25(4), 534–558. https://doi.org/10.1108/ECAM-05-2016-0110

Akbari, S., Rahimian, F. P., Sheikhkhoshkar, M., Banihashemi, S., & Khanzadi, M. (2020). Dynamic Sustainable Success Prediction Model for Infrastructure Projects: A Rough Set Based Fuzzy Inference System. Construction Innovation, 20(4).

Aladag, H., & Isik, Z. (2016). Sustainable key performance indicators for urban regeneration projects. Sigma Journal Engineering and Natural Sciences, 34(1), 1–13. Bai, C., & Sarkis, J. (2014). Determining and applying sustainable supplier key performance indicators. Supply Chain Management, 19(3).

Bouziotas, D., van Duuren, D., van Alphen, H. J., Frijns, J., Nikolopoulos, D., & Makropoulos, C. (2019). Towards circular water neighborhoods: Simulation-based decision support for integrated decentralized urban water systems. Water (Switzerland), 11(6). https://doi.org/10.3390/w11061227

Bouzouidja, R., Cannavo, P., Bodénan, P., Gulyás, Á., Kiss, M., Kovács, A., Béchet, B., Chancibault, K., Chantoiseau, E., Bournet, P. E., Bouzidi, R., Guénon, R., Lebeau, T., Musy, M., & Rodriguez, F. (2021). How to evaluate nature-based solutions performance for microclimate, water and soil management issues – Available tools and methods from Nature4Cities European project results. Ecological Indicators, 125.

Branca, T. A., Matino, I., Colla, V., Petrucciani, A., Singh, A. K. M., Zaccara, A., Beone, T., de Cecco, L., Hakala, V., Lorito, D., Moreira, S., & Piras, E. (2020). Paving the way for the optimization of water consumption in the steelmaking processes: Barriers, analysis and KPIs definition. Materiaux et Techniques, 108(5–6).

Broad, K. C., Sneath, R. J., & Emery, T. M. J. (2016). Use of business analysis in beef businesses to direct management practice change for climate adaptation outcomes. Rangeland Journal, 38(3), 273–282. https://doi.org/10.1071/RJ15103

Brown, M. (2009). DEVELOPING KPIS THAT DRIVE PROCESS SAFETY IMPROVEMENT. Symposium Series No. 155 - Hazards XXI.

Bryde, D. J. (2005). Methods for managing different perspectives of project success. British Journal of Management, 16(2), 119–131.

Colla, V., Cirilli, F., Kleimt, B., Unamuno, I., Tosato, S., Baragiola, S., Klung, J. S., Quintero, B. P., & de Miranda, U. (2016). Monitoring the environmental and energy impacts of electric arc furnace steelmaking. Materiaux et Techniques, 104(1).

Consilvio, A., Solís-Hernández, J., Jiménez-Redondo, N., Sanetti, P., Papa, F., & Mingolarra-Garaizar, I. (2020). On applying machine learning and simulative approaches to railway asset management: The earthworks and track circuits case studies. Sustainability (Switzerland), 12(6). https://doi.org/10.3390/su12062544

Cooper, J., Lee, A., & Jones, K. (2020). Sustainable built asset management performance indicators and attributes: A UK social housing case study example. International Journal of Building Pathology and Adaptation, 38(3), 508–522.

Corbière-Nicollier, T., & Jolliet, O. (2002). Measuring sustainability at the communal level. In C. Brebbia, J. Martin-Duque, & L. Wadhwa (Eds.), The Sustainable City II. WIT Press. Cruz, C. O., Gaspar, P., & de Brito, J. (2019). On the concept of sustainable sustainability: An application to the Portuguese construction sector. Journal of Building Engineering, 25. https://doi.org/10.1016/j.jobe.2019.100836

Dodd, M. B., Wedderburn, M. E., Parminter, T. G., Thorrold, B. S., & Quinn, J. M. (2008). Transformation toward agricultural sustainability in New Zealand hill country pastoral landscapes. Agricultural Systems, 98(2), 95–107.

Ekambaram, A., & Økland, A. (2018). Lessons learned on lessons learned: Gathering knowledge on energy-efficient rehabilitation of buildings. Proceedings of the European Conference on Knowledge Management, 216–224.

Fourie, H. (2016). Improvement in the overall efficiency of mining equipment: A case study. Journal of the Southern African Institute of Mining and Metallurgy, 116(3), 275–281. https://doi.org/10.17159/2411-9717/2016/v116n3a9

Gackowiec, P., Podobinska-Staniec, M., Brzychczy, E., Kühlbach, C., & Özver, T. (2020). Review of key performance indicators for process monitoring in the mining industry. In Energies (Vol. 13, Issue 19). MDPI AG. https://doi.org/10.3390/en13195169

Gottsche, J., Kelly, M., & Taggart, M. (2016). Assessing the impact of energy management initiatives on the energy usage during the construction phase of an educational building project in Ireland. Construction Management and Economics, 34(1), 46–60.

Guarini, M. R., Morano, P., & Sica, F. (2019). Integrated ecosystem design: An evaluation model to support the choice of eco-compatible technological solutions for residential building. Energies, 12(14). https://doi.org/10.3390/en12142659

Gumbo, B. (2004). The status of water demand management in selected cities of southern Africa. Physics and Chemistry of the Earth, 29(15-18 SPEC.ISS.), 1225–1231. https://doi.org/10.1016/j.pce.2004.09.029

Gunduz, M., & Abu-Hijleh, A. (2020). Assessment of human productivity drivers for construction labor through importance rating and risk mapping. Sustainability (Switzerland), 12(20), 1–18. https://doi.org/10.3390/su12208614

Hurtado, D. G., Pérez, R. N., & Devece, C. (2019). Contribution from the Balanced Scorecard implemented at the University of Ciego de Ávila to the sustainable development of the territory. Proceedings of EDULEARN19 Conference.

Huynh, T. T. M., Dang, C. N., Le-Hoai, L., Pham, A. D., & Nguyen, T. D. (2020). Proposing a strategy map for coastal urban project success using the balanced scorecard method. Engineering, Construction and Architectural Management, 27(10), 2993–3030. https://doi.org/10.1108/ECAM-11-2018-0527

Jahangirian, M., Taylor, S. J. E., Young, T., & Robinson, S. (2017). Key performance indicators for successful simulation projects ga. Journal of the Operational Research Society, 68(7), 747–765. https://doi.org/10.1057/jors.2016.1

Kasem, E., Trenz, O., Hřebíček, J., & Faldík, O. (2015). Key Sustainability Performance Indicator Analysis for Czech Breweries. Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis, 63(6), 1937–1944. https://doi.org/10.11118/201563061937

Kitchin, R., & Stehle, S. (2021). Can Smart City Data be Used to Create New Official Statistics? Journal of Official Statistics, 37(1), 121–147. https://doi.org/10.2478/jos-2021-0006

Kocmanova, A., & Simberova, I. (2012). Kolektyvinio valdymo veiklos rodikliu modeliavimas. Engineering Economics, 23(5), 485–495.

Kucukaltan, B., Irani, Z., & Aktas, E. (2016). A decision support model for identification and prioritization of key performance indicators in the logistics industry. Computers in Human Behavior, 65, 346–358. https://doi.org/10.1016/j.chb.2016.08.045

Leones, J. L., Morales, M. P., D'Alto, L., Escalonilla, P. S., Herrer, D. F., Bravo, M. S., Cámara, F. C., Mateo, Á. M., MacNamee, B., Wang, S., Grover, A., & Plantholt, P. (2018). Advanced flight efficiency key performance indicators to support air traffic analytics: Assessment of European flight efficiency using ADS-B data. AIAA/IEEE Digital Avionics Systems Conference - Proceedings, 2018-September.

Marzouk, M., & El-Hesnawi, M. (2018). Framework for assessing serviceability and socio-economic risk associated with ppps projects in Libya. Journal of Civil Engineering and Management, 24(7), 556–567. https://doi.org/10.3846/jcem.2018.5623

Matino, I., Colla, V., Cirilli, F., Kleimt, B., Iriondo, I. U., Tosato, S., Baragiola, S., Kling, J. S., Peña Quintero, B., & de Miranda, U. (2017). Environmental impact evaluation for effective resource management in EAF steelmaking. La Metallurgia Italiana, 10, 48–58. https://www.researchgate.net/publication/299453162

McGarvey, R., Matthews, J. M., Feenstra, J. E., Punt, A. E., & Linnane, A. (2016). Using bioeconomic modeling to improve a harvest strategy for a quota-based lobster fishery. Fisheries Research, 183, 549–558. https://doi.org/10.1016/j.fishres.2016.05.005

Mohammed, A. B. (2022). Applying BIM to achieve sustainability throughout a building life cycle towards a sustainable BIM model. International Journal of Construction Management, 22(2), 148–165. https://doi.org/10.1080/15623599.2019.1615755

Moradi, S., Ansari, R., & Taherkhani, R. (2022). A Systematic Analysis of Construction Performance Management: Key Performance Indicators from 2000 to 2020. In Iranian Journal of Science and Technology - Transactions of Civil Engineering (Vol. 46, Issue 1, pp. 15–31). Springer Science and Business Media Deutschland GmbH.

Muntean, M. (2018). Business intelligence issues for sustainability projects. Sustainability (Switzerland), 10(2). https://doi.org/10.3390/su10020335

Petrov, A. M., Savkina, R. v, Kuzmina, A. A., Poluleh, M. v, & Belousova, T. A. (2020). Assessing investment attractiveness through sustainability criteria in turbulent economy. Bulletin of National Academy of Sciences of the Republic of Kazakhstan, 4(386), 181–188. https://doi.org/https://doi.org/10.32014/2020.2518-1467.118

Prause, G., & Schröder, M. (2015). KPI building blocks for successful green transport corridor implementation. Transport and Telecommunication, 16(4), 277–287.

Rodriguez-Trejo, S., Ahmad, A. M., Hafeez, M. A., Dawood, H., Vukovic, V., Kassem, M., Naji, K. K., & Dawood, N. (2017). Hierarchy based information requirements for sustainable operations of buildings in Qatar. Sustainable Cities and Society, 32, 435–448. https://doi.org/10.1016/j.scs.2017.03.005

Sanz, M. P., Veenstra, S., de Montalvo, U. W., van Tulder, R., & Alaerts, G. (2013). What counts as "results" in capacity development partnerships between water operators? A multi-path approach toward accountability, adaptation and learning. Water Policy, 15(SUPPL.2), 242–266. https://doi.org/10.2166/wp.2013.022

Sezer, A. A. (2015). Contractor use of productivity and sustainability indicators for building refurbishment. Built Environment Project and Asset Management, 5(2), 141–153. https://doi.org/10.1108/BEPAM-11-2013-0065

Silvestri, A., Falcone, D., di Bona, G., Forcina, A., & Gemmiti, M. (2021). Global performance index for integrated management system: GPI-IMS. International Journal of Environmental Research and Public Health, 18(13). https://doi.org/10.3390/ijerph18137156

Tavella, C., Spoerndli, C., Beu, D., & Ceclan, A. (2021). CoME EASY—synchronizing european energy award with other initiatives. Case study: Romanian local communities. Energies, 14(19). https://doi.org/10.3390/en14196248

Villazón, C. C., Pinilla, L. S., Olaso, J. R. O., Gandarias, N. T., & de Lacalle, N. L. (2020). Identification of key performance indicators in project-based organisations through the lean approach. Sustainability (Switzerland), 12(15). https://doi.org/10.3390/su12155977

Wahaab, R. A., Elsayed, W. H., Ibrahiem, M. S., & Hasballah, A. F. (2021). Water safety plan for securing drinking water supply from river bank filtration projects in egypt - a case study. Egyptian Journal of Chemistry, 64(8), 4233–4249.

Wibowo, M. A., Elizar, Sholeh, M. N., & Adji, H. S. (2017). Supply Chain Management Strategy for Recycled Materials to Support Sustainable Construction. Procedia Engineering, 171, 185–190. https://doi.org/10.1016/j.proeng.2017.01.325

Yuan, H. (2017). Achieving Sustainability in Railway Projects: Major Stakeholder Concerns. Project Management Journal, 115–132.

Yuan, J., Li, L., Wang, E., & Skibniewski, M. J. (2019). Examining sustainability indicators of space management in elderly Facilities—a case study in China. Journal of Cleaner Production, 208, 144–159. https://doi.org/10.1016/j.jclepro.2018.10.065

Zou, X., & Moon, S. (2014). Hierarchical evaluation of on-site environmental performance to enhance a green construction operation. Civil Engineering and Environmental Systems, 31(1), 5–23. https://doi.org/10.1080/10286608.2012.749871

Appendix C

Results from association tests performed

C.1 Use of KPIs as the main variable

- Age

Testes qui-quadrado

	Valor	df	Significância Assintótica (Bilateral)	Sig. Monte Carlo (Bilateral) Significância	Intervalo de Confiança 95% Limite inferior	Intervalo de Confiança 95% Limite superior
Qui-quadrado de Pearson	6,321[a]	5	,276	,273[b]	,264	,282
Razão de verossimilhança	8,204	5	,145	,231[b]	,223	,239
Teste exato de Fisher-Freeman-Halton	6,083			,257[b]	,248	,265
N de Casos Válidos	38					

a. 10 células (83,3%) esperavam uma contagem menor que 5. A contagem mínima esperada é ,39.

b. Baseado em 10000 tabelas de amostra com a semente 1451419960.

FIGURE C.1: Results of association test between Use of KPIs and Age

- Academic level

Testes qui-quadrado

	Valor	df	Significância Assintótica (Bilateral)	Sig. Monte Carlo (Bilateral) Significância	Intervalo de Confiança 95% Limite inferior	Intervalo de Confiança 95% Limite superior
Qui-quadrado de Pearson	4,725[a]	4	,317	,377[b]	,367	,386
Razão de verossimilhança	6,103	4	,192	,337[b]	,327	,346
Teste exato de Fisher-Freeman-Halton	3,903			,426[b]	,417	,436
N de Casos Válidos	38					

a. 6 células (60,0%) esperavam uma contagem menor que 5. A contagem mínima esperada é ,79.

b. Baseado em 10000 tabelas de amostra com a semente 1451419960.

FIGURE C.2: Results of association test between Use of KPIs and Academic Degree

- Role in organization

Testes qui-quadrado

	Valor	df	Significância Assintótica (Bilateral)	Sig. Monte Carlo (Bilateral) Significância	Intervalo de Confiança 95% Limite inferior	Intervalo de Confiança 95% Limite superior
Qui-quadrado de Pearson	5,757[a]	7	,568	,703[b]	,694	,712
Razão de verossimilhança	7,816	7	,349	,642[b]	,633	,651
Teste exato de Fisher-Freeman-Halton	5,244			,795[b]	,787	,803
N de Casos Válidos	38					

a. 13 células (81,3%) esperavam uma contagem menor que 5. A contagem mínima esperada é ,39.

b. Baseado em 10000 tabelas de amostra com a semente 1451419960.

FIGURE C.3: Results of association test between Use of KPIs and Role at the organization

C.2 Use of Knowledge as the main variable

- Age

Testes qui-quadrado

	Valor	df	Significância Assintótica (Bilateral)	Sig. Monte Carlo (Bilateral) Significância	Intervalo de Confiança 95% Limite inferior	Intervalo de Confiança 95% Limite superior
Qui-quadrado de Pearson	4,924[a]	5	,425	,461[b]	,451	,471
Razão de verossimilhança	5,920	5	,314	,449[b]	,439	,459
Teste exato de Fisher-Freeman-Halton	4,550			,496[b]	,487	,506
N de Casos Válidos	38					

a. 10 células (83,3%) esperavam uma contagem menor que 5. A contagem mínima esperada é ,18.

b. Baseado em 10000 tabelas de amostra com a semente 2000000.

FIGURE C.4: Results of association test between Knowledge and Age

- Academic level

Testes qui-quadrado

	Valor	df	Significância Assintótica (Bilateral)	Sig. Monte Carlo (Bilateral) Significância	Intervalo de Confiança 95% Limite inferior	Intervalo de Confiança 95% Limite superior
Qui-quadrado de Pearson	1,068[a]	4	,899	1,000[b]	1,000	1,000
Razão de verossimilhança	1,784	4	,775	1,000[b]	1,000	1,000
Teste exato de Fisher-Freeman-Halton	1,126			1,000[b]	1,000	1,000
N de Casos Válidos	38					

a. 8 células (80,0%) esperavam uma contagem menor que 5. A contagem mínima esperada é ,37.

b. Baseado em 10000 tabelas de amostra com a semente 2000000.

FIGURE C.5: Results of association test between Knowledge and Academic Degree

- Role in organization

Testes qui-quadrado

	Valor	df	Significância Assintótica (Bilateral)	Sig. Monte Carlo (Bilateral) Significância	Intervalo de Confiança 95% Limite inferior	Intervalo de Confiança 95% Limite superior
Qui-quadrado de Pearson	10,788[a]	7	,148	,160[b]	,152	,167
Razão de verossimilhança	12,029	7	,100	,109[b]	,102	,115
Teste exato de Fisher-Freeman-Halton	9,664			,154[b]	,147	,161
N de Casos Válidos	38					

a. 13 células (81,3%) esperavam uma contagem menor que 5. A contagem mínima esperada é ,18.

b. Baseado em 10000 tabelas de amostra com a semente 2000000.

FIGURE C.6: Results of association test between Knowledge and Role at the organization

- Environmental sustainability concern

Testes qui-quadrado[c]

	Valor	df	Significância Assintótica (Bilateral)	Sig exata (2 lados)	Sig exata (1 lado)
Qui-quadrado de Pearson	,588[a]	1	,443	,592	,383
Correção de continuidade[b]	,052	1	,820		
Razão de verossimilhança	,539	1	,463	,592	,383
Teste Exato de Fisher				,592	,383
N de Casos Válidos	38				

a. 1 células (25,0%) esperavam uma contagem menor que 5. A contagem mínima esperada é 1,29.

b. Computado apenas para uma tabela 2x2

c. Para a tabulação cruzada 2x2, resultados exatos são fornecidos em vez dos resultados de Monte Carlo.

FIGURE C.7: Results of association test between Knowledge and Environmental concern

- Social sustainability concern

Testes qui-quadrado[c]

	Valor	df	Significância Assintótica (Bilateral)	Sig exata (2 lados)	Sig exata (1 lado)
Qui-quadrado de Pearson	,010[a]	1	,922	1,000	,661
Correção de continuidade[b]	,000	1	1,000		
Razão de verossimilhança	,009	1	,923	1,000	,661
Teste Exato de Fisher				1,000	,661
N de Casos Válidos	38				

a. 2 células (50,0%) esperavam uma contagem menor que 5. A contagem mínima esperada é ,92.

b. Computado apenas para uma tabela 2x2

c. Para a tabulação cruzada 2x2, resultados exatos são fornecidos em vez dos resultados de Monte Carlo.

FIGURE C.8: Results of association test between Knowledge and Social concern

Bibliography

Adabre, M. A., & Chan, A. P. C. (2019). The ends required to justify the means for sustainable affordable housing: A review on critical success criteria. Sustainable Development, 27(4), 781–794. https://doi.org/10.1002/sd.1919

Ahmad, W., Soskolne, C. L., & Ahmed, T. (2012). Strategic thinking on sustainability: Challenges and sectoral roles. Environment, Development and Sustainability, 14(1), 67–83. https://doi.org/10.1007/S10668-011-9309-5/TABLES/1

Albuoul, B. (2017). Key Performance Indicators (KPIs) Impacts in Project Management. Business and Economics Journal, 08(03). https://doi.org/10.4172/2151-6219.1000316

Alkire, S., Conceição, P., Barham, A., Calderón, C., Conconi, A., Dirksen, J., Espinal, F. C., Evans, M., Hall, J., Jahic, A., Kanagaratnam, U., Kivilo, M., Kovacevic, M., Kovesdi, F., Mitchell, C., Nogales, R., Oldiges, C., Ortubia, A., Pinilla-Roncancio, M., … Walkey, C. (2019). Global Multidimensional, Poverty Index 2019, Illuminating Inequalities. In OPHI and UNDP.

Al-Malkawi, H. A. N., Pillai, R., & Bhatti, M. I. (2014). Corporate governance practices in emerging markets: The case of GCC countries. Economic Modelling, 38, 133–141. https://doi.org/10.1016/J.ECONMOD.2013.12.019

Alves, A. T. A. da R. B. A., Nascimento, A., Ulhôa, A., Batista, B., Capela, C., Venturine, C., Rodrigues, D., Moreira, E., Silva, F., Ribeiro, E., Demba, J., Lapa, L. D. P., Mota, M., & Silva, P. C. B. da. (2021). Reflexões em torno de Metodologias de Investigação: recolha de dados (volume 2) (P. Sá, A. P. Costa, & A. Moreira, Eds.; Vol. 2). UA Editora. https://doi.org/10.34624/ka02-fq42

Armenia, S., Dangelico, R. M., Nonino, F., & Pompei, A. (2019). Sustainable project management: A conceptualization-oriented review and a framework proposal for future studies. Sustainability (Switzerland), 11(9). https://doi.org/10.3390/su11092664

Baillie, J., & Zhang, Y. P. (2018). Space for nature. Science, 361(6407), 1051. https://doi.org/10.1126

Balachandran, B., & Faff, R. (2015). Corporate governance, firm value and risk: Past, present, and future. Pacific-Basin Finance Journal, 35, 1–12. https://doi.org/10.1016/J.PACFIN.2015.07.002

Balvanera, P., Quijas, S., Karp, D. S., Ash, N., Bennett, E. M., Boumans, R., Brown, C., Chan, K. M., Chaplin-Kramer, R., Halpern, B. S., Honey-Rosés, J., Kim, C.-K., Cramer, W., José Martínez-Harms, M., Mooney, H., Mwampamba, T., Nel, J., Polasky, S., Reyers, B., … Professor, A. (2017). Ecosystem Services. The GEO Handbook on Biodiversity Observation Networks, 39–78. https://doi.org/10.1007/978-3-319-27288-7_3

BCSD. (2020a). BCSD - Conselho Empresarial para o Desenvolvimento Sustentável. https://www.bcsdportugal.org/

BCSD. (2020b). Objetivos de Desenvolvimento Sustentável.

Boltanski, L., & Chiapello, E. (2005). The New Spirit of Capitalism. Verso.

Brones, F. A., Carvalho, M. M. de, & Zancul, E. de S. (2017). Reviews, action and learning on change management for ecodesign transition. Journal of Cleaner Production, 142, 8–22. https://doi.org/10.1016/j.jclepro.2016.09.009

BSR/GlobeScan. (2019). The State of Sustainable Business 2019.

Carboni, Dr. J. B., Duncan, W. (Bill), Gonzalez, M., Milsom, P. S., & Young, M. (2018). Sustainable Project Management: The GPM Reference Guide. July, 156.

Carlowitz, H. C. (1713). Sylvicultura oeconomica oder haußwirtschaftliche Nachricht und naturgemäße Anweisung zur wilden Baumzucht. Braun.

Cerne, A., & Jansson, J. (2019). Projectification of sustainable development: implications from a critical review. International Journal of Managing Projects in Business, 12(2), 356–376. https://doi.org/10.1108/IJMPB-04-2018-0079

Comissão Europeia. (2020a). Estratégia da Biodiversidade da UE para 2030. https://ec.europa.eu

Comissão Europeia. (2020b). Pacto Ecológico Europeu. https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_pt

Coutinho, C. M. P. (2018). Metodologia de Investigacao em Ciencias Sociais e Humanas: Teoria e Pratica. In Almedina. 2o edição. https://www.almedina.net/metodologia-de-investiga-o-em-ci-ncias-sociais-e-humanas-teoria-e-pr-tica-1563799552.html

Crawford, L. (2005). Senior management perceptions of project management competence. International Journal of Project Management, 23(1), 7–16. https://doi.org/10.1016/J.IJPROMAN.2004.06.005

Czech, Brian. (2013). Supply Shock: Economic Growth at the Crossroads and the Steady State Solution. 388.

de Lange, D. E., Busch, T., & Delgado-Ceballos, J. (2012). Sustaining Sustainability in Organizations. Journal of Business Ethics, 110(2), 151–156. https://doi.org/10.1007/s10551-012-1425-0

Deloitte, T. (1992). Business Strategy for Sustainable Development: Leadership and Accountability for the 90s.

Department of Economic and Social Affairs. (2020). World Social Report 2020: Inequality in a rapidly changing world. In World Social Report 2020. https://doi.org/10.18356/7f5d0efc-en

DesJardins, J. (1998). Corporate environmental responsibility. In Journal of Business Ethics (Vol. 17, Issue 8, pp. 825–838). https://doi.org/10.1023/A:1005719707880

du Gay, P. (2000). In Praise of Bureaucracy: Weber , Organization , Ethics (First Edition). Copenhagen Business School.

Dummett, K. (2008). Drivers for corporate environmental responsibility (CER) [RMIT University]. https://doi.org/10.1007/s10668-005-7900-3

Eid, M. (2009). Sustainable Development & Project Management. Lambert Academic Publishing. Elkington, J. (1997). Cannibals with Forks: The Triple Bottom Line of 21st Century Business. Capstone Publishing Ltc.

Elkington, J. (1998). Partnerships from cannibals with forks: The triple bottom line of 21st-century business. Environmental Quality Management, 8(1), 37–51. https://doi.org/10.1002/tqem.3310080106

Engelman, R. (2011). Nine population strategies to stop short of 9 billion. State of the World 2012: Moving Toward Sustainable Prosperity, 121–128. https://doi.org/10.5822/978-1-61091-045-3_9/COVER

Evans, B., Joas, M., Sundback, S., & Theobald, K. (2007). Governing local sustainability. Journal of Environmental Planning and Management, 49(6), 849–867. https://doi.org/10.1080/09640560600946875

Frost & Sullivan, & Global Scan. (2017). The Sustainable Development Goals (SDGs): The Value for Europe.

Gareis, R., Huemann, M., & Martinuzzi, A. (2010). Relating sustainable development and projet management: a conceptual model. PMI Research Conference: Defining the Future of Projet Management.

Gladwin, T. N., Kennelly, J. J., & Krause, T. (1995). Shifting Paradigms for Sustainable Development: Implications for Management Theory and Research. The Academy of Management Review, 20(4), 874–907. https://doi.org/10.5465/AMR.1995.9512280024

GPM. (2022). What is Sustainable Project Management?
https://www.greenprojectmanagement.org/about/what-is-sustainable-project-management

GPM Global. (2019). The P5 Standard for Sustainability in Project Management (Version 2.0). GPM.

Grabis, J., Haidabrus, B., Protsenko, S., Protsenko, I., & Rovna, A. (2019). Data science approach for it project management. Vide. Tehnologija. Resursi - Environment, Technology, Resources, 2, 51–55. https://doi.org/10.17770/etr2019vol2.4163

GRI, United Nations Global Compact, & WBCSD. (2020). SDG Compass: Guia para alinhar as estratégias empresariais com os ODS. BCSD.

Hristov, I., & Chirico, A. (2019). The role of sustainability key performance indicators (KPIs) in implementing sustainable strategies. Sustainability (Switzerland), 11. https://doi.org/10.3390/su11205742

Huemann, M., & Silvius, G. (2017a). Projects to create the future: Managing projects meets sustainable development. In International Journal of Project Management (Vol. 35, Issue 6, pp. 1066–1070). Elsevier Ltd. https://doi.org/10.1016/j.ijproman.2017.04.014

Huemann, M., & Silvius, G. (2017b). Projects to create the future: Managing projects meets sustainable development. In International Journal of Project Management (Vol. 35, Issue 6, pp. 1066–1070). Elsevier Ltd. https://doi.org/10.1016/j.ijproman.2017.04.014

International Organization for Standardization. (2010). ISO 26000 - Guidance on Social Responsability.

IPCC. (2014). Climate change 2014: Synthesis Report - Summary chapter for policymakers. https://doi.org/10.1017/CBO9781107415324

Ipsos, & Eurasia Group - Politics first. (2021). AXA Future Risks Report 2021.
https://www.axa.com/en/press/publications/future-risks-report-2021

Janssen, C., Sen, S., & Bhattacharya, C. B. (2015). Corporate crises in the age of corporate social responsibility. Business Horizons, 58(2), 183–192. https://doi.org/10.1016/J.BUSHOR.2014.11.002

Kaur, P., Stoltzfus, J., & Yellapu, V. (2018). Descriptive statistics. International Journal of Academic Medicine, 4(1), 60. https://doi.org/10.4103/IJAM.IJAM_7_18

Kerzner, H. (2011). Project Management Metrics, KPIs, and Dashboards. In Project Management Metrics, KPIs, and Dashboards. https://doi.org/10.1002/9781118086254

Kerzner, H. (2022). Project Management Metrics, KPIs, and Dashboards: A Guide to Measuring and Monitoring Project Perfomance (Third Edition). JOHN WILEY & SONS. https://doi.org/10.1002/9781119427599

Kim, H., Park, K., & Ryu, D. (2017). Corporate Environmental Responsibility: A Legal Origins Perspective. Journal of Business Ethics, 381–402. https://doi.org/10.1007/s10551-015-2641-1

Kivilä, J., Martinsuo, M., & Vuorinen, L. (2017). Sustainable project management through project control in infrastructure projects. International Journal of Project Management, 35(6), 1167–1183. https://doi.org/10.1016/j.ijproman.2017.02.009

Kolk, A. (2008). Sustainability, accountability and corporate governance: exploring multinationals' reporting practices. Business Strategy and the Environment, 17(1), 1–15. https://doi.org/10.1002/BSE.511

Kozlowski, A., Searcy, C., & Bardecki, M. (2015). Corporate sustainability reporting in the apparel industry an analysis of indicators disclosed. International Journal of Productivity and Performance Management, 64(3), 377–397. https://doi.org/10.1108/IJPPM-10-2014-0152/FULL/XML

Lam, T. Y. M. (2020). Driving sustainable construction development through post-contract key performance indicators and drivers. Smart and Sustainable Built Environment, 2010. https://doi.org/10.1108/SASBE-07-2020-0111

Larsson, J., & Larsson, L. (2020). Integration, application and importance of collaboration in sustainable project management. Sustainability (Switzerland), 12(2), 1–17. https://doi.org/10.3390/su12020585

Li, K., Rollins, J., & Yan, E. (2018). Web of Science use in published research and review papers 1997–2017: a selective, dynamic, cross-domain, content-based analysis. Scientometrics, 115(1), 1–20. https://doi.org/10.1007/s11192-017-2622-5

Lidicker, W. Z. (2020). A Scientist's Warning to humanity on human population growth. Global Ecology and Conservation, 24. https://doi.org/10.1016/J.GECCO.2020.E01232

Ma, J., Harstvedt, J. D., Jaradat, R., & Smith, B. (2020). Sustainability driven multi-criteria project portfolio selection under uncertain decision-making environment. Computers and Industrial Engineering, 140(December 2019), 106236. https://doi.org/10.1016/j.cie.2019.106236

Madureira, R. C., Silva, C. S., Amorim, M., Dias, M. F., Lins, B., & Mello, G. (2022). Think Twice to Achieve a Sustainable Project Management: From Ecological Sustainability towards the Sustainable Project Management Cube Model. Sustainability (Switzerland), 14(6). https://doi.org/10.3390/su14063436

Magano, J., Silvius, G., Silva, C. S. e., & Leite, . (2021). The contribution of project management to a more sustainable society: Exploring the perception of project managers. Project Leadership and Society, 2. https://doi.org/10.1016/j.plas.2021.100020

Malthus, T. R. (1798). An essay on the principle of population. J. Johson in St Paul's Church-Yard.

Marlin, A., & Marlin, J. (2003). A brief history of social reporting. Business Respect.

Martens, M. L., & Carvalho, M. M. (2016). The challenge of introducing sustainability into project management function: Multiple-case studies. Journal of Cleaner Production, 117, 29–40. https://doi.org/10.1016/j.jclepro.2015.12.039

Meadows, D. H., Meadows, D. L., Randers, J., & Behrens, W. W. (1972). The Limits to Growth. Universe Books.

Midler, C. (1995). "Projectification" of the firm: The renault case. Scandinavian Journal of Management, 11(4), 363–375. https://doi.org/10.1016/0956-5221(95)00035-T

Mishra, P., Pandey, C., Singh, U., Keshri, A., & Sabaretnam, M. (2019). Selection of appropriate statistical methods for data analysis. Annals of Cardiac Anaesthesia, 22(3), 297–301. https://doi.org/10.4103/aca.ACA_248_18

Mossalam, A., & Arafa, M. (2019). The role of project manager in benefits realization management as a project constraint/driver. Https://Doi.Org/10.1016/j.Hbrcj.2014.12.008, 12(3), 305–315. https://doi.org/10.1016/J.HBRCJ.2014.12.008

Papoutsi, A., & Sodhi, M. M. S. (2020). Does disclosure in sustainability reports indicate actual sustainability performance? Journal of Cleaner Production, 260. https://doi.org/10.1016/j.jclepro.2020.121049

PMI. (2017). A Guide to the Project Management Body of Knowledge (PMBOK Guide) (Sixth Edit). Project Manager Institute.

Ripple, W. J., Wolf, C., Newsome, T. M., Galetti, M., Alamgir, M., Crist, E., Mahmoud, M. I., Laurance, W. F., & 15364 scientist signatories from 184 countries. (2017). World Scientists' Warning to Humanity: A Second Notice. BioScience, 1026–1028.

Ritchie, H., Roser, M., & Rosado, P. (2020). CO and Greenhouse Gas Emissions. Our World in Data. https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions

Robbins, P. T. (2001). Greening the Corporation. Earthscan.

Sabini, L., & Alderman, N. (2021). The Paradoxical Profession: Project Management and the Contradictory Nature of Sustainable Project Objectives. In Project Management Journal (Vol. 52, Issue 4). Sabini, L., Muzio, D., & Alderman, N. (2019). 25 years of 'sustainable projects'. What we know and what the literature says. International Journal of Project Management, 37(6), 820–838. https://doi.org/10.1016/j.ijproman.2019.05.002

Sankaran, S., Jacobsson, M., & Blomquist, T. (2021). The history and future of projects as a transition innovation: Towards a sustainable project management framework. Systems Research and Behavioral Science, 38(5), 696–714. https://doi.org/10.1002/sres.2814

Shaukat, A., Qiu, Y., & Trojanowski, G. (2016). Board Attributes , Corporate Social Responsibility Strategy , and Corporate Environmental and Social Performance. Journal of Business Ethics, 569–585. https://doi.org/10.1007/s10551-014-2460-9

Shaukat, M. B., Latif, K. F., Sajjad, A., & Eweje, G. (2021). Revisiting the relationship between sustainable project management and project success: The moderating role of stakeholder engagement and team building. Sustainable Development, 1–18. https://doi.org/10.1002/sd.2228

Silva, C. C., Ferreira, V., & Alexandre, N. (2022, September 30). "As escolas ainda estão desalinhadas. Continuam a ensinar a ciência do século XIX." Jornal Público.

https://www.publico.pt/2022/09/30/azul/entrevista/escolas-estao-desalinhadas-continuam-ensinar-ciencia-seculo-xix-2021973

Silvius, A. J. G., & de Graaf, M. (2019). Exploring the project manager's intention to address sustainability in the project board. Journal of Cleaner Production, 208, 1226–1240. https://doi.org/10.1016/j.jclepro.2018.10.115

Silvius, A. J. G., & Schipper, R. P. J. (2014). Sustainability in project management: A literature review and impact analysis. Social Business, 4(1), 63–96. https://doi.org/10.1362/204440814x13948909253866

Silvius, G. (2021). The role of the project management office in sustainable project management. Procedia Computer Science, 181, 1066–1076. https://doi.org/10.1016/j.procs.2021.01.302

Silvius, G., & Marnewick, C. (2021). Interlinking Sustainability in Organizational Strategy, Project Portfolio Management and Project Management A Conceptual Framework. Procedia Computer Science, 196, 938–947. https://doi.org/10.1016/j.procs.2021.12.095

Silvius, G., & Schipper, R. (2020). Exploring variety in factors that stimulate project managers to address sustainability issues. International Journal of Project Management.

https://doi.org/10.1016/j.ijproman.2020.08.003 Silvius, G., Schipper, R., Planko, J., van den Brink, J., & Kohler, A. (2012). Sustainability In Project Management. Gower Publishing Limited. https://doi.org/10.4324/9781315639185-4

Stanitsas, M., Kirytopoulos, K., & Leopoulos, V. (2021). Integrating sustainability indicators into project management: The case of construction industry. In Journal of Cleaner Production (Vol. 279). Elsevier Ltd. https://doi.org/10.1016/j.jclepro.2020.123774

Tam, G. (2010). The program management process with sustainability considerations. Journal of Project, Program & Portfolio Management, 1(1), 17. https://doi.org/10.5130/PPPM.V1I1.1574

Tharp, J. (2012). Project management and Global Sustainability. PMI Global Congress 2012.

The World Counts. (2020). The World Counts. https://www.theworldcounts.com

Toljaga-Nikolić, D., Todorović, M., Dobrota, M., Obradović, T., & Obradović, V. (2020). Project management and sustainability: Playing trick or treat with the planet. Sustainability (Switzerland), 12(20), 1–20. https://doi.org/10.3390/su12208619

Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. British Journal of Management, 14(3), 207–222. https://doi.org/10.1111/1467-8551.00375

United Nations. (2015). Transforming our World: The 2030 Agenda for Sustainable Development. A/RES/70/1 (p. 41). United Nations. https://doi.org/10.1201/b20466-7

United Nations. (2020). Sustainable Development Goals.
https://sustainabledevelopment.un.org/

van Tulder, R., van Tilburg, R., Francken, M., & da Rosa, A. (2013). Managing the transition to a sustainable enterprise: Lessons from frontrunner companies. Managing the Transition to a Sustainable Enterprise: Lessons from Frontrunner Companies, 1–262. https://doi.org/10.4324/9781315879956

Vogel, D. (2005). The Market for Virtue: The Potential Limits of Corporate Social Responsability. Brookings.

Washington, H. (2019). What can i do to help heal the environmental crisis? What Can i Do to Help Heal the Environmental Crisis?, 1–227. https://doi.org/10.4324/9780429324666

Washington, H., Lowe, I., & Kopnina, H. (2020). Why Do Society and Academia Ignore the "Scientists Warning to Humanity" On Population? Journal of Futures Studies, 2020(1), 93–106. https://doi.org/10.6531/JFS.202009_25(1).0009

World Commission on Environment and Development. (1987). Our common future. Oxford University Press.

World Economic Forum, & PwC. (2020). Nature Risk Rising: Why the Crisis Engulfing Nature Matters for Business and the Economy.

WWF. (2018). Living Planet Report 2018: Aiming higher. In WWF.
https://doi.org/10.1080/09528820802312343

Yáñez, S., Uruburu, Á., Moreno, A., & Lumbreras, J. (2019). The sustainability report as an essential tool for the holistic and strategic vision of higher education institutions. Journal of Cleaner Production, 207, 57–66. https://doi.org/10.1016/J.JCLEPRO.2018.09.171

Zdan, T. (2010). Assessing sustainable development: Principles in practice. International Institute for Sustainable Development.