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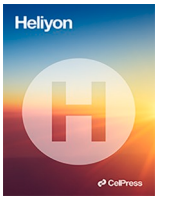

Organizations and stakeholders' roles and influence on implementing sustainability requirements in construction projects

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A R T I C L E I N F O

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A B S T R A C T

Construction projects significantly affect a country's development, consume many resources, and impact many stakeholders. Project sustainability requirements are essential to overcome the current social and environmental challenges, yet entrepreneurs, decision-makers, and technical professionals still ignore them. This research aims to reveal the leading players that can influence implementing sustainability requirements in construction project development, the barriers, and possible solutions. The results show that organizational strategies, maturity level in sustainability, and the ability to change corporate values and beliefs play a significant role in this pivotal movement. At the same time, a set of external stakeholders, such as investors, banks, communities, suppliers, regulatory agencies, and insurance companies, may push a specific behavior to the market and influence change. On top of this, organizations shall build their strategy toward sustainability and implement sustainable project management. This study employs the Complex Holographic Assessment of Paradoxical Problems (CHAP2) to investigate the current situation in Brazil related to the integration of construction project development and sustainability requirements.

1. Introduction

Over the years, the impact of industrial growth on the planet has increased, drawing the scientific community's attention to the fact that our world needs a more sustainable business model. Construction projects significantly affect a country's development and consume many resources. Organizations, entrepreneurs, decision-makers, and technical professionals still do not hold sustainable management processes to preserve our planet.

After reviewing the set of sustainable project management definitions published in papers, Silvius and Schipper [1] suggested a broader one encompassing the Triple Bottom Line (TBL) during the project's life cycle to achieve stakeholders' benefits and perform with transparency, ethics, and participation. The new definition is more comprehensive and supports this study's purposes.

In the 2019 world estimate, Global GDP amounted to approximately $ 87.6 trillion, and the megaprojects consumed 8.0 %, equivalent to $ 7.0 trillion. Ten countries comprise two-thirds of the Global GDP (first, The USA - 24.46 %, second, China −16.37 %).

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Brazil was in the ninth position with 2.10 %. We took the 2019 GDP because it was the last one before the COVID-19 pandemic, and the countries are still recovering from its impact.

Regarding the TBL, Elkington [2] made a "recall" since the organizations understood the original concept proposed as a trade-off tool instead of its real intention of provoking deeper thinking about capitalism and its future.

The current dominant behavior is that sustainability requirements represent only additional project costs to the projects' capex. One of the reasons this view perpetuates is that decision-makers use a short-term perspective for their analysis, not exploring the project life cycle long-term perspective, which brings the total cost of ownership to the discussion.

The global scenario outlined above underscores a deficiency in the current project development practices, where the integration of sustainability requirements remains far from the usual for most organizations. This deficiency is not merely a concern; it poses a grave problem, given that our planet's finite resources are under increasing strain. The prevailing short-term approach to the development pursued by nations and organizations alike risks inflicting irreversible harm upon the natural resources upon which we depend. On top of it, the world is already grappling with the ongoing and tangible effects of climate change.

Recognizing that construction projects serve as pivotal vehicles for ushering in progress and development within countries, it becomes imperative to overhaul how these initiatives are conceived and executed. This study's motivation lies in our commitment to fostering sustainable project management—an approach that, regrettably, has yet to gain widespread traction within organizations, as evidenced by our comprehensive literature review. By addressing this critical shortfall and championing sustainable project management practices, we aim to pave the way for a more responsible and environmentally conscious approach to development that safeguards our natural resources and mitigates the adverse impacts of climate change.

This study aims to identify the key stakeholders capable of exerting an impact on incorporating sustainability requirements into projects and identify the obstacles and potential remedies. The findings indicate that organizational strategies, sustainability maturity level, and the capacity to evolve corporate principles and convictions are influential factors in driving this critical initiative. Concurrently, external stakeholders, including investors, financial institutions, communities, suppliers, regulatory bodies, and insurance firms, can drive particular market behaviors and induce transformation.

The problem studied is not confined to a unique organization or country but vast and complex. As a novelty contribution, we captured a deepening view of what is currently happening in Brazil regarding sustainable project management, encompassing a broad perspective of the diverse players who impact integrating sustainability requirements into project development. Implementing sustainability requirements through project management can be a means to enable a new business model to emerge.

The following sections present this study's development. Section 2 describes the literature review methodology and the findings about the primary constructs: project management and sustainability, construction projects and sustainability, and related constructs. In Section 3, we present the CHAP2 Method and the results. Section 4 presents the discussion and results, and Section 5 indicates the study's contributions, limitations, and suggestions for future research as the conclusion.

2. Literature review methodology

The literature review methodology included identifying research keywords, selecting studies, assessing study quality, data extraction, and data synthesis, as recommended by Tranfield et al. [3].

Sustainability is not a recent concept, but it has been in the spotlight only in the last few years; therefore, the review encompassed a

Table 1
Search strategy, results, and selection.

Search number	Keywords	Interval	Refining topics	Results	Pre-screening Title and Abstract	Selection complete reading
1	Sustainability and Project Management	2014–2020	Engineering + Sustainability + Sustainable development	552	29	18
2	Sustainability Indicators and Project Management	2014–2018	Engineering + sustainable development + sustainability + project management	82	16	6
3	Sustainable Projects and Project Management	2019–2020	Not applied	66	3	2
4	Sustainability and Project Management	2018–2020	Journal of Cleaner Production	110	9	5
5	Sustainability and Brazilian	2014–2020	Not applied	204	7	5
6	Sustainable Project Management and Review	2018–2020	Sustainability	14	3	2
7	Suggested articles while performing searches from 1 to 6	Any year	Not applied	20	12	7
8	Selected articles from the reference list of the searched articles	Any year	Not applied	30	30	17
9	Sustainability and Construction	2018–2021	International Journal of Construction Management	27	4	2
	Total			1105	113	**64**

Source: Developed by this study authors according to the articles in Scopus base

period beginning in 2014 to capture the most recent and updated publications.

This literature review identifies the state of the art of integrating sustainability requirements into a project's development.

Tranfield et al. [3] suggest five steps for conducting a literature review:

1. Identify keywords and search terms within the theme under study, reporting the search strategy so that anyone can reproduce it;
2. Indicate the set of articles resulting from the search strategy that represents the base of the literature review;
3. Analyze the set of articles and sort the most relevant ones for more detailed evaluation;
4. Document the number of sources included and excluded;
5. Resume data and register.

The identified keywords, search terms, and combination reflect the theme studied: integrating sustainability requirements into construction project development. The results were refined by reading the title and abstract to choose those likely to fit the study, resulting in the pre-screening (one hundred and thirteen articles). Those articles were read, and the selection used in this study is sixty-four.

The resume of the search strategy in the Scopus base is in Table 1, indicating the search number, keywords and combination, range of years, and refining topics used. While searching in the Scopus Base with the strategy described, some sets of articles were automatically suggested to have a relationship with the theme, as indicated in item seven of Table 1. Additionally, while reading the selected articles, we selected others from their reference list for an in-depth analysis, as indicated in item eight ofTable1.

2.1. Literature review results

Over the last few years, researchers such as [4–9], to mention a few, have discussed integrating sustainability and project management, including the related aspects that influence it.

Life cycle assessment techniques are relevant to integrate both areas and stakeholder management processes contribute to identifying and considering the social and ethical aspects [4]. Nevertheless, organizations neither consider literature suggestions nor use the project's sustainability requirements in decision-making processes [4,10].

Karunasena et al. [5] and Sánchez [11] recommend integrating sustainability requirements in projects since the portfolio management early decisions and conceptual phases. Chawla et al. [6] indicate that aspects such as project life cycle, location of the projects, ethicality, clear policies and procedures, stakeholders' expectations, uncertainty, elimination of wastes, and use of resources play a role in setting sustainable project goals. Yu et al. [12] developed a sustainable project planning scale to evaluate construction engineering projects in China.

According to Horak et al. [13], among the coercive, mimic, and normative pressures that integrate sustainability requirements into project management, "government intervention and standards and norms imposed by industry and stakeholders, as well as societal expectations, are the strongest."

Outstanding results in time, cost, and quality are no longer sufficient to conclude that a project succeeds [14]. Three studies [14–16] propose measuring projects' success using sustainable success factors and criteria. That approach is interesting, but the concept of success varies from project to project, and it will depend on the range of stakeholders involved, making the definition of success somehow subjective.

Goni et al. [17] propose a conceptual sustainable business model that incorporates value as a cross-cutting concept in supply chains, innovation processes, and organizational structures. The model highlights the significance of circular economy, performance management, information technology, and stakeholder management as valuable requirements for fostering sustainability within businesses.

On the one hand, several articles indicated barriers to integrating sustainability requirements into project management processes, with the economic dimension and the project team's lack of knowledge being the most cited [5,18–22]. On the other hand, Hwang et al. [18] suggested possible solutions to mitigate those barriers, such as government-provided subsidies to offset premiums and stimulate demand for sustainable construction in public projects, cost-saving-sharing with contractors from building operations, compulsory implementation of sustainable construction processes, hire or engage a Green Mark Manager/Professional, lower interest on the loan for sustainable construction projects.

Chofreh et al. [23] report that sustainable project management is beneficial, but it is still necessary to support organizations in taking a step toward sustainability. Navarro et al. [24] state that "the current state of science lacks an objective and universal methodology to properly assess the sustainability of a particular infrastructure design."

The findings above confirm that it is essential to consider project sustainability requirements in the projects. However, organizations still do not consider them, and it depends on many different and correlated aspects. Assessing project practices is crucial to understanding the challenges and barriers and proposing solutions. Fostering discussions during portfolio management and planning for the solutions in the early phases is imperative to comply with the new societal and regulatory sustainability requirements on projects. Using the life-cycle analysis techniques during the project's viability studies enables organizations to consider the project's long-term perspective, which contributes to evaluating the sustainability benefits. Those approaches make sense since the most cited barriers are the economic aspect and the project team's lack of knowledge.

The following paragraphs present the relationship between the primary constructs of sustainability requirements, construction, and project management processes captured in the literature review.

2.1.1. Project Management & Sustainability

Depending on a country's development level, sustainability may not be a theme of discussion since there might be fundamental infrastructure aspects in the country's agenda. Goel et al. [25] indicated in their research that the 2012–2019 period produced several articles on integrating sustainability requirements in construction project management. So, we can acknowledge that the attention to the theme is relatively recent.

Project management is becoming an increasingly important vehicle for implementing sustainability requirements [26,27]. However, "integrating project management and sustainability is not a straightforward process" [28]. Professionals acknowledge the need to integrate sustainability in project management, but assessing the organizations' practices reveals that they do not discuss sustainability requirements.

It takes long until research becomes part of the day-to-day organizations' processes. As a result, projects are still timid in integrating sustainability requirements into their development and face organizational challenges. Additionally, there is no offer of practical tools that the industry can quickly absorb.

The triple helix principle posits that universities, governments, and organizations should collaborate to foster innovation and entrepreneurship.

As developers and regulators, governments should liaise with the researchers and promote cooperation between universities and industry to support the development. In this process, researchers, business owners, governments, and contractors are essential players who should articulate working together to challenge the status quo and avoid isolated actions. Sustainable project management requires a collective effort, as no single entity can achieve it alone. Therefore, it becomes imperative for them to identify critical factors in their respective domains of responsibility and authority, which can either facilitate or hinder the integration between sustainability and project management.

Organizations play a crucial role in integrating sustainability requirements into project management, and they must define policies and processes to support and integrate sustainability into the core business and projects [4,26,29–32].

According to Silvius and Schipper [1], we shall manage the economic, environmental, and social impacts rather than time, budget, and quality, which aligns with [33,34]. "Sustainable project processes, organizations' commitment, and seasoned-trained project managers are all necessary elements to integrate sustainability and project management" [4,35].

Sabini et al. [28] claim that "precise objectives and time-bound activities" are characteristics of project management, while sustainability addresses "long-term challenges, with often no clear solution," highlighting that "sustainability objectives are implemented or considered only when they match business objectives or are required by law." Although projects have a start and a finish date, the delivered results last many years and can impact the world positively or negatively, so project development should adopt sustainable processes. Therefore, the chosen solutions to meet the project's objectives shall have sustainable requirements.

From the suppliers' perspective, "benefits, demands, intrinsic motivation, and strategy" could be enablers in adopting sustainability requirements [36].

According to Borges et al. [37], between 2014 and 2015, Brazilian companies published thirty Corporate Sustainability Reports (CSR) in different sectors, including construction, and "there is still room for improvements" regarding "the integration between organizational structure and CSR, stakeholder engagement, and continuous improvement practices." Musa and Bashir [38] mapped sustainable practices in construction projects in the United Arab Emirates, relating them to the PMBOK Guide processes (initiating, planning, executing, monitoring, controlling, and closing). Their study offers a sustainability practices checklist to use in the projects. That checklist can add value to project development. However, as the various articles state, sustainability is not part of the current projects' planning and portfolio management phases. Hence, stepping back and offering mechanisms to insert sustainability requirements in those phases is necessary.

Considering sustainability as a source of competitive advantage [39] and showing the stakeholders how sustainability can mitigate risks and capture opportunities [40] can improve sustainable project management.

The discussion of climate change, social responsibility, and governance is leaving the poetic room and becoming the agenda of banks, investors, and consumers. Organizations shall take a path to engage in sustainable project management. They shall assess the risks and respective financial materiality of their social and environmental impacts deriving from their business model. The impacts can affect an organization's image, reputation, revenue, and profit. So, organizations shall acknowledge sustainability as a valuable tool to improve performance and maintain longevity.

Schrippe and Ribeiro [41] define the minimum performance on mandatory items that classify an organization as sustainable based on "i) the Corporate Sustainability Index (ISE) used by B3 (formerly BM&FBovespa), (ii) perception of specialists, and (iii) identification of mandatory and compensatory criteria". Circa thirty criteria were evaluated, and only six were considered compensatory; the others were mandatory. That can help measure and monitor organizations' sustainability levels. However, the articles reveal that the organizations do not even raise and discuss the projects' sustainability requirements. It is necessary first to overcome the barriers to consider sustainability requirements in project development and then measure their maturity level on sustainability.

Not all desired sustainability requirements are viable to implement in the projects. To address that issue, Magalhães et al. [42] propose a decision-making tool based on negotiable and non-negotiable aspects, using the Analytic Hierarchy Process (AHP) method to prioritize the requirements, which will depend on the organization's sustainability culture and values.

The literature review shows that most organizations still do not discuss project sustainability requirements. So, stepping back and encouraging the beginning of the debate about sustainability requirements in project solutions is necessary, and project management can be a means to achieving it.

2.1.2. Construction Projects & Sustainability

Due to climate change, deforestation, pollution, and resource scarcity, among other impacts on our planet, researchers are chasing to understand the difficulties and constraints that inhibit integrating sustainability requirements into construction projects.

"Industrial activities are largely responsible for the pollution," and it is necessary "to facilitate the penetration of sustainability thinking into various system scales" [43].

Regarding construction and demolition waste management in the UK, Ghaffar et al. [44] indicate that "incentives and appreciation from the government should also be given to stakeholders who are innovating and setting benchmarks in circular construction."

The world's construction industry consumes a significant amount of the global GDP and raw materials, being responsible for 40 % of total solid production waste globally [45].

Brazil's GDP in 2019 was $1.8 trillion. According to IBGE [46] (Brazilian Institute of Geography and Statistics), the amount spent on construction was approximately US$ 75 billion (4.19 % of the national GDP) in 2019.

The figures above corroborate the importance of having a well-planned and robust project design and execution plan, saving resources, having as little environmental impact as possible, and promoting social development. Projects employ millions of people and modify the status quo, being a critical vehicle for promoting social sustainability. It is of utmost importance to focus on the productive processes within the construction industry and the critical decisions made during portfolio management and early project phases. Therefore, sustainability requirements play an essential role and shall be discussed in the early phases of a project to enable implementation in the execution phase, with project management being a valuable means of integrating them.

2.1.3. Sustainability and related constructs

This study concluded that sustainability is a cross-cutting concept influencing and being influenced by project phases, value management, sustainability requirements and indicators, success factors, soft and technical skills, procurement, social sustainability, stakeholders, motivation, and barriers.

Yates and Asce [21] indicate that the portfolio management phase shall apply sustainability criteria so that decision-makers can choose the most sustainable projects. Siew [47] highlights that the planning phase shall incorporate sustainability practices. Discussing sustainability requirements in the portfolio management phase enables the decision-makers to assess the long-term benefits and plan for them carefully. In advanced phases, changes are more costly and can broadly impact planning [48], which would prevent inserting new requirements in the projects.

Organizations want to deliver sustainability value to the stakeholders. The Institute of Value Management's motto is: "Developing competence to deliver sustainable value." So, it is necessary to train project managers and the technical team in sustainability knowledge [1]. Sustainable project management seeks to create value through innovative approaches grounded in the 3Ps – People, Planet, and Profit – with a steadfast commitment to long-term perspectives.

Soft and technical skills influence the sustainability culture and capability of integrating sustainability requirements into project management [49–51]. In this scenario, contractors', civil infrastructure industry experts', consultants', and project managers' skills crucially influence change.

Managers are concerned with "environmental practices and resource-saving, competitive and economic advantage, stakeholder management, and sustainable innovation of the business model" [52], corroborating the need to improve their sustainability knowledge. Conversely, their self-perceived soft skills are also essential to influence them to support sustainability requirements [53].

Having a consultant expert in the team, establishing sustainable criteria beyond those to comply with laws, and stakeholder engagement are factors that influence the ability to discuss or not the projects' sustainability requirements [54]. However, other than sustainability professionals' experts, organizations shall provide the team with institutional support to integrate sustainability within project management to achieve success.

Sustainability and projects' success relate positively [55,56], with the most favorable success criteria: "the stakeholders of the project are satisfied, the project prepares the organization for the future, and the project is executed in a controlled manner."

Kamali and Hewage [57] researched sustainability indicators, investigating the mapping, the standards, the usage, and their relationship with stakeholders. The most cited are water and waste management, energy consumption, safety, security, and health. Similar business areas should have a common ground about the sustainability indicators to monitor and measure results to allow the stakeholders to have comparable measures for an accurate assessment as indicated by the GRI Standards Values [58].

Stanitsas and Kirytopoulos [59] recommended ten leading indicators to measure sustainability in construction projects derived from their research on resources, efficiency, impact technologies, training, and financial aspects, other than scope, time, and cost.

With increasingly complex megaprojects requiring multidisciplinary technical qualifications, an organization must contract third parties to compose the project's scope and should investigate the supply chain's sustainable practices. Clients should include more sustainability requirements in procurement documents, whereas suppliers should improve their education to offer sustainable solutions to the projects. Finally, the construction industry institutions shall promote more benefits to stimulate interest.

Public-work procurement policies should promote using social criteria [60]. Requesting evidence of sub-suppliers' compliance with the client's corporate sustainability standards is not a contracting organization's practice [61].

Cole and Aitken [62] state that "suppliers must now demonstrate a commitment to sustainability through implementing improvements highlighted in corrective actions reports at the pre-selection point before any financial transaction occurs," while Qorri et al. [63] indicate that "research on measuring sustainability performance of the supply chain is scattered, fragmented, incomplete, and a relatively new research area."

According to Ref. [64], contractors shall adapt to environmentally sustainable construction by accumulating knowledge, skills, and operational resources, applying modernized construction processes, and isomorphic drivers (coercive, mimetic, and normative).

As a result, the procurement area must improve sustainable procurement management processes and develop sustainability knowledge among stakeholders, contractors, and clients.

Megaproject social sustainability indicators comprise the organization level (OL) and the project level (PL) [65]. Li et al. [66] evaluated megaproject indicators from a multistakeholder perspective. The result revealed that "well-established stakeholder participatory channels and encouraging stakeholder participation" were the most important for government officials and the public. At the same time, industry practitioners and academics rated "practical mechanisms coping with stakeholder conflicts" at the top of their lists. The principal concern of Non-Governmental Organizations (NGOs) was "timely feedback to the participants".

Those findings make sense and address two different ways of achieving change. Industry uses hierarchical motivation through legislation, while NGOs use an intrinsic motivation that promotes cooperation between the involved parties.

Changing traditional procurement practices is mandatory to achieve corporate social responsibility [67]. Business owners have a significant role in promoting those changes and liaising with managers to implement social responsibilities. The government shall enact legislation to address social responsibility in construction projects. Increasing social responsibility implementation in small to medium organizations is another goal to chase.

Toledo et al. [68] indicate that most used management frameworks "do not pay attention to the issue of sustainability" and that "sustainable project management methodology by companies and professional associations is emergent." Such statements corroborate the need for guidelines to help organizations apply sustainable project management.

Project Management & Sustainability, Construction Projects & Sustainability, and Sustainability & Related Constructs sections presented several aspects that influence or interconnect sustainability to projects and what happens in the projects' day-to-day practices. The conclusion is that it is necessary to make sustainability more present in projects, and aspects such as project team knowledge, organizational culture and value, and stakeholder engagement must be improved.

The problem studied is not confined to a unique organization or country but vast and complex. The previous sections presented a worldwide review. As a novelty contribution, we captured a deepening view of what is currently happening in Brazil regarding sustainable project management. The following section presents the method used.

3. Method – CHAP 2

The Complex Holographic Assessment of Paradoxical Problems (CHAP2), developed by Lins and Netto [69], is the method that supports this study. CHAP2 employs a system thinking approach to structure and address poorly structured, highly complex problems, typically characterized by intricate interactions among human, technological, organizational, and environmental elements. Paradoxical solutions, commonly found in complex problem-solving, emerge from dialogues with multiple stakeholders, fostering in-depth analysis of the situation, which demands consideration of organizational cultures, emotional perception, and metacognition.

The method utilizes concept maps to represent subjects and issues visually. These concept maps facilitate comprehension of causality and interrelationships by linking two concepts through a verb, providing an integrated problem perspective.

According to Lins and Netto [69], resolving complex paradoxical problems needs interactive and iterative engagement with various agents. In the context of this study, agents are the professionals participating in the interview process. The CHAP2 method encourages uninhibited communication with these agents, creating an environment where they can freely express their viewpoints without constraints or restrictions. This open dialogue promotes a comprehensive exploration of the problem, identification of potential barriers, and a deeper understanding of organizational processes.

Furthermore, it highlights the importance that external regulation alone is insufficient to inhibit or stimulate the actions of the involved parties. Instead, self-regulation becomes imperative, where each entity understands the processes in which they engage. This understanding fosters intrinsic motivation, surpassing the hierarchical one.

Additionally, effectively managing divergences, harnessing multiple and distributed intelligence, and employing diverse methodologies are crucial for achieving a more comprehensive understanding of reality. This approach allows for problem-solving through various perspectives rooted in metacognitive explanations.

Integrating sustainability requirements into a project's development is a complex problem, and the characteristics of the CHAP2 method are relevant to solving it.

Table 2 presents the CHAP2 phases used in this study and the objective of each one.

Table 2
CHAP2 - Phases description.

Phase	Description	Objective
I	Define the initial agents Individual 2-h interview	Understand the big picture of the problem by interviewing a small and initial group of agents with a broad and open perspective of the situation. Draw the Initial Concept Map of the existing system/problem.
II	Define the seasoned complementary agents (professionals) Individual 2-h interview	Interview seasoned professionals to understand the issues mentioned by the initial agents represented in the Initial Concept Map. Capture the individual metacognitive perspective of the complementary agents. .
III	Characterize agents' perception using thematic maps	Analyze the agents' individual metacognitive perspectives and gather their content in thematic maps to represent the problems per theme. That will facilitate prioritizing the actions to solve the problems.

3.1. CHAP2 method results

CHAP2 Phase I aims to understand the big picture of the problem studied. Since the problem is vast, we carefully chose, for this first phase, six professionals with broad experience in sustainability and project management, with critical thinking, to broadly analyze the situation in Brazil as they are leaders in numerous projects or executive professionals with over twenty years of experience (Table 3).

The agents could introduce themselves with a brief resumé at the beginning of the interview process. The next step was a concise explanation of the study's objectives and a comprehensive presentation of the CHAP2 method. Throughout the interviews, the agents freely shared their insights on Brazil's project sustainability requirements, encompassing various aspects such as the decision-making phase, barriers, organizational culture, enabling factors, and market pressures. The six interviews yielded diverse perspectives, shedding light on various factors that influence the integration of, or lack thereof, sustainability requirements in projects' development.

After the agents freely presented their viewpoints, complementary questions were asked when necessary. The questions are in Table 4.

The initial concept map graphically represents crucial insights and provides a holistic view of the current situation, enabling an assessment of the possible actions to contribute to enhancement.

The map presents the central concept – sustainability in projects - which is the objective of this study. The subjects and issues presented by the professionals were clustered to build the broad view captured. The colors in the maps relate to a set of interconnected concepts and make it easier to read.

The map shall be read from the concept's boxes according to the arrow direction, which connects the two boxes. So, for example, in the upper left part of the map, sustainability in projects is influenced by organizational strategy and decision-makers. The organizational strategy considers financial criteria that seek lower capex; decision-makers consider financial criteria that seek lower capex; and so on. That is the way to read the map.

The concepts relate to organizations and stakeholders (Fig. 1). Although organizations are undeniably stakeholders, this study intentionally treats them as detached entities to focus specifically on their capacity to drive change when assuming the roles of project entrepreneurs or business owners. By doing so, we aim to understand better their potential to influence incorporating sustainability requirements.

On the one hand, the organizations responsible for launching and developing the projects still do not understand the concept of sustainability and how it could help the projects' success. On the other hand, the diverse external stakeholders, namely investors, regulatory bodies, banks, insurers, government, and communities, play roles that can positively or negatively impact organizations toward sustainable development. The stakeholders, other than shareholders, shall be involved in the projects from the early phases and have their demands evaluated. That was the initial broad perspective of sustainable project management in Brazil.

Proceeding to CHAP2 Phase II, eighteen seasoned professionals distributed in eleven organizations contributed to understanding the issues mentioned by the initial agents, capturing possible barriers and solutions to foster sustainability requirements in project development. The cohort of eighteen agents encompasses diverse positions in different organizations (Table 5). Their collective expertise spans an impressive spectrum, with individual experience ranging from 10 to over 30 years.

The insights extracted from the individual interviews with the eighteen agents revealed a range of pertinent issues interconnected with both organizational aspects and stakeholders' considerations, confirming the initial perspective captured by the first six interviews. The interview process with the eighteen professionals was similar to the one in Phase I. After the agents freely expressed their perspectives about the factors that influence sustainability in the projects, the initial concept map was shown, and they could comment on the map content and add any subject or issue they had not previously mentioned during the interview. The issues discussed subsequently cascaded into sub-themes, meticulously explored during the interviews, and effectively synthesized into four distinct and specific thematic maps, showing that organizations' and stakeholders' sponsorship is crucial to achieving sustainable project management.

This study comprehensively assessed the influence of stakeholders and organizations to integrate sustainability requirements into project development. It represented the results in concept thematic maps, which provide a holistic view of the current situation and

Table 3
CHAP2 phase I - agents.

Organizations' business sector	Agents' roles
[1]Consulting Firm	DSc - Consultant/Director/Owner Project Management and Sustainability/ESG
[2]Consulting Firm	DSc - Sustainability Consultant/Owner Certified teacher at COPPE/SAGE - in the GRI Course
[3]Multinational Energy Company	MSc - Head of Portfolio Management
[4]Consulting Firm	DSc - Consultant in the areas of Corporate Sustainability and Valuation of Companies and Investment Projects
[5]Mining Sector	Project Manager of Disaster Remediation Project Master's Certificate in Project Management by the George Washington University/ESI
[6]Leading sustainable design, engineering, and consulting solutions provider for natural and built assets.	President of the Environmental Division in the Company

Table 4
Interview questions.

Item	Questions
1	Based on your experience, what would you say about the criteria decision-makers consider in the early phases of a project (feasibility, conceptual, and basic design to authorize a project?) Are the sustainability requirements taken into account?
2	What reasons restrict the integration of sustainability requirements in organizations and projects?
3	What is your opinion about the influence of organizational culture and strategy in integrating sustainability requirements in construction projects?
4	Based on your experience, do the decision-makers only consider the sustainability requirements when they are part of the legislation?
5	How do stakeholders influence integrating sustainability requirements in projects' development?
6	Would a practical guideline addressing sustainability requirements at the organizations and project levels contribute to integrating sustainability requirements in construction projects?

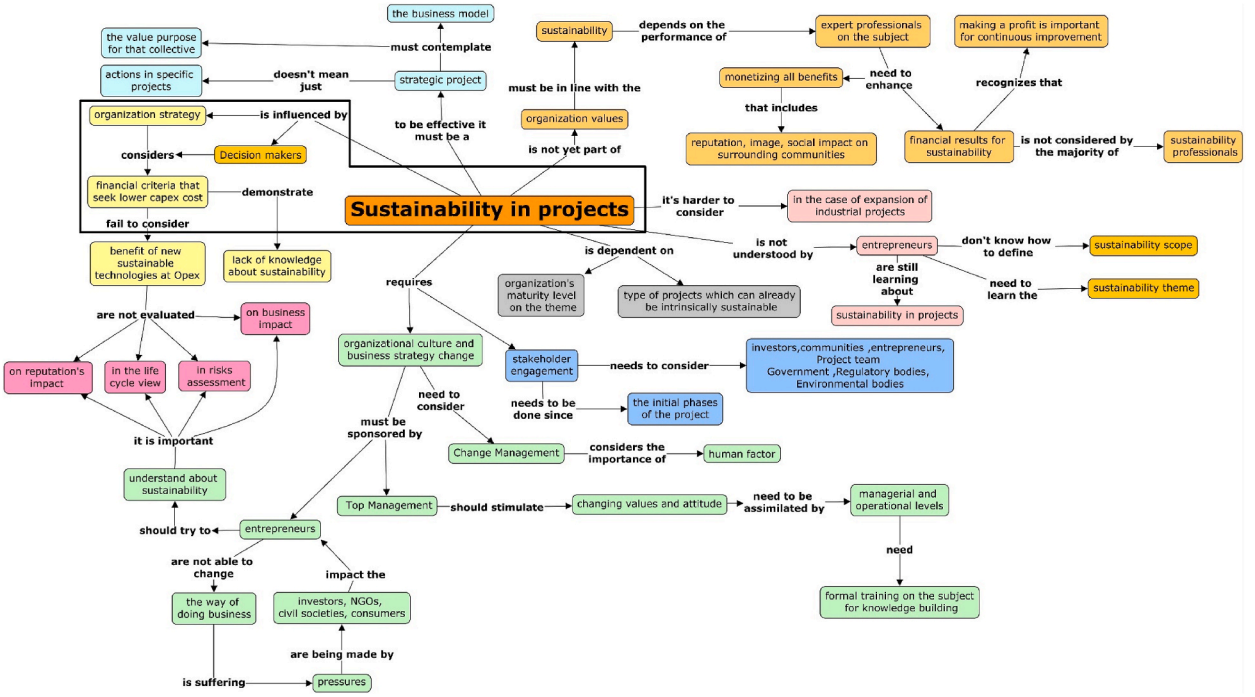

Fig. 1. Initial concept map.

enable an assessment of the possible actions to contribute to enhancement.

In this study, we categorized the stakeholders into two main groups: direct project participants and those who impact or are impacted by the project. Stakeholders' power to influence and bring about changes varies based on their position or professional roles, though this aspect was not further analyzed here. Instead, the study underscores the pivotal role of organizational strategy and the organizational sustainability maturity level in shaping team behavior and establishing guidelines within the organization. Those factors significantly impact stakeholders' engagement with the project and its sustainability requirements. These aspects regarding stakeholders and organizations (Fig. 2) were developed as large thematic maps in CHAP2 Phase III (not presented here). Instead, the Discussion and Results section presents the content derived from the four thematic maps.

4. Discussion and results

The main findings of this study show that sustainability requirements are still not part of most construction project development and that there are many challenges and barriers to integrating them to achieve sustainable project management. The organizations and stakeholders are the leading players who exert significant influence on implementing sustainability requirements into construction projects, along with the specific role and power of each one in the process.

Entrepreneurs often lack sufficient knowledge of sustainability principles, whether representing private, public, or state-owned organizations. The prevalent culture prioritizes contracts based on the lowest price and fails to comply with mitigating or compensatory measures related to sustainability. Consequently, their approach to conducting business and their limited awareness of sustainable practices hinder the effective implementation of sustainable project management. So, organizational strategy is fundamental to providing the guidelines.

Table 5
CHAP2 phase II agents.

Organizations' business sector	Agents' roles
[7]ESG Integrated Solutions Provider	MSc - CEO
[8]Engineering and Construction Contractor	Sustainability Advisors (03 professionals)
[3]Multinational Energy Company	ESG Head/Corporate Social Development/Head for Generation Sustainable Projects
[9]O&G Organization	DSc - Consultant Environmental licensing and prevention of natural disasters
[10]Rail and Subway sector	Maintenance Manager
[11]Bank of Investment Private Equity, Infrastructure, Real Estate, and Credit	Head of ESG Project Manager Master's Certificate in Project Management by the George Washington University/ESI
[11]Bank of Investment Private Equity, Infrastructure, Real Estate, and Credit	MSc - Engineering Superintendent for Railways
[11]Bank of Investment Private Equity, Infrastructure, Real Estate, and Credit	Coordinator of the Environment area
[12]Consulting, Engineering, Digital, Management, and Integration	ESG and Compliance Expert (1) MSc - Law and Compliance Director (2) Human Relations/Adm/Facilities/Social Responsibility and Knowledge Management Director (3) MSc - Executive and Operations Director (4)
[13]Consulting Firm	Consultant/Director/Owner Master's Certificate in Project Management by the George Washington University/ESI Sustainability Strategic Management
[14]Global professional services	ESG and Compliance Director
[15]Brazilian pulp and paper company.	MSc - Head of Strategy and Controller
[16]Business Consulting, Risk Management and Advisory, Financial Advisory, Tax Management, and Auditing	MSc - Director

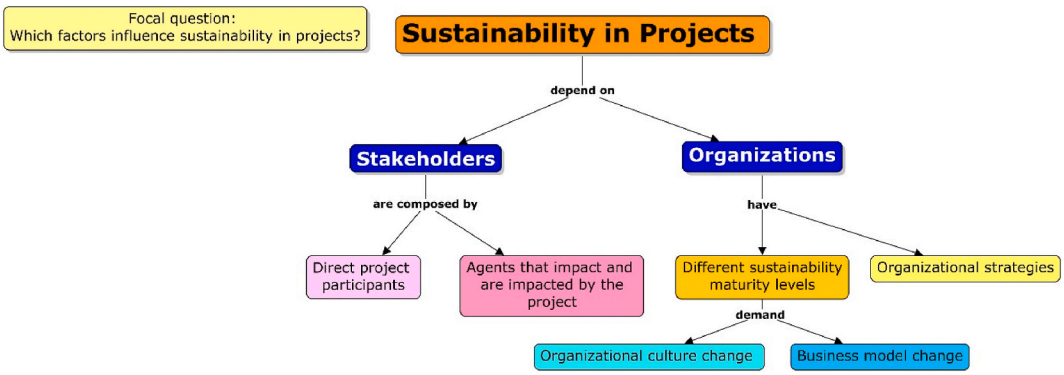

Fig. 2. Thematic maps - the big picture.

Similarly, the project teams themselves face challenges in this regard. Insufficient education and lack of awareness impede their ability to engage in meaningful discussions about environmental data and propose sustainable solutions for the projects they handle. Additionally, the organizations tend not to engage their ESG teams (if they have) during the early project phase, missing out on the valuable support and insights they can provide to the project teams in adopting recommended sustainable solutions. The perspective above shows the organizations' internal issues as barriers to integrating sustainability requirements into project development.

Organizations show low sustainability maturity levels and do business in an old-fashioned way. The focus is frequently placed on minimal compliance with environmental and regulatory legislation rather than actively seeking comprehensive sustainability solutions. Moreover, these organizations' decision-making processes rely on conventional financial criteria such as Net Present Value (NPV), Internal Rate of Return (IRR), and Payback Period. While these metrics have merits, they do not adequately capture sustainable initiatives' broader impacts and long-term benefits.

In decision-making, organizational strategies should combine financial and sustainability criteria to highlight possible adverse risks to the image, reputation, legal, and financial. This approach could also reveal the opportunities related to operational gains of sustainable solutions, benefits on the business, mitigation of organizations' risk of exposure, and the positive or negative social impact on the communities. Risk analysis associated with the defined sustainability criteria is essential to support decision-making.

Related to the financial aspects, getting funds for projects or securing them is becoming more complex. Financial institutions began establishing sustainability requirements for granting loans and sometimes demanding compliance with Equator Principles [70]. Additionally, investors and insurers exercise caution when selecting projects to invest in or insure. They carefully assess the nature of

the project to ensure it aligns with their values and principles, aiming at safeguarding their image and reputation in the market. Moreover, they seek to mitigate potential financial risks, avoiding scenarios where they could face losses due to unsustainable or high-risk ventures. This behavior underscores the growing recognition of safeguarding the interests of investors and insurers alike. Organizations that ignore this trend can face difficulties obtaining funds or paying enormous insurance premiums.

Organizations can exert a significant influence in integrating sustainability requirements into project development depending on their strategic approach and readiness to recognize that it is necessary to implement changes toward sustainability. Organizations can also suffer financial materiality if they fail to assess their impact materiality.

As direct project participants, suppliers find themselves entangled in complex situations. They are often compelled to adhere to designs that may not prioritize sustainable solutions, and their involvement in the early project phase is limited or does not exist, hindering their potential contributions. Simultaneously, suppliers fail to offer sustainable solutions due to insufficient expertise. That fragility leads to disputes with organizations that attempt to shift the entire sustainability responsibility onto them. In addition, suppliers and organizations may find themselves compelled to forgo sustainable solutions when facing time or cost constraints, further diminishing the prioritization of sustainability requirements within the project.

Concerning the stakeholders who impact the projects, regulatory or environmental agencies and the government play a significant role in fostering sustainability requirements by using their regulations and legislation to push organizations, regularly inspecting them, and monitoring compliance with sustainability requirements. The current legislation still allows some environmental impact, but the environmental agencies should foster a change and only authorize impacts that can be fully compensated. The government could create a sustainability agency to deal with those issues and regulate the market.

In project scenarios, communities often find themselves with limited influence despite being directly impacted by projects' outcomes. Traditionally, NGOs have been perceived as adversaries to projects. However, building partnerships with NGOs can offer organizations valuable resources for engaging with communities more effectively. Communities possess their demands and should actively influence the implemented solutions. The extent to which these demands are addressed can determine whether communities become supporters or detractors of the project. Given this context, organizations must demonstrate compassion and sensitivity towards the communities affected during the project's implementation and operation. It is essential to consider the legacy left behind for these local populations and to engage in responsible practices prioritizing the well-being of both people and the environment. By considering these factors, sustainable project development can foster positive impacts and create a more harmonious relationship between projects and the communities they impact.

As a primary possible solution to overcome the challenges mentioned above, the comprehensive training initiative for professionals, suppliers, and entrepreneurs in sustainability practices can contribute to understanding the value delivered by sustainable solutions related to long-term perspectives. Entrepreneurs can embrace a transformative approach to conducting business by grasping the concept of their business double materiality. Projects can significantly benefit from proactive managers who champion and prioritize sustainability practices. Those managers play a crucial role in fostering a culture of sustainability within the project teams, supporting ongoing training efforts, and ensuring that sustainability requirements are fully understood and shared among all project stakeholders. The organizational strategy shall be improved to embrace sustainable project management, and this can be achieved if the entrepreneurs acquire sustainability knowledge and recognize the benefits. If this change does not happen for intrinsic motivation, the coercive pressure exerted by investors, financial institutions, regulators, or the government will play this role.

Sustainability is a crossing-cutting concept, and all disciplines' experts should integrate its requirements into the projects' solutions. Moreover, assets without environmental or social liabilities are worth more in mergers and acquisitions. A specific organization's sustainability area could work with the project team to explore opportunities using specific analysis tools and technical advice. However, organizations should not assume the government's responsibilities, trying to solve all social and environmental issues.

Top management must sponsor the organizational culture change by implementing a strategic project. Providing sustainability training to the team, walking the talk to educate by example, and implementing a sustainability requirements governance to portfolio and project management may help enhance the performance.

The current way of doing business does not meet investors', NGOs', civil societies', consumers', and financial institutions' expectations anymore. Those institutions and entities are pressing the organizations to have sustainable solutions and commitment to the theme. To understand sustainability opportunities and benefits, business owners shall acknowledge the organization's risk exposure and the importance of an integrated approach to the engineering disciplines, encompassing design, construction, and operation phases.

Laws or regulations are coercive means to increase sustainability maturity level and a faster way to introduce change. Laws and regulations depend on professional bodies, government, and political will. If sustainability requirements are not regulatory demands, the intrinsic will is necessary to change the culture and beliefs. Knowledge in sustainability will help shift from a short-term strategy to a long-term one. Project management can be a valuable tool to shorten this path by introducing the project and organizations' sustainability requirements to the early stages of discussion and influencing the change. Portfolio management criteria comprising financial and sustainability requirements can also contribute to fostering decisions in sustainability compliance.

If organizations ignore stakeholders' behavior change, they may lose market share and business opportunities, eventually going bankrupt.

5. Conclusion

This study found that the average project is yet to meet sustainability-related guidelines despite substantial research linking projects, sustainability, and sustainable conceptual framework development.

This finding is particularly relevant since this study's literature review comprises journals of diverse territories, and the interviews

brought a comprehensive view of the perspective in Brazil. The thematic maps revealed, in Brazil, a gap of knowledge in sustainability, maintenance of an old-fashioned way of doing business, and a trend of investors and banks demanding sustainability requirements, to cite a few like those captured in the literature review. All those perspectives reinforce that a significant behavior change is needed, encompassing the stakeholders' roles and responsibilities and the organizations' strategies.

The articles reviewed indicate a gap between theory and a project's reality, although the professionals recognize the need to consider sustainability in projects. The integration between organizations and academia is timid, and the two entities should foster closer cooperation. Organizations tend to consider that academia delivers only theoretical solutions, lacks practical experience, and does not apply the proposed solutions. Most organizations consider sustainability an additional cost and not an innovative approach to improving their endeavors to mitigate social and environmental impacts.

Practical mechanisms to facilitate the approach to sustainability in projects are lacking, making it difficult for decision-makers to identify how meeting sustainability requirements can add value to their projects [4,10,27,69,71]. A project management guideline with sustainability requirements, both at the organizational and project levels, can be a valuable tool to help organizations in their journey to sustainability.

Sustainability is a cross-cutting concept influencing and being influenced by project phases, value management, sustainability factors and indicators, success factors, soft and technical skills, procurement, social sustainability, stakeholders, motivation, and barriers.

On the one hand, using the hierarchal approach, organizations shall promote the integration of sustainability into project management by defining policies, processes, and governance to enhance sustainability requirements in the core business and projects. Hiring a specialist consultant can be an approach to establish the sustainability requirements, engage the stakeholders accordingly, and monitor the project results to the defined successful sustainability indicators linked to the project's objectives.

On the other hand, we cannot ignore that the hierarchal approach alone is not enough to introduce changes. The professionals shall understand the importance of sustainability requirements in the project to promote changes. The systemic bottom-up view of the system-thinking approach influences that behavior. However, to lead change, the systemic bottom-up view depends on one's self-perceived soft skills, organizational culture, and self-motivation, which are critical to influencing themselves to support sustainability.

Among the aspects that impact or prevent integrating sustainability in project management processes, we can mention that communication with stakeholders is critical to ensure that the expectations, perceptions, and advocated causes align with the project's guidelines. Whereas organizations should shift from the short-to the long-term perspective of their business, the government should act as the primary entrepreneur for most megaprojects and regulate the various business areas to foster and contribute to sustainable development. Additionally, the government should implement policies to support sustainable development, implement incentives, or demand sustainable solutions in construction projects.

Meanwhile, the organizations shall define and implement a sustainable approach in their business areas, enabling the decision-makers to consider sustainability criteria in the early portfolio management phase, the feasibility study, and the project's conceptual and basic designs. That will enable the project teams to plan and implement the sustainability requirements in the subsequent execution phase.

Likewise, the project manager and discipline leaders must have sustainability training and foster the cause in the team. Organizations, playing clients' role, shall support suppliers that promote sustainability in their production processes and demand further sustainability requirements in their projects to influence change. Clients shall broaden their sustainability knowledge and understand its benefits for the long-term and their reputation, adopt sustainability criteria since the portfolio management decision phase, and engage stakeholders other than shareholders, besides contracting experts to discuss sustainable solutions. Projects should consume resources efficiently, according to their regeneration rates, so organizations must hold sustainability requirements in the projects' early phases. Such approaches can add value to the project.

The organizations' and the stakeholders' sponsorship are crucial to sustainable project management. This study presents comprehensive information about what needs to change, who needs to acquire knowledge, and who needs to support the change to achieve sustainable project management.

This study can be a foundational resource for organizations embarking on a sustainability journey and aspiring to become leading players in this field. It offers a roadmap for initiating a self-assessment, enabling organizations to scrutinize their operational landscape and identify any existing barriers. Moreover, it presents practical solutions to overcome these obstacles effectively.

In addition, organizations can employ this study to internally evaluate their eligibility for loans, especially concerning their adherence to sustainability requirements. This evaluation can shed light on whether they encounter challenges securing financing due to sustainability-related factors. Furthermore, project teams within these organizations can benefit from understanding the relevance of acquiring sustainability expertise. This knowledge is crucial for devising and implementing sustainable solutions. Moreover, it underscores the importance of cross-disciplinary collaboration within project teams to optimize outcomes and attain superior results.

This study is a valuable tool for organizations at the outset of their sustainability journey. It offers insights, solutions, and a holistic perspective on integrating sustainability principles into their operations and projects. It sheds light on the importance of organizational-level changes in effectively incorporating sustainability requirements into project development. Additionally, it offers a comprehensive perspective, drawing from a global literature review and a specific analysis focused on the Brazilian context. This analysis encompasses insights from twenty-four leaders representing sixteen national and multinational organizations in São Paulo, Rio de Janeiro, Bahia, and Minas Gerais states.

The study employs the CHAP2 Method, which fosters a dialogical approach between interviewers and interviewees. This approach encourages the emergence of metacognition and the generation of novel conclusions.

The study's findings are an invaluable starting point for researchers seeking to delve into this theme. It is worth noting that the

sustainability challenge is not confined to a particular region or country, as corroborated by the literature review. Naturally, the severity of these issues will fluctuate depending on various factors, including a nation's financial status, developmental stage, degree of governmental intervention in the economy, maturity in sustainability standards, and the legislative framework, among others. Therefore, solutions need to be tailored to each unique context.

Future research endeavors could delve into the potential impact of the evolving sustainability standards within the European Union on emerging economies. Such investigation is particularly pertinent since these emerging economies often export goods and commodities to developed EU nations and assessing the impacts is a vital area of study.

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Data included in article/supp. material/referenced in article.

CRediT authorship contribution statement

Marcia de Almeida Vittori Ferreira: Writing - review & editing, Writing - original draft, Investigation, Formal analysis, Data curation, Conceptualization. **Cláudia do Rosário Vaz Morgado:** Supervision. **Marcos Pereira Estellita Lins:** Writing - review & editing, Supervision, Methodology, Formal analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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