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Bioeconomy in the Amazon and traditional knowledge: a reflection on inter-scientificity from the perspective of Amazonian peoples

Bioeconomia na Amazônia e conhecimento tradicional: uma reflexão sobre a intercientificidade a partir da perspectiva dos povos amazônicos

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ABSTRACT The concept of bioeconomy has emerged as a potential pathway to simultaneously promote environmental sustainability, local well-being, and community autonomy in the Amazonian context. This essay aims to examine the challenges and recommendations in the debate on bioeconomy in the Amazon and to reflect on the role of interculturality and inter-epistemic dialogue between scientific and traditional knowledge. It applies a cartography of controversies (Latour, 2007; Venturini, 2012), mapping the main approaches of key stakeholders drawn from seven virtual events. The content is organized into five thematic blocks — conceptual, economic, contextual, environmental, and cultural/epistemic — highlighting the importance of Amazonian peoples' perspectives, based on the concept of inter-scientificity (Baniwa, 2019). The findings point to convergences among stakeholders around the need to listen to and ensure the effective participation of these peoples and their knowledge, as a foundation for truly innovative bioeconomy processes. The term itself remains contested, and its definition continues to be the subject of debate.

Keywords: bioeconomy; Amazonia; traditional knowledge; inter-scientificity; environment.

RESUMO O conceito de bioeconomia tem emergido como um potencial caminho para a promoção simultânea da sustentabilidade ambiental, do bem-estar local e da autonomia comunitária no contexto amazônico. O objetivo deste ensaio é analisar problemas e recomendações ligados ao debate sobre bioeconomia na Amazônia e refletir sobre o papel da interculturalidade e do diálogo interepistêmico entre conhecimentos científicos e tradicionais. Realiza uma cartografia de controvérsias (Latour, 2007; Venturini, 2012), sistematizando as

principais abordagens de atores-chave extraídas de sete eventos virtuais. Os conteúdos foram organizados em cinco blocos temáticos – as dimensões conceitual, econômica, contextual, ambiental e cultural/epistêmica – com destaque para a importância das perspectivas dos povos amazônicos, a partir do conceito de intercientificidade (Baniwa, 2019). Como resultados, aponta para as convergências manifestadas pelos atores em torno da necessidade de escuta e efetiva participação dos povos e seus saberes para a emergência de processos realmente inovadores de bioeconomia, que se revela um termo ainda em disputa e cuja delimitação segue sendo foco de controvérsias.

Palavras-chave: bioeconomia; Amazônia; conhecimento tradicional; intercientificidade; meio ambiente.

1. Introduction

The debate on the bioeconomy as a pathway for Amazonian development, driven by the leadership of its peoples, is gaining prominence. It reveals the potential of a model capable of simultaneously promoting environmental sustainability, local well-being, and community autonomy. Recognizing this discussion as strategic for rethinking traditional knowledge and its importance in strengthening non-hegemonic economies compatible with life in the forest, this essay draws on the concept of inter-scientificity (Baniwa, 2019) to address the topic from the perspectives of different stakeholders. Its aim is to examine the challenges and recommendations in the debate on the bioeconomy in the Amazon and to reflect on the role of interculturality and inter-epistemic dialogue, using a cartography of controversies (Latour, 2007; Venturini, 2012).

What are the main limitations identified by the stakeholders regarding the bioeconomy in the Amazon? Is traditional knowledge being heard in this debate? How can this listening take place — in other words, how can crystallized epistemic hierarchies be broken? These were some of the questions that guided this analysis, a virtual ethnography (Beaulieu, 2004) examining seven remotely broadcast public events and systematizing key points raised by the panelists. The content was compiled and reorganized into mind maps structured around five thematic blocks: conceptual, economic, contextual, environmental, and cultural/epistemic dimensions.

The concept of inter-scientificity, which serves as the backdrop for this analysis, is based on the principle that academic knowledge is not incompatible with Indigenous and traditional knowledge. According to Gersem Baniwa (Alves, 2022), these forms of knowledge are not mutually exclusive but rather mutually complementary, although distinct in their epistemological, ontological, and methodological foundations. Inter-scientificity therefore calls for the creation of multi-epistemic frameworks for the development of practices and interactive dialogues that allow for pedagogical and epistemic coexistence. In an interview, using his own culture as an example, Baniwa states:

> The pedagogy of seeking the expansion, interaction, and complementarity of knowledge is inherent to the Baniwa people and other Indigenous peoples of the Amazon. These are open worldviews and epistemologies, always in pursuit of new knowledge, wherever it may be found. This is the primary daily role of wise shamans: to seek to broaden their knowledge (Alves, 2022, p. 15, free translation).

Grounded in this potential for intercultural convergence, the analysis presented herein is part of the project "Technical-Productive Prospecting and Prioritization for the Integration of the Amazonian Herbal Medicine Supply Chain" (PROFitos-Bio-AM), coordinated and developed by the Institute of Geosciences at the Universidade Estadual de Campinas (IG/Unicamp) and the Instituto Nacional de Pesquisas da Amazônia (INPA), with the participation of the Universidade Federal do Amazonas (UFAM). Conducted between February 2021 and January 2024, the project was jointly funded by the Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP) and the Fundação de Amparo à Pesquisa do Estado do Amazonas (FAPEAM) under the 2020 FAPEAM-FAPESP Call. The objective of PROFitos-BioAM was to develop a participatory methodology for technical-scientific and productive prospecting and prioritization to integrate the Amazonian herbal medicine supply chain, applying sustainability criteria. The project was organized into five work fronts, with the present discussion stemming from Work Front I – Prospecting of actors, processes, institutions, and organizations.

From a theoretical standpoint, we reflect on Amazonian knowledge based on the perception that it is often rendered invisible, disregarded, and excluded from debates seeking new solutions to environmental problems. The concept of traditional knowledge varies, and according to Manuela Carneiro da Cunha (2007), there are at least as many traditional knowledge systems as there are peoples. Her analysis is based on the example of ethnomedicine, which serves as a reference for reflecting on the potential of traditional science to renew understanding of the action of active substances. According to the author, the paradigms and practices of traditional sciences constitute potential sources of innovation.

By using a qualitative approach, we explored the topic of "bioeconomy in the Amazon" through the analysis of events streamed online via YouTube and Facebook. Following Actor-Network Theory, which recommends the strategy of "following the actors themselves" (Latour, 2012, p. 31), this virtual ethnography systematized the main problems and recommendations expressed by different stakeholders, aiming to analyze the concept from multiple perspectives. The workflow involved:

1) drafting a synthesis of each event;
2) creating a mind map for each event;
3) identifying the main thematic blocks addressed;
4) producing a synthesis of the combined content of all events, organized by thematic block;
5) describing the problems and recommendations derived from each thematic block.

We therefore conducted a systematization process that began with a more extensive exploration of the content, which was systematically organized and synthesized until we identified the major themes, central issues, and recommendations. Once the data had been collected and organized, we complemented the analysis of Amazonian knowledge by revisiting specific content that reflected stakeholders' perception that such knowledge must be integrated into debates aimed at shaping new solutions for environmental problems and fostering local development.

The selection of events was guided by the pursuit of diversity among stakeholders — encompassing, for example, participants from acade-

mia, the third sector, government, and traditional communities. The events were:

1) Webinar "Indigenizing the Amazon Bioeconomy", promoted by Coordination of the Indigenous Organizations of the Brazilian Amazon (COIAB) (October 1, 2021);

2) "FAPEAM/FAPESP Bioeconomy Project: Bioeconomy in the State of Amazonas – Interview with Tatiana Schor" (October 6, 2021);

3) "Systemic Alternatives Cycle Toward the Sustainability of Life: Bioeconomy in the Amazon", organized by the Institute of Economics/IG at Unicamp (November 29, 2021);

4) "1st Bioeconomy Workshop INPA/USP, Session 1 – Priorities for the Study of Bioeconomy in the Amazon";

5) "Session 2 – Concepts of Bioeconomy and Sustainability in Extractive Communities" (August 1-4, 2021);

6) "Ethical Challenges in Research and the Protection of Genetic Heritage and Associated Traditional Knowledge", organized by the Universidade Federal do ABC (August 9, 2021); and

7) "OCAA Webinars: What Kind of Bioeconomy Does the Amazon Want?", promoted by the Amazon Trade and Environment Observatory (February 17, 2022).

We therefore present the results of this systematization process. The perspectives of the stakeholders were selected based on their critical approaches, particularly regarding the necessary link between the concept of bioeconomy and the active participation of the region's Indigenous and traditional peoples. We begin the discussion by reflecting on the concept of inter-scientificity. We then present the results of the event systematization process, organized into five thematic blocks—highlighting the voices of the stakeholders, who point to the potential of a bioeconomy shaped by an intercultural perspective.

2. Knowledge in dialogue: inter-scientificity and the breaking of the human/nature dichotomy

Dialogue between cultures can be a deeply challenging experience, especially when it takes place in a context where hierarchies and violence have been long entrenched. The personal journey of Gersem Baniwa, now a professor in the Department of Anthropology at the Universidade de Brasília (UnB), exemplifies these difficulties. On one hand, becoming literate in Portuguese at the age of 12 opened reading to him as a gateway to other realities: "The ability to read opened my mind to the world, beyond my Baniwa world, sparking in me a genuine passion for reading, along with a deep curiosity and an immense desire to discover and unravel the white man's world" (Alves, 2022, p. 13, free translation). However, his schooling experience in the Rio Negro region was also marked by violence:

> The boarding school experience with other Indigenous students was extremely difficult because the missionary boarding school, on one hand, prohibited and condemned our mother tongues, our cultures, our traditions, our knowledge — in short, our own ways of being, doing, and living — and, on the other, forcibly imposed the foreign ways of being and living of the white man, notably semi-slavery (labor, punishments, mistreatment, forced and unpaid work, etc.), individualism, competition, rivalry, the colonial religion, submission to the religious and political authority of

> the white man's world, the colonial language, and so on (Alves, 2022, p. 14, free translation).

The concept of inter-scientificity stands in opposition to such barriers between knowledge systems, cultures, and ways of life. It is a proposal for inter-scientific dialogue between knowledge systems — a challenge for higher education institutions that are opening themselves to this possibility. It entails the coexistence, circulation, interaction, application, and mutual recognition of knowledge based on distinct logical, cosmological, philosophical, and epistemological foundations. Gersem Baniwa (2019) notes that if science complements its limited portfolio of knowledge with others, it will become richer, stronger, and less incomplete. From his perspective, this is the challenge and ideal of a more radical interculturality: inter-epistemology, or inter-scientificity. The concept does not seek to break with the Eurocentric colonial epistemology but rather to diversify and pluralize it with other epistemologies, which, from the Indigenous perspective, Baniwa (Alves, 2022) calls ancestral.

For Baniwa, epistemic decolonization is not about dismantling or denying colonial science but about creating space for other sciences, ontologies, and epistemologies. Regarding Indigenous epistemologies, he adds that knowledge from modern Western science is welcomed by Indigenous peoples as a meaningful complement to their own knowledge, particularly in improving material and immaterial living conditions. It is also complementary in the management of territories, in public policy discussions, and in matters of economy and sustainability. Thus, complementarity is welcome, while the idea of exclusivity and superiority of academic scientific knowledge — and the resulting denial, devaluation, and subordination of Indigenous knowledge — is rejected (Alves, 2022).

What inter-scientificity proposes is the construction of multidisciplinary, multi-epistemic frameworks that enable practices and exercises in tolerant, interactive dialogue and pedagogical and epistemic coexistence — in other words, effective exercises in interculturality. Baniwa's own life reflects this possibility: if, on one hand, school and university represented places to seek other forms of knowledge, "my academic life experience has always been permeated, nurtured, and enlightened by the wisdom of the Baniwa people" (Alves, 2022, p. 15, free translation).

This aspiration for convergence shares common ground with other related concepts, such as the utopia of interknowledge — the ability to learn from other knowledge systems without forgetting one's own (Santos, 2006) — and confluence, a concept proposed by the Quilombola intellectual Antônio Bispo dos Santos (2015; 2023). Confluence envisions the possibility of encountering the "other" without losing one's identity, evoking dynamics of interpenetration between epistemic and cultural paradigms through openness to sharing. Using the metaphor of water, the author observes that when one river flows into another, instead of disappearing, it becomes stronger (Santos, 2023). Bispo dos Santos contrasts the concept of decolonization — including the decolonization of knowledge — with that of counter-colonization, which refers to traditional ways of life and their organic knowledge. By contrasting the Quilombola ethos with the colonialist paradigm, he underscores the cultural resistance of those who were never colonized and whose civilizational paradigms predate the European invasion.

Also from a Quilombola perspective, Givânia Silva (2022) challenges the idea that knowledge generated in specific contexts should be regarded as lesser or lacking scientific value, warning of how hegemonic knowledge remains tied to white, male, and Global North power structures. Aligned with these critical perspectives, Medeiros and Gitahy (2009, p. 13) argue that intercultural convergence "can enable the emergence of concrete and feasible proposals for intervening in reality."

In discussions on the bioeconomy in the Amazon, one of the most relevant aspects of interculturality is the pursuit of non-destructive relationships between humans and nature. Gersem Baniwa describes Indigenous economies as possessing a high capacity for self-sustainability, which he explains through the "deep interdependence between the world of nature — something alive, made up of plants and animals, stones, mountains, and rivers — and the world of humans" (Baniwa, 2006, p. 190). In his view, environmental sustainability — which ensures the physical and cultural sustainability of these peoples — is grounded in the ability to know and respect nature. This means adopting an integrated vision of the material and spiritual needs and potential of both individuals and communities. Other Indigenous authors also highlight similar non-hegemonic logics, such as Ailton Krenak:

> For a long time, we were lulled by the story that we are humanity. Meanwhile — as the wolf never came — we became alienated from this organism of which we are a part, the Earth, and began to think of it as one thing and ourselves as another: the Earth and humanity. I cannot perceive anything that is not nature. Everything is nature. The cosmos is nature. Everything I can think of is nature" (Krenak, 2019, p. 9-10, free translation).

Referring to the worldview of the Yanomami people, Davi Kopenawa explains: "In the forest, ecology is us, the humans. But it is also, just as much as we are, the *xapiri*[1], the animals, the trees, the rivers, the fish, the sky, the rain, the wind, and the sun! It is everything that came into existence in the forest" (Kopenawa & Albert, 2015, p. 480).

These perspectives seem essential in the search for truly innovative solutions to the environmental dilemmas that haunt our present. Climate change and the threat of environmental collapse are examples showing that we live in times of strong questions and weak answers — a period of paradigmatic transition that reflects the crisis in the hegemony of the sociocultural model of Western modernity (Santos, 2009).

As Luiz Marques (2018, p. 477) notes when referring to the concept of the Anthropocene, "more than ever, we are today essentially vulnerable to what has become vulnerable to us." The Anthropocene — and related concepts such as the Capitalocene — signals an era in which the impact of human forces on shaping the Earth system rivals that of major planetary forces, such as variations in the planet's orbit. According to Marques, the concept describes a moment when nature becomes an effect of humanity, in such a way that "wherever he roams, from the stratosphere to the deep sea, man henceforth encounters — objectively, and no longer merely as a projection of his consciousness

[1] Mythical creatures.

— the effects of himself" (Marques, 2018, p. 477, free translation).

Vandana Shiva (1992) points out that a common thread guiding sustainable societies is the principle of regeneration. However, in industrial society there is neither the time nor the space to live regeneratively, which is, she argues, the root cause of our current ecological crisis. Marques (2018) observes that the environmental collapse now at our doorstep stems from a slow historical process of distancing humans from other species and from nature as a whole. From this perspective, which became dominant over time, nature came to mean the "nonhuman" — that which surrounds humanity. Indeed, René Descartes (2001 [1637]), considered a pioneer of modern philosophical thought, described humans as "masters and possessors of nature," rendering it something to be controlled and conquered.

This long historical process that leads to the present crisis places the Amazon at its center. The struggle over territory, the advance of capital through large-scale projects, the expansion of the agricultural frontier driven by agribusiness, the spread of organized crime, among other factors, have demanded great eco-territorial resistance from Amazonian peoples. In 2007, Marengo had already warned that extreme weather events — such as droughts induced by global warming and deforestation — could split the Amazon in two and turn 600,000 square kilometers into savanna. Future scenarios, according to the author, project a savanna-type climate for the Amazon by 2050, with warming of 6 to 8°C by 2100 and rainfall reductions of up to 20%. "Rainfall will decrease, the dry season will lengthen, which may worsen the problem of wildfires, and as a result, the ecosystem will lose its capacity to sustain a tropical forest as we know it today," he wrote (Marengo, 2007, p. 135, free translation).

As Eliane Brum (2021) states, the Amazon holds a central role in the great confrontation of this century. In this struggle of forces, among other dynamics, she describes the transformation of forest peoples into "the poor" — a category that, in her view, is strategic for understanding the Amazon and the system driving the climate crisis. Because it is treated as a homogeneous category, it fuels the notion that this entire population labeled "poor" has, as its ultimate goal, the expansion of its consumption capacity. As will be discussed later, this is considered a flawed assumption for building a bioeconomy model that truly meets the needs of Amazonian peoples, since their relationship with the territory and their own concept of "well-being" differ from the dominant paradigm. Thus, is bioeconomy a convincing way to counter the destructive path threatening the forest? The answer to this question is neither simple nor singular, as we will see next.

3. Thematic blocks: mapping stakeholder perspectives

The process of narrowing down the content systematized from the seven virtual events analyzed in this essay led to the organization of five thematic blocks which, as previously mentioned, synthesize the central concerns expressed by stakeholders regarding the bioeconomy. These are the conceptual, economic, contextual, environmental, and cultural/epistemic dimensions. Each of these groups unfolds into problems and recommendations put forward by the participants.

The conceptual dimension draws attention to the need to clearly define the very concept of bioeconomy. Throughout the events, various participants mentioned the risk of the term becoming so broad that it loses its transformative potential — especially if it comes to include, for example, agribusiness. The statements analyzed therefore point to the importance of establishing clear parameters for what can and cannot be classified as bioeconomy. These boundaries should be set through extensive dialogue that incorporates the perspectives of Amazonian peoples, who often lack access to such debates. Principles such as expanding the notion of well-being — beyond mere access to material goods — the purpose of reducing inequalities, conserving socio-biodiversity, and fostering inclusion (across various spheres) were mentioned as essential components for an appropriate definition.

The inseparability of culture and environment was one of the key points in the discussion on how to delimit the bioeconomy. According to Danicley de Aguiar, coordinator of the Amazon Campaign at Greenpeace, speaking at the webinar "Indigenizing the Amazon Bioeconomy", biodiversity is not limited to biological aspects but also encompasses the millennia-old knowledge and practices of local peoples. In many cases, the former results from the latter. In the Amazon, this represents some 10 000 years of human-nature interaction, he emphasized. Therefore, in his view, market-oriented approaches — and the risk of commoditizing the forest — generate pressures on traditional communities that cannot be overlooked.

The definition of what can truly be classified as bioeconomy is far from consensual. On the contrary, it remains an open and contested topic. For instance, according to Joice Ferreira, a researcher at Embrapa Eastern Amazon, this definition must adhere to certain basic premises: "We must guide it so that the concept — and the application of bioeconomy — brings us this: reduced deforestation, increased conservation, and improved social well-being." For Ferreira, who participated in the "OCAA Webinars", the idea of well-being thus emerges as a condition that goes beyond economic growth. The complex relationships between forest and market, and the alliance between nature and culture, are also emphasized by Tatiana Schor, who at the time headed the Secretariat for Development, Science, Technology, and Innovation (SEDECTI, 2021)[2]:

> The Amazon involves hydroclimatological issues, and many conventional indicators do not work at the local level, starting with the very structure of the market. For example, local fruits do not circulate through formal market structures but rather through so-called "public fruit stands," driven by an economy of affection shaped by culture. Thus, it is essential to know the people and visit the places (free translation).

The discussion on the economic dimension converges around the central concern of the risk of commoditizing Amazonian products, in which market interests overshadow environmental conservation needs and the well-being of local populations. Another pressing issue, according to the participants, is the difficulty in ensuring effective income generation, benefit-sharing, and the fight

[2] Schor served as secretary from 2019 to 2022 and is currently head of the Amazon Unit at the Inter-American Development Bank (IDB). The content highlighted here is drawn from the interview conducted by the FAPEAM/FAPESP Bioeconomy Project.

against exploitation. The discussions therefore point to the need not only to generate income but also to ensure its fair distribution and to strengthen community dynamics and the diverse economies that already exist in the Amazon region.

These concerns are compounded by recent regional changes, such as the historic drought of 2023 linked to climate change. As Paulo Moutinho, from the Amazon Environmental Research Institute (IPAM) and the Amazon Trade and Environment Observatory (OCAA), stated during the "OCAA Webinars": "There are now local transformations in the Amazon — not talking about global changes — of such magnitude that anything we plan economically (with or without 'bio') will be compromised if we continue the process of deforestation."

Schor suggests that any development process based on bioeconomy should:

1) conserve socio-biodiversity;
2) reduce socio-territorial inequalities;
3) incorporate broad-spectrum science, technology, and innovation (including social technologies) into processes;
4) expand areas of biodiverse forest.

Notably, SEDECTI (2021) advocated the use of the term "productive knowledge networks" instead of "productive chains" to better reflect the state of the art in bioeconomy market structures and to support the development of collaborative mechanisms.

The participants therefore converge on the idea that the risk of commoditizing Amazonian products is a core issue, and that a truly meaningful contribution from the bioeconomy must emerge with and for the Amazonian peoples. "There is not just one economy, there are economies. For example, what is the structure of the economy that already exists among Indigenous peoples?" asked social scientist Valéria Paye — executive director of the Podáali Fund and a Tiriyó and Kaxuyana woman from the Tumucumaque Indigenous Park — during the webinar "Indigenizing the Amazon Bioeconomy". She stressed the lack of consensus and the controversies surrounding new terms such as bioeconomy, which are used to address long-standing issues of interest to these peoples, yet without adequately listening to their perspectives. As she noted during the event:

> Several concepts (such as development, ethno-development, bioeconomy) are introduced from the outside into the scope of Indigenous Peoples and Traditional Communities. These terms are presented as new, but they do not consider, at the core of the discussion, the realities of the peoples. They arrive as new packages, but they are not (free translation).

The contextual dimension, which also includes the regulatory framework, was shaped by participants' concerns over the structural fragilities of the territories, including the forced expulsions of peoples through violent actions. Access to their own territory is a fundamental prerequisite for other initiatives related to the advancement of the bioeconomy to genuinely thrive. Recommendations from the participants include restructuring key sectors, strengthening laboratories, improving working conditions (especially for young PhDs and master's graduates), and protecting territories. Other important aspects are ensuring the enforcement of legal provisions and increasing the representation of local peoples.

Reflecting on the contextual dimension of the Amazon, Joaquim Correa de Souza Belo, director

of the National Council of Extractivist Populations and a panelist at the "Indigenizing the Amazon Bioeconomy" event, stated that it is contradictory to think about advanced technologies in communities that often lack even access to treated water. He noted that, on one hand, the struggle for rights is a historically important aspect in the face of their systematic denial; on the other, he warned that the push toward consumption can undermine both the ecosystem and local production processes, as illustrated by the commoditization of açaí. What mechanisms can ensure dialogue with Traditional Peoples and Communities? How can collaborative income be generated? he asked.

During the "OCAA Webinars", Belo also observed that the forest and its biodiversity follow their own natural rhythms, which differ greatly from the pace of the market. Aligning these timelines requires the participation of the State — as a regulatory entity — along with businesses and communities, which in turn demands the creation of mechanisms to facilitate the process, such as safeguards, participatory monitoring, and control systems.

Regarding the environmental dimension, which runs through the entire bioeconomy debate, the panelists pointed to risks such as the continuation of deforestation in the Amazon and the resulting loss of biodiversity, compounded by the effects of climate change, as previously mentioned. They stressed the importance of maintaining the forest standing, aligning with the Sustainable Development Goals (SDGs), and recognizing the critical role of Amazonian peoples in regulating climate change.

On sustainable development, Valéria Paye questioned how it would be possible to go beyond the "cover" that seeks to sell a certain image — linking this abstract idea to content that is truly transformative. Her view aligns with the critique of sustainable development offered by Indian political scientist Rajni Kothari:

> In the absence of an ethical imperative, environmentalism has been reduced to a technological prescription, and, as always in such cases, solutions end up in the hands of technocratic entrepreneurs. Driven by technology-intensive approaches and sustained by the overexploitation of nature, economic growth was once considered one of the main causes of environmental degradation; suddenly, it has been assigned a decisive role in solving the environmental crisis. An even more important role has been given to the market economy to organize nature and society. The label 'environment' and the slogan 'sustainability' have become deceptive devices, used as a cover to continue doing business as if nothing had happened" (Kothari apud Sachs, 2007, p. 220, free translation).

Finally, regarding the cultural/epistemic dimension, participants emphasized the importance of an effective, genuine, and non-hierarchical dialogue between different forms of knowledge, fostering horizontality in the debate. To prevent the bioeconomy from becoming yet another abstract idea imposed "from the outside in," it must prioritize overcoming such hierarchies, enabling fluid dialogue among academia, government, NGOs, Indigenous peoples, and traditional communities, among other sectors. Recommendations included promoting capacity--building and digital inclusion, while always considering the heterogeneity of values. The alliance between cutting-edge technology and traditional management techniques was another point raised by some participants, aligning closely with the concept of inter-scientificity.

For Nurit Benzusan, from the Socio-Environmental Institute (ISA), the profound knowledge

produced, accumulated, and transmitted by Amazonian peoples must be given the prominence it truly deserves. She describes the Amazon as a "cultural forest", marked by geoglyphs that bear witness to human presence throughout history. Speaking at the event "Ethical Challenges in Research and the Protection of Genetic Heritage and Associated Traditional Knowledge", Benzusan noted that the forest has historically undergone major transformations carried out by its peoples — for example, the distribution of Brazil nut groves, which can only be explained by human occupation and management. Another example she cited is the Traditional Agricultural System of the Rio Negro, recognized as Brazilian intangible cultural heritage by the National Institute of Historic and Artistic Heritage.

During the "OCAA Webinars", Indigenous professor and activist André Baniwa, representing the COIAB, reinforced this epistemic issue, noting that the Baniwa have identified more than 320 landscape units within their territory — an indication of the vast knowledge that should be valued by those who engage with Indigenous peoples. For such intercultural appreciation of knowledge, he stressed, it is necessary to value not only traditional knowledge but also science, technology, and entrepreneurial efforts. "It is important to feel that you are an essential part of the process," he affirmed. In addition to this encounter between epistemic frameworks — which points toward the concept of inter-scientificity — André Baniwa also emphasized the how-to, or methodology:

> If "bio" means life, then [bioeconomy] should mean worrying about extracting without destroying; it should be an economy that cares for life. If that is the meaning — caring for human beings and all ecosystems in the water, air, and forest — then it needs its own methodology. This word comes in the context of climate change and, to counteract that, it must be formulated in this sense. But if the methodology continues to be deforestation, without respecting the rights of Indigenous peoples, then it is not bioeconomy. There is a high risk that people will continue using the same methods (free translation).

Thus, during the "OCAA Webinars", he advocated for a discussion on new methodologies capable of challenging scale-based production aimed at achieving high-profit targets, as such an approach neither protects life nor relieves pressure on producers. He argued that large-scale production is not suitable for bioeconomy, as it pushes for the selection and exploitation of certain species while ignoring those deemed less productive. This modus operandi leads to biodiversity loss.

These voices raise further questions: What strategies and methodologies can genuinely value traditional knowledge? How can benefits be fairly distributed? Benefits for whom, for what, and at what scale? How can we dismantle a development mindset focused on macroeconomics? How can short-, medium-, and long-term interests be reconciled?

As seen, Indigenous and traditional peoples in Brazil — and Amazonian peoples in particular — have a different relationship with nature, grounded in their own worldviews, distinct from the human–nature separation of Western modernity. According to the stakeholders analyzed in this essay, the successful implementation of bioeconomy in the region depends on listening to this knowledge, which must be freed from a hierarchical and rigid view of the different cultures that make up the

Amazonian environment. Without such listening — if bioeconomy is implemented in an exogenous manner — the cultural and epistemic models that underpin predatory exploitation of nature, rooted in control and conquest, will remain intact, undermining the process from its very foundations.

Thus, in terms of controversies, one of the most prominent aspects is the very definition of what truly constitutes bioeconomy and how it differs from older terms. Regarding convergences, these voices indicate that a genuine transformation of the Amazonian context requires, on one hand, the inseparability of environmental sustainability, local well-being, and community autonomy — which, in turn, is grounded in the right to territory. Furthermore, as emphasized by several panelists in the events studied, it also entails rejecting the commoditization of Amazonian products and creating collective spaces for dialogue with local peoples, integrating into the bioeconomy the perspective of ancestral knowledge and an ethos based on nature as a whole.

In the Amazonian context, bioeconomy has the potential to be more than just another concept, emerging as a normative ethical imperative — as stated by Joice Ferreira during the OCAA event. For this to happen, the biocultural dimension is essential, meaning the effective integration of knowledge derived from the relationship between Amazonian peoples and biodiversity. Therefore, the term bioeconomy will appear empty if it does not involve the decolonization of the idea of innovation and the breaking down of hierarchies between knowledge systems, opening concrete pathways toward inter-scientificity.

4. Conclusion

The research findings highlight the centrality of the epistemic dimension and of listening to local peoples for the bioeconomy to truly advance in the Amazonian territory. Among the main concerns expressed by the stakeholders analyzed in our mapping, we highlight:

1) The challenges in defining the very concept of bioeconomy and its appropriation by Amazonian peoples;

2) The risks of commoditizing products and the search for ways to prevent it;

3) The structural fragilities in the territories — including invasions, expulsions, and various forms of violence — and the need for responses to address them;

4) The destructive advance over the forest and the urgent need for strategies to reverse environmental collapse;

5) The difficulties in inter-epistemic dialogue and the need for solutions to overcome them, through new relationships between knowledge systems, new methodologies, and the creation of spaces for participation and debate.

On the challenge of defining the concept of bioeconomy, the narratives of several stakeholders indicate that the term risks becoming so broad that it could lose its transformative potential. One key point raised was the need for a clear definition of the term, making explicit what can and cannot be classified as bioeconomy. This definition must be established through extensive dialogue, necessarily including the perspectives of Amazonian peoples.

The commoditization of Amazonian products was another risk identified by the participants, who stressed the need to ensure that market interests do not override environmental conservation and community well-being. Structural fragilities and disputes over territory — often leading to the expulsion of peoples through violent actions — were also highlighted as a major concern. Access to their own territories is a fundamental prerequisite for other initiatives related to the advancement of bioeconomy to be genuinely possible. In this regard, the evolution of the regulatory framework and the effective enforcement of existing rights — frequently violated — are of particular importance. Another recommendation, both obvious and inescapable, is the control of deforestation. Within the broader power dynamics in Brazil, and in the Amazon region in particular, there are explicit contradictions between the implementation of bioeconomy as an alternative for promoting well-being in the region and the setbacks caused by the growing interest in territorial exploitation — illustrated by conflicts over mining or the *Marco Temporal* land demarcation policy.

The epistemic dimension calls for the establishment of an effective, genuine, and non-hierarchical dialogue between knowledge systems. This dimension — discussed here through the concept of inter-scientificity — underscores the importance of a bioeconomy capable of challenging the hegemonic epistemic paradigm, philosophically built on the human–nature dichotomy. The voices of the stakeholders highlighted in this research warn that if the proposal is implemented top-down, without genuine listening — meaning only a simulated consultation — of Amazonian peoples, the same patterns of thought that have threatened the forest and its socio-biodiversity since colonial times will remain in place. As Baniwa cautioned in an interview:

> It has been almost two centuries since the period of the 'Just Wars' and 50 years since the start of the military dictatorship, yet the developmentalist mindset that sees Indigenous peoples as a nuisance, a hindrance, and an obstacle remains alive. The arguments are virtually the same: the need to ensure control over the land and its resources, and to bring progress and civilization to colonized peoples considered uncivilized, without culture, or even non-human (Alves, 2022, p. 25, free translation).

Considering that the crystallization of hierarchies between knowledge systems plays a decisive role in rendering peoples invisible and excluding them, overcoming the obstacles that stand between Amazonian communities and their well-being means, among other things, fostering horizontality in dialogue with actors whose knowledge has been historically subordinated. This also requires new protocols, forums for debate, and methodologies. Since no single culture is capable of answering all the pressing problems we face, the implementation of bioeconomy in the Amazon points to inter-epistemic and intercultural relations as an unavoidable path for generating new responses to the questions that challenge us.

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