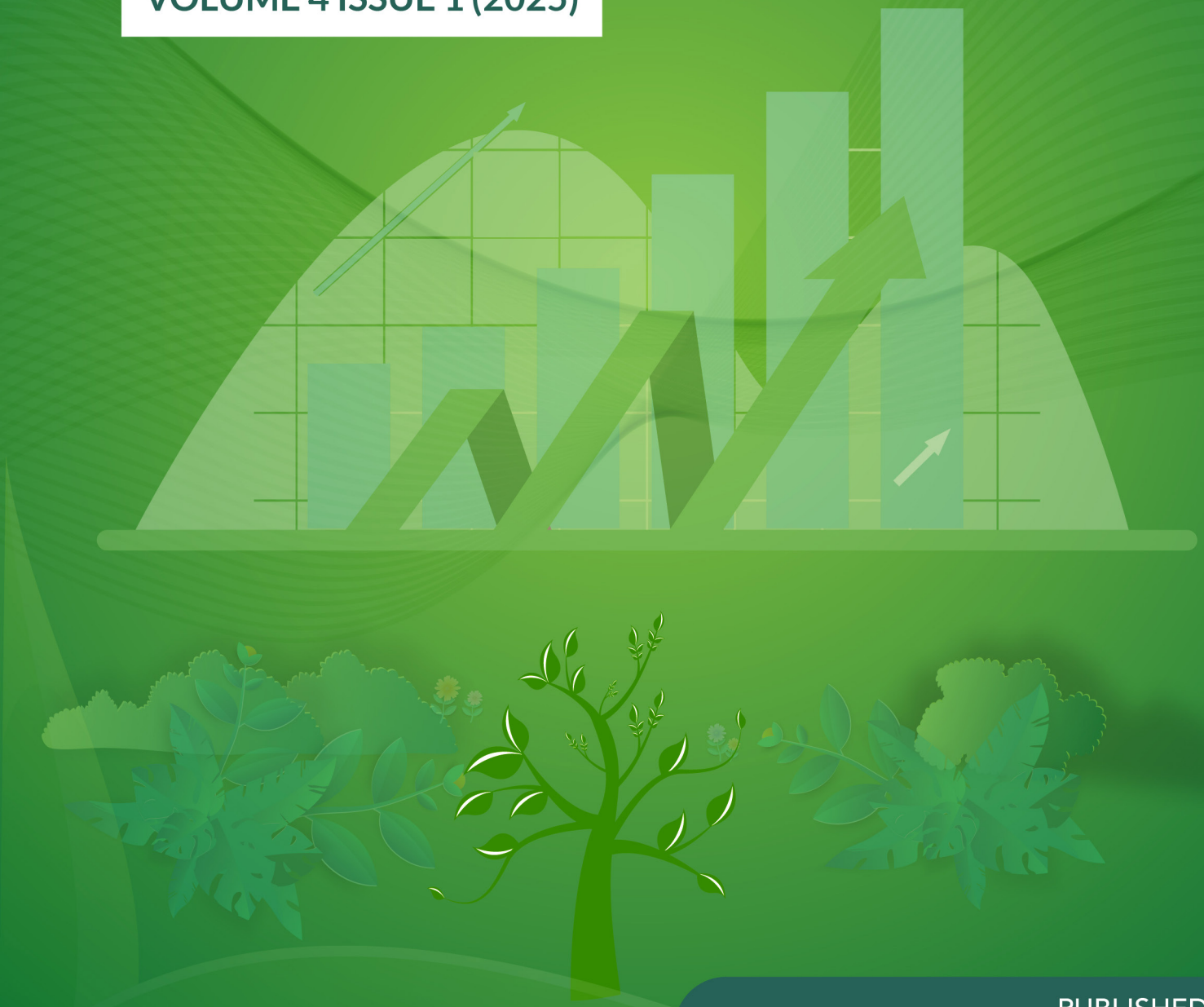
American Journal of Environmental Economics (AJEE)

ISSN: 2833-7905 (ONLINE)

VOLUME 4 ISSUE 1 (2025)



PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

American Journal of Environmental Economics (AJEE)

Volume 5 Issue 1, Year 2026
ISSN: 2833-7905 (Online)
DOI: https://doi.org/10.54536/ajee.v5i1.5823
https://journals.e-palli.com/home/index.php/ajee

Strategic Decision Making in the Digital Age: Contributions of Management Accounting and Industry 4.0 Technologies to Organizational Sustainability

Antônio José de Souza[1*], Ednaldo Ferreira e Silva[1], Fábio André De Farias Vilhena[2], Felipe Gramonski dos Santos[1], Isidro José Bezerra Maciel Fortaleza do Nascimento[3], Rafael Soares Cardoso[4], Ruany Idalice Martins Barros[1], Tiago Luz de Oliveira[5], Amarildo Jesus Teles Contreiras[1]

Article Information

Received: August 10, 2025

Accepted: September 12, 2025

Published: January 13, 2026

Keywords

Accounting, Decision-Making, Industry 4.0, Managerial Control, Sustainability

ABSTRACT

Accounting has undergone intense transformations driven by digital technologies and sustainability demands, consolidating itself as a strategic tool for governance and decision-making. In this scenario, the integration between accounting practices and Industry 4.0 solutions creates new possibilities, but also exposes challenges related to managerial adaptation and continuous training. For this reason, this article aims to investigate strategic decision-making in the digital age, highlighting the contributions of management accounting and Industry 4.0 technologies to organizational sustainability. The study was conducted through an integrative literature review, based on national and international databases, systematizing evidence published between 2020 and 2025, in dialogue with productions of our research group. The results indicate that digital tools, ESG indicators, and hybrid costing methodologies increase the accuracy of management accounting, while technologies such as blockchain, big data, and cyber-physical systems strengthen transparency and efficiency. It is concluded that organizational sustainability in the digital age depends on the convergence between innovative accounting practices, training of managers and the critical adoption of emerging technologies, allowing the alignment of competitiveness, governance and socio-environmental responsibility.

INTRODUCTION

The convergence between digital innovation and sustainability has repositioned management accounting as a strategic lever for decision-making, by integrating esg metrics, data analytics, and information-driven controls to generate responsible competitive advantage; in this context, the managerial function migrates from mere reporting to the design of systems that connect economic and socio-environmental performance, requiring new skills, data governance, and judicious use of emerging technologies so that digitalization actually translates into sustainable value creation (Ascani *et al.*, 2021).

In view of this scenario, this article proposes to investigate strategic decision-making in the digital age, with emphasis on the contributions of management accounting and Industry 4.0 technologies to organizational sustainability, through an integrative literature review. This approach allows us to gather recent theoretical and empirical evidence, highlighting how digitalization and management instruments contribute to aligning efficiency, innovation, and sustainability in the corporate environment.

LITERATURE REVIEW

Verhoef *et al.* (2021) argue that digital transformation is not a mere technical advance, but a strategic process that redesigns business and management models, combining data, platforms, and governance. This approach expands innovation and competitiveness, but depends on cultural and organizational integration for technology to translate into concrete results.

Campana *et al.* (2025) highlight that environmental accounting and ESG indicators play a central role in integrating financial and socio-environmental performance. When supported by digital technologies and reliable measurement standards, these instruments reduce risks such as greenwashing and consolidate sustainability as part of the organizational strategy.

Pereira *et al.* (2025) argue that education for sustainability depends on digital methodologies capable of developing socio-environmental skills. Simulation and digital evaluation platforms promote managers who are better prepared to integrate management accounting, technological innovation, and sustainability into strategic decision-making processes.

Silva *et al.* (2024) reinforce that blockchain, big data, and automation bring efficiency and reliability gains to accounting processes. However, they warn that institutional barriers, high costs, and cultural resistance limit full adoption, showing that digital transformation is only consolidated when combined with institutional and regulatory changes.

Akter *et al.* (2020) demonstrate that synergies between AI, blockchain, cloud, and analytics generate transformational gains, reducing coordination costs and increasing

[1] Miami University of Science and Technology Instituto Federal do Triangulo Mineiro, Brazil
[2] Faculdade Interamericana de Ciências Sociais, Brazil
[3] Universidade de São Paulo, Brazil
[4] Faculdade Cesgranrio, Brazil
[5] Universidade Federal do Amazonas, Brazil
[*] Corresponding author's e-mail: edson_nogueira@ufam.edu.br

algorithmic trust. However, this potential depends on the existence of a robust data architecture and organizational readiness to absorb and apply technologies.

Monteiro *et al.* (2025) show that interinstitutional collaboration in open innovation, strengthened by digital technologies, accelerates modernization and sustainability. The study demonstrates that networks between government, universities and companies reduce gaps between technological supply and organizational absorption, creating conditions for more agile and data-based decisions.

Matos *et al.* (2025) point out that social innovation in the third sector is amplified by digital platforms, which allow co-design, impact monitoring, and collaborative decision-making. This process increases the effectiveness and strengthens the sustainability of cross-sector initiatives, pointing to the importance of digitized management accounting.

Sousa *et al.* (2025) show that the integration of the Sustainable Development Goals into organizational policies is enhanced by digital technologies and management information systems. By incorporating environmental indicators into management accounting, organizations are able to align their decisions with the 2030 Agenda and strengthen their institutional governance.

Liu *et al.* (2025) note that digital entrepreneurship, driven by big data, blockchain, and AI, expands the capacity for innovation, but requires constant updating of managerial skills. This move reinforces that competitive sustainability depends on the continuous integration between human creativity and intelligent automation.

Reis *et al.* (2023) state that digital transformation should be understood as structural and cultural reconfiguration, and not just as technological adoption. The most robust results emerge when organizations adapt their institutional structures and governance strategies to fully capture the benefits of digitalization.

MATERIALS AND METHODS

This study was developed through an integrative literature review, which allows to gather, analyze and synthesize previous research on a specific topic, combining theoretical and empirical evidence. This method was chosen because it enables a comprehensive understanding of the relationship between management accounting, Industry 4.0 technologies and organizational sustainability, meeting the objective of mapping contributions and challenges in strategic decision-making.

The searches were carried out between April and August 2025 in databases recognized by the scientific community, including Web of Science (WoS), Scopus, ScienceDirect, Google Scholar and journals indexed via the CAPES Portal. Descriptors in English and Portuguese, combined by Boolean operators, such as: "management accounting", "Industry 4.0", "sustainability", "decision-making", "digital transformation" and their counterparts in Portuguese, were used. The strategy was built in order to expand the coverage of contemporary studies, prioritizing the period between 2020 and 2025.

The selection process followed three stages:

(i) Reading of titles and abstracts to identify adherence to the theme;

(ii) Analysis of the full text of eligible articles, considering pertinence to the research objective; and

(iii) Exclusion of duplicate studies or studies not aligned with the thematic scope.

In addition, articles produced by the authors' research group, previously published in international journals, were included because they have a strong relationship with the theme. The analysis of the selected articles was conducted through thematic categorization. The categories emerged from the literature and national findings, organized into four axes:

(1) Training and digital literacy;
(2) Security and interoperability;
(3) Institutional capacity and regulatory framework; and
(4) Technological innovation and sustainability.

This categorization made it possible to triangulate national and international contributions, identifying convergences and divergences.

Finally, the discussion was constructed in an argumentative and comparative way, connecting international evidence to national case studies, in order to assess the extent to which management accounting and digital technologies contribute to strategic decisions that strengthen organizational sustainability.

RESULTS AND DISCUSSION

Within this informational aspect, Santiago (2024) and Campana *et al.* (2024) emphasize the importance of accounting for the disclosure of corporate governance principles in Brazil. The advancement of automation and intelligent systems contributes directly to strategic decision-making, by speeding up analysis processes, reducing errors, and facilitating access to performance indicators in digital industrial environments. This context requires managers to adapt their strategies and routines to the reality of real-time data, enabling more timely decisions based on dynamic scenarios, essential for competitive sustainability. Despite these advantages, there is a need to overcome limitations in the standardization and integration of systems so that the positive impact is maximized (Silva *et al.*, 2024).

Santos *et al.* (2025) add that the adoption of cyber-physical systems, artificial intelligence, and big data analysis generate critical support for management accounting, providing greater accuracy and speed in sustainability decisions in organizational environments. The article demonstrates that Industry 4.0 is the central catalyst for innovative management practices that meet the ESG pillars, highlighting the impact of green technologies on the strategic reconfiguration of organizations.

Tiwari and Khan (2020) demonstrate that Industry 4.0 especially technologies such as IoT, big data, and AI provides a technically robust foundation for accounting modeling and sustainability reporting, aligned with the GRI framework. They map the degree of maturity of

these technologies in practice and how this can improve the accuracy and reliability of socio-environmental indicators. The argument strengthens the connection between industrial digitalization and the integrity of accounting reports aimed at sustainability.

Petcu *et al.* (2024) argue that the integration of digital technologies (such as cloud computing and Industry 4.0) into sustainability accounting and reporting processes significantly improves the quality of information for stakeholders. They identify that, although there is positive impact, concerns about privacy, the need for training and infrastructure still limit full adoption. This focus underlines the practical challenges of digitizing sustainable accounting.

Within this informational aspect, Santiago (2024) and Campana *et al.* (2024) emphasize the importance of accounting for the disclosure of corporate governance principles in Brazil. The advancement of automation and intelligent systems contributes directly to strategic decision-making, by speeding up analysis processes, reducing errors, and facilitating access to performance indicators in digital industrial environments. This context requires managers to adapt their strategies and routines to the reality of real-time data, enabling more timely decisions based on dynamic scenarios, essential for competitive sustainability. Despite these advantages, there is a need to overcome limitations in the standardization and integration of systems so that the positive impact is maximized (Silva *et al.*, 2024).

Santos *et al.* (2025) add that the adoption of cyber-physical systems, artificial intelligence, and big data analysis generate critical support for management accounting, providing greater accuracy and speed in sustainability decisions in organizational environments. The article demonstrates that Industry 4.0 is the central catalyst for innovative management practices that meet the ESG pillars, highlighting the impact of green technologies on the strategic reconfiguration of organizations.

Tiwari and Khan (2020) demonstrate that Industry 4.0 especially technologies such as IoT, big data, and AI provides a technically robust foundation for accounting modeling and sustainability reporting, aligned with the GRI framework. They map the degree of maturity of these technologies in practice and how this can improve the accuracy and reliability of socio-environmental indicators. The argument strengthens the connection between industrial digitalization and the integrity of accounting reports aimed at sustainability.

Petcu *et al.* (2024) argue that the integration of digital technologies (such as cloud computing and Industry 4.0) into sustainability accounting and reporting processes significantly improves the quality of information for stakeholders. They identify that, although there is positive impact, concerns about privacy, the need for training and infrastructure still limit full adoption. This focus underlines the practical challenges of digitizing sustainable accounting.

In the context of strategic management, management accounting based on environmental and social indicators has proven vital in integrating economic objectives with corporate responsibility practices, allowing organizations not only to understand, but also to mitigate environmental and reputational impacts. The intensive use of ESG analysis tools and integration with digital technologies reinforces the holistic view of sustainability, facilitating business decisions aligned with both regulators and the global market. This alignment strengthens reputation and long-term competitiveness (Campana *et al.*, 2024).

The strategic use of managerial costing methods variable and absorption is essential for companies to adjust their decisions to market volatility and regulatory requirements, balancing efficiency, accuracy, and tax flexibility. The focus on the contribution margin and detailed cost analysis favors quick and assertive decisions in digitalized and competitive environments, while the adoption of hybrid models enhances the alignment between tax compliance and operational efficiency, an essential condition for organizational sustainability in times of connectivity (Teixeira *et al.*, 2024; Barros *et al.*, 2025).

Finally, Huy (2025) explores how the effectiveness of digital accounting information systems drives innovation in sustainable business models, especially through digital ecosystems that mediate between information systems and social and environmental impacts. The study indicates that well-structured digital systems directly contribute to the evolution of sustainability-aligned business practices.

CONCLUSION

The objective of this article was to analyze the impact of information and communication technologies (ICT), management accounting and Industry 4.0 innovations on strategic decision-making aimed at organizational sustainability. It was based on the understanding that digital transformation transcends the technical aspect and demands integration with institutional, managerial, and governance factors, becoming central to strengthening competitiveness and consolidating sustainable business models.

The findings of the integrative review demonstrated that the adoption of digital technologies such as automation, artificial intelligence, blockchain, and big data has high potential to increase the accuracy, transparency, and timeliness of accounting information, providing solid support for strategic decision-making. It was found, however, that such benefits only materialize when accompanied by continued training, organizational readiness and adequate regulatory frameworks. The literature and national data analyzed also converge in showing that the role of management accounting is key to aligning ESG metrics, governance practices, and sustainable performance, reducing greenwashing risks and strengthening stakeholder confidence.

Thus, it is concluded that the objective was achieved, since the results confirm that the combination between managerial accounting and Industry 4.0 technologies favors strategic decision-making oriented to organizational

sustainability. However, the study also reveals that significant barriers persist, such as cultural resistances, interoperability limitations, and training deficiencies. In summary, the positive impact of ICT on sustainability is not automatic: it depends on the convergence between people, processes and technology. This understanding opens space for future research that delves into how to overcome such barriers in specific institutional contexts.

REFERENCES

Akter, S., Michael, K., Uddin, M. R., McCarthy, G., & Rahman, M. (2020). Transforming business using digital innovations: The application of AI, blockchain, cloud and data analytics. *Annals of Operations Research*. https://doi.org/10.1007/s10479-020-03620-w

Arrieta, A. B. (2020). Explainable Artificial Intelligence (XAI): Concepts, taxonomies, opportunities and challenges toward responsible AI. *Information Fusion, 58,* 82–115. https://doi.org/10.1016/j.inffus.2019.12.012

Barros, R. I. M., Campana, C. A., Vilhena, F. A. F., Pereira, G. A. B., Ferreira, H. S., Fagundes, J. M., De Oliveira, T. L., Fernandes, L. O. R., & Silva, E. N. da. (2025). Digital Transformation in Accounting: Integrating Emerging Technologies to Enhance Decision-Making and Organizational Sustainability. *American Journal of Financial Technology and Innovation, 3*(1), 109-114. https://doi.org/10.54536/ajfti.v3i1.5286

Campana, C. A., Neto, A. C., do Carmo, A. P. F., da Silva, A. T. P., ... & Oliveira, K. de. (2025). Inovação tecnológica na sustentabilidade: Uma revisão sistemática sobre o papel das tecnologias verdes na transição para economia circular. *Contribuciones a las Ciencias Sociales, 18*(1), e14482.

Huy, P. Q. (2025). Does effectiveness of digital accounting system intensify sustainable business model innovation with mediating role of digital business ecosystem? *Journal of Innovation and Entrepreneurship, 14,* 3. https://doi.org/10.1186/s13731-024-00444-x

Kraus, S. (2021). Digital transformation: An overview of the current state of the art of research. *Journal of Business Research, 123,* 899–906. https://doi.org/10.1016/j.jbusres.2020.10.045

Mikalef, P., Pappas, I. O., Krogstie, J., & Giannakos, M. (2020). Big data analytics capabilities and firm performance: A dynamic capabilities perspective. *Information & Management, 57*(2), 103169. https://doi.org/10.1016/j.im.2019.103169

Monteiro, S. M. C., Silva, A. T. P. da, Gomes da Silva, B. B., Oliveira, E. D. de, Nascimento, J. W. do, Miranda, N. V. de, Carvalho, R. do N., Moreira, P. S. S., & Silva, E. N. da. (2025). Interinstitutional Collaborations in Open Innovation and Sustainability: An Integrative Literature Review. *American Journal of Development Studies, 3*(2).

Pereira, G. A. B., Printes, A. T., Almeida De Souza, E. J., Lima, G. S., Nascimento, I. J. B. M. F., Fagundes, J. M., Beker, J. C., Veloso, L. J. O., Teixeira, L. E. A., Oliveira, M. M., Moreira, P. S. S., Cardoso, R. S., de Oliveira, T. L., Cavalcante Junior, T. S., & Ferreira, H. S. (2025). Educação Para A Sustentabilidade E O Desenvolvimento De Competências Socioambientais. *IOSR Journal of Research & Method in Education, 15*(2), 53-57.

Petcu, M. A., Sobolevschi David, M. I., & Curea, S. C. (2024). Integrating digital technologies in sustainability accounting and reporting: Perceptions of professional cloud computing users. *Electronics, 13*(14), 2684. https://doi.org/10.3390/electronics13142684

Rajput, S., & Singh, S. P. (2020). Connecting circular economy and Industry 4.0. *Journal of Cleaner Production, 263,* 121582. https://doi.org/10.1016/j.jclepro.2020.121582

Silva, E. N. (2025). A influência da contabilidade ambiental no desempenho sustentável das empresas: uma revisão sistemática da literatura. *Contribuciones a Las Ciencias Sociales, 18*(3), 1-17. https://doi.org/10.55905/revconv.18n.3-049

Silva, E. N. da, Veloso, C. C. F., E Silva, E. F., Abreu Silva, F. D., De Matos, F. R. P., Do Nascimento, J. W., Da Cunha Lins, L., Soares, L., De Castro, M. A. A., & Freitas, V. M. D. S. (2024). Innovation in the Evolution of Accounting: A Study of Accounting Transformation in the Digital Age. *IOSR Journal of Business and Management, 26*(8), 09-15. https://doi.org/10.9790/487X-2608020915

Silva, F. D. A. E., da Silva, E. N., Pinho De Matos, F. R., ..., & Ferreira, H. S. (2025). Desenvolvimento E Avaliação De Cidades Inteligentes Na Região Norte Do Brasil: O Caso De Palmas-TO. *IOSR Journal of Multidisciplinary Research, 2*(3), 10-16.

Silva, M. C. J., Carmo, A. P. F. do, Da Silva, A. S., Teixeira, A. R., Campana, C. A., ..., & Barros, R. I. M. (2025). Inovação na Auditoria Contábil: Uma Análise Bibliométrica das Tecnologias Emergentes. *IOSR Journal of Business and Management, 27*(1), 06-11. https://doi.org/10.9790/487X-2701060611

Sony, M., & Naik, S. (2020). Industry 4.0 adoption: A systematic review of the literature. *Technology in Society, 61,* 101259. https://doi.org/10.1016/j.techsoc.2020.101259

Tiwari, K., & Khan, M. S. (2020). Sustainability accounting and reporting in the Industry 4.0. *Journal of Cleaner Production, 258,* 120783. https://doi.org/10.1016/j.jclepro.2020.120783

Verhoef, P. C. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research, 122,* 889–901. https://doi.org/10.1016/j.jbusres.2019.09.022

Sousa, B. H. A. B., da Silva, C. A., de Souza, C. A., de Oliveira, E. A., de Souza, E. J. A., ..., & da Silva, E. N. (2025). A integração dos Objetivos de Desenvolvimento Sustentável (ODS) nas políticas ambientais: Uma revisão integrativa. IOSR *Journal of Business and Management, 27*(3), 50–54.

Teixeira, A. R., da Silva, A. S., Franco, D. M., Serudo, E.

C. A., ... , & Silva, E. N. (2024). Análise comparativa entre o custeio variável e por absorção: Implicações contábeis e gerenciais. *International Journal of Scientific Management and Tourism, 10*(6), 1–14.