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SUSTAINABILITY, CIRCULAR ECONOMY, AND PROJECTS: RESEARCH OPPORTUNITIES

SUSTENTABILIDADE, ECONOMIA CIRCULAR E PROJETOS: OPORTUNIDADES DE PESQUISA

Luciano Ferreira da Silva
Doctor
Nove de Julho University – UNINOVE
São Paulo, SP – Brazil.
prof.lfs7725@gmail.com

Nelson José Rosamilha
Doctor
Nove de Julho University – UNINOVE
São Paulo, SP – Brazil.
rosamilha@uni9.edu.br

Abstract:
This editorial explores the intersection of sustainability, circular economy, and project management, highlighting its growing relevance in the contemporary context. Sustainability is deeply integrated into management modern practices, incorporating economic, social, and environmental dimensions. The circular economy, as an alternative to the traditional linear economic model, aims to reintegrate products and materials into the production live cycle, minimizing waste and maximizing resource use. Digital technologies such as IoT, AI, and blockchain provide new opportunities for implementing sustainable practices in real time, especially within the context of Industry 4.0. In project management, the incorporation of sustainability principles is crucial for ensuring long-term success. Frameworks such as the P5 Standard and PRiSM offer practical tools for integrating these concepts of sustainability into the daily routines of project professionals, promoting resource efficiency and social responsibility. The active engagement of stakeholders and the development of specific frameworks are essential for advancing project management that generates positive environmental and societal impacts. The editorial also highlights various research opportunities related to the integration of sustainability and the circular economy in project management. Research opportunities include understanding the impact of circular economy principles on project efficiency, stakeholder engagement in sustainable projects, and the development of frameworks aligned with the Sustainable Development Goals (SDGs). By addressing these topics, researchers and organizations not only address environmental challenges but also gain a competitive advantage.

Keywords: Sustainability. Circular economy. Project managementm Digital technologies. Stakeholders. Sustainable development goals. P5 standard. PRiSM.

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Resumo:
Este editorial explora a interseção entre sustentabilidade, economia circular e gestão de projetos, destacando sua crescente relevância no contexto contemporâneo. A sustentabilidade está profundamente integrada às práticas modernas, abrangendo dimensões econômicas, sociais e ambientais. A economia circular, como alternativa ao modelo linear tradicional, visa reintegrar produtos e materiais ao ciclo produtivo, minimizando o desperdício e maximizando a utilização de recursos. Tecnologias digitais, como IoT, IA e blockchain, proporcionam novas oportunidades para a implementação de práticas sustentáveis em tempo real, especialmente no contexto da Indústria 4.0. Na gestão de projetos, a incorporação de princípios de sustentabilidade é crucial para garantir o sucesso em longo prazo. Frameworks como o P5 Standard e o PRiSM oferecem ferramentas práticas para integrar esses conceitos ao dia a dia dos profissionais de projetos, promovendo a eficiência dos recursos e a responsabilidade social. O envolvimento ativo dos stakeholders e o desenvolvimento de *frameworks* específicos são fatores fundamentais para avançar na gestão de projetos que gerem impactos positivos no meio ambiente e na sociedade. O editorial também ressalta diversas oportunidades de pesquisa relacionadas à integração da sustentabilidade e da economia circular na gestão de projetos. Nós podemos citar como oportunidades de pesquisas a compreensão sobre o impacto dos princípios da economia circular na eficiência dos projetos, o engajamento dos stakeholders em projetos sustentáveis e o desenvolvimento de *frameworks* alinhados aos Objetivos de Desenvolvimento Sustentável (ODS). Ao abordar esses tópicos de estudo, pesquisadores e organizações não só enfrentam os desafios ambientais, como também obtêm vantagem competitiva.

Palavras-chave: Sustentabilidade. Economia circular. Gestão de projetos. Tecnologias digitais. Stakeholders. Desenvolvimento sustentável. P5 standard. PRiSM.

1 Introduction

Sustainability is deeply rooted in the activities and processes of contemporary society, encompassing economic, social, and environmental aspects (Elkington, 1998). Sustainability refers to the ability to meet present needs without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development [WCED], 1987). To ensure this paradigm of sustainability, it is essential to use environmental resources and products consciously, considering practices such as reduction, reuse, reintegration, and recycling. This approach guides decision-making in both public and private organizations, ensuring the responsible use of resources and minimizing negative impacts on the environment and society, thus contributing to the long-term survival of these organizations.

A fundamental concept related to sustainability is the circular economy (Madaan *et al.*, 2024). To understand it, one must comprehend its counterpart, the linear economy, which is based on the extraction of materials from nature, waste generation, and disposal. This linear model usually directs waste from production and consumption systems to landfills. However, with increasingly strict standards and regulations, such as the Solid Waste Law (Law 12.305/2010 - Brazil), waste management has become an increasing challenge, requiring innovation in disposal and reuse practices.

The circular economy seeks to transform the production and consumption cycle into a sustainable one by promoting the reintegration of products and materials into the production system, minimizing waste, and maximizing resource utilization (Geissdoerfer *et al.*, 2018). This approach not only proposes a paradigm shift in relation to excessive consumption but also integrates biological and technical cycles. The biological cycle refers to the responsible use of natural resources, while the technical cycle involves the transformation of materials into consumer goods. The harmony between these cycles is essential to ensuring sustainability in production processes, guaranteeing that materials remain in use for as long as possible and contribute to other production chains.

Moreover, the intersection between sustainability and digital technologies, especially in the context of Industry 4.0, offers new opportunities for promoting sustainable consumption. Technologies such as IoT (Internet of Things), AI (Artificial Intelligence), and Blockchain are transforming supply chains, enabling the real-time implementation of sustainable practices (Büyüközkan & Göçer, 2018). For example, IoT can monitor resource usage in real time,

allowing for adjustments that promote efficiency, while Blockchain can ensure transparency and traceability in supply chains, facilitating environmental responsibility.

In this context of sustainability and the circular economy, project management becomes an ally both in the implementation of digital technology projects and in promoting organizational and societal transformations through program management (Dalto *et al.*, 2024). In the same vein, we can say that sustainability can be achieved within the context of projects through their management or through the product generated by the project, as pointed out by Rego and Faillace Junior (2024).

Concerns about resource usage by companies should already be a reality from the ideation phase of a project, with the introduction of concepts such as ecodesign (Brones, Zancul, & Carvalho, 2021), product life cycle analysis (Gigli, Landi, & Germani, 2019), industrial symbiosis (Neves *et al.*, 2020), reverse logistics (Ding, Wang, & Chan, 2023), among others related to sustainability and the circular economy. The products of projects and their management represent an opportunity for promoting sustainability (Rego & Faillace Junior, 2024).

Based on what has been presented, this editorial discusses research opportunities that emerge from the interrelationship between sustainability, the circular economy, and project management. We will highlight the importance of the active engagement of all stakeholders involved, including businesses, governments, and civil society, to create a more sustainable and resilient future, including through more sustainable projects.

Therefore, in the next section, we will explore the interrelationship between sustainability, the circular economy, and project management, highlighting how these concepts complement each other and present opportunities for more efficient project management aligned with sustainability principles.

2 Sustainability and circular economy

The integration of biological and technical cycles leads us to understand a circular ecosystem (Neves *et al.*, 2020), where the provision of goods and services is combined with the responsible use of natural resources. An important topic in this context is reverse logistics. Rethinking the supply chain in bidirectional flows allows for the handling of non-waste generation, reduction, reuse, recycling, treatment, and final disposal when necessary.

Da Silva *et al.* (2022) highlights the search for the development of statistical models to assist in projecting landfill capacity, estimating the volumes and flows of waste generated by production and consumption processes, as well as evaluating the life cycle of products for the development of products with a lower environmental impact.

Reverse logistics helps to understand the supply chain and a reverse flow, such as the reuse of packaging, use of refills, and the return of unused or broken equipment to the beginning of the production chain for the reuse and recycling of their materials (Ding, Wang, & Chan, 2023). An example of the benefits of reverse logistics is the use of waste from electronic equipment such as cell phones and computers (Da Silva *et al.*, 2022). The wealth of resources that these devices carry must be reintegrated into the chain or used as byproducts in other production chains.

To think about the circular ecosystem, it is necessary to understand that various actors must interact to promote a more sustainable society in a symbiotic process (Neves *et al.*, 2020). This concept includes the conscious insertion of natural resources into the production and consumption chain, ensuring that materials remain in use for as long as possible. We must integrate waste generators, treatment companies, public agents, recyclers, scavengers, transporters, and other actors. When considering this ecosystem, we must understand three basic elements: People, Processes, and Technologies.

Digital technologies represent a means to achieve a more sustainable society. From precision agriculture to last-mile intelligent logistics systems, the digital economy emerges as an ally in promoting the circular economy. Examples include the use of Digital Twin for modeling production and logistics systems in the cloud, big data and data analytics from IoT sensorization or data sources from digital platforms, and the use of blockchain to ensure traceability and better resource management. All of this is integrated into reverse logistics activities in a symbiotic relationship between the various nodes in the supply chain. Thus, the development of smart manufacturing that integrates various suppliers and customers into intelligent production and consumption systems raises the concept of just-in-time to a higher level.

In terms of customer service, we highlight the great opportunity for decentralized product supply structures using the omnichannel concept. Customers can buy products online and conveniently pick them up at various sales points. A decentralized and complex system composes stocks to provide products and services to consumers.

A word that helps in these reflections is servitization, as we must think about environmental services such as filtering rainwater through trees, CO2 absorption, climate control, plant pollination, and the control of diseases and pests, among other benefits that people obtain from natural ecosystems. On the other hand, we must think about products from the perspective of servitization (Doni, Corvino, & Martini, 2019). Product as a service is a concept that has been well explored in recent times (Da Silva *et al.*, 2022); therefore, it is necessary to think from the product ideation phase, associating ecodesign activities (Brones, Zancul, & Carvalho, 2021), to develop products with low environmental impact.

As can be seen, sustainability in its circular economy aspect has impacted everyday activities, such as waste disposal at home and packaging use, among others. The circular economy has influenced production processes and the use of industrial packaging, such as the traceability of plastic packaging in agriculture. Urban cleaning activities now see increased use of water and recycled materials. Ultimately, the circular economy is already part of our lives and the strategy of organizations that must adapt or modify their processes for a more conscious and sustainable business model.

3 Sustainability, circular economy and project management

The relationship between sustainability, the circular economy, and project management is a topic of growing relevance in today's context, where the search for practices that minimize environmental impacts and promote resource efficiency has become imperative. Data from the UN indicates that achieving the Sustainable Development Goals (SDGs) requires the integration of these concepts into project management practices (Silvius *et al.*, 2012). These three concepts interact significantly, creating opportunities for project management that not only meets economic needs but also promotes social and environmental benefits (Rego & Faillace Junior, 2024).

Sustainability in the context of project management involves considering social, economic, and environmental impacts throughout the lifecycle of a project, with the goal of ensuring beneficial results not only in the present but also for future generations (Armenia *et al.*, 2019). Rego and Faillace Junior (2024) emphasize the importance of understanding sustainability in both project management processes and the sustainability resulting from the project's product.

Therefore, it is essential that project managers integrate sustainability principles, such as waste minimization and resource efficiency maximization, into their daily practices, as discussed in "Sustainability in Project Management" (Silvius *et al.*, 2012). Additionally, sustainability should be an integral part of project planning and execution, considering social and environmental responsibility (Moreno-Monsalve *et al.*, 2023). The adoption of sustainability principles is essential, as they guide managers to adopt practices that respect the environment and society, promoting transparency and stakeholder inclusion in decision-making.

By using the perspective of the circular economy in projects, we move toward a paradigmatic shift from the traditional linear production and consumption model. In this way, rather than thinking of project resources in a flow of extraction, production, use, and disposal, the circular economy perspective will seek to reintegrate products and materials into the production live cycle, minimizing waste. Adebayo *et al.* (2024) highlight that applying circular economy principles in project management can lead to more sustainable outcomes and better resource utilization. This is reflected in practices such as ecodesign for durability and resource optimization, which can be implemented through effective stakeholder management in projects.

The intersection between the three concepts proposed in this editorial comment highlights the need for a collaborative approach involving all stakeholders. Effective stakeholder management is crucial to ensuring that sustainability and circular economy initiatives are successful. Projects must be planned and executed with a vision that not only meets economic objectives but also considers the social and environmental impact of the decisions made (Woźniak, 2021). The literature indicates that active stakeholder engagement can increase the acceptance and success of circular economy initiatives within projects. Additionally, the use of agile methodologies can facilitate the adaptation and innovation necessary to integrate sustainable practices into day-to-day operations (Zaleski & Michalski, 2021).

There are several methods and frameworks that can support project professionals in organizational initiatives, including the P5 Standard (or i5 Standard), which is a methodology that considers five dimensions: Product, Process, People, Planet, and Prosperity. It allows for the analysis and measurement of the impact of projects in relation to sustainable development goals (GPM EMEA, 2024). PRiSM (Projects integrating Sustainable Methods) is a

methodology that integrates sustainability practices into project management, promoting waste reduction and resource efficiency (GPM EMEA, 2024).

Two other examples are the "Circular Economy Roadmapping" methodology, which provides a strategic framework for implementing the circular economy in projects, aligning long-term goals with sustainable practices (Abu-Bakar & Charnley, 2024). Finally, we can cite eco-design, a concept that emphasizes project planning to facilitate the recovery and reuse of materials (IAARC, 2021; Brones, Zancul, & Carvalho, 2021).

Although there are various methods and frameworks for promoting sustainability in projects, the growing urgency to face increasingly complex environmental and social challenges makes sustainability principles essential in project management. These principles guide managers to adopt practices that ensure positive results today and in the future. Thus, the pursuit of integrating sustainability-oriented perspectives, tools, and technologies into the context of projects is ongoing.

The principles of commitment and responsibility highlight the importance of respecting the environment and the specific needs of people in their localities, while ethics and decision-making promote choices based on data that mitigate negative impacts. Transparency and integration across different areas are fundamental to the success of sustainable initiatives, allowing stakeholders to collaborate effectively (PMI, 2014; GPM, 2014). Additionally, social and ecological equity ensures that the needs of vulnerable people are respected, and economic prosperity guides managers to implement strategies that benefit all stakeholders. Active stakeholder engagement is vital, as it strengthens support for and acceptance of sustainability initiatives (Woźniak, 2021; Zaleski & Michalski, 2021).

The literature on project management, including studies such as "Sustainability in Project Management" (Silvius *et al.*, 2012), "Sustainable Project Management" (Armenia *et al.*, 2019), as well as Friedrich (2023) with his systematic review of the literature on the topics discussed here, which reinforce the need to incorporate these principles into the daily practices of professionals involved in projects. By adopting these guidelines, project professionals become agents of change, creating innovative solutions that benefit both society and the environment.

4 Research opportunities

After recognizing the relevance of sustainability and the circular economy in project management, it is also possible to identify research opportunities. In this sense, we have listed some of these opportunities, which are not exhaustive but may provide insights for researchers and project management professionals. These include:

- The impact of circular economy on project efficiency – Investigating how the application of circular economy principles impacts resource efficiency in projects can offer valuable insights. Empirical studies may establish correlations between the adoption of circular practices and sustainable outcomes in project management. For example, including industrial symbiosis as a premise during the initial planning phase of projects, treating a project's waste as input for other production chains.
- Integration of sustainable principles in different sectors – Researching how sustainability principles, such as commitment and responsibility, are applied in various sectors can reveal best practices and specific adaptations. This research can help consolidate sustainable management theory in different industrial contexts. For example, in digital transformation projects, addressing electronic waste management and life cycle analysis.
- Stakeholder engagement in sustainable projects – The literature indicates that active stakeholder engagement is crucial for the success of sustainability initiatives. Research can explore effective methods to increase this engagement and how it can be measured across different types of projects. For example, incorporating stakeholders as co-creators of sustainable values in sustainable projects, using open innovation as a platform for generating sustainability, or considering both the negative and positive externalities of projects for stakeholders
- Evaluation of agile methodologies in sustainable projects – Analyzing how the use of agile methodologies facilitates the integration of sustainable practices can offer a deeper understanding of their applicability and effectiveness in real-world situations, contributing to project management literature. For instance, researchers could understand how each iteration can mitigate negative sustainability impacts through learning cycles.

- Development of frameworks for sustainable project management – Creating frameworks that align project management practices with the SDGs can be a relevant research topic. These frameworks can serve as practical guides for project managers, facilitating the implementation of sustainable strategies. For example, creating frameworks that consider sectoral or local specificities could bring greater contributions to the audience that can benefit from these solutions, moving away from generic solutions.
- Internal perspective on sustainability in it projects – There is a lack of studies addressing the internal perspective of sustainability in IT project management, particularly how this perspective can impact project management methodologies and customer satisfaction. For example, using models to evaluate the life cycle of technological products in projects.
- Analysis of the contribution of sustainable project management to competitive advantage – How sustainable project management can influence companies' competitive advantage, both economically and strategically, is still limited and deserves further investigation. For example, using and developing sustainable practices as a competitive differentiator due to their exclusivity within a value chain.
- Policies and protocols for sustainability in project management – There is significant opportunity to develop guidelines that help align sustainability-related policies with sustainable project management practices. For example, analyzing ISO 59004/2024, "Circular Economy — Vocabulary, Principles, and Guidelines for Implementation" (ISO, 2024), to incorporate its content as guidelines for project management.

The research opportunities presented are not an exhaustive list of topics that can be addressed in research that contemplates sustainability and project management. However, the purpose of this list is to encourage reflection on opportunities that can guide relevant research and productions for the Journal of Business and Project (https://periodicos.uninove.br/gep/index), as well as other national and international journals. Thus, it is possible to understand how different sustainable project management practices apply in various industrial contexts, particularly regarding resource management to prevent them from becoming waste discarded in the environment.

5 Final considerations

This editorial highlighted the growing relevance of the intersection between sustainability, circular economy, and project management in the contemporary context. Throughout this discussion, it became evident that the integration of these concepts is not only a response to environmental and social pressures, but a strategic opportunity to promote resource efficiency and generate economic, social and environmental benefits for all.

The circular economy, supported by digital technologies, presents a promising path to transform production chains and organizational practices, promoting a more sustainable life cycle for products and services. With regards to project management, the challenge of incorporating the principles of sustainability is not only urgent, but essential to ensure long-term success. The aforementioned practices, such as the P5 Standard and PRiSM, provide a robust framework for project professionals to adopt these approaches in a practical and measurable way. The active involvement of stakeholders and the creation of specific frameworks were also highlighted as central elements for the evolution of project management that promotes a positive impact on the environment and society.

Finally, the research opportunities presented in this editorial reinforce the need to expand knowledge and develop innovative practices in the field of sustainability applied to project management. By exploring these opportunities, it is expected that new sustainable solutions and strategies will emerge, enabling organizations to not only address environmental challenges but also create competitive advantage on the global stage.

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