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# Corporate Power in the Bioeconomy Transition: The Policies and Politics of Conservative Ecological Modernization in Brazil

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**Abstract:** The bioeconomy transition is a double-edged sword that may either address fossil fuel dependence sustainably or aggravate human pressures on the environment, depending on how it is pursued. Using the emblematic case of Brazil, this article analyzes how corporate agribusiness dominance limits the bioeconomy agenda, shapes innovation pathways, and ultimately threatens the sustainability of this transition. Drawing from scholarship on power in agri-food governance and sustainability transitions, an analytical framework is then applied to the Brazilian case. The analysis of current policies, recent institutional changes and the case-specific literature reveals that, despite a strategic framing of the bioeconomy transition as a panacea for job creation, biodiversity conservation and local development (particularly for the Amazon region), in practice major soy, sugarcane and meatpacking conglomerates dominate Brazil's bioeconomy agenda. In what can be described as conservative ecological modernization, there is some reflexivity regarding environmental issues but also an effort to maintain (unequal) social and political structures. Significant agribusiness dominance does not bode well for smallholder farmers, food diversity or natural ecosystems, as major drivers of deforestation and land-use change (e.g., soy plantations, cattle ranching) gain renewed economic and political stimulus as well as greater societal legitimacy under the bioeconomy umbrella.

**Keywords:** agriculture; bioeconomy; agri-food systems; sustainability transitions; power relations; biofuels; Amazon; soy; sugarcane; value chains



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## 1. Introduction

A transition from a largely fossil-based to a renewable bio-based economy (a bioeconomy) has been increasingly seen as an imperative worldwide. Most global climate scenarios for staying under a 1.5 °C or 2 °C mean temperature increase foresee increased bioenergy use [1]. Climate change mitigation is, therefore, a key rationale behind bioeconomy promotion, but not the only one. Marine plastic pollution, too, reveals the urgent need to shift away from non-biodegradable goods and towards a circular economy based on renewable resources. Circularity, in this regard, includes adding value to by-products and reducing waste [2]. A question often left unasked, however, is who rules the circle. While most studies address the environmental and economic dimensions of circular bioeconomies, their social and political aspects have continuously been identified as a research gap [3].

Agri-food systems worldwide—understood as the entirety of supply chains, processing and retailing stages "from farm to fork"—have become increasingly consolidated over the past decades [4,5]. The bioeconomy, being significantly built on top of such systems, does not emerge over a level playing field; rather, the bioeconomy mostly adds to pre-existing agricultural and forestry sectors [6]. The novelty lies primarily in the new applications that such biomass starts having or in new value chains being created, while ideally also in the displacement of conventional fossil-based goods (e.g., fuels, plastics, lubricants). Bioeconomy proponents frequently hail the potentials for creating jobs, conserving biodiversity, and the overall social and environmental good that such a transition

can spur [7–10]. Yet, it is fundamental not to take such ideal scenarios for granted, as power imbalances and vested interests can lead the bioeconomy onto tortuous ways.

This article explores some usually underexposed political dimensions of the bioeconomy transition. In particular, it assesses the role of power in steering bioeconomic development pathways to date, using Brazil as an in-depth case study. Political and economic power, notably from corporate agribusiness, largely shape the global agri-food system as we know it. Several studies have detailed how powerful actors broadly set agri-food agendas [11,12], mold policy incentive structures [13,14], establish dominant patterns of agricultural production (including the pervasive use of toxic chemicals such as glyphosate pesticides) [5], and broadly influence dietary patterns, food availability and consumer preferences [15]. These issues are critical not only from the perspective of democracy but also of sustainability, as corporate dominance limits governance agendas as well as shapes technological and innovation pathways [16].

The bioeconomy, nevertheless, despite being built mostly over and from such a consolidated agro-industrial system, is often approached gleefully, with its ample goodness assumed at face value [7,17]. Yet it is key to unpack how actors have been steering its development so far, off certain pathways and onto others, and the various ways power is used to effectively govern the bioeconomy. That means going beyond merely investigating the use of the concept of bioeconomy as a "master narrative" [18] to also assess the practices linked to it, i.e., policies coming now under its aegis and the concrete sectors that currently represent the bioeconomy's de facto building blocks. As we shall see, while creating some environmental benefits (notably from fossil fuel replacement), and despite continuous talk of its potential for poverty alleviation and native biodiversity valorization, the Brazilian bioeconomy remains primarily anchored on large sugarcane, soy and cattle agroindustrial conglomerates—major drivers of deforestation, other ecological impacts, and social exclusion [19–21]. How that dominance is achieved (and its workings) needs to be understood if such a pathway is to eventually change towards sustainability.

Based on a comprehensive review of policies, government reports, and specific literature on Brazil (in English and Portuguese), this analytical article is structured as follows. The next section develops a conceptual framework to study power manifestations in bioeconomy governance. It draws from work on the political economy of agri-food systems as well as scholarship on power in sustainability transitions. Section 3 analyzes Brazil's bioeconomy to date, reviewing its latest developments. Section 4 examines how different forms of corporate power have been used to steer the agenda, and Section 5 discusses the broader implications of that for the bioeconomy and sustainable development. Finally, Section 6 concludes the article with its key points and recommendations for further research.

## 2. Assessing Power in the Bioeconomy Transition: A Conceptual Framework

Although transition studies long remained focused on economic and technological dimensions, political interrogations have gained growing traction [22,23]. Analysts have observed that the governance of sustainability transitions does not escape the grips of politics; rather, their governance designs get embedded in pre-existing political conditions and often risk being captured by powerful actors [22,24]. Often, there are not just one but multiple possible transition pathways and competing visions, including of the bioeconomy and what it should accomplish [25,26]. Either out of self-interest, divergent values, different worldviews or any combination of those, different actors or advocates for particular pathways pursue distinct "policy beliefs." That refers to actors' contrasting visions of how the institutional setting should look like, and therefore how it should change or not change [27,28]. As such, there is a critical—and not to be overlooked—political element to governing bioeconomy transitions.

A key concept for such political analyses is power. Power is a multi-faceted concept that lacks a consensual and unambiguous definition. It has multiple dimensions. The most straightforward one is that of "power to", that is, the ability to get things done—or, more specifically in a governance setting, "*the capacity to mobilize resources and institutions to*

*achieve a goal*" ([22], p. 516). However, it may not be suitable to regard power in an atomistic way, as if individual actors were isolated entities imbued with more or less power. Social and political contexts are made of relations, including power relations. That is where the dimension of "power over" comes to the fore, i.e., the ways through which one actor or social group can exert dominance over others. Some authors also speak of "power with", emerging from forms of cooperation that increase the means and possibilities of the ones involved [29].

In addressing power in the specific context of sustainability transitions, it is important to regard who gets empowered and who becomes disempowered through (the pursued) change [22]. In other words: who wins and who loses, whose capacities are increased or diminished. Understanding these processes is critical not only because we live in a world of marked inequalities that tend to be reproduced over time, but also because sustainability—by definition—is to entail improvements in social equity [30,31]. The bioeconomy is regularly presented as a socially benign transformation that can attain social as much as broader environmental good [7,8,32], yet it is pivotal to analyze the facts under that claim.

One framework identifies three forms of power in transitions: (a) innovative power, or the capacity to create new resources (e.g., technical innovations); (b) transformative power, or the ability to change institutional settings (changing policies, obtaining new incentives, etc.); and (c) reinforcive power, the capacity to reproduce—and, eventually, reinforce—existing institutions [22]. In a way, they all are framed as instances of "power to." However, the latter two also have clear dimensions of "power over", as control over agendas—to either reinforce or change existing institutions—denote a level of political dominance over other actors and competing advocacy. Those are different *ends* that may be sometimes pursued via the same type of means (e.g., lobbying for self-serving policy changes), and which change resulting configurations of who gets (further) empowered or disempowered in transitions [22].

An alternative three-part framework—building on a long tradition of power studies—focuses on the *ways* corporate power is exercised in agri-food governance [11]. First, *instrumental power* is when an actor mobilizes resources to directly accomplish a goal or impose its will over others, such as through political lobbying. Simply put, "*A has power over B to the extent that he can get B to do something that B wouldn't otherwise do.*" ([33], p. 203). However, that does not capture the exercise of power in the form of agenda-setting—what some authors refer to as *structural power* [11]. This "second face of power" builds on a longstanding observation that actors can also exert dominance by constraining others' range of choices and options, including limiting public or policy debates. As some have put it:

> "*[P]ower is also exercised when A devotes his energies to creating or reinforcing social and political values and institutional practices that limit the scope of the political process to public consideration of only those issues which are comparatively innocuous to A. To the extent that A succeeds in doing this, B is prevented, for all practical purposes, from bringing to the fore any issues that might in their resolution be seriously detrimental to A's set of preferences.*" ([34], p. 942)

Finally, a third face of power relates to how actors may shape the very views and wants of others, securing their consent and, thus, pre-empting political competition. This form of power encompasses various socially induced modifications of beliefs, attitudes or views—what some of the literature treats under the concept of *influence* [35]. As it has been argued:

> "*A may exercise power over B by getting him to do what he does not want to do, but he also exercises power over him by influencing, shaping or determining his very wants. Indeed, is it not the supreme exercise of power to get another or others to have the desires you want them to have—that is, to secure their compliance by controlling their thoughts and desires?*" ([36], pp. 23/27)

This more subtle form of power is extensively studied in the neo-Gramscian political science tradition, concerned with how actors may achieve hegemony through consent rather

than coercion [37,38]. Through influential discourses, understood as ways of framing and apprehending the world, certain actors may come to shape what gets viewed as common sense and benefits from social legitimacy ([39], p. 9). That is regarded as *discursive power*, and some authors note how agribusiness corporations routinely use it to frame contentious issues (e.g., genetically modified organisms) favorably in the public discourse—which may, eventually, affect policymaking, regulations, and incentives [11,15]. Therefore, these various dimensions of power should not be seen as separate but intertwined. Preponderance and domination are usually achieved through a combination of the above, "*through an alignment of material, organizational and discursive formations which stabilize and reproduce relations of production and meaning*" ([40], p. 806).

Failure to address such a politics almost invariably is to the benefit of dominant actors, which tend to more or less silently reproduce and reinforce their privileged positions. Research, therefore, can "*denaturalize dominant constructions, in part by revealing their connection to existing power relations*", whereas researchers can work "*to unmask these ideational structures of domination and to facilitate the imagining of alternative worlds*" ([41], p. 398).

Figure 1 illustrates this analytical framework based on the reviewed literature. The three concentric circles—or the range of such power relations—suggest the width of work of that power dimension. While the first is very specific to within a given economic sector and its materially related environs, the second pertains to a whole set of policy and politics surrounding the sector (in the bioeconomy's case, land-use policy, agricultural policy, energy policy, etc.), while the third theoretically reaches out to everyone from whom recognition and support are ultimately sought. This broadest reach frequently may be equated to public opinion and societal mores, which may in turn create social momentum for particular agendas, stir consumer behavior, and create political will towards one's desired goals. In other words, that is also about securing legitimacy, understood as "*a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions*" ([42], p. 574). Working to not only conform to but also mold those broad social perceptions is therefore crucial, as actors can then enjoy a so-called social license to operate or to pursue one's (private) agendas under public approval [43].

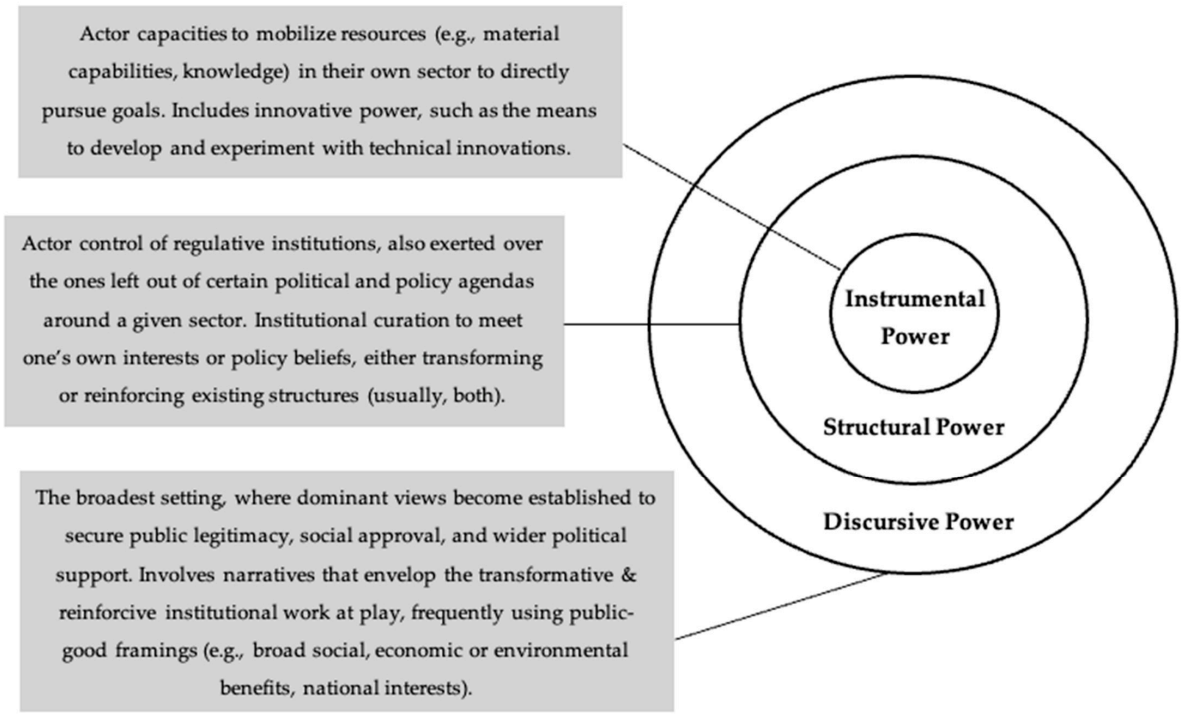


**Figure 1.** The range of power relations in governance.

## 3. Brazil: From Ethanol to the Bioeconomy

The bioeconomy has become a new framing concept rapidly gaining momentum in Brazil. Public and private actors linked to agribusiness, in particular, have warmly embraced it. Although the country lacks a unified bioeconomy strategy (as the EU and various European countries for example have), Brazilian scientists, government agencies and the business sector—notably well-established agroindustries such as the sugarcane one—have readily adopted the new umbrella term [9,17,44]. In a sense, the bioeconomy has been Brazil's prime way of engaging with ecological modernization, i.e., economic and technological modernization that seeks to address perceived environmental issues [28,45].

The bioeconomy is not an unambiguous concept—it is a field where multiple views compete, not the least over its definition [26]—and in Brazil it has been utilized quite liberally. On the one hand, some Brazilian scientists and government actors have utilized the term to refer mainly to novel bio-based value-chains, especially those designed to deliver goods or services that can replace fossil-based products [9,44]. A slight variation of that view focuses on biodiversity valorization, "biorefining" and value chain creation more generally (irrespective of whether new goods replace fossil-based products or not), particularly for the Amazon region [10,32]. On the other hand, however, some government and agribusiness actors refer to the bioeconomy in its broadest possible sense, to include not only well-established biofuel industries but *all* agricultural production [46,47]. Such an all-encompassing understanding is perhaps indicative of the appeal this new term has had among Brazilian agribusiness and shows its eagerness to frame itself under the bioeconomy umbrella.

In this article, the bioeconomy is regarded as all bio-based economic sectors beyond food and other conventional agricultural production (e.g., fibers, tobacco). This scope avoids overstretching the concept, while at the same time not limiting it to only the newest markets embraced after the term came in vogue. For bioenergy is a key—and still dominant—bioeconomy sector *avant la lettre*. As the following sections will show, it is primarily for bioenergy that crops traditionally regarded as food crops have been diverted, although their multiple uses have been expanding rapidly.

### *3.1. Bio-Based Add-Ons Have Sustained and Boosted Established Agribusiness*

Brazil is the world's second-largest biofuel producer after the US and an active promoter of the bioeconomy worldwide. A long large-scale commercial experience with biofuels—with ethanol blending mandates being first introduced in the 1930s—and efficient agroindustries highly linked to the government have made Brazil the only country where more than 10% of the energy used in the transport sector comes from renewables [48]. Such an agro-efficiency, however, often obfuscates the power workings behind biofuel promotion in Brazil. Although the country boasts significant biodiversity, two Asian crops—sugarcane and soy—currently account for the bulk of the Brazilian bioeconomy. Most of the remainder, in turn, originates from animal fats that are by-products of large meatpacking industries. As such, there may be essential differences between the currently portrayed image and discourse of an Amazonia-friendly biodiverse bioeconomy and what a reality check can show.

Being the most established bio-based sector (aside from food and other traditional crop uses), biofuels dominate the bioeconomy in Brazil—as elsewhere. Sugarcane-based ethanol, used as a gasoline additive or replacement, represents 85% of the country's biofuel output [49]. Corn, which in Brazil is normally intercropped with soy, has nevertheless started also being used for ethanol production to "offload" fast-growing supplies and prevent a market glut that could depress corn prices [50]. Biodiesel, which replaces fossil diesel, in turn is chiefly produced from soybean oil (61%) or beef tallow (10.3%), followed by pork and chicken fat originating mostly from large meatpacking companies that in turn use soymeal for animal feed ([49], p. 14). One can see, therefore, how bioeconomy production to date—represented at commercial scale essentially by bioenergy—builds neatly on pre-existing agroindustrial conglomerates. In total, biofuel production claims as

much as 37% of Brazil's vegetable oil supply and, on average, 65% of all its sugarcane, to then meet 23% of the country's transport energy needs ([51], p. 82).

Given that sugarcane is increasingly used also for electricity cogeneration, by processing the crushed remains (bagasse) after the sugar juice has been extracted, one can see that—despite its name—the crop has become far more an energy crop than a sugar crop in Brazil. Grown mostly in large-scale estates, some of them inherited and expanded from past centuries after the Portuguese introduced the crop to the country in 1530, the sector has deftly found new uses and downstream markets for it. The sugarcane agroindustry has navigated socio-technical changes—and, as we shall see, often actively promoting such changes—without significantly losing its power position but rather gaining further economic prominence in Brazil. In line with technological upgrading, however, it has mostly done away with manual laborers. While strenuous or even forced labor remained commonplace in the Brazilian sugarcane sector until at least the 2000s [52], now mechanized harvesting predominates.

Soy, in contrast, is a much newer "boom crop"—that is, a rapidly expanding cash crop embraced mostly for international markets ([53], p. 451)—that has made inroads across South America since the mid-20th century. If global soy production grew ten-fold between 1960 and 2016, today more than half of it originates from that continent [54]. Some speak of a process of increasing "soyzation", whereby soy has been replacing other land uses and gaining ever more economic relevance at the expense of other sectors in producing countries (notably Argentina, Brazil and Paraguay) [55]. In Brazil, the area dedicated to soy cultivation has been skyrocketing, having more than tripled—from 11 million hectares to over 36 million hectares—only between 1990 and 2020, largely at the expense of native ecosystems and smallholder farming [20,56]. Its biggest market is animal feed industries, primarily in China and Europe (which respectively import 68% and 13% of all Brazilian soy) [57]. Yet the bioeconomy, too, has offered a supplementary pull for the soy sector through ever-higher biodiesel blending mandates (see Section 4).

Table 1 shows how much of the supplies of some key agricultural commodities are destined to make biofuels in Brazil compared to their global averages. It indicates how some agroindustries have become deeply vested in bioeconomy promotion. Besides increasing market demand for products whose prices sometimes become undesirably low for the industry, the bioeconomy widens the range of possible downstream markets. That, in turn, grants producers the flexibility to choose what is most profitable and, sometimes, the possibility to switch back and forth according to price signals—as sugarcane mills routinely do between sugar and ethanol [6,58]. Some suggest such sectors have gone beyond single value chains to develop "value webs", where single crops lead to multiple interrelated strings (e.g., sugarcane-based electricity from bagasse being used to power ethanol production) [59].

**Table 1.** Agricultural commodity utilization for the Brazilian and global bioeconomies.

| Agricultural Commodity Supplies | Brazil | Global Average (2016–2018) |
|---|---|---|
| Vegetable oil | 37% | 12.5% |
| Sugar | 65% | 21% |
| Coarse grains (corn and other cereals excluding wheat and rice) | 4.5% * | 13.4% |

Data source: [49,60]. * This estimate refers exclusively to corn supplies, increasingly used as a secondary ethanol feedstock in Brazil [61].

Overall, biomass sources (including liquid biofuels and sugarcane electricity cogeneration) have met as much as 19% of Brazil's total energy consumption ([49], p. 27). Notably, bioenergy's growing relevance also represents an expanding share of private suppliers in a setting previously dominated by state-controlled energy companies. Energy supplying, therefore, is becoming increasingly privatized, even if to a degree those market shares are also being taken from transnational oil companies operating in Brazil. At any rate, given

the significant consolidation of the sugarcane, soy or meatpacking sectors in the country, it can be said that its energy transition takes place essentially between giants—from the usual energy giants to agribusiness ones.

### *3.2. Opening Moves of the New Bioeconomy: In Whose Benefit?*

As the bioeconomy broadens, there is growing momentum for expanding the realm of applications and products from the dominant agribusiness crops. Sugarcane has been increasingly used to produce renewable (though so far usually not biodegradable) polymers for so-called "green plastics." There are also prospects for using the crop to make solvents, lubricants, enzymes, cosmetics, and pharmaceutical products. The idea is not only to replace industrial inputs currently made from oil but generally to create novel and high value-added goods [59]. As it has come to be described, that is the idea of applying a "biorefinery" concept to agricultural crops, that is, extracting multiple components that can supply several markets [6].

Meanwhile, there is a growing appetite for widening Brazil's bioeconomy resource base to include, notably, Amazonian biodiversity as a basis for (bio)technological development and value chain creation [32]. A new landmark Biodiversity Law (13.123/2015) has paved the way for increased use of native flora and fauna by industry sectors (e.g., cosmetics, pharmaceuticals) while creating hurdles for public research institutions and less resourceful local actors. High entry costs in complex bureaucracy with technical and legal requirements have disproportionately impacted local actors such as indigenous communities or smallholder farmer associations vis-a-vis well-resourced corporate ones [62]. The number of private companies authorized to commercially utilize native Brazilian biodiversity under the new framework quintupled from 42 before the 2015 law to over 200 by 2018, as most stakeholders agree industry actors have been the new law's primary beneficiaries [63]. This growing dynamic, of course, raises fears that the bioeconomy may simply promote further corporate-led commodification of nature and accumulation by dispossession in the Amazon [64].

An additional piece of legislation has been a new framework in place since 2021 on payments for environmental services (Law 14.119/2021). Problematically, it requires only a self-made declaration into the online Rural Environmental Registry (*Cadastro Ambiental Rural*—CAR) as sufficient demonstration that one is supposedly entitled to the land and, therefore, to sell its environmental services (e.g., carbon credits). Although the CAR system has been designed for land-use change monitoring, in practice private landholders' entries have often dubbed as proofs of land tenure [65]. These entries have already been used for obtaining bank credit and, thus, the system has been conducive to pasture expansion at the expense of forests [66]. Overlapping claims have also been commonplace, with individual farmers and companies often utilizing CAR declarations to "grab" lands by registering as theirs plots that are under customary community use or even within protected areas and indigenous territories [20,65,67]. Such conflicts have been particularly salient in the Amazon, where traditional communities abound, tenure security is fragile, and land grabbing is rampant [68]. Environmental authorities are supposed to analyze and filter out undue claims, but deadlines for doing so have been continually extended over the years. In practice, as with regular amnesty to land grabbers (*grileiros*), Brazilian governments have continually shown leniency toward undue claimants and their utilization of CAR entries as suggestive of land rights in the meanwhile [65].

Despite a narrative of inclusive and sustainable development, Brazil's bioeconomy—old and new—seems therefore fit for dominant agribusiness actors. While indigenous people and other traditional communities have been recognized as the best in conserving forests in Latin America [69], it is unclear how they may gain or at least not experience further encroaching and dispossession. The following section analyzes how power workings of various kinds have shaped the Brazilian bioeconomy this way.

## 4. The Brazilian Bioeconomy and Its Powers That Be

### *4.1. Instrumental Forms of Power*

Corporate agribusiness's instrumental power has manifested itself in at least three ways to shape Brazil's bioeconomy to date—both its policy agenda and concrete practices. First, agribusiness has abundantly used its vast material capabilities (e.g., financial resources, control over relevant technology) to expand its activities. That includes widening their market portfolio by pursuing technical innovations that suit their interests (i.e., novel goods produced from the crops they control). Power is also manifested—and increases—through sheer area expansion. Investments in soy's highly consolidated sector tripled its cropland area in Brazil between 1990 and 2020. That means that more of the country's land (and, at times, water) resources fall under an agribusiness that has no place for smallholders due to economies of scale requirements and where a handful of traders control the bulk of the market [20]. Corn, intercropped with soy, has accompanied that expansion and quickly become a sizeable ethanol feedstock [70]. Corporate agribusiness therefore utilizes its already-existing economic prowess, using multiple forms of "power to" (e.g., financial resources, control over land, technology) to get things done at scale and rapidly *be* the bioeconomy.

If, on the one hand, agribusiness actors disproportionately have the instrumental power to get things done on a practical level due to their economic prowess, on the other they have been stimulated by the bioeconomy, in a positive feedback loop [28,71]. Continual expansion means the economic power base of corporate agribusiness grows. That, in turn, allows for increasing say and leverage over agri-food and (other) biomass-based systems. For instance, while Brazil's sugarcane area has not expanded as much as soy's, it still doubled in the late 2000s during the country's latest ethanol boom [28]. The sector also continuously succeeds in conquering new markets (e.g., electricity) and developing new applications (e.g., cane-based "green plastics") [17,59]. In short, agribusiness uses its amassed power to create self-serving technological and innovation pathways, repeating in the bioeconomy what it does in the broader agri-food realm [16].

Second, besides using its material capabilities directly to expand its economic activities, agribusiness as an interest group has long had Brazil's most powerful parliamentary representation, too, and counts on notoriously successful lobbying [12,72]. Helping large agroindustries such as the sugarcane one has always been a key reason for the Brazilian government's creation of captive biofuel markets through blending mandates [28]. Such a form of political lobbying is a typical example of instrumental power use in agri-food governance [11], and its results yet another noxious effect of corporate dominance [16].

It is important to observe, however, that not all political lobbying relevant to shaping the bioeconomy relates specifically to it. Plenty of lobbying molds Brazil's broader agribusiness practices and, thus, shapes its bioeconomy production base indirectly. That includes, among others, land use policies that disproportionately benefit corporate agriculture [72,73] and lax rules on pesticide utilization suited for industrial monocultures [74]. Crucially, it also includes efforts to hinder collective land rights recognition, such as in indigenous territories that could block agribusiness expansion—as in the case of the sugarcane industry and the Guarani-Kaiowá people in Mato Grosso do Sul State [21].

The third prevalent form of instrumental power shaping Brazil's bioeconomy is corporate agribusiness's capacity to coercively displace competition that could eventually pursue alternative development pathways. Agribusiness's direct power over other actors is not limited to their sway over politicians or policymakers, it also affects the Judiciary. Even if often unconstitutionally, law enforcement is regularly used to evict communities from disputed lands and to combat rural social movements that mobilize local resistance [75]. Between 2019 and 2020, a federal investigation arrested numerous judges that had colluded with large-scale farmers to favorably address land conflicts in the agricultural frontier region of Matopiba—an area of aggressive expansion of soy, Brazil's main biodiesel feedstock [76].

Besides manipulating the state apparatus to serve their interests, large agribusiness sometimes relies also on extra-legal—when not illegal or outright criminal—forms of coercion. That includes the forceful appropriation of land and water resources (land and

water "grabbing") as well as intimidation and violence against local communities, rural social movements, or traditional populations in frontier regions [20]. Even if they are not always acknowledged as a form of power in governance, such direct actions in the end are critical for how agri-food systems—and the bioeconomy—become shaped.

While far from being an exhaustive list, Table 2 presents some key bioeconomy policies that have provided large agroindustry sectors with tax cuts, subsidized credit, public funding for R&D, biofuel blending mandates, as well as laws that facilitate business-controlled commodification of nature. As we shall see, those policies have sometimes responded to global trends (e.g., oil price hikes in the 1970s and 2000s, besides changing dynamics in international sugar markets in ethanol's case). Yet, *how* Brazil responded to such challenges—and who benefits from the chosen responses—are, in part, what indicates who holds power and how that power is manifested.

**Table 2.** A summary of Brazilian policies for bioeconomy promotion.

| Year | Policy | Description |
|---|---|---|
| 1931 | E5 on imported gasoline | Mandatory blending of 5% of sugarcane-ethanol in all imported gasoline |
| 1938 | E5 all-across | E5 blending mandate extended to all gasoline, imported or not |
| 1971 | National Program of Sugarcane Improvement (*Planalsucar*) | Public R&D funding for sugarcane yield improvements |
| 1975 | Pro-Alcohol ethanol program (with E22) | Public funding for ethanol distilleries; mandatory 22% blending of ethanol in all gasoline |
| 1979 | Pro-Alcohol (Phase II) | Fiscal incentives for the automobile industry to produce cars running on 100% ethanol (E100) |
| 2003 | Flex-fuel cars | Fiscal incentives for the production and purchasing of cars able to run on any mixture of ethanol and gasoline |
| 2004 | National Program on Biodiesel Production and Use (*PNPB*) | Phase-in of mandatory biodiesel blending (B5 by 2013). Social Fuel Seal created as a certificate of smallholder inclusion, incentivized through preferential procurement and additional fiscal benefits. |
| 2006 | National Agroenergy Plan | Framework announcing public biofuel R&D and broad policy goals |
| 2009 | Sugarcane zoning policy introduced | Restriction of public credit eligibility to sugarcane cultivation outside ecologically sensitive biomes (e.g., the Amazon) |
| 2009 | Social Fuel Seal requirements hardened | Farming contracts between smallholder suppliers and biodiesel companies require approval by some rural worker union or collective organization |
| 2014 | New biodiesel blending mandates | Phase-in timeline for higher blends (B10 by 2018) |
| 2015 | Biodiversity Law (13.123/2015) | Legal framework for R&D and economic use of Brazilian biodiversity and its genetic resources |
| 2017 | National Biofuels Policy (*RenovaBio*) | Creation of a "decarbonization credits" market linked to carbon intensity reduction targets in Brazil |
| 2018 | New biodiesel blending mandates | Phase-in timeline for higher blends (B15 by 2023) |
| 2019 | Sugarcane zoning policy abolished | End of the area-based credit restrictions for sugarcane |
| 2019 | Social Fuel Seal requirements softened | Larger cooperatives become eligible as suppliers; end of the approval requirement by a rural worker union |
| 2021 | Payments for Environmental Services Law (14.119/2021) | Legal framework allowing payments for environmental services *even in untitled lands*, based on self-declaratory entries on the CAR registry |

Sources: [28,77–79].

### *4.2. Structural Power*

Structural power arguably emerges as an extension of what agribusiness can do through instrumental power. It then acquires an additional, analytically distinct facet. For instance, agrochemical companies that put together "technology packages" involving genetically modified seeds, fertilizers and pesticides keep great control over how crops such as soy and corn are produced [5]. Their initial instrumental power in creating those innovations then becomes also structural power in those sectors.

In Brazil's bioeconomy governance, agribusiness's structural power manifests itself in at least two complementary ways: (a) control over public institutions, building on path dependencies; and (b) agenda setting of overall agricultural development and specifically on bioeconomy pathways. Such an agenda-setting power grants corporate agribusiness the ability to exclude unwanted issues from sustainability debates, effectively preventing them from being addressed or even acknowledged in certain governance venues.

#### 4.2.1. Agribusiness's Hold of Public Institutions

The policies displayed in Table 2 reveal how the Brazilian state has actively promoted biofuels (as the most developed bio-based sector) over three broad periods: the 1930s and the 1970s, before a resurgence in the 2000s' under a sustainability rationale. While part of the logic from the beginning was to reduce Brazil's oil import dependence and expenditures, those policies have also been mechanisms to support large agribusiness with public funding, credit, R&D investments, and new markets.

While rhetorically the emphasis is usually placed on the (globally benign) fossil-fuel replacement aspect of these policies, the adoption of sugarcane-ethanol, for one, has been equally—if not more—about supporting the sugarcane agroindustry in the face of low sugar prices and other market challenges [28,77,78]. The sugarcane sector had landed elites that for centuries enjoyed economies of scale and a privileged political position in the country. Such economies of scale and path dependency were associated with a measure of control over public institutions that has long made sugarcane Brazil's "favorite" feedstock, to the detriment of smallholders growing other crops [80]. Those public institutions then were transformed accordingly to create new incentives and structures that reinforced large agribusiness's hold over the country's ethanol sector and nascent bioeconomy. Once sustainability concerns came to the fore in the 2000s, a large sugarcane-ethanol sector was already prominent and could boast at least thirty years of commercial production experience. Similarly, once a biodiesel policy was introduced in 2004, the established soy sector managed to claim nearly all of the newly-created captive market despite the government's alleged smallholder inclusion goals.

Large agribusiness would become further empowered and, in time, support Brazil's growing shift to the right of the political spectrum [81,82]. In 2016, after President Rousseff's controversial impeachment, a new government promptly abolished the smallholder-oriented Ministry of Agrarian Development and, thereby, substantially cut funding and support for small-scale agriculture [83]. Corporate agribusiness would essentially crowd out those weaker players from Brazil's bioeconomy agenda. Since 2019, rule changes have allowed commercial soy-grower cooperatives to qualify as "family farmers" and thus benefit from the Social Fuel Seal policy originally conceived for smallholder inclusion and rural poverty alleviation [28]. In line with this and growing agribusiness representation in the federal government, recent government publications then started taking corn-and-soy endeavors from wealthy landholders as examples of biofuels originating from "family agriculture" ([70], p. 66). If anything, as a result of power feedback loops, consolidation in the hands of corporate agribusiness has only increased with Brazil's bioeconomy.

#### 4.2.2. Setting the Agenda: What to Look at and How

Agenda-setting generally has two levels: (1) the definition of *what* comes onto the agenda and what is left out; and (2) questions of "attribute salience", i.e., *how* issues and actors are presented, which aspects are emphasized, and which ones are downplayed

or obfuscated [84]. A broad literature on issue-framing points out how situations get recognized as problems only when successfully framed as such [85,86].

By pushing certain socio-economic and environmental issues out of Brazil's bioeconomy agenda, corporate agribusiness has been able to portray itself as sustainable and to offer its preferred bioeconomy pathways as a desirable option. Even though the bioeconomy agenda generally has sustainable development as a defining rationale and its very *raison d'être*, there are conspicuous absences. For instance, issues of agrobiodiversity loss, unsustainable water use by large-scale agriculture, land rights violations or widespread pesticide contamination—to name but a few—all are salient topics that nevertheless do not usually appear in Brazil's bioeconomy discussions [9,46,47]. For instance, the National Industries' Confederation flagship report on the bioeconomy extols sugarcane's multiplicity of products and boasts about the copious economic potentials from Brazil's biodiversity without ever acknowledging that monoculture expansion is a crucial driver of deforestation and overall biodiversity loss in the country [17].

In the same vein, as Brazil becomes the world's largest user of pesticides, it utilizes an abundance of known carcinogenic substances forbidden in Europe and other parts of the world. Yet, pesticides such as paraquat and other highly toxic substances have been applied on an increasingly large scale and gain speedy adoption in Brazil due to agribusiness's sway over the approval process [74]. Environmental and human contamination from increasing pesticide use in soy, corn and sugarcane crop fields are significant [20], but they are not acknowledged as a sustainability issue at the heart of a bioeconomy largely based on those monocultures. Arguably, the invisibility conferred to some of these environmental issues may suggest a level "solution aversion" in those dominant players, as their acknowledgement could bring the whole mainstream industrial agriculture into question [87].

Novel bioeconomy strands, too, seem poised to benefit business disproportionately. The 2015 biodiversity law empowering well-endowed industries instead of local communities is a case in point, and a look at the ways the CAR system has been used—and may come to be used, to draw payments for environmental services—is revealing of who is set to win the most and who may lose. As such laws privilege private land tenure over indigenous territory recognition or other collective land titling, the monetarization of "environmental services", and business-oriented rules for biodiversity use, they create a legal framework that secures disproportionate structural power to corporate actors. These actors indeed have eagerly benefited from further commodification of nature and control over natural resources, as seen. Meanwhile, indigenous and other Amazonian communities not only have been mostly left out of what so far has essentially been an effort to "mine the ecosystem" for more commodities, but they also stand to lose as these legal frameworks linked to bioeconomy promotion facilitate accumulation by dispossession in their environments [64,65].

Such a structural power of agribusiness in Brazil involves not only public but also private governance instances such as the various multi-stakeholder initiatives related to agriculture. Certification mechanisms such as the Round Table on Responsible Soy (RTRS) or Bonsucro (formerly Better Sugarcane Initiative) essentially represent agroindustry interests [88]. Even the more encompassing multi-stakeholder initiatives such as the Soy Working Group or the Cerrado Working Group, composed of environmental NGOs and commodity traders to govern agribusiness's "sustainable" expansion, tend to be busy mostly with the promotion of "best practices" and voluntary zero-deforestation commitments [89]. While that is often taken to represent "sustainable agriculture", this framing is deceptive as a plethora of environmental issues—and, thus, industrial monocultures' broad unsustainability—remain unchecked [90].

These various forms of structural power result in the exclusion of unwanted stakeholders, thorny issues, and competing narratives or alternative development pathways [20]. While endorsing and boosting conventional large-scale agriculture, this mainstream bioeconomy keeps alternative ways of rural development—as well as the local stakeholders that

advocate for them—out of the agriculture sustainability debates and institutional spaces where such debates are held [89,91]. Through structural power, corporate agribusiness strategically makes local stakeholders, their concerns, views and visions invisible, even in the venues nominally dedicated to sustainability.

### *4.3. Discursive Power*

As Gramsci put it, certain actors' political preeminence relies not only on material dominance but also on their portrayal as "*intellectual and moral leadership*", from which emerges social legitimacy and, ultimately, consent ([92], pp. 182, 269). In Brazil, two key tactics underscore corporate agribusiness's discursive power over diverse social actors and the public at large: the portrayal of a corporate-controlled bioeconomy as a desirable, environmentally friendly endeavor; and the framing of "Brazilian" agribusiness as national champions whose successes and setbacks are tied to that of Brazil itself. As we shall see, the playing out of these two tactical discourses works to multiple effects and, eventually, also coalesce around a grand narrative of the bioeconomy as *the* way for Brazil to become a "great power".

Agribusiness in Brazil has a long history of associating its interests with that of the country in the public mind. Efforts, for instance, to collate agribusiness development with Brazilian pride, identity and self-image date as far back as the 1930s, with the promotion of banana plantations at the times of the famed "banana republics" [93]. It is not possible to understand Brazil's mainstream discourse around the bioeconomy without situating this in a longstanding effort by large agribusiness to earn public legitimacy, broad political support, and a social license to operate. On the backdrop of bioeconomy promotion is an overall framing of Brazil as a global protein breadbasket and, increasingly, also a supplier of other bio-based goods and (salable) environmental services [17]. Under a globally dominant neo-Malthusian food security narrative, the country is to fulfill a supposedly natural vocation as a major agricultural producer and meet the food demands of a growing world population [94,95]. In the minds of an increasingly evangelical popular base in Brazil's countryside, that operates as the country's "calling" to expand production with quasi-missionary zeal [96].

In the face of growing concerns about the "reprimarization" of Brazil's economy in recent years (that is, its growing economic dependence on agriculture and mining sectors in tandem with significant deindustrialization [97]), agribusiness has also been deft to portray itself as technologically advanced. In a broadly popular ongoing marketing campaign since 2019, the agricultural sector has portrayed itself as an "industry" to be regarded as the "wealth of the nation;" with prime-time commercial ads showing large-scale production, corporate agribusiness adopts a more informal shorthand—"agro"—and markets itself as being "tech", "pop", and "everything" (*o agro é tech*, *o agro é pop*, *o agro é tudo*) [98]. As such, a highly exclusive business group with considerable multinational capital poses as a national champion that should be the pride of Brazilians [99].

Environmental or human rights critiques hence become framed as outsiders' jealous attempts to undermine Brazil's development. Domestic NGOs who join that chorus are tarnished as a "fifth column" working for foreign interests. In Brazilian media coverage of international critiques against deforestation in Brazil—such as in the context of the EU-Mercosur trade agreement, which would see an increase in the exports of agricultural commodities from Brazil—it is routine for considerations to be made implying that, in truth, those are protectionist concerns and excuses due to fear of competition with the powerful Brazilian agriculture. While there may well be some truth to that, such a reasoning is tactically used to dismiss environmental critiques entirely [100]. Only "constructive" NGOs—which do not question the premises of Brazil's agribusiness expansion or bring thorny issues to the fore—are recognized as legitimate interlocutors and eventually welcomed in agri-food sustainability debates [89].

The bioeconomy strategically enters this setting as a way to boost both the "green" and the "high-tech" images corporate agribusiness wishes to confer to itself. As elsewhere

in Latin America, the sector puts forth an "economic imaginary" grounded on crop-based technological developments and value-added from agriculture [101]. The bioeconomy, in Brazil's case, provides it with particularly "green" hues due to a growing emphasis on the economic potentials of Amazonian biodiversity. It is seen as offering nearly endless potential for value-chain creation with genetic improvements on "wild" foods and the commercialization of novel products through biotechnology (e.g., enzymes, pharmaceutical components, cosmetics) [17]. As elsewhere, technological progress is conflated with overall societal improvements, and a future is envisioned where scientific innovation supersedes all social problems and conflicts [102]. Noticeably, the bioeconomy here has little to do with replacing fossil-based products and more with sheer bio-based economic development. Some Brazilian scientists have, for instance, put forth an ambitious "Amazonia 4.0" agenda to promote economic and technological upgrading in the region, using its vast biodiversity to engender a socio-economic transformation [32]. The Bolsonaro administration's Ministry of Agriculture has endorsed the initiative and often pays lip service to such a bio-based economic development [103], but espousing deforestation activities all the while [104].

As Brazil has been on international headlines due to its soaring deforestation rates that tarnish agribusiness reputation and threaten to close export markets (notably in Europe), the bioeconomy also becomes part of an effort to "green" its image. Part of the sector's hope is that the bioeconomy may help Brazil join the Organisation for Economic Co-operation and Development (OECD) and dispel European hesitations regarding the EU-Mercosur free-trade agreement [105]. Finally, this effort blends with nationalistic grandeur to harness further public support for agribusiness and agro-technology also within Brazil. Drawing from an article in *The Economist* (possibly for increased legitimacy, as if it were merely reiterating what others abroad are saying), the National Industries Confederation has proposed that "*with bioeconomy development, there is a unique opportunity for Brazil to become one of the world's great powers*." ([17], p. 77) (see also [106]).

Once again, the tactic is to stir a sense of national pride where Brazil's fate is governed by the wishes and whims of corporate agribusiness. As some authors put it, "*such promises and the expectations they generate are performative: they act to build consensus around a technological project; mobilize investment; enroll scientific, social, and economic actors; and construct a case for facilitative and supportive legislation*" ([102], p. 13). In Brazil's case, however, the bioeconomy's utopia of "*overcoming environmental, social, and economic challenges through biotechnological progress alone*" ([102], p. 12) includes also geopolitical achievements.

## 5. Discussion: Sustainable Development or Conservative Ecological Modernization?

Some authors have long noted that the bioeconomy, of which biofuels remain the leading sector to date, consists mainly of politically instituted markets. In other words, they are not markets that spontaneously arise out of consumer demand, but instead are created from "above" via directives, blending mandates, and other public policy determinations [107]. To a large extent, public policies have not only created such markets but also shaped them [28]. Some critics have, therefore, flagged the bioeconomy as "a political project" to reassert the interests of capital [102]. Other times, its expansion is rationalized as countries pursuing their national interests in an unregulated international space and sometimes with consequences beyond borders [108]. States have, indeed, been active—and some would say crucial—bioeconomy promoters worldwide [28,107]. Still, it is worth remembering that the state is neither an isolated entity nor a monolith; rather, the state usually expresses the will of competing interest groups and advocacy coalitions; it is an arena where some policy preferences become structured [109]. Therefore, understanding the inner workings of how bioeconomy politics takes place is of paramount importance.

Brazil's case shows a very supply-driven bioeconomy. Corporate agribusiness, amassing increasing land for a few "flex-crop" commodities (frequently at the cost of deforestation or smallholder displacement), mobilizes to develop more uses for them and thereby enjoy a wider variety of markets, greater demand, and better prices. The bioeconomy has therefore allowed such agribusiness actors to sustain and reinforce dominant positions,

becoming all the more resilient in the face of international price volatility. The sugarcane sector, for one, has achieved that by transitioning seamlessly from a primary producer of sugar to becoming mostly dedicated to agroenergy—while retaining and expanding on the significant economic and political weight it historically inherited. The intercropped soy-corn duo, too, even if to a lesser extent, has also found in the bioeconomy new markets that help those producers modulate commodity prices.

Growing economic prowess, in turn, translates into political and social influence, shaping government agendas and the public discourse. Brazil's biodiversity may be broadly used as window-dressing for the bioeconomy, but in practice largeholder crops dominate the sector. The regard for biodiversity conservation or social inclusion remains entirely aspirational, if not deceptive. Table 3 summarizes the power uses through which such a corporate agribusiness dominance has been accomplished.

**Table 3.** Uses of power in Brazil's bioeconomy.

| Power Typologies: Ends and Means | Instrumental | Structural | Discursive |
|---|---|---|---|
| Innovative | Technical innovations (e.g., biofuels, feedstock processing pathways, additional bio-products) | Institutional innovations for agenda-setting or privileged access to new markets or governance (e.g., private certification and governance instances, a credits market under the *RenovaBio* program.) | Innovative ideas and new framings (e.g., the "bioeconomy" label itself as a new framing for the well-established bioenergy industry) |
| Transformative | Political lobbying to secure new public policy incentives such as funding or tax cuts to agribusiness. | Changing agendas, excluding unwanted issues from the fore (e.g., abolition of sugarcane zoning, modification of rules that hitherto restricted large agribusiness, such as the Social Fuel Seal's flexibilization, virtually emptying it of its poverty-reduction rationale.) | The effort to transform the agri-food sustainability debate into a question only of efficiency and renewability, purposefully leaving out various social and environmental issues (e.g., land rights, water access, agrobiodiversity loss) from the public mind or the debate. |
| Reinforcive | Expansion of material capabilities (e.g., crop area, financial and technological resources) reinforcing Brazil's economic dependence on—and, thus, the political leverage of—corporate agribusiness in the country. | Creation of path dependencies around conventional, input-intensive and corporate-controlled monocultures (e.g., sugar economies giving rise to a dominant sugarcane-ethanol industry and, increasingly, entire sugarcane-based value webs as opposed to value webs from other crops.) | Legitimacy strengthening; the bioeconomy as a benign umbrella (a) portraying Brazilian agribusiness as a technologically advanced national champion, responding to growing concerns about "reprimarization" of the country's economy while (b) giving it "green" hues and shielding it from environmentalist critiques |

In a neo-Gramscian sense, corporate agribusiness thus enjoys substantive hegemony in Brazil, achieved "*through the coercive and bureaucratic authority of the state, dominance in the economic realm, and the consensual legitimacy of civil society*" ([40], p. 806). The Brazilian bioeconomy clearly has no level playing field. Corporate agribusiness captures most if not all such new markets due to skewed material capabilities and power configurations. Often, indeed, entire bioeconomy segments (e.g., corn-based and sugarcane-based ethanol) serve primarily for the repurposing of supplies in captive markets. If others have noted that many of the emerging renewable energy regimes across the Americas have reproduced pre-existing inequalities [110], this analysis now exposes the details of their power workings and suggests that inequalities, as a consequence, are not just reproduced but have been widened.

A counter-hegemonic movement exists: various civil society organizations and rural social movements have coalesced around the banners of agroecology and food sovereignty to call for sustainable agri-food systems and, at times, an inclusive bioeconomy [28,91]. For instance, the concept of *alimergia*—a merger of the words "food" (*alimento*) and "energy" (*energia*) in Portuguese or Spanish—has been espoused by some of those critics of corporate agribusiness and advocates of locally-controlled farming [111]. Yet, if anything, these movements have become weaker since Brazilian politics shifted to the right and then to

the far-right in the late 2010s [28]. It remains to be seen whether competing discourses and institutional agendas for the bioeconomy can eventually gain momentum.

Such an agribusiness-dominated bioeconomy represents, no doubt, a missed opportunity for sustainable development. There is little betterment to people's lives, a basic tenet of development [20,112], or social inclusiveness and poverty alleviation to speak of. Instead, the expansion of large-scale cash-cropping systems such as soy has been considered a driver of maldevelopment in Brazil, with numerous negative social impacts and resource dispossession for local populations [20]. As to sustainability, there is little of it in conventional input-intensive monocultures [113,114]. Even its "Brazilian" nationality is a misleading discursive tactic, as multinational corporations dominate the bulk of agribusiness in the country [99].

There is little development as such, entailing the overcoming of poverty and deprivation, but mostly technical and institutional innovations by and for those who already have power. This dynamic, in turn, reinforces their dominant positions in Brazil's overall agri-food governance. Innovative ideas such as Amazonia 4.0 are emptied of their hopes for "disruptive" or "transformative" change [32] and instead tamed into purely techno-economic upgrading and increased market opportunities for dominant actors. Such a pattern can be considered a case of *conservative modernization*, whereby political and social dominance structures largely remain in place or are even reinforced despite some economic and technological change [115,116]. As the bioeconomy is to a degree also a form of ecological modernization, which tries to reflect upon (some) environmental impacts and address them [117], what happens in Brazil can therefore be termed a form of conservative ecological modernization [28]. Not only are inequality matters tactically avoided, but environmental issues, too, are selectively addressed. Attention is limited to only relatively innocuous ones which do not require significant changes in the corporate agri-food system or threaten the dominant position of regime incumbents. Rather, these incumbents design the bioeconomy to precisely reinforce their positions of dominance. Without targeted incentives or redress measures that consider such pre-existing inequalities and skewed power relations in agri-food systems, the bioeconomy is therefore likely to expand on inequalities, entrench marginalization, and deepen exclusion.

## 6. Conclusions

This article has addressed the question of which stakeholders control the transition to circular bioeconomies—and how they do so. While the literature acknowledges that such social and political dimensions are important for understanding and steering these developments towards sustainability [2,6], this is among the first in-depth empirical studies on bioeconomy politics. The analysis shows that such questions are important not only in and of themselves but also because they bear consequences for the environmental and economic benefits of the transition.

Brazil's case shows that, while the bioeconomy has become an attractive umbrella term for environmentally-minded technical and institutional innovations, these have disproportionately benefited corporate agribusiness. Such already-dominant actors have resorted to instrumental, structural, and discursive power in multiple forms to shape bioeconomy policies and markets favorably. Under the guise of the public (environmental) good, they have transformed institutions and, ultimately, reinforced their dominant positions. That is problematic because, although closed-loop circular economies and bioeconomy value-addition are environmentally beneficial [3], socially inequitable production systems disempower vulnerable actors and concentrate economic benefits in a few hands, thus augmenting inequality. Moreover, such a corporate agribusiness dominance shapes technological and innovation pathways, limits potential developments to well-established sectors (e.g., sugarcane, soy), and expands on the environmental impacts these very systems create (e.g., freshwater depletion, deforestation). Such social equity considerations, therefore, are of paramount importance.

In Brazil, rather than sustainable development, the mainstream political project for its bioeconomy can be seen as a case of conservative ecological modernization. It promotes environmentally-minded technical and economic upgrading, but preserving social inequalities and reinforcing skewed power structures. Alas, being based primarily on industrial monocultures that coincidentally are also key drivers of water depletion, environmental pollution and land-use change, the bioeconomy further incentivizes these industries, their crops and production arrangements. It may, therefore, aggravate sustainability issues while precisely helping shield those agroindustries from environmental critiques. Portraying corporate agribusiness as national champions whose thriving would be equated to that of Brazil—in a bio-based, contemporary version of what General Motors once famously claimed to do for the United States—these actors also successfully earn further societal legitimacy, even while leading environmental destruction and social exclusion in the country.

Given that agri-food system consolidation has been a global trend, such an agribusiness dominance over emerging bioeconomies raises warning signs also to other countries, for in other similar contexts those powerful players may be similarly advantageously positioned to reap most benefits and set the bioeconomy agenda. It is important to reflect on who stands to benefit (and to lose) from the promotion of other circular economies, too. Further research is needed to understand such politics and how to make circular and bioeconomy promotion more equitable and sustainable.

The bioeconomy may well be an inevitable transition if fossil resources are to be phased away. Its potentials for inclusive and sustainable development remain in place, but these are not achievements to be taken for granted as a natural consequence of furthering bio-based sectors. It appears that redress efforts to correct for existing imbalances are needed if such new developments are not to fuel existing unsustainable systems under the guise of "green" progress. How to avoid such an elite capture through skillful bioeconomy governance, and how to effectively deliver on its social and environmental potentials, remain perhaps the most critical research and policy questions yet to be addressed.

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