



PUBLIC INNOVATION POLICIES IN ACRE: a systemic analysis of the regional ecosystem of Science, Technology and Innovation

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Abstract

The strengthening of public policies in science, technology, and innovation (ST&I) is strategic for development in peripheral contexts. In Brazil, the consolidation of regional ecosystems faces challenges such as low institutional capacity and weak coordination among actors, particularly in the Legal Amazon. This study analyzed the ST&I policy in Acre, with emphasis on legal frameworks, public investments, and coordination mechanisms. A qualitative approach was used, based on literature review, document analysis, and the construction of an analytical model structured into six dimensions and three levels. The results indicated normative advances and increased investments, but also operational weaknesses and low integration among actors. The proposed model contributes to the diagnosis and planning of policies in territories marked by structural asymmetries.

Keywords: Public policy; innovation; science and technology; regional ecosystems; Southwestern Amazon.

POLÍTICAS PÚBLICAS DE INOVAÇÃO NO ACRE: uma análise sistêmica do ecossistema regional de Ciência, Tecnologia e Inovação

Resumo

O fortalecimento de políticas públicas de Ciência, Tecnologia e Inovação (CT&I) é estratégico para o desenvolvimento em contextos periféricos. No Brasil, a consolidação de ecossistemas regionais enfrenta entraves como baixa capacidade institucional e fraca articulação entre os atores, especialmente na Amazônia Legal. Este estudo analisou a política de CT&I no Acre, com ênfase em marcos legais, investimentos públicos e mecanismos de coordenação. Foi adotada uma abordagem qualitativa, com revisão de literatura, análise documental e construção de modelo analítico estruturado em seis dimensões e três níveis. Os resultados indicaram avanços normativos e aumento de investimentos, mas também fragilidades operacionais e baixa integração entre os agentes. O modelo contribui para o diagnóstico e o planejamento de políticas em territórios com assimetrias estruturais.

Palavras-chave: Políticas públicas; inovação; ciência e tecnologia; ecossistema regional; Amazônia Sul-Occidental.

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1 INTRODUCTION

Public policies in Science, Technology, and Innovation (ST&I) have been highlighted as strategic instruments to promote economic, social, and environmental development (Kwilinski et al., 2025). By directing public and private investments toward research, infrastructure, and human capital formation, these policies enhance productive capacity, stimulate the generation of applied knowledge, and promote technological diffusion. They also contribute to international competitiveness by fostering strategic sectors with innovation potential and higher added value (Zhou; Huang; Mard, 2023).

In contexts marked by regional inequalities and transformations in the global economy, ST&I policies gain relevance as responses to structural challenges such as the energy transition, digitalization, and environmental sustainability (Guaita Martínez *et al.*, 2022). Their effectiveness, however, depends on the coordination among legal, institutional, and financial instruments, in ways that are sensitive to territorial specificities. In this scenario, innovation-oriented policies become essential to create, adapt, and apply technologies that meet both local demands and national development strategies (Song; Zhao, 2024).

Brazil, however, faces persistent difficulties in translating its institutional innovation structure into consistent results in the adoption and creation of technological solutions, especially in states with lower levels of industrialization and structural weaknesses (Cassânego; Carvalho; Morales, 2024). Although the country has a relatively robust national innovation system compared to other middle-income countries, its effectiveness is limited by policy discontinuity, weak coordination across government levels, regional concentration of investments, and limited engagement with the local productive sector.

As Lema, Kraemer-Mbula, and Rakas (2021) highlight, most policies remain anchored in theoretical models from the Global North, which are poorly adapted to local institutional and productive realities. These limitations underscore the challenge of building state capacities to lead innovation agendas that respond to the social and economic challenges of the country's less developed regions.

These challenges are particularly increased in states such as Acre, located in the Southwestern Amazon of Brazil. Acre presents economic, social, and environmental characteristics that require specific approaches to the formulation of public innovation policies. According to the Ecological-Economic Zoning of Acre (2021), 87% of the territory is covered by native forests and 75% is designated for sustainable use or territorial planning, which calls for technological solutions compatible with both conservation and development.

Despite this strategic potential, the state faces significant structural limitations. The same report indicates that only 40.6% of households have access to a sewage network, just 16.1% of the road

network is paved, and only 68.7% of households are served by regular waste collection. Acre also exhibits a high level of socioeconomic inequality, reflected in a Gini Index around 0.60, an indicator of income concentration, where values closer to 1 indicate greater inequality.

Most municipalities have low population density and predominantly rural profiles, which hinders access to public services. This scenario is further aggravated by one of the lowest performances in the Basic Education Development Index (IDEB), with high school results falling below the national average (Acre, 2021). In this context, innovation policies must integrate science, technology, and sustainability to foster economic growth, social inclusion, and environmental preservation.

Given this scenario, this study analyzes public policies supporting innovation in the state of Acre, with emphasis on recent normative initiatives, institutional limitations, and prospects for consolidating a regional innovation ecosystem. Based on a literature review and document analysis, the study examines the state regulatory framework, governance arrangements, and the role of key actors involved in formulating and implementing ST&I policies.

Drawing on the empirical evidence gathered, an analytical model was proposed to integrate the main drivers, weaknesses, and systemic interactions of the local ecosystem. The main objective is to provide an interpretive tool that supports the diagnosis and improvement of public policies, guiding the development of a more functional, integrated, and territorially aligned innovation ecosystem in Acre.

2 ST&I POLICIES AND THE DYNAMICS OF REGIONAL ECOSYSTEMS

Public policies are instruments through which the State seeks to address collective problems and induce social, economic, and institutional transformations (Bryan; Williams, 2021). Their effectiveness depends on intersectoral coordination, alignment across government levels, and adaptation to territorial contexts. In the ST&I field, they play a foundational role by creating conditions for knowledge generation and application, with impacts on productive development and competitiveness (Yawson, 2021).

In this study, we adopt the definition of innovation proposed by Cirera et al. (2020), as the capacity to create something new or improve existing practices, generating relevant outcomes for businesses, governments, and society. Thus, public innovation policies are planned actions by state organizations to foster the development and dissemination of innovations (Costa; Moreira, 2022).

In Brazil, the institutionalization of these policies was consolidated through Law No. 10.973/2004, which established incentives for funding innovative projects (Brasil, 2004). Since then,

progress has been made in structuring the National Innovation System (NIS), with expanded scientific infrastructure (Oliveira *et al.*, 2020).

Nonetheless, results remain limited, reflecting institutional weaknesses and coordination difficulties (Buainain; Corder; Bonacelli, 2020). These limitations stem from macroeconomic instability, a concentrated productive structure, and low business dynamism, but also from flaws in policy design and implementation. The national system remains incomplete and poorly adapted to challenges such as social inclusion and sustainable development (Cassiolato; Lastres, 2021).

Given this, it is necessary to deepen the analysis of ST&I policies at the subnational level. Regional approaches allow for the identification of local bottlenecks and the proposal of strategies tailored to territorial realities. Although typically formulated from a national perspective (Lotta, 2019), these policies also depend on the actions of subnational governments, universities, research centers, the productive sector, and civil society (Coscarello, 2024).

The regional innovation ecosystem perspective emphasizes the interaction among local actors shaped by historical and institutional factors (Santos, 2024). In Amazonian states, these ecosystems face structural weaknesses but also hold assets such as biodiversity and traditional knowledge, which have potential for bioeconomy- and sustainability-based strategies (Silva *et al.*, 2025).

These particularities highlight significant gaps in the innovation literature, which remains largely focused on middle-income countries and theoretical approaches based on Global North experiences. Such approaches generally assume consolidated institutional structures, dynamic markets, and strong state capacity—conditions often absent in peripheral contexts.

As Lema, Kraemer-Mbula, and Rakas (2021) point out, there is a lack of theoretical models capable of capturing the institutional, productive, and territorial specificities of these contexts, which undermines both analysis and the formulation of effective policies. The absence of more grounded analytical frameworks makes it difficult to translate local assets into innovation trajectories aligned with goals of inclusion, sustainability, and regional development.

In this context, strengthening regional innovation requires territory-sensitive approaches and collaborative governance (Wanzenböck; Frenken, 2020). Coordination across government levels and the engagement of local Science and Technology institutions are fundamental to designing policies aligned with regional specificities (Kovanen; Ulrich; Gailing, 2023; Song; Zhao, 2024). Understanding the dynamics of regional ecosystems and the role of subnational actors is essential for assessing the effectiveness of ST&I policies in contexts marked by low state capacity and high social vulnerability.

3 METHODOLOGY

This study adopts a qualitative, exploratory, and descriptive approach, based on bibliographic and documentary analysis. According to Lösch, Rambo, and Ferreira (2023), this strategy is appropriate for investigating complex and situated phenomena, such as public innovation policies in regions marked by structural and institutional asymmetries. The methodological choice is justified by the complexity of the object—ST&I policies in Acre—which requires an integrated understanding of the historical, normative, institutional, and territorial dimensions of the state's innovation ecosystem.

The methodology was structured into four interconnected stages: (i) literature review on public innovation policies in subnational contexts; (ii) data collection and documentary analysis of Acre's state-level ST&I policy; (iii) qualitative analysis of empirical evidence, organized into structuring dimensions of the local ecosystem; and (iv) development of an analytical model based on the integration of theory and data.

The literature review aimed to map theoretical and empirical debates on innovation policies, regional systems, and multilevel governance. Searches were conducted between January and March 2025 in the SciELO, Scopus, and Web of Science databases, using descriptors combined with Boolean operators. Inclusion criteria covered publications from 2015 to 2025, focused on subnational contexts, peripheral regions, or developing countries. In total, 37 publications were selected to form the theoretical foundation of the study.

Document collection focused on regulations and institutional records available in official sources (State Secretariat for Industry, Science, and Technology – SEICT, government websites, and JusBrasil), covering the period from 1985 to 2025. Included documents comprised laws, decrees, strategic programs, and budget reports related to the state ST&I policy. This survey enabled the reconstruction of the institutional trajectory and the evaluation of the coherence of the current regulatory framework.

Data analysis followed a qualitative interpretative approach, as proposed by Felizola, Aragão and Silva (2023), and was developed in two phases. In the first phase, the evidence was organized into six interrelated analytical dimensions: institutional (legal framework and funding bodies); governance and coordination (interinstitutional coordination); technical and administrative capacity (human resources and public management); infrastructure and investment (access to technology, material resources, and financing); productive and territorial base (business profile, production chains, and local assets); and ST&I culture and popularization (science education, social participation, and knowledge dissemination). In the second phase, these dimensions were connected with the specialized literature, allowing for the identification of patterns, gaps, and opportunities for improvement. The

triangulation of regulatory data, empirical evidence, and theoretical references gave greater robustness to the interpretations.

The analytical model was developed based on a systemic reading of the evidence, inspired by the European University Association (EUA, 2019) approach, which emphasizes interaction between government, the productive sector, higher education, and civil society. It is structured into three interdependent analytical levels: territorial constraints, encompassing structural factors such as population density, infrastructure, and socioeconomic inequalities; structuring dimensions, corresponding to the six axes that support the state ST&I system; and systemic interactions, understood as the mechanisms that connect institutions and ensure coherence, continuity, and effectiveness of public innovation policies.

The model aims to support diagnostics and guide policy planning in peripheral contexts. In the case of Acre, it enables the identification of structural bottlenecks and highlights opportunities to strengthen a more integrated and territory-sensitive innovation ecosystem.

4 RESULTS AND DISCUSSION

The process of consolidating public ST&I policies in Acre has been marked by significant legal and institutional advances over the past decades. The state constitution, established in 1989, stipulates in Articles 211 and 214 the promotion of scientific research and sustainable development, in line with the principles of the Federal Constitution (Acre, 1989). These legal provisions form the basis for state action aimed at knowledge production, environmental conservation, and the promotion of regional technological progress.

Building on this foundation, a progressive construction of the legal framework sustaining Acre's ST&I ecosystem can be observed. Several ordinary laws, complementary laws, and decrees have been enacted to institutionalize initiatives, structure responsible agencies, and align the state's regulatory environment with the guidelines of the national innovation policy. Table 1 summarizes the main legal instruments, organized chronologically, to illustrate the institutional evolution of the sector in the state.

Table 1 - Legislative history of innovation support in the State of Acre

Year	Type	Number	Description
1985	Ordinary Law	Law No. 833	Creates the Department of Technological Research on Natural Resources of the State of Acre.
1989	Constitution	Constitution of the State of Acre	Articles 211 and 214: Promotion of science, technology, and innovation focused on sustainable development.

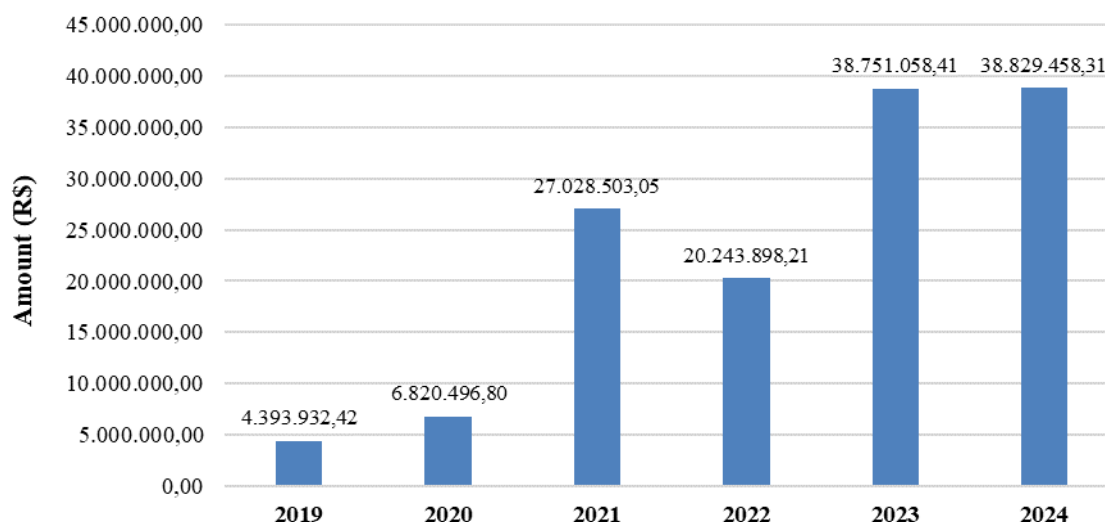
PUBLIC INNOVATION POLICIES IN ACRE: a systemic analysis of the regional ecosystem of Science, Technology and Innovation

1992	Ordinary Law	Law No. 1,022	Establishes the State System for Environment and Forests (SISMAF) and provides other measures.
2005	Ordinary Law	Law No. 1,643	Amends provisions of Law No. 1,022/1992 regarding the State System for Environment, Science, and Technology.
2011	Ordinary Law	Law No. 2,451	Establishes the State Week of Science and Technology.
2012	Complementary Law	Complementary Law No. 246	Establishes the Foundation for Research Support of the State of Acre (FAPAC).
2013	Ordinary Law	Law No. 2,837	Regulates scholarships for teaching, research, and extension provided by FAPAC.
2018	Ordinary Law	Law No. 3,387	Establishes the State System for Science, Technology, and Innovation of Acre (SisTec-AC) and the PROINNOVA Program.
2019	Decree	Decree No. 3,144	Establishes the basic organizational structure of the State Secretariat for Industry, Science, and Technology (SEICT).
2020	Ordinary Law	Law No. 3,600	Declares the Foundation for Support and Development of Teaching, Research, and University Extension in Acre (FUNDAPE) as a public utility.
2020	Decree	Decree No. 5,132	Establishes the basic organizational structure of SEICT.
2022	Decree	Decree No. 10,974	Reorganizes SEICT's structure, repealing Decree No. 5,132/2020.
2023b	Ordinary Law	Law No. 4,132	Provides incentives for research, innovation, and scientific and technological training in Acre.
2023a	Complementary Law	Complementary Law No. 438	Amends Complementary Law No. 246/2012, regarding FAPAC.
2024	Decree	Decree No. 11,478	Restructures SEICT and repeals Decree No. 10,974/2022.

Source: Prepared by the authors (2025).

In addition to legal development, the consolidation of the state ST&I policy has been accompanied by a significant increase in public resources allocated to the area. The State Secretariat for Industry, Science, and Technology (SEICT), the main agency responsible for coordinating innovation actions in the state, has been restructured in recent years and now operates with an expanded budget. Figure 1 shows the evolution of SEICT's expenditures between 2019 and 2024.

Figure 1 - Annual SEICT Expenditures (2019–2024)



Source: Adapted by the authors, based on Acre/SEICT (2025).

The budget trajectory reveals a significant intensification of the state's efforts in ST&I starting in 2021. SEICT's expenditures increased from R\$ 6.8 million in 2020 to over R\$ 27 million in 2021, reaching approximately R\$ 38.8 million in both 2023 and 2024. In comparative terms, this represents a growth of over 780% relative to 2019.

This increase coincides with the Secretariat's institutional restructuring, the expansion of its budgetary authority, and the consolidation of new legal instruments, such as Law No. 4,132/2023, which promotes innovation. It also reflects the strengthening of the state's participation in national funding programs, such as TECNOVA and SEBRAETEC, which require local counterpart funding and coordination with the federal government. These factors indicate a process of institutionalization of the state policy, both in its normative and financial aspects.

Based on documentary analysis and budget data, a set of elements was identified that directly influence the performance of ST&I policy in the state. These elements were organized into eight analytical dimensions: (i) territorial base, (ii) local institutional capacity, (iii) institutional, (iv) governance and coordination, (v) technical and administrative capacity, (vi) infrastructure and investment, (vii) regional productive base, and (viii) ST&I culture and popularization.

To deepen the analysis, these dimensions were grouped into three interdependent analytical levels, according to the proposed model: territorial constraints, which refer to structural and contextual limitations; structuring dimensions, which include institutional, operational, and productive components directly related to policy implementation; and systemic interactions, which refer to the coordination and articulation mechanisms among the various system actors.

PUBLIC INNOVATION POLICIES IN ACRE: a systemic analysis of the regional ecosystem of Science, Technology and Innovation

Table 2 presents a synthesis of these dimensions, highlighting their drivers and weaknesses, based on the triangulation of specialized literature, empirical evidence, and documentary data.

Table 2 - Analytical summary of the structuring dimensions of the innovation ecosystem in Acre

Analytical Level	Analytical Dimension	Drivers (Potentialities)	Limitations (Weaknesses)
Territorial Constraints	Territorial base	Environmental and sociocultural assets. Potential for bioeconomy, sustainable technologies, and carbon credits. Traditional knowledge and sustainable value chains.	Poor infrastructure, low population density, logistical isolation, and institutional asymmetries. Social inequalities and digital inclusion deficit.
	Local institutional capacity	Presence of institutions with capacity. Potential for regional specialization.	Low institutional reach in municipalities. Technical and operational limitations for decentralization.
Structuring Dimensions	Institutional	Updated legal framework (Constitution, Laws No. 4,132/2023 and No. 3,387/2018). FAPAC, SisTec-AC, FUNTAC, and restructured SEICT.	Low institutional capacity. Dispersed regulations, strong federal dependency, and limited budget execution. Innovation Law decree not yet published.
	Governance and coordination	CEICT and Technical Chamber established. Recognition of cooperation between companies and STI institutions (ICTs).	Fragmented governance. Weak integration between government, ICTs, and the productive sector. Absence of permanent coordination channels and business leadership.
	Technical and administrative capacity	Technical training. Digital Hub. Training of young researchers and professional alignment.	Skills deficit. Execution difficulties, brain drain, and shortage of qualified labor.
	Infrastructure and investment	780% increase in SEICT spending (2019–2024). Structuring projects. Support for research, startups, and MSMEs. Funds, incentives, and seed capital.	Logistical and energy bottlenecks. ICTs lacking advanced laboratories. Limited connectivity and low physical implementation of projects.
	Regional productive base	Potential for bioeconomy. Sustainable value chains. Support for enterprises and agro-industries. FUNTAC as a technology support institution.	Low business density. Predominance of Micro, Small, and Medium Enterprises with limited innovation capacity. Weak linkage among value chains and lack of innovation habitats.
Systemic Interactions	Innovation culture and popularization	ST&I Week. Events such as DemoDay, Startup Day, and Caravana. Promotion of innovation culture. Collaborative spaces and science for youth.	Low social engagement. Incipient institutional innovation culture. Fragmentation among actors and low conversion of assets into solutions.

Source: Prepared by the authors (2025).

Despite regulatory advances and increased investment, SEICT reports and the study on innovation policies in Acre indicate a significant gap between market needs and the outcomes actually delivered. The talent shortage remains a central obstacle. Although the ecosystem's governance is

formally established, it is described as fragmented, weakly institutionalized, and lacking stable mechanisms for strategic coordination (Gran Sistemas LTDA, 2024).

Significant limitations also persist in infrastructure (physical, digital, and logistical) and in technical and administrative capacity, particularly regarding the shortage of qualified professionals and the low execution capacity at the municipal level. The productive base remains characterized by a low density of innovative enterprises and weak linkage among production chains. The ecosystem still operates with a strong dependency on federal programs and resources (Acre, 2025b).

The systematization of the dimensions enables an integrated understanding of Acre's innovation ecosystem. Based on the identified drivers and weaknesses, it was possible to construct an analytical model that structurally represents the main components of the system and their interrelations. The purpose of this model is to provide an interpretive tool for diagnosis, planning, and the formulation of strategies aimed at strengthening ST&I policy, particularly in subnational contexts marked by structural inequalities and low institutional maturity.

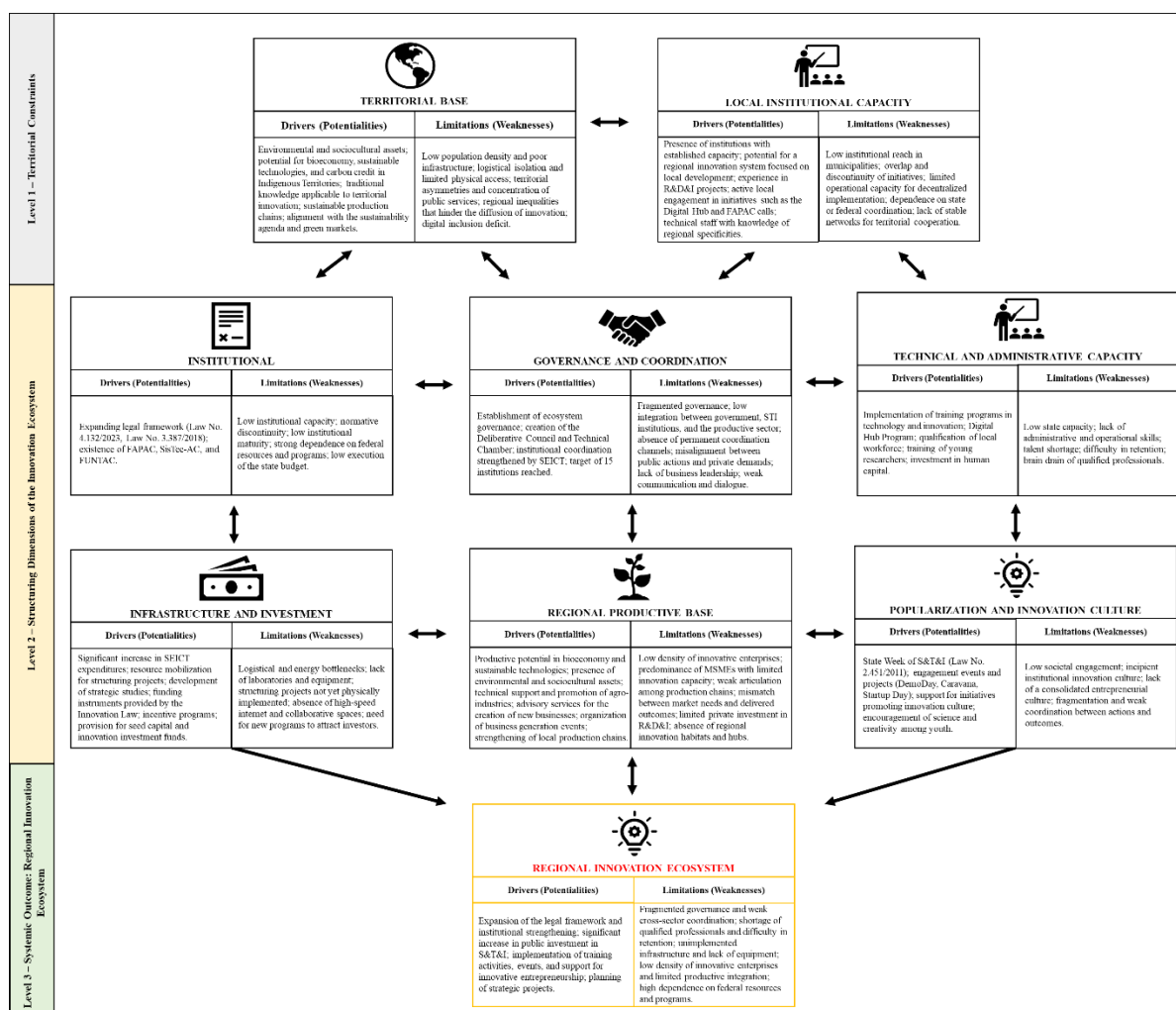
5 PROPOSAL OF AN ANALYTICAL MODEL OF THE INNOVATION ECOSYSTEM IN THE STATE OF ACRE

Based on the regulatory, institutional, and budgetary analysis presented in the previous section, the key components structuring the innovation ecosystem in the State of Acre were systematized. The analytical model was built from a systemic interpretation of the empirical evidence gathered, focusing on the articulation between territorial constraints, structuring dimensions, and institutional actors.

The proposed model aims to schematically represent the current configuration of the ecosystem, highlighting the active drivers, persistent bottlenecks, and factors influencing its consolidation. More than a static description, it serves as an interpretive tool for understanding the relational dynamics among the elements that comprise the system.

Its objective is to support the diagnosis, planning, and reformulation of public innovation policies, especially in subnational contexts marked by structural inequalities, low institutional density, and capacity asymmetries. Figure 2 presents the general structure of the model.

Figure 2 - Analytical model of the innovation ecosystem in the State of Acre



Source: Prepared by the authors (2025).

The model is structured into three interdependent analytical levels that jointly influence the systemic performance of the regional ST&I environment. These levels provide a conceptual basis for interpreting the conditions, capacities, and interactions that shape the state's innovation ecosystem.

The first level, Territorial Constraints, constitutes the structural foundation on which the system develops. It includes long-term factors related to the physical, social, and institutional environment that shape the reach, effectiveness, and resilience of public ST&I policies. Key positive drivers include relevant environmental and sociocultural assets, the potential for bioeconomy and sustainable technologies, traditional knowledge applicable to territorial innovation, and productive chains associated with extractivism and biodiversity.

Indigenous Territories and conservation units also offer opportunities for strategies such as carbon credit markets. Moreover, the presence of capable institutions like the Federal University of Acre (UFAC), the Federal Institute of Acre (IFAC), the Acre State Technology Foundation (FUNTAC), the

Acre Research Support Foundation (FAPAC), Embrapa/AC, SEBRAE, SENAI, and private higher education institutions forms the regional scientific and technological base.

These assets are reinforced by strategic guidelines such as the Ecological-Economic Zoning (ZEE), the State ST&I Plan, and bioeconomy policies, which provide long-term institutional orientation and foster alignment between territorial vocations and funding instruments. On the other hand, the regional environment is constrained by limiting factors such as low population density, poor infrastructure, logistical isolation, and limited access to knowledge networks.

Territorial and institutional asymmetries persist, with public structures concentrated in a few urban centers, alongside social inequalities that hinder the uptake of public policies. Digital exclusion exacerbates these constraints, limiting access to platforms, networks, and innovation environments.

The second level encompasses the Structuring Dimensions, represented in the central blocks of Figure 2. These are six analytical axes directly related to the implementation of ST&I policies and actions, which interact and form the dynamic core of the system. The institutional dimension has made progress, especially with the strengthening of the state's legal framework (Laws No. 4,132/2023 and No. 3,387/2018), and the activities of FAPAC, SisTec-AC, and FUNTAC. Public investment in SEICT increased by over 780% between 2019 and 2024. However, institutional capacity remains limited, the decree regulating the Innovation Law has not been published, and a significant portion of the budget is still underutilized in addressing the ecosystem's real needs.

In governance and coordination, advances include the creation of the State Innovation Council (CEICT) and the Technical Chamber, as well as the coordinating role assumed by SEICT. Nonetheless, governance remains fragmented, with weak integration among government, the productive sector, and scientific institutions, a lack of permanent coordination channels, and poor institutional responsiveness to business sector demands.

The technical and administrative capacity dimension shows positive results in training initiatives, such as the Digital Hub Program, youth researcher development, and technology training. However, high turnover among appointed staff and difficulties in talent retention undermine continuity and institutionalization of these actions.

In terms of infrastructure and investment, there has been a significant budget increase and the announcement of strategic projects such as the Technology Transfer Office (NIT), the Infovia network, and the Technology Park. Nonetheless, physical execution remains limited, research institutions lack advanced laboratories and equipment, and digital connectivity is still restricted in several regions.

The regional productive base shows recognized potential for bioeconomy, with cooperation among FUNTAC, UFAC, IFAC, and SEBRAE. Support actions for new businesses, technical advisory,

and entrepreneurship events have been implemented. However, innovative business density is low, with a predominance of Micro, Small, and Medium Enterprises (MSMEs) with limited capacity for investment in Research, Development, and Innovation (R&D&I) and weak integration across value chains.

Lastly, the innovation culture and popularization dimension shows advances, with events like the State ST&I Week, Startup Day, DemoDay, and the Entrepreneurship Caravan. Nevertheless, social engagement remains limited, and the institutional culture of innovation is still emerging, with weak synergy among the involved actors.

The third level, Systemic Outcome, expresses the activation level of the regional ecosystem. In Acre, the system is in an early stage of consolidation, with regulatory progress and increased investments, but still facing serious limitations in institutional coordination, infrastructure, and the productive base. Institutional maturity is low, and the system remains heavily dependent on federal programs.

The model, therefore, shows that the innovation ecosystem in Acre has promising conditions but still lacks systemic consolidation. Its schematic representation offers a useful conceptual tool for policymakers, researchers, and administrators, enabling an integrated reading of the capacities, challenges, and opportunities for building a more robust and sustainable regional trajectory in ST&I.

6 INSTITUTIONAL CHALLENGES AND STRATEGIES FOR CONSOLIDATING THE INNOVATION ECOSYSTEM IN ACRE

The findings of this research indicate significant progress in the institutionalization of ST&I policy in the state of Acre, but also reveal structural limitations that hinder the consolidation of a coordinated and functional innovation ecosystem. The interpretation of these results was guided by the three analytical levels defined in the proposed model — territorial constraints, structuring dimensions, and systemic interactions — which serve as the basis for linking empirical evidence with the specialized literature.

From an institutional standpoint, Acre possesses a relatively consistent legal framework compared to other states in the Northern region. The creation of FAPAC, the establishment of SisTec-AC, and the enactment of Law No. 4,132/2023 reflect a deliberate effort to build state structures aligned with national innovation promotion guidelines. As discussed by Borrás and Edquist (2019) and Rocha Neto (2021), well-designed legal frameworks are essential to reduce uncertainty, guide public and private action, and enable long-term planning, especially in contexts of low institutional maturity.

The alignment between state regulations and the New Legal Framework for Innovation (Federal Law No. 13,243/2016) signals an attempt at federative integration, which is considered crucial

in countries with pronounced regional inequalities and multiple levels of government (Brazil, 2016). Studies such as those by Priebe and Herberg (2024), Scholta, Halsbenning, and Niemann (2025), and Souza (2019) emphasize that cooperation among administrative spheres is a condition for ensuring coherence and effectiveness in innovation policies. However, persistent gaps between the legal framework and its practical implementation undermine these advances. As noted by Cirera et al. (2020) and Cavalcante (2023), formal rules do not automatically translate into action capacity, especially in states with weak institutional capacity. In Acre, this fragility is evident in normative dispersion, dependency on federal resources, and low budget execution aimed at system demands.

The role of SEICT and the significant increase in investments since 2019 indicate a prioritization of the innovation agenda. However, governance capacity remains limited. There is little coordination among universities, the productive sector, intermediary institutions, and local governments. This mismatch between budgetary effort and weak strategic coordination reflects a recurring pattern in Brazil's public ST&I policies. According to Buainain, Corder, and Bonacelli (2020), institutional fragmentation, overlapping mandates, and discontinuity of actions are persistent barriers to policy effectiveness, particularly in contexts with low institutional density.

This reality can be understood through the lens of the multilevel governance approach, which emphasizes the need for coordination across government levels and the inclusion of territorial actors in decision-making processes (Conteh, 2020; Furtado; Marchi, 2023). In Acre, this gap is reflected in the poor integration between the state government, municipalities, S&T institutions, and the productive sector, hindering the development and implementation of integrated innovation strategies.

The analysis of the Innovation Hub in Acre's capital, Rio Branco (Maritan et al., 2024), illustrates this scenario, noting that the absence of stable coordination channels among local actors limits the ecosystem's functionality and reduces its impact. Federal Institutes, such as IFAC, have played an important role by promoting actions aimed at social inclusion, biodiversity valorization, and local entrepreneurship (Munaretti et al., 2025). However, coordination among these initiatives remains weak, restricting knowledge exchange and the scalability of solutions.

The adopted analytical model emphasizes the role of systemic interactions, demonstrating that the performance of regional ecosystems depends not only on the presence of resources, but on the quality of connections among their components. This perspective is consistent with the approach proposed by the European University Association (EUA, 2019), which states that regional technological development requires effective articulation among universities, companies, governments, and civil society, mediated by context-specific institutional structures.

In territories with low institutional density, such as Acre, these connections do not emerge spontaneously. A coordinated effort is needed to create permanent shared governance spaces and

mechanisms that build trust among system actors (Pereira; Terrenas, 2022; Virga; Costa, 2021). The absence of these elements compromises policy continuity and prevents integration among science, technology, and the market. Studies such as Zheng and Cai (2022) show that, in peripheral regions, uncoordinated ecosystems tend to stagnate and fail to convert assets into technological solutions or consistent socioeconomic gains.

Another decisive factor is the development of state capacities, understood as the technical, analytical, and administrative competencies required for policy formulation and implementation (Castro; Boschi, 2020). These capacities enhance territorial autonomy, allowing for better alignment between policy instruments and local specificities. In Acre, these limitations are especially visible at the municipal level and in decentralized agencies, where there is a shortage of technical staff, poor infrastructure, and high turnover. These factors hinder the operationalization of legal provisions and reduce the reach of innovation policies.

Despite institutional limitations, territorial constraints reveal a significant set of opportunities. Acre has biodiversity, traditional knowledge, and sustainable value chains, which provide a concrete basis for innovation strategies aligned with the Amazonian reality (Freitas et al., 2025). The study by Silva et al. (2025) points out that the Amazon has unique conditions for sustainable and endogenous innovation models with strong territorial anchoring. Lobão (2024), in an analysis of development plans as public policies in the Brazilian Amazon, highlights these possibilities but clearly shows that this must be a state-induced process and coordinated, without which it will not be possible to advance the local and regional development agenda, especially in ST&I.

This territorial focus is reinforced by authors such as Cassiolato and Lastres (2021) and Miri and Macke (2024), who advocate for policies shaped by local characteristics as a condition for effectiveness. The model proposed in this study seeks precisely to integrate these variables, organizing the central elements of the ST&I system into an analytical structure that helps guide planning, improve governance, and support the formulation of public policies that are more realistic and better suited to the local context. By highlighting critical vectors of coordination, the model contributes to the construction of more integrated innovation trajectories, capable of converting latent potential into sustainable and structured solutions.

The empirical results systematized throughout the study confirm the model's usefulness as a tool for interpreting the regional innovation ecosystem. More than a descriptive instrument, it serves as an analytical support for formulating evidence-based public policies tailored to Acre's institutional and territorial reality.

7 FINAL CONSIDERATIONS

The analysis of public policies for Science, Technology, and Innovation (ST&I) in the State of Acre highlights an ongoing process of institutionalization, aimed at reconciling scientific development, environmental sustainability, and the valorization of regional assets. The state's legal framework, aligned with the new national Legal Framework for ST&I, reflects a consistent effort to harmonize regulations and create instruments to foster innovation.

However, its effectiveness remains limited due to the absence of specific regulations, which restricts the operationalization of legal provisions. The Acre Research Support Foundation (FAPAC) plays a strategic role in strengthening the State ST&I System (SisTec-AC), but its actions still rely heavily on federal programs, limiting the impact of policies on regional challenges.

The advances observed in legislation and budgetary allocation — especially the significant increase in investments from the Secretariat of Industry, Science and Technology (SEICT) — indicate that the innovation agenda is being prioritized in the state. Nonetheless, the analysis reveals persistent limitations related to low institutional maturity, fragmented governance, and a strong dependency on external resources. These factors hinder the construction of a functional, coordinated, and territorially responsive innovation ecosystem.

The analytical model developed in this study synthesizes these contradictions by structuring, across three interdependent levels, the territorial constraints, operational dimensions, and observed systemic outcomes. It thus provides a conceptual and methodological foundation for redesigning more integrated public policies that are territorially sensitive and institutionally coordinated. In this process, the role of systemic interactions among public, private, and academic actors stands out as a necessary condition for increasing the effectiveness and sustainability of ST&I initiatives in the state.

Although Acre has made progress in creating a more favorable legal and institutional environment for innovation, it still faces the challenge of consolidating a cohesive, resilient ecosystem rooted in its territorial vocations. Overcoming this challenge requires strengthening state capacities, improving multisectoral governance, and investing in strategies that link science, technology, and the bioeconomy, anchored in traditional and Indigenous knowledge as key drivers of regional development.

Future research should focus on evaluating the effectiveness of ST&I policies in Acre, based on economic, social, and environmental impact indicators. Comparative studies with other states in the Legal Amazon could also help identify best practices and foster institutional improvement. Additionally, it is recommended to further investigate the role of universities and research centers in stimulating the local ecosystem, as well as to explore the perspectives of entrepreneurs and managers

regarding barriers to innovation. Finally, analyses on the integration between innovation policies and sustainable territorial development strategies may offer valuable insights to consolidate an innovation model that aligns with the potentials and challenges of the Western Amazon.

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