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# Amazon Bioeconomy: Extractive Cycle or Structural Transformation?

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**Abstract:** Bioeconomy strategies have emerged as prominent tools for aligning economic development with environmental sustainability. In the Amazon, these strategies are often promoted as greener alternatives to deforestation-based growth. However, this paper argues that current Amazonian bioeconomy models risk reproducing historical patterns of extractivism under a sustainability discourse. We conceptualize this contradiction as green extractivism, meaning a mode of resource use where nominally sustainable practices preserve external control, reinforce value drain, and marginalize local innovation and governance. Drawing on structuralist development theory and political ecology, we position the Amazon bioeconomy within a landscape of competing paradigms: pro-growth technological innovation, market-based circularity, and critical ecological models. We introduce the concept of a developmental bioeconomy, grounded in structural transformation, strong sustainability, and territorial governance. Through an analysis of institutional patterns, value chains, and emerging financial mechanisms such as carbon markets, we identify three critical constraints in the current model: structural stagnation, green extractivism, and speculative financialization. These dynamics prevent the Amazon bioeconomy from generating inclusive prosperity or enabling regional autonomy. As an alternative, we propose a developmental strategy focused on local value capture, participatory institutions, and public-cooperative financing structures. This reorientation would transform biodiversity and ecological wealth into foundations for local-driven innovation and equity-driven development. Our findings highlight the need to rethink sustainability frameworks in peripheral regions and to realign conservation and climate finance with territorial justice.

**Keywords:** bioeconomy, green extractivism, Amazon, development theory, sustainability paradigms

## 1. Introduction

Over recent decades, “bioeconomy” initiatives, such as non-timber forest product extraction, forest-based carbon credits, and green investment mechanisms, have been heralded as promising pathways toward sustainable growth [1, 2]. However, despite mounting enthusiasm and policy endorsements, current bioeconomic practices may fail to promote genuine structural transformation or equitable socio-economic outcomes in developing countries [3]. This gap in our understanding stems from an overreliance on the narrative that exploiting natural resources more “sustainably” can seamlessly drive prosperity without addressing deeper questions of value creation (local processing, brand development, and local Human Capital for R&D), governance, and local livelihoods [4]. For instance, in the case of the Amazon, bioeconomy narratives might simply perpetuate historical patterns of resource dependency and external control [5], if they ignore historical lessons from the boom and bust in the extractivist cycles.

This paper starts from the premise that sustainability-oriented resource use, by itself, does not guarantee development. Historical experience in the Amazon shows that extractive cycles have repeatedly generated external rents while leaving behind weak local institutions, limited industrial diversification, and persistent inequality. The central concern is that contemporary bioeconomy

initiatives risk reproducing this pattern under a sustainability discourse, substituting “green” commodities and financial instruments for conventional raw material exports without altering the underlying economic logic.

The Amazon region has emerged as a critical focal point for reconciling conservation imperatives with economic development [6]. While many NGOs and environmentalists assume that bioeconomy policies in the Amazon inherently offer a greener alternative to deforestation-based industries, there is limited clarity on whether they address the systemic challenges of low-value extractivism, precarious employment, and external financial control. Indeed, prevailing frameworks have overlooked the extent to which bioeconomy ventures can replicate historical center-periphery dependencies and perpetuate resource-intensive export models [7, 8]. First, structural stagnation keeps activities confined to low-value primary production, failing to generate the industrial upgrading essential for development [9]. Second, what we term “green extractivism” maintains external control over resources and value chains, even when activities are nominally sustainable [3]. Green extractivism refers to the appropriation and commercialization of nature-based resources under the guise of environmental sustainability, but without transforming the underlying extractivist economic logic. Indeed, green discourses can justify new forms of resource exploitation, often reproducing historical patterns of inequality, environmental degradation, and territorial control. Third, emerging financialization through carbon markets and conservation investments often prioritizes external returns over local

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reinvestment [10, 11]. This raises a key question: Does the bioeconomy, as currently implemented, genuinely advance sustainable development, or does it risk becoming a new form of “green extractivism” with limited local benefits?

To address this question, we place the Amazon bioeconomy in dialogue with two contrasting development lenses to propose an alternative vision. First, we drew on the structural transformation model [12], which posits that genuine economic development demands a shift away from primary activities toward higher-value industries and services. Based on historical events that surrounded economic development across western regions, the structural transformation means a reallocation of resources and moving workers from farming and extraction to manufacturing and services sectors, typically accompanied by urbanization, technological advances, and increased per capita income. Second, we combine it with the sustainable livelihoods approach [13], which foregrounds local capabilities, equity, and long-term resilience as pillars of development. Through this lens, we examine whether the Amazon bioeconomy fundamentally challenges or simply reproduces the logic of neo-extractivism.

This paper argues that most existing bioeconomy models fall into old extractive and exploitation patterns. In response, we propose a developmental bioeconomy framework, centering on structural transformation, local innovation systems, and equitable governance as prerequisites for achieving sustainability that is not only ecological but also economically sovereign and socially just. A truly developmental approach for bioeconomy must embed three critical elements: state-coordinated industrial policy [14], robust local innovation systems, and inclusive governance mechanisms. This study indicates that current bioeconomy approaches too often remain confined to low-value primary production and precarious labor conditions, while large-scale financial investments such as carbon credits and green bonds prioritize returns over local reinvestment. These findings highlight a mismatch between the stated environmental and socio-economic goals of bioeconomy advocates and the tangible outcomes observed on the ground. By critically assessing the relationships between structural change, livelihood equity, and financialization, we reveal how the Amazon bioeconomy frequently falls short of delivering the transformative potential claimed by its proponents.

The rest of this paper is organized as follows. After presenting the background (Section 2), Section 3 discusses the developmental contradictions of the Amazon bioeconomy, with a particular focus on structural stagnation, green extractivism, and the rise of speculative finance. Section 4 then rethinks these contradictions through alternative development pathways, highlighting how state-led industrial policy, local value chains, and equitable governance structures might create a more truly “developmental bioeconomy.” We define a developmental bioeconomy as a state-coordinated approach that invests in domestic processing, equitable value chains, and R&D aimed at enhancing local capabilities, while prioritizing social equity and environmental integrity. Finally, the paper concludes with policy implications, urging a departure from extractive patterns toward a genuinely sustainable and inclusive model for Amazonian futures.

## 2. Background

### 2.1. The Amazonian context

The Brazilian Amazon is ecologically vital and geopolitically significant, historically shaped by cycles of extractivism that prioritize raw material exports over local development [15]. From

the rubber booms to timber, agro-industrial expansion, and mining, these externally driven cycles have entrenched economic dependency and limited industrial upgrading. Bioeconomy initiatives risk repeating these patterns if they do not prioritize local value chains, research, and equitable governance. Experimentalist state-level governments, such as community-led forest management in Acre and participatory budgeting in Pará, have shown promise [16] but remain isolated and unscaled due to policy fragmentation.

The Manaus Free Trade Zone (*Zona Franca de Manaus*, or ZFM in Portuguese acronym) illustrates the challenge of industrialization without integration. Like special economic zones in Africa and Asia, the ZFM attracted investment but failed to create backward linkages with local economies, that is, local supply connections, functioning as an enclave economy disconnected from rural production systems. Established in the 1960s, it brought manufacturing to Manaus but did not integrate the surrounding rural economy, reinforcing a dual economic structure of industrial urban hubs and low-productivity rural sectors.

Deforestation and inequality persist, driven by large-scale agricultural expansion, logging, and infrastructure projects. While bioeconomic activities like non-timber forest products (NTFP) and agroforestry offer alternatives, they face barriers such as insecure land tenure, limited finance, and weak industry linkages. Simply branding activities as “green” does not resolve core issues of value distribution [3]. Emerging financial mechanisms, such as carbon markets and biodiversity credits, further complicate this issue [10, 17]. While these tools aim to incentivize conservation, they often benefit external stakeholders (e.g., investors) more than local communities, reinforcing dependency rather than fostering regional development [18].

### 2.2. Competing bioeconomy paradigms and development theories

Bioeconomy strategies are increasingly invoked to reconcile sustainability goals with economic development [19]. However, the concept remains fragmented, reflecting deep-seated divergences in how sustainability, growth, and transformation are interpreted. The literature converges around three dominant visions of the bioeconomy [20]: (i) the biotechnology paradigm, focused on innovation-driven, high-tech solutions; (ii) the bio-resource paradigm, emphasizing biomass upgrading and circular use; and (iii) the bio-ecology paradigm, which centers on ecological resilience and landscape-based approaches.

While all visions for bioeconomy claim alignment with Sustainable Development Goals (SDGs), they map onto distinct development theories. For example, technological paradigms align with modernization and innovation economics, assuming green growth can be achieved through R&D and global integration. In contrast, bio-ecology visions resonate with strong sustainability and political ecology, questioning the substitutability of ecological functions and highlighting power asymmetries in global value chains [20, 21]. In fact, different countries align bioeconomy initiatives with their agents’ interests and SDGs, partly to access international funding and fit narratives [22].

In Latin America, especially in the Amazon, the operationalization of bioeconomy strategies has been led by NGOs and reveals enduring contradictions. For instance, case studies show that many initiatives mirror neo-extractivist development models: they rely on low-value biomass extraction, benefit external firms or NGOs, and rarely generate transformative spillovers [7]. Even when branded as sustainable, these models perpetuate dependence on external capital and technological importation, which are hallmarks of

underdevelopment in structuralist theory [23, 24]. Recently, the 2022 elected Brazilian government engaged in the debate of bioeconomy to formalize public policies, but it is too soon to report or analyze any advances.

To this point, the prevailing logic reflects weak sustainability, which assumes natural capital losses can be offset by financial or technological gains. This contrasts with strong sustainability, which insists on maintaining critical ecological functions and territorial equity [21]. Political ecology critiques go further, arguing that sustainability discourses can serve as legitimizing tools for dispossession, elite capture, and ecological commodification [17].

We argue that existing bioeconomy approaches in the Amazon fall short because they are structurally misaligned with the institutional, technological, and distributive requirements of sustainable development. In response, we propose a developmental bioeconomy: one that draws from structural transformation theory, strong sustainability, and territorial governance to re-embed biodiversity use in locally controlled, high-value, and equitable production systems. Table 1 compares the theoretical visions and development paradigms we applied to the bioeconomy.

### 3. Bioeconomy's Developmental Issues

#### 3.1. Structural stagnation: low value addition

The bioeconomy's potential to drive sustainable development has garnered significant attention [19]. However, structural limitations prevent meaningful economic transformation. While bioeconomy initiatives promote niche markets such as açaí and Brazil nuts, these industries contribute only a fraction of Brazil's GDP, and it is insufficient to sustain the region's 30 million inhabitants. Moreover, expanding these markets does not guarantee inclusive growth, as economies of scale favor large agribusinesses over smallholders, potentially leading to land concentration, monocultures, and continued deforestation. This reinforces a long-standing pattern where raw material extraction fails to catalyze broader industrialization or urban-led development [6, 25].

Drawing from structuralist economic theory, the bioeconomy in the Amazon has not catalyzed meaningful transformation because it remains embedded in traditional commodity circuits. Activities such as açaí or Brazil nut extraction, though often promoted as sustainable, generate limited value-added (through local

processing) and reinforce existing patterns of informality. Their expansion rarely translates into backward linkages, technological learning, or wage improvements throughout structural upgrading.

This stagnation manifests in three key dimensions. First, value-chain positioning remains predominantly in low-value segments, for example, raw material extraction and basic processing. According to recent analyses of Amazonian bioeconomy ventures [7], most activities concentrate on primary extraction and basic processing, with minimal participation in research, product development, or marketing. This pattern contradicts successful bioeconomy transitions observed in Europe, where robust innovation systems enabled forest-based industries to move up the value chain [26]. The gap between raw material export and value-added processing reflects a key challenge for industrial transformation in developing regions [14].

Second, employment patterns reveal limited skill development and formal job creation. The bioeconomy sector, while growing, still faces challenges in creating formal employment. While the development literature by Timmer [12] highlights that sustained economic growth requires labor reallocation from informal rural employment to formal urban-industrial sectors and transitioning labor toward higher-productivity, knowledge-intensive activities, the Amazon's bioeconomy instead reinforces dualism, where urban enclaves coexist with stagnant rural hinterlands [21]. As a result, the bioeconomy activities currently generate an annual gross value of production of BRL 15 billion in the Legal Amazon [27], meaning less than 2% of the current GDP in the Amazon.

The main issue is basic human capital and local R&D; for instance, the ZFM has struggled to generate substantial high-skill employment or technological spillovers despite its industry aspirations. Therefore, the region needs to tackle educational gaps before proposing a highlighted technological or innovative development model. The R&D investment in Amazonian bioeconomy ventures lags significantly behind global benchmarks [22]. This underinvestment reflects weak linkages between research institutions, the private sector, and local communities—a critical barrier to developing domestic technological capabilities.

These structural limitations stem from institutional weaknesses and policy fragmentation. While state governments have launched bioeconomy initiatives, they often lack coordination with federal industrial policy or local development plans. The result is a “dual economy” where modern bio-based industries remain

**Table 1**  
**Bioeconomy visions and development paradigms**

Paradigm and bioeconomy vision	Theoretical foundation	Policy logic and risks
Technological/innovation supporting the biotechnology approach	Entrepreneur-driven growth theory, modernization	High-tech R&D, public–private innovation hubs, despite capital dependence and concentration
Market efficiency paradigm supporting bio-resource/circular economy	Ecological modernization, weak sustainability	Converting biological waste into valuable products, despite uneven access to infrastructure that could benefit large companies over small producers
Ecological/degrowth supporting Bio-ecology and agroecology approach	Strong sustainability, political ecology	Focus on local systems, ecosystem stewardship; however, it has limited scaling
Neo-extractivism, based on NTFP/REDD+ exports	Resource dependency, export-led growth	Export raw biodiversity, conservation finance, with risks of external capital appropriation
Developmental approach, biodiversity-based and local-driven	Structuralist economics, capabilities approach	Territorial value chains, participatory governance, but requires institutional coordination and public investments

disconnected from traditional extractive activities, failing to generate the backward linkages essential for regional development [14, 28].

From a theoretical perspective, this stagnation highlights a disconnect between bioeconomy rhetoric envisioning an innovative economy, while the reality is limited capital investments, low labor productivity, and minimal value addition. As a result, the Amazon bioeconomy remains anchored in primary sector dependence, falling short of the industrial diversification and urban-led employment opportunities that typically characterize successful development transitions [12].

### 3.2. Green-extractivism under a sustainability discourse

Another issue arises at the level of political economic discourses and shapes many bioeconomy projects as a form of neo-extractivist. Neo-extractivism refers to resource extraction led by states or corporations under a discourse of sustainable development [3], yet often continuing patterns of external dependency and unequal benefit-sharing. Under this umbrella concept, there is green extractivism, that is, how nominally sustainable activities can reproduce traditional extractivist patterns through unequal power relations and external value capture. We draw from political ecology literature to frame this problem in the Amazon bioeconomy through three measurable dimensions: ownership structures, value distribution, and governance arrangements.

Ownership patterns reveal persistent external control. Most of the processing facilities and patents are controlled by non-local entities [29]. For instance, companies such as Nestlé, Fuji Oil, BASF, and Unilever hold numerous patents related to Amazonian plants in the food and medicine sectors, indicating significant external control over bioeconomic resources [30]. This concentration of ownership undermines local autonomy and reinforces dependency on external capital and technology. For example, in Acre state's natural rubber initiative, while local tappers provide raw material, processing and marketing remain dominated by southern Brazilian firms, capturing most of the final product value. As a consequence, Amazonian communities typically retain only a small fraction of end-product value in bioeconomy ventures [31]. This disparity stems from (i) limited local processing capacity, with most bioeconomy products exported in raw or semi-processed form; (ii) weak bargaining power in price negotiations, exacerbated by poor market information and infrastructure; and (iii) restricted access to technical knowledge and certification systems [32].

While these industries emphasize sustainability and traditional knowledge, benefit-sharing remains limited [33]. Green extractivism often operates through subtle mechanisms of control. Bio-certification requirements, while important for sustainability, can create barriers for small producers [2]. Similarly, technical assistance programs, while nominally supportive, frequently promote external technological packages over local innovation systems, as observed in studies of Amazon forest management [34].

Finally, the vagueness of the bioeconomy concept enables policy drift as well as misuse by other primary sector activities. For instance, regenerative agriculture is not a bioeconomic model but rather an important strategy for mitigating environmental degradation within a commodity-based economy. Still, Brazilian policymakers have included it under the umbrella of the bioeconomy in the National Bioeconomy Strategy. Unlike bioeconomy initiatives that emphasize biotechnology, non-timber forest products, or biodiversity-based industries, regenerative agriculture primarily operates within conventional agribusiness by seeking to restore soil

health, reduce input dependency, and enhance carbon sequestration. It does not fundamentally alter the underlying market structure of commodity production but instead aims to make it more sustainable. Recognizing the distinction between concepts is critical to ensuring that bioeconomy policies do not merely serve as a greenwashing tool for industrial agribusiness expansion.

The implications extend beyond economics to social and environmental outcomes. Communities engaging in bioeconomy projects might create dependence on external buyers and technical experts, leading to a seek for capital efficiency that erodes traditional resource management practices. The consequence might be a growing internal conflict over resource access and benefit distribution. Therefore, we can challenge the assumption that merely labeling activities as "sustainable" or "bio-based" ensures equitable development. Instead, without fundamental changes in ownership, value distribution, and governance, the bioeconomy risks becoming another chapter in the Amazon's long history of extractive development.

### 3.3. Financialization: carbon markets and speculative investment

One of the most salient but least scrutinized features of the Amazon bioeconomy is its growing entanglement with financial markets. Conservation finance instruments, such as carbon credits, biodiversity offsets, and green bonds, are increasingly promoted as tools to reconcile ecological protection with capital accumulation. Yet, this turn toward financialization of nature raises critical concerns about equity, autonomy, and long-term sustainability.

Financialization refers to the process by which economic value is redefined through speculative, liquid, and often volatile financial instruments, usually decoupled from productive investment and local benefit to strengthen external control over land, resources, and economic benefits [10, 11]. The increasing prominence of carbon credits, green bonds, and biodiversity offsets has transformed the Amazon into a site of speculative investment, where financial actors capture most of the economic gains [3, 35], rather than local communities. For instance, in the Amazon, carbon markets under programs like REDD+ (reducing emissions from deforestation and forest degradation) are emblematic: forest lands are converted into carbon assets, traded on global markets, and managed by private or quasi-private intermediaries. Financialized conservation schemes frequently prioritize land tenure formalization as a prerequisite for participation, but in practice, this has led to elite capture, where powerful actors acquire land titles to benefit from carbon trading while marginalizing smallholders and Indigenous groups.

Moreover, the market-driven nature of carbon finance shifts environmental governance from the public sphere to private actors, weakening the role of state regulation and democratic accountability [4]. As a result, conservation projects become corporate assets, with multinational firms and investment funds controlling vast forested areas through carbon contracts and conservation concessions [34]. This mirrors historical patterns of resource control by external capital, where the Amazon's resources are extracted not through logging or mining, but via financial instruments that generate revenue for distant investors rather than local economies.

The speculative nature of carbon markets further exacerbates instability. Carbon credit prices are highly volatile, influenced by regulatory uncertainty, global market fluctuations, and shifting corporate sustainability commitments [10, 26]. This financial instability contrasts with the long-term conservation commitments required for true sustainability, creating a mismatch between market incentives and environmental goals. Additionally, fraud and

greenwashing in carbon markets have undermined their credibility, with multiple investigations revealing cases where carbon offsets fail to deliver promised emissions reductions while allowing polluting firms to continue business-as-usual practices [36].

This model reflects the logic of weak sustainability, which assumes that natural capital can be substituted by financial or manufactured capital. Under this logic, deforestation or ecological degradation in one area may be “offset” by conservation elsewhere, if the total capital stock is preserved. But this framing ignores the non-substitutable nature of critical ecosystems and obscures the power dynamics embedded in land commodification. By contrast, strong sustainability holds that certain ecological functions, such as biodiversity, cultural landscapes, or Indigenous territories, cannot be reduced to financial metrics or traded without irreversible loss [1].

For a developmental bioeconomy perspective, financial mechanisms must be restructured to serve local interests rather than speculative investors. This requires stronger state regulation of carbon markets, transparent revenue-sharing mechanisms, and legal safeguards against land speculation [14, 25]. Alternative financing models, such as community-led conservation funds, public investment in bio-based industries, and decentralized carbon benefit-sharing, could offer pathways that align economic gains with local development rather than perpetuating new forms of green extractivism [4]. Without such structural reforms, the financialization of the Amazon risks replicating past cycles of external dependency and wealth extraction, leaving local communities with little more than the illusion of sustainability.

## 4. Rethinking the Amazon Bioeconomy

### 4.1. Toward a developmental bioeconomy

The Amazon bioeconomy cannot simply be a green rebranding of traditional extractivist models; it must be a developmental bioeconomy—one that breaks from historical patterns of commodity dependence and external control [9]. This requires a structural transformation anchored in domestic value creation, industrial upgrading, and equitable governance [14].

Unlike the prevailing approach, which focuses on raw material extraction with minimal local processing, a developmental bioeconomy must integrate three core principles. First, industrial diversification and value addition: The bioeconomy must move beyond the simple extraction of açaí, essential oils, and carbon credits to develop bio-based manufacturing industries. Lessons

from Finland and other industrialized bioeconomies demonstrate the importance of state-backed R&D investments, biotechnology innovation, and public–private partnerships [19]. Without these, Amazonian economies remain locked in a cycle of low-value extractivism.

Second, market and financial mechanisms must favor regional economies. Current bioeconomic value chains remain externally controlled, with profits captured by intermediaries and investors outside the region. A developmental approach requires cooperative-based supply chains, fair trade pricing mechanisms, and financial instruments designed to reinvest capital locally [35, 37]. Conservation finance, such as biodiversity credits, must be restructured to ensure benefits reach local producers rather than speculative investors [10, 11].

Third, the Amazon region needs equitable governance and labor formalization. The bioeconomy must recognize that without formalized employment, secure land tenure, and participatory decision-making, it risks replicating previous models of labor precarity [3, 4, 38]. Strengthening worker cooperatives, regional planning councils, and participatory governance is essential to prevent green extractivism. Table 2 compares green extractivism with the developmental bioeconomy.

### 4.2. Addressing urban–rural disparities and structural inequalities

Historically, Amazonian development models have reinforced an urban–rural divide. A developmental bioeconomy must reverse this pattern by embedding rural producers into industrial supply chains through cooperative processing plants, rural R&D centers, and infrastructure investments [34]. The distribution of winners and losers in the bioeconomy mirrors past economic cycles. Under current conditions, foreign investors, urban processing hubs, and speculative conservation finance firms benefit most, while rural producers, Indigenous communities, and land-based laborers face exclusion and limited upward mobility [3, 35]. A developmental bioeconomy must ensure that value accrues to those directly involved in bioresource management, preventing new forms of rural exploitation [16, 39].

Ultimately, without systemic reform, based on local knowledge and stakeholders, the bioeconomy risks being another phase in the Amazon’s history of extractivism. A developmental bioeconomy approach should offer a transformative alternative, where economic upgrading, local empowerment, and sustainability are intertwined rather than competing objectives.

**Table 2**  
**Contrasting green extractivism and developmental bioeconomy in the Amazon**

Dimension	Green extractivism	Developmental bioeconomy
Ownership	External control of assets, patents, and profits; limited local stakeholding	Local ownership of resources, IP, and firms; reinvestment of profits into regional economy
Value chains	Raw material export, minimal local processing; profit capture by intermediaries	Local and community-based supply chains; value-added processing embedded in rural economies
Knowledge systems	Traditional knowledge extracted or marginalized; IP captured by external actors	Local-driven innovation; support for Traditional ecological knowledge and community-based R&D
Governance	Expert-driven rules imposed by outside organizations (top-down) and donor frameworks; limited local agency	Participatory institutions, inclusive planning, and multilevel participatory governance
Development model	Weak sustainability; market integration with ecological discourse; persistent dualism	Strong sustainability; structural transformation; equity, resilience, and autonomy

## 5. Conclusion

This paper has shown that while the Amazon bioeconomy is often championed for reconciling economic development with environmental protection, its prevailing models frequently rest on external control, low-value primary extraction, and speculative carbon finance. Through a critical examination of value chains, ownership patterns, governance arrangements, and emerging financial instruments, we demonstrate how current bioeconomy models tend to concentrate control, externalize value, and marginalize local agency. These patterns reflect not a break from extractivism, but its reconfiguration under a green label, while risk reproducing historical “boom-and-bust” cycles that have long typified Amazonian development. To foster genuine transformation, regional actors must move beyond mere extraction of non-timber forest products and carbon offsets, investing instead in robust local processing, research, and innovation systems. By embedding livelihood security and inclusive governance, Amazonian economies could build more equitable and sustainable futures—particularly through community-led initiatives, cooperative-based value chains, and state-backed industrial policies.

Our analysis draws on two theoretical pillars. First, from structuralist development economics, we highlight the absence of industrial upgrading, technological learning, and capital reinvestment. Currently, Amazon remains confined to low-value segments, with weak productive linkages and minimal local-driven innovation. Second, from political ecology and critical sustainability studies, we expose how the financialization of nature and technocratic governance models reinforce peripheral dependency and foreclose democratic control. This reflects a logic of weak sustainability, where ecological value is monetized without challenging power asymmetries or ensuring ecological integrity. Therefore, we propose the concept of a developmental bioeconomy as an alternative framework grounded in structural change, territorial equity, and ecological resilience. This vision demands a realignment of policy instruments: from global carbon offsets to local cooperative finance, from certification-driven market access to regional industrial policies, and from donor-led planning to democratic governance.

Concretely, the transition to a developmental bioeconomy implies strengthening local institutions to coordinate scientific research, upgrading industrial capacity for higher-value product manufacturing, and ensuring transparent benefit-sharing arrangements that empower rural producers and Indigenous groups. Community-driven financing mechanisms can help counteract the pitfalls of financialization, while participatory governance structures can anchor long-term commitments to conservation and social equity. These measures, collectively, would help the Amazon break from its extractivist legacy and secure a future in which biodiversity conservation aligns with local welfare gains. Ultimately, success will depend on the region’s ability to harness its biodiversity not merely as a raw export commodity but as a foundation for knowledge-intensive, inclusive, and locally owned economic pathways.

## Ethical Statement

This study does not contain any studies with human or animal subjects performed by the author.

## Conflicts of Interest

The author declares that he has no conflicts of interest to this work.

## Data Availability Statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

## Author Contribution Statement

**Daniel Silva:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing.

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