

Regional Innovation Ecosystems: Contributions of Universities, Startups and Strategic Partnerships for Sustainable Development

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Abstract: Regional innovation ecosystems are configured as strategic spaces for sustainable development, articulating universities, startups, and intersectoral partnerships around knowledge, entrepreneurship, and public policies. The objective of the study was to analyze the contributions of universities, startups and strategic partnerships to regional innovation ecosystems aimed at sustainable development. The research was conducted through an integrative literature review, prioritizing studies between 2020 and 2025, without disregarding classic authors. Scopus, Web of Science and Google Scholar were consulted, using descriptors in Portuguese and English. The results show that university-company cooperation, institutional density and Technological Innovation Centers are structuring axes, but their effectiveness depends on the expansion of collaborative arrangements. It is concluded that such ecosystems present relevant contributions, although challenges persist in measuring social impacts, multisectoral governance and inclusion of local epistemologies, pointing to the need for studies on adaptive models of sustainable innovation.

Keywords: Governance; Innovation Ecosystems; Startups; Sustainability; Universities.

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I. INTRODUCTION

Regional innovation ecosystems have been consolidated as strategic pillars for sustainable development, as universities, startups, and intersectoral partnerships articulate knowledge, resources, and collaborative practices. Recent studies show that the resilience and sustainability of these arrangements depend on the ability to integrate technological innovation, entrepreneurship, and public

policies (Akinsete et al., 2025; Utomo & Wirawan, 2025). In this scenario, it becomes increasingly relevant to understand how such ecosystems drive development trajectories anchored in social inclusion, environmental sustainability, and economic dynamism.

As Sarin and Tandon (2025) point out, the logic of the Triple Helix and regional cooperation networks has expanded the role of universities and startups as agents of

transformation. However, gaps remain on the effectiveness of these ecosystems in different institutional and geographical contexts, especially in countries of the Global South.

Thus, this study aims to analyze the contributions of universities, startups and strategic partnerships to regional innovation ecosystems aimed at sustainable development, through an integrative literature review.

II. MATERIALS AND METHODS

This study was developed through an integrative literature review, considering productions published primarily between the years 2020 and 2025. However, classic authors that were fundamental to the consolidation of the debate, even prior to this period, were also carefully incorporated, in order to ensure theoretical solidity to the analysis. The search for articles was carried out in databases of wide scientific recognition, including Scopus, Web of Science and Google Scholar, in order to ensure the scope and diversity of the publications analyzed.

Descriptors in Portuguese and English were used that combine terms related to the research theme, such as "digital transformation", "entrepreneurial universities", "innovation ecosystems", "ESG" and "sustainability". This strategy has made it possible to capture studies that address both the technological and social and environmental dimensions of regional innovation ecosystems.

The inclusion criteria included articles aligned with the central theme, with methodological adherence and theoretical relevance for understanding the contributions of universities, startups and strategic partnerships in sustainable development. Studies without scientific rigor, duplicate publications, and studies that did not have a direct relationship with the defined descriptors were excluded.

After the selection of the studies, the data were organized and submitted to content analysis, with thematic categorization. This procedure allowed the identification of patterns, convergences and divergences between the empirical results, enabling the construction of analytical axes that guided the discussion.

III. LITERATURE REVIEW

Destruction and collaboration between multiple actors, moving from linear models to open and participatory arrangements. In this sense, innovation is not restricted to the production of new goods, but incorporates organizational methods and institutional arrangements that allow the transfer of scientific knowledge to society in a strategic way.

On the other hand, Chesbrough (2003) introduces the concept of open innovation, reinforcing that companies must absorb external knowledge to accelerate innovative processes. According to Nascimento et al. (2024), open innovation can be understood as the strategic use of knowledge flows that go beyond organizational boundaries,

with the aim of incorporating new ideas and solutions. This model has gained relevance in the face of accelerated market transformations and growing technological complexity, factors that make it difficult to generate exclusive internal knowledge.

According to West and Bogers (2014), this openness generates benefits such as cost reduction and market expansion, but, according to Teece (2010), it entails risks of information leakage and loss of competitive advantage, questioning its universal applicability in all sectors.

At the same time, contemporary advancement is represented by digital platforms and green technologies, according to Autio et al. (2018), which identify digital ecosystems as catalysts for regional and sectoral innovation, although they face institutional barriers to ensure effective transfer and protection of knowledge. In this scenario, according to Nascimento et al. (2025), it is observed that the limits of open innovation drive the need to integrate new social and environmental actors, reinforcing the transition to more complex arrangements, in which innovation assumes a systemic and multisectoral character. This inflection opens space for the incorporation of the social dimension as a structuring axis of innovative practices.

According to Mulgan (2006), social innovation overcomes limitations of the market and the State, as it seeks to solve complex problems through collaborative action between civil, academic and political spheres. Despite representing a transformative alternative, Murray et al. (2010) warn that its measurement is difficult due to diffuse impacts, due to its collective nature and the valorization of non-economic factors.

According to De Sousa Santos (2007), the recognition of cognitive justice is indispensable: local and peripheral epistemologies need to integrate innovation models to ensure social legitimacy.

According to Silva (2024), the Triple Helix model proposes that innovation arises from dynamic collaboration between university, industry, and government. However, Delmondes et al. (2024) argue that helix arrangements require mature institutional environments for knowledge exchange to be efficient, and structural insufficiencies can limit their results. González-Moreno et al. (2020) and Rexhepi et al. (2020) move towards the Quadruple and Quintuple Helix, including civil society and the environment as central pillars, broadening the impact of innovation to social and environmental agendas.

However, according to Nascimento et al. (2025), there are difficulties in practical operationalization, especially in peripheral contexts, due to institutional fragmentation and the low engagement of the new helical axes. On the other hand, Silva et al. (2024) point out that innovation governance requires adaptive intersectoral networks that connect all agents and promote clear public missions, reinforcing sustainability and inclusion guidelines.

According to Campana et al. (2025), regional innovation ecosystems, composed of universities, startups, and productive clusters, are essential for economic dynamism and the strengthening of collaborative environments.

On the other hand, Pereira et al. (2022) warn that, without integration between the five axes, barriers to the legitimacy and adaptability of innovative solutions persist. As Koundouri and Akinsete (2025) point out, entrepreneurial ecosystems are consolidated as agents of sustainable development, but success depends on overcoming institutional, cultural, and financial challenges, in addition to the inclusion of cognitive justice and multisectoral participation.

According to Mulgan (2006), social innovation overcomes limitations of the market and the State, as it seeks to solve complex problems through collaborative action between civil, academic and political spheres. Despite representing a transformative alternative, Murray et al. (2010) warn that its measurement is difficult due to diffuse impacts, due to its collective nature and the valorization of non-economic factors. According to De Sousa Santos (2007), the recognition of cognitive justice is indispensable: local and peripheral epistemologies need to integrate innovation models to ensure social legitimacy. On the other hand, authors such as Gallouj (2020) and Stuchi (2022) highlight that methodological gaps and institutional resistance make it difficult to welcome these cognitive pluralities, perpetuating inequalities and subordinations.

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According to Campana et al. (2025), regional innovation ecosystems, composed of universities, startups, and productive clusters, are essential for economic dynamism and the strengthening of collaborative environments. On the other hand, Barros et al. (2025) observe that the adoption of the Sustainable Development Goals (SDGs) and ESG practices enhances the social and environmental reach of these ecosystems, even if it depends on the creation of public incentive policies and effective governance. On the other hand, Pereira et al. (2022) warn that, without integration

between the five axes, barriers to the legitimacy and adaptability of innovative solutions persist. As Koundouri and Akinsete (2025) point out, entrepreneurial ecosystems are consolidated as agents of sustainable development, but success depends on overcoming institutional, cultural, and financial challenges, in addition to the inclusion of cognitive justice and multisectoral participation.

According to Silva et al. (2024), sustainability needs to be incorporated in a transversal way into public policies, requiring alignment between budget planning and socio-environmental objectives. This integration, although necessary, encounters resistance due to the predominance of short-term fiscal agendas, which often neglect the intergenerational perspective. On the other hand, Viana et al. (2025) show that environmental governance practices tend to reproduce coercive isomorphisms, in which organizations seek formal legitimacy without necessarily internalizing the principles of sustainability. Such weaknesses expose the distance between the institutional discourse and the effective structural transformation, limiting the results achieved.

IV. DISCUSSION AND RESULTS

The systematization of the articles identified in the survey shows that the empirical results converge around axes related to the governance of innovation, the role of universities, and the strengthening of collaborative ecosystems.

Silva et al. (2024) emphasize that university-business cooperation plays a decisive role in promoting innovation, as it creates conditions for scientific knowledge to circulate towards the productive sector. This strategic relationship strengthens the formation of academic startups and expands the regional insertion of universities in collaborative ecosystems. Such dynamics reinforce the importance of the university as an active agent in socioeconomic development.

In addition, it is evident that innovation does not occur in isolation, but depends on institutional networks capable of sustaining its continuity. This process strengthens the formation of academic startups and expands the regional insertion of universities in collaborative ecosystems, confirming that innovation depends on knowledge flows that go beyond organizational boundaries and collaborative practices capable of reducing costs and expanding markets (Chesbrough, 2003; Nascimento et al., 2024; West & Bogers, 2014).

According to Miranda et al. (2024), institutional density is a determining factor to explain the different levels of effectiveness of partnerships between universities and companies. In his study, it is observed that environments with greater structural maturity and governance capacity tend to present more consistent innovative trajectories. This phenomenon demonstrates that innovation is not only the result of the intention to cooperate, but requires institutional contexts prepared to absorb and transfer knowledge. At the same time, it is revealed that peripheral ecosystems face additional barriers to consolidating their processes.

This perspective is supported by the literature in indicating that helix arrangements only thrive in robust institutional contexts and that digital ecosystems come up against barriers to effective knowledge transfer (Delmondes et al., 2024; Autio et al., 2018).

According to Alves et al. (2024) highlight that the Technological Innovation Centers (NITs) play a central role as mediators of the university-company relationship, by legally structuring the transfer of technology. These centers offer administrative and legal support, ensuring the protection of intellectual property and the formalization of partnerships. Such a function strengthens the capacity of universities to act as protagonists in the innovation ecosystem. However, its performance remains conditioned to the availability of resources and the support of institutional bodies.

These centers strengthen the capacity for university innovation, but their effectiveness depends on continuous institutional support and adaptive collaborative networks, in line with models that advocate collaboration between universities, government, and civil society (Silva, 2024; Nascimento et al., 2025).

Nascimento et al. (2025) show that collaboration in innovation expands beyond the university-business-government relationship, incorporating civil society and broader social dimensions. This shift signals the need to rethink collaborative arrangements, preparing the debate for perspectives that consider the social and environmental impacts of innovation.

Matos et al. (2025) demonstrate that Third Sector organizations, when articulated in collaborative networks, enhance innovative solutions aimed at sustainability, reinforcing co-creation practices and environmental governance. This result is connected to the literature that had already pointed out that such initiatives seek to transform social realities through intersectoral cooperation, although their measurement is still difficult due to diffuse impacts (Mulgan, 2006; Murray et al., 2010).

In this regard, Sousa et al. (2025) point out that the integration of the Sustainable Development Goals into environmental policies faces significant barriers to governance, financing, and institutional coherence, especially in peripheral countries. These findings are supported by the literature that denounces the need for cognitive justice to legitimize local epistemologies, while recognizing the institutional resistances and methodological gaps that limit the inclusion of new actors in the innovative process (De Sousa Santos, 2007; Gallouj, 2020; Stuchi, 2022).

Monteiro et al. (2025) show that open innovation can drive sustainable practices, but its adoption faces obstacles related to data protection, information asymmetries, and lack of regulatory incentives. Such difficulties are confirmed by the literature, which points out that collaborative arrangements, although promising, remain vulnerable to risks

of information leakage and loss of competitive advantage (Teece, 2010; West & Bogers, 2014).

Finally, Pereira et al. (2025) point out that education for sustainability is a central vector of cultural and institutional transformation, by stimulating socio-environmental skills. These findings find literary support in indicating that social innovation demands formative processes that integrate cultural and social dimensions, expanding its legitimacy in innovation ecosystems (Mulgan, 2006; Murray et al., 2010).

The results reveal that the governance of innovation, the role of universities and the integration of new actors are dimensions that are intertwined and condition the effectiveness of innovative ecosystems. University-business cooperation, institutional maturity and NITs reinforce the capacity to generate technological solutions, but their effectiveness remains limited when detached from social and environmental commitments. In this sense, the findings related to the Third Sector, the SDGs, and education for sustainability tension the debate, by showing that innovation is not only based on economic gains, but demands more inclusive collaborative arrangements and governance capable of overcoming institutional, methodological, and cultural barriers.

V. CONCLUSION

The present study aimed to analyze the contributions of universities, startups and strategic partnerships to regional innovation ecosystems aimed at sustainable development. The results show that these actors play a decisive role in the consolidation of collaborative arrangements, either through knowledge transfer and institutional strengthening, or through the integration of social and environmental dimensions into innovative practices.

The systematization demonstrated that university-company cooperation, institutional density and the role of NITs are structuring axes for the functioning of innovation ecosystems. At the same time, the findings on the third sector, SDGs and education for sustainability indicate that the effectiveness of these arrangements depends on an expansion of the collaborative logic, incorporating social and environmental commitments that tension and expand the notion of innovation. This articulation shows that the sustainability of ecosystems cannot be dissociated from the inclusion of multiple actors and the ability to overcome institutional, cultural, and methodological barriers.

As a critical conclusion, it is emphasized that regional innovation ecosystems present relevant contributions to sustainable development, but still face limitations that compromise their full effectiveness. Gaps persist in measuring the social impacts of innovation, the governance of multisectoral arrangements, and the integration of local epistemologies, especially in peripheral contexts. Such challenges open space for future research that investigates more robust evaluation mechanisms, adaptive governance models, and institutional strengthening strategies capable of

legitimizing innovation as an instrument of social and environmental transformation.

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