



The challenge of reconciling conservation and development in the tropics: Lessons from Brazil's oil palm governance model



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ABSTRACT

Due to its controversies, oil palm cultivation has been targeted by regulatory innovations. Among these, transnational efforts—such as the Roundtable on Sustainable Palm Oil (RSPO) and corporate commitments to zero deforestation have been highly influential but often tend to overvalue environmental over socio-economic outcomes. This article discusses to what extent domestic governance models of palm oil producing countries can be better equipped to reconcile domestic demands such as economic development and poverty alleviation, and transnational concerns about forest conservation. We do so by looking into the Brazilian case, where the government intended to drive oil palm expansion in the Amazon through a program launched in 2010 that simultaneously only allowed expansion into already deforested areas and offered companies incentives to engage smallholder farmers in their supply chains. Our findings, drawn from primary research activities and existing literature, indicate that Brazil has managed to avoid deforestation typically associated with oil palm expansion elsewhere. Oil palm establishment involved the conversion of 0.8% and 1.3% of primary forests for corporate and smallholder plantations, respectively. However, the Brazilian government did not manage to optimally enhance smallholder participation in the sector, as significant differences in performance were observed between farmers, ranging from very successful (17%) to highly unsuccessful (12%); and failed to achieve sectoral development and competitiveness targets. While some failings can be attributed to external factors such as context, broader domestic governance frameworks and alignments, and private supply chain initiatives, the program itself did not manage to reconcile social, environmental and economic objectives into a single coherent sectoral governance model. Yet, this case study suggests that domestic governance strategies can enable commodity production in a way that is more coherent with national priorities, at the same time as preventing deforestation and minimizing social risks more effectively.

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1. Introduction

Few tropical commodities have been as controversial as palm oil. The sector's large social and environmental footprint has in recent decades made it a primary target for civic action, driving the emergence of several transnational regulatory innovations (Noordwijk, Pacheco, Slingerland, Dewi, & Khasanah, 2017; Rival & Levang, 2014). The voluntary certification scheme developed

under the Roundtable on Sustainable Palm Oil (RSPO)—a multi-stakeholder platform led by non-state actors—and corporate commitments to zero deforestation are examples of highly influential private regulations that aim to enhance the sector's sustainability in which public regulation plays virtually no role (Garrett, Levy, Carlson, Gardner, Godar, Clapp, & Villoria, 2019; Nesadurai, 2018). Moreover, consumer country initiatives such as the European Union Renewable Energy Directive (EU-RED) and public procurement policies have emerged as influential demand-side strategies, developed without significant producer government involvement or endorsement (Jopke & Schoneveld, 2018; Pacheco, Hospes, & Dermawan, 2017).

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These initiatives were partly a response to mounting societal pressure and the recognition that producer country governments are insufficiently capacitated or incentivized to address many of the socio-environmental impacts of commodity production (Pattberg & Stripple, 2008). Such developments took place in a context of globalization, privatization, and decentralization that challenged the traditional role of nation states. They also facilitated deployment of alternative regulatory instruments to address international public good problems such as climate change (Legendijk, Arts, & Houtum, 2009; Lemos & Agrawal, 2006).

Many of these regulatory innovations, however, are predominantly designed to demonstrate that production does not adversely affect the environment and, often secondarily, laborers and host communities (Dauvergne, 2018; Pye, 2018). The challenge of leveraging the sector effectively in support of socio-economic development thereby remains the duty of the nation state and beyond the remit of transnational governance (Schouten & Hospes, 2018). As such, many producer country governments are confronted by complex trade-offs between agricultural development, conservation, and poverty alleviation (Hidayat, Offermans, & Glasbergen, 2018; Pramudya, Hospes, & Termeer, 2016). In particular, governments and the development community alike are increasingly challenged to develop innovative solutions to stimulate further agricultural development that avoids conversion of high conservation value ecosystems and improves the livelihoods of vulnerable groups. All the while, they act to accommodating the needs and remaining responsive to pressures from international actors (Astari & Lovett, 2019; Breslin & Nesadurai, 2018).

This raises urgent questions of both theoretical and practical relevance. Is it at all possible to harmonize the interests of both producer and consumer countries (including those of final consumers), and of both corporations and smallholder farmers in the global South? Should sector development remain dictated by transnational governance or is there an emergent space for nation states to retake authority and govern the sector more holistically towards specific national development needs and interests?

In this article we aim to respond to these questions by critically evaluating the unique case of Brazil. There, the federal government sought to develop an alternative governance model for the sector that explicitly seeks to reconcile conservation, sectoral development, and poverty alleviation from the outset. Through the Sustainable Palm Oil Production Program (SPOPP), launched in 2010, the government established a governance structure that aims to create enabling conditions for expanding oil palm plantations and industrial capacity in the Brazilian Amazon, while simultaneously: (a) restricting expansion to degraded areas to prevent deforestation and restore degraded lands, and (b) promoting social inclusion by incentivizing companies to engage smallholder farmers in their supply chains through contract farming (Brandão & Schoneveld, 2015). This article evaluates whether the federal government through SPOPP has managed to accomplish these economic, environmental, and social objectives, and effectively balance trade-offs between these objectives. This allows us to provide new insights into debates on transnational versus national governance systems in high forest risk sectors and identify opportunities for better aligning sector development with socio-environmental concerns (Astari & Lovett, 2019; Ewert & Maggetti, 2016).

The article proceeds as follows. After this introduction, a background section briefly introduces the governance debates around oil palm both globally and in Brazil. This is followed by a third section that presents the analytical framework and the methodological approach. The fourth section synthesizes our findings on environmental, social, and economic outcomes of oil palm expansion under the auspices of SPOPP, followed by an analysis of outcome attribution to specific governance arrangements. The paper then reflects on trade-offs between different types of outcomes,

before concluding with a reflection on the findings and implications for governance.

2. The governance of palm oil supply

2.1. Transnational versus domestic debates

The palm oil value chain is governed by a variety of different domestic and transnational sustainability initiatives. The complexity of sustainability initiatives is such that some authors refer to it as the 'palm oil governance complex' (Pacheco, Schoneveld, Dermawan, Komarudin, & Djama, 2018). The most important transnational initiative is arguably the RSPO. Established in 2004 as a multi-stakeholder platform, RSPO involves non-state actors in response to a pervasive regulatory vacuum in producer countries (Ruyschaert & Salles, 2014). Thus, it created a set of certification rules (principles and criteria) to minimize adverse social and environmental effects of oil palm expansion. In some cases, national interpretations were developed to better align principles and criteria with national conditions. By 2018, 19% of global palm oil production was RSPO certified (Lyons-White & Knight, 2018).

In addition to RSPO, many companies have in recent years made, often supplementary, commitments to zero deforestation. Notably under the New York Declaration on Forests, they have committed themselves to eliminating deforestation from their supply chains of so-called high forest risk commodities, such as palm oil, soy, pulp and paper, and beef, by no later than 2020 (Jopke & Schoneveld, 2018). According to one estimate, 96% of the global palm oil supply is linked to one of these commitments (Pirard, Gnych, Pacheco & Lawry, 2015).

Despite their socio-environmental ambition, such transnational initiatives have been criticized for their limited effectiveness at scale and failure to systematically reconcile conservation and development objectives (Higgins & Richards, 2019; Lyons-White & Knight, 2018). RSPO, for example, has been criticized for being dominated by commercial interests, for depoliticizing contentious issues, for focusing exclusively on North-South trade relationships, externalizing sectoral authority and power, not being sufficiently pro-poor and failure to account for the local socio-political-legal context (Higgins & Richards, 2019; Pichler, 2013). In turn, zero deforestation commitments typically fail to acknowledge externality risks and may further exacerbate processes of market bifurcation (Jopke & Schoneveld, 2018; Pacheco, Schoneveld, Dermawan, Komarudin & Djama, 2018). RSPO governs an amount smaller than 20% of global production while less stringent emerging markets such as China, Russia, India, and Pakistan represent a large share of global consumption. Companies that are unwilling or unable to meet supply chain standards can simply target these countries, further consolidating so-called shadow markets (Jopke & Schoneveld, 2018; Schleifer & Sun, 2018).

A particularly problematic issue with both initiatives is that they risk excluding large numbers of smallholders in the sector from benefiting from formal certified markets. Capacity and resource constraints typically pose significant compliance barriers for smallholders. As a result, they are increasingly alienated from standards-driven markets (Astari & Lovett, 2019; Schoneveld, Van Der Haar, Ekowati, Andrianto, Komarudin, Okarda, Jelsma, & Pacheco, 2019).

Consumer countries have also implemented demand-side regulations to further stimulate sustainable production. One of the most relevant to palm oil is the European Union's (EU) revised Renewable Energy Directive (RED II), which imposes significant restrictions on the use of crude palm oil (CPO) in the European energy mix. This decision attracted significant consternation by major producing countries such as Malaysia and Indonesia over alleged protectionism (Hinkes, 2019).

Even though regulatory innovations have long taken place transnationally, producer governments are increasingly taking actions to prevent externalization of regulatory authority with – what some perceive to be – competing regulatory initiatives (Hidayat et al., 2018; McCarthy, Gillespie, & Zen, 2012). In 2011, Indonesia began to design a mandatory certification system based on domestic regulations in the form of Indonesian Sustainable Palm Oil (ISPO). A few years later, Malaysia implemented the Malaysian Sustainable Palm Oil (MSPO) standard that also intends to become mandatory. These initiatives are regarded by some as a reaction against transnational interference and as strategies to undermine RSPO legitimacy (Hospes & Kentin, 2014). According to many producer governments, transnational initiatives such as the RSPO do not align well with domestic economic and rural development goals (Ruyschaert, Carter, & Cheyns, 2019). By developing their own certification standards, Indonesia and Malaysia, on paper at least, can become more equipped to align global concerns, such as climate change, with domestic priorities, such as economic development and poverty reduction (Higgins & Richards, 2019). Despite some enthusiasm about improved national action, critics have pointed to the tensions of such initiatives with more rigorous transnational standards and a tendency to prioritize economic development over environmental considerations (Meijaard & Sheil, 2019). Moreover, there is also a lack of clarity regarding the benefits for smallholders and doubts about the government capacity and willingness to implement and enforce such rules (Hidayat et al., 2018).

2.2. Palm oil governance in Brazil

Where countries like Malaysia and Indonesia developed more reactionary regulatory initiatives seeking to appease international supply chain pressures, Brazil adopted a different model. Long dependent on soy and looking to diversify its biodiesel feedstock sources, and recognizing the high forest and social risk associated with oil palm expansion elsewhere, the government established the Sustainable Palm Oil Production Program (SPOPP) in 2010 to regulate expansion in the Amazon biome (Villega, Jaccoud, Rosa, & Freitas, 2014). That was a response to a looming global energy crisis and the enactment of the Brazilian Biodiesel Law (Law 11.097, 13/01/2005) in 2005 (Andrade & Miccolis, 2011). SPOPP was firmly rooted in national policy priorities and market objectives, preempting rather than responding to adverse sectoral effects. Since the Brazilian palm oil value chain at that time largely served domestic end-markets that only marginally considered transnational initiatives, SPOPP was neither a response to or inspired by externally imposed rules (Brandão & Schoneveld, 2015).

SPOPP principally sought to stimulate private-sector investments in the palm oil sector in support of its domestic biodiesel targets and agricultural development policies, without undermining ongoing efforts to protect high conservation value ecosystems. Moreover, the agricultural sector in the Amazon has been traditionally dominated by large-scale plantation systems. SPOPP sought to incentivize more meaningful integration of smallholders, who had long been alienated by and at times conflicted with agribusiness interests (Córdoba, Selfa, Abrams, & Sombra, 2018). Being more labor than capital intensive, oil palm cultivation is more compatible with smallholder production systems than commercial crops such as soy.

To achieve these objectives, the program introduced six specific instruments (see Table 1), with two deserving special attention. The first is the Agro-Ecological Zoning of Oil Palm in Deforested Areas of the Amazon (ZAE-Palma). It identifies areas available to oil palm cultivation that had been deforested before 2008 and do not contain or conflict with primary forests, conservation units,

Table 1
SPOPP's policy instruments.

Name	Description
ZAE-Palma	Developed by Embrapa (the Brazilian Agricultural Research Corporation), it considers agro-ecological suitability and accounts for restricted areas (e.g., primary forests, areas deforested since 2008, indigenous territories, and conservation units). More than 29 million ha in the Amazon were identified as suitable for development; 12 million of these hectares are in Pará. It was approved as Presidential Decree 7172 in 2010.
Draft bill	Draft bill (119) prepared by the federal government and submitted to Congress in 2013. It establishes the SPOPP by, for example, complementing Presidential Decree 7172 forbidding the suppression of primary forests in order to plant oil palm, plantations outside the limits established by ZAE-Palma, among several others. The most controversial issue relates to the possibility to restore legal reserves with oil palm. ¹ Since 2015, the bill has been awaiting rapporteur designation at a Senate commission. In 2018, there had been no further developments.
Palm Oil Federal Chamber (POFC)	Created in 2010, the POFC is a consultative body to promote dialogue between government, private sector, and civil society. It includes representatives of federal bodies (ministries of Agriculture, Livestock and Supply (MAPA), Agrarian Development (MDA), Mining and Energy (MME), Environment (MMA), Development, Industry and International Trade (MDIC), Embrapa and Civil House) and representatives of producers, consumers, and workers. By 2017, it had held 25 meetings.
Research & development	US\$ 18.75 million ² over 10–12 years to be allocated to research & development. Priority areas include genetic improvement, increased seedling production and strengthening of international partnerships, and development of technical assistance capabilities of technical service providers.
PRONAF Eco	Established in 2007, PRONAF Eco is a credit line available for smallholders. Since SPOPP in 2010, major requirements include a maximum of 10 ha of palm oil, a signed contract endorsed by the smallholder representative organization (FETAGRI, the Pará state Agricultural Workers Federation), a minimum purchasing price, and the obligation for the contracting company to provide inputs at market price and free technical assistance on a monthly basis.
PROPFLORA and PRODUSA	Other credit lines for medium/large holders were revised to include oil palm.

¹ The Forest Code created two important long-lasting concepts, namely the area of permanent preservation (APP) and legal reserves. A legal reserve is a proportion of a rural property that should remain forested, while an APP is a sensitive area such as a riverside, hilltop, or steep slope that should be protected from conversion. The Forest Code required that 80% of a rural property should be maintained as a legal reserve in the Legal Amazon. State governments may, however, reduce the size of a legal reserve from 80% to 50% by designating certain areas as agricultural production zones through Ecological–Economic Zoning (ZEE) plans. This is the case in northeast Pará, for example, where oil palm plantations have expanded.

² Amounts have been converted from Brazilian real (BRL) at an exchange rate of BRL 3.2 per US dollar (1 June 2015).

and indigenous territories. The second is a credit line for smallholders created under the Program to Support Family Farming (PRONAF) called PRONAF Eco, which promotes the inclusion, through contract farming, of smallholder farmers in the sector. PRONAF Eco provides a loan at concessionary interest rates of up to US\$25,000 to smallholders to cultivate oil palm on up to 10 ha of land. To receive the loan, smallholders are required to enter into a 25-year contract with a company, who in turn is required to commit to providing inputs and technical assistance to smallholders and guaranteeing the purchase of fresh fruit bunches (FFB) at a minimum price. Participation is, however, conditional on the

property being registered in the Rural Environmental Registry (CAR), observance with ZAE-Palma and a family farmer certificate stating that annual income exceeds US\$6250 (DAP-V). Smallholders in Brazil are defined by law as a family who works in agriculture, possesses no more than four “fiscal modes”, utilizes predominantly family labor, and makes a living primarily through their own production activities. A fiscal mode represents a unit of economically viable farmland unit, ranging in Pará from 5 to 80 ha. Companies are incentivized to contract smallholders since that increases their supply base without a significant capital outlay. Furthermore, under the Biodiesel Law, companies can gain preferential access to national biodiesel auctions through the so-called Social Fuel Stamp (SFS) when sufficient feedstock is sourced through smallholders (see Brandão & Schoneveld, 2015 for more details).

In addition to specific instruments, the program builds on several existing social, environmental, and economic regulations and incentives in Brazil (Fig. 1). Besides social innovations such as SFS, this includes the Forest Code as the flagship regulatory instrument, which introduced amongst others the abovementioned CAR system. On the economic side, investors have for a long time benefited from lower tax rates and more favorable financing conditions. This includes finance through FNO (North Constitutional Fund) or FDA (Amazon Development Fund) and fiscal incentives through the Superintendence of Development in the Amazon (SUDAM).

3. Methods

3.1. Analytical framework

SPOPP is principally a regulatory intervention that aims to alter the actions of and relations between smallholders and companies and, to a lesser extent, state agencies, with respect to land use, production practices, contractual responsibilities and cost and benefit flows, amongst others. However, we acknowledge that not all pertinent outcomes can be solely attributed to SPOPP, since these can also be shaped both directly and indirectly by other factors (see Fig. 2). In an evaluation of programmatic performance, it is critical to isolate which successes and failures are attributable to the program and which to other factors beyond the programmatic sphere of control.

As also discussed by (Howes, Wortley, Potts, Dedekorkut-Howes, Serrao-Neumann, Davidson, Nunn, 2017), one such factor is the specific context in which a regulation is implemented, enforced, and/or monitored. Infrastructure, market, political, socio-cultural, climatic, and geographic characteristics, to name a few, can both constrain or enable SPOPP implementation. While some of these can be accounted for as an intervention is designed or translated into practice, some contextual factors are beyond the capacity of the intervention to anticipate or control such as, for example, sectoral development compromised by crop pest or climatic shocks.

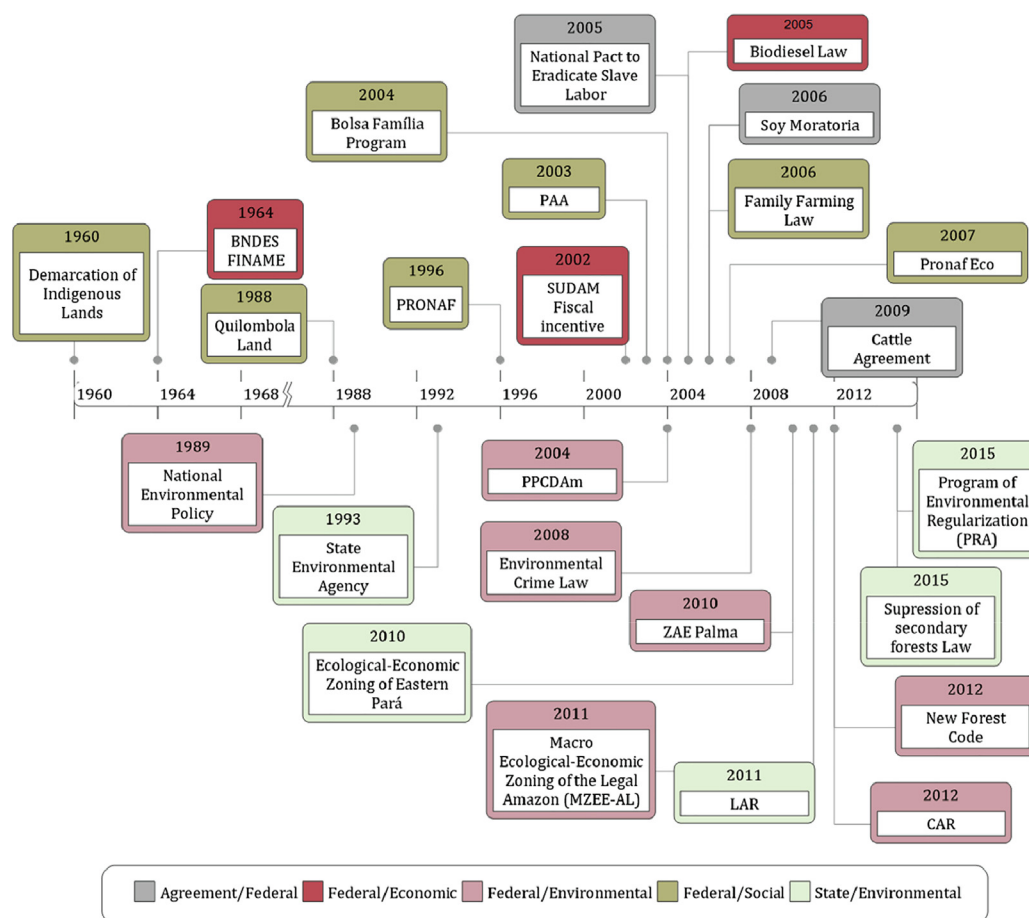


Fig. 1. Evolution of relevant national regulations and incentives.

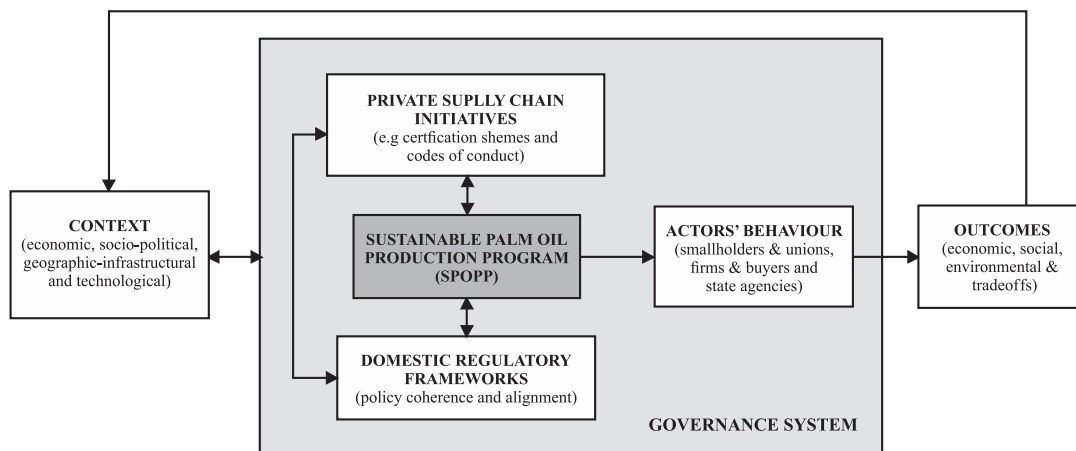


Fig. 2. Analytical framework.

Another such factor is the broader domestic governance system. Some specific instruments introduced by the program build on, complement, and leverage existing socio-environmental regulations and incentives. In such a case, SPOPP can be credited for explicitly seeking to exploit synergies and complementarities (Lambin, Meyfroidt, Rueda, Blackman, Börner, Cerutti, Dietsch, Jungmann, Lamarque, Lister, Walker, & Wunder, 2014), but not necessarily for outcomes attributable to existing regulations or institutional structures. An example is good employment conditions at corporate plantations due to progressive labor laws and well-capacitated enforcement agencies. Nevertheless, overall programmatic success and ability of SPOPP to deliver on its objectives are strongly influenced by such synergies and complementarities. Conversely, existing regulatory and institutional structures can also frustrate SPOPP implementation. Programmatic failures attributable to governance antagonisms cannot therefore be solely attributable to SPOPP but do importantly provide insights into outcome determinants.

Finally, private supply chain initiatives such as private standards, specific corporate zero-deforestation commitments, smallholder policies and codes of conduct further contribute to or detract from programmatic success (Lambin, Gibbs, Heilmayr, Carlson, Fleck, Garrett, Walker, 2018). Given the sector's domestic market orientation, these are in principle not as relevant as in other countries. Nevertheless, the extent to which environmental and inclusivity considerations are integrated into corporate business models undoubtedly bears on outcomes and plays an important mediating role.

3.2. Methodological approach

There is no official document clearly articulating SPOPP objectives. Existing literature (e.g., Villela et al., 2014; Benami, Curran, Cochrane, Venturieri, Franco, Kneipp, & Swartos, 2018; Córdoba et al., 2018) tends to draw on secondary sources or public presentations and speeches by government officials. By means of a review of government SPOPP communications and documentation, notably a 2010 presidential speech in Tomé Açu, Presidential Decree 7172 in 2010 that instituted the ZAE-Palma, Project Law 119 from 2013 that instituted the SPOPP (though is still awaiting congressional approval), and two MDA public information booklets, it is clear SPOPP design is influenced by three overarching objectives, namely: (a) preventing oil palm-induced deforestation, (b) promoting smallholder inclusion, and (c) sectoral expansion and competitiveness.

In order to evaluate whether these intended programmatic outcomes were realized, we drew on both existing literature and pri-

mary research activities. In order to causally attribute outcomes to SPOPP, we relied on expert opinions. Specific activities undertaken under each step are summarized below.

3.2.1. Literature review of outcomes

We first conducted a systematic literature review. This involved developing a database of published journal articles and grey literature in English and Portuguese that referred to palm oil in Pará. The state holds Brazil's largest palm oil producing area, accounting for approximately 88% of the total hectareage in the country (Abrapalma, 2017). Since this article is concerned with oil palm development under SPOPP, only literature published after 2010 was considered.

Based on this literature search, three knowledge gaps were identified that impede our ability to conduct a comprehensive programmatic evaluation. Specifically, extracted literature failed to provide insights into and/or explicitly assess (1) forest footprint of smallholder oil palm cultivation; (2) ability of smallholders to successfully adopt oil palm as a profitable income generating activity; and (3) sectoral competitiveness.

3.2.2. Primary data collection activities

In order to address knowledge gap 1, we manually mapped 5160 ha of smallholder oil palm planted after 2010 (620 plots) through visual interpretation of high-resolution satellite imagery available through Google Earth. 436 of the mapped plots were identified through the CARs of smallholders contracted to four major companies. The remaining plots (184) were identified through visual inspection. Based on data from (Abrapalma, 2017), we captured an estimated 42% of the total area planted with oil palm by smallholders since 2010. The map we produced was laid onto official spatial deforestation data (PRODES) for the period 2010–18. We further triangulated these results through visual interpretation of high-resolution SPOT imagery from 2010.

In order to address knowledge gap 2, we adopted the expert knowledge method to develop a smallholder 'performance' typology (Alvarez, Aaas, Descheemaeker, Tiftonell, & Groot, 2014). Smallholder households were assigned to clusters through a participatory workshop with managers from the three largest oil palm companies in Pará, which collectively source from approximately two-thirds of Pará's oil palm contract farmers. Two indicators were considered indicative of smallholder performance: productivity and adoption of best management practices. Productivity is measured by the number of tons produced per year compared to the average expected productivity for the relevant stand age. Degree of adoption of best management practices is a qualitative indicator companies use to assess contract farmer's default risks. Using these

indicators, company managers grouped a total of 1031 farmers into 4 groups.

We recognize the limitation of using productivity and adoption of best management practices as proxies for determining the ability of smallholders to successfully adopt oil palm (see for example (Prowse, 2012) for a discussion on successful and failed contract farming cases). Even so, this was the only feasible way to make a consistent comparison across different companies and datasets due to corporate reluctance to disclose confidential information.

To address knowledge gap 3, we collected data from official governmental and other secondary sources. Data on imports, exports and production was obtained from government (MDIC, 2019) and the sector association (Abrapalma, 2017). Production cost data was collected from conference presentations and technical documents (Brito, 2014a; Fry, 2016; Veiga & Rodrigues, 2016; Yokoyama, 2017). The accuracy of information was verified through expert consultations.

3.2.3. Causal attribution

Following the analysis of outcomes, we used our analytical framework to evaluate how those outcomes can be attributed to SPOPP. This evaluation was based on 193 semi-structured key informant interviews across the state of Pará (Table 2). These interviews focused on stakeholder perceptions of outcome determinants and causal pathways. This is a commonly employed and veracious approach in impact evaluations (Boyce & Neale, 2006; Peersman, 2014). This analysis also relied on observations from field visits to the operations of eight of the nine companies functional in the state, nine municipalities (Acará, Baião, Bujaru, Concórdia do Pará, Mãe do Rio, Mocajuba, Moju, Tailândia and Tomé-Açu), and 55 visits to communities directly or indirectly affected by oil palm expansion.

4. Results

4.1. Deforestation

Five secondary sources that evaluated the impact of oil palm expansion on forests were found (Table 3). According to Benami et al. (2018), only 0.8% of oil palm planted by companies since SPOPP establishment involved the conversion of primary forests, and 3% involved conversion of secondary forests. A recent study by (Almeida, Vieira & Ferraz, 2020) corroborates these findings by demonstrating that approximately 1% of the area planted with oil palm involved primary forest conversion. This is a marked improvement over the pre-SPOPP era, when between 2006 and 2010 an estimated 4.1% of oil palm was established at the expense of primary forests and 4.9% at the expense of secondary forests (Benami et al., 2018). A study by Vijay, Pimm, Jenkins & Smith (2016) found that between 1989 and 2013 39.4% of oil palm expansion involved conversion of primary forest. Almeida et al. (2020) additionally estimate that approximately 30% of oil palm estab-

lished in select study sites since 1991 involved forest conversion. Noting that expansions since 2010 contributed only marginally to deforestation, these figures suggest that earlier plantations were considerably more likely to have been established on forestland. These figures are also in line with estimates from Agropalma, one of Brazil largest palm oil producers. They acknowledge that 35% of their oil palm involved primary forests conversion until their zero-deforestation commitment came into effect in 2002 (Agropalma, 2013).

However, a major omission in all studies is that they only focus on corporate plantation expansion. Whether smallholder oil palm expansion contributed to deforestation since 2010 has yet to be explored. The main results of our gap filling activities are presented below (Table 4). Additional information can be found in Annex 1.

Results show that, like corporate plantation expansion since 2010, smallholder expansion has taken place largely on non-forestland. Visual interpretation of SPOT imagery suggested that only 44 ha of land was deforested from the 1395 ha analyzed, equivalent to a 3.2% deforestation rate. However, extrapolating results to the total area mapped, assuming that PRODES consistently overestimates deforestation by 102% (as identified in the sampled area), we estimate that of the 5162 ha mapped, 69 ha of forest was converted; equivalent to 1.3% of the total area mapped. These results suggest that under SPOPP only few smallholders deforested land to establish their plantations. In sum, based on primary and secondary data, we estimate that since the launch of SPOPP in 2010, oil palm establishment involved the conversion of 0.8% and 1.3% of primary forests for corporate and smallholder plantations, respectively.

4.2. Smallholder inclusion

Literature on smallholder inclusion under SPOPP (Table 5) suggests that SPOPP's smallholder inclusion targets were not met. Only 1313 smallholders planted oil palm under SPOPP since 2010. This represents only 24% of initial inclusion targets established by the companies at the time SPOPP was launched (4850 families) (Brandão, De Castro & Futemma, 2019). In total, not more than 1% of Pará's smallholder properties contain oil palm. Even in the municipalities with a higher concentration of contracted farmers, oil palm has not become a dominant crop. It is planted in only 8% of smallholder properties in Tailândia, 7% in Tomé Açu, and 6% in São Domingos do Capim (Abrapalma, 2017; IBGE, 2017).

With respect to the ability of smallholders to successfully adopt oil palm as a profitable income generating activity, no robust evidence has been presented in existing literature that can be attributed convincingly to SPOPP. While Santos, Homma, Sena, Júnior, Menezes & Monteiro (2014) suggest that oil palm cultivation is comparatively profitable for smallholders and Homma, Menezes, Monteiro, Santos, Rebello, Costa & Mota (2014) suggest that smallholders are by and large satisfied with adoption, these studies concern high-profile pilot schemes established prior to SPOPP. Such schemes were under political scrutiny, with companies pressured to demonstrate the viability of oil palm contract farming.

Results from our participatory cluster analysis revealed that significant differences in performance can be observed between farmers (Fig. 3). This ranges from very successful (Group A, 17%) to critical (Group D, 12%). Group A (very successful, 17%) comprises highly motivated farmers that comply fully with best management practices and are more productive than expectations. Such smallholders experience positive returns on their investment, enabling significant wealth creation compared to traditional alternatives such as cassava. Group B (successful, 29%) consists of farmers that do comply with best management practices but are only averagely productive. For these farmers oil palm cultivation does nevertheless provide an important source of stable income to maintain a

Table 2
Key informant interviews.

Type	number
Representatives of civil society at state, municipal, and community levels	65
Individual farmers	34
Representatives of municipal institutions	33
Policymakers at state and federal levels	7
Representatives of companies	32
Representatives of banks	5
Others	4

Table 3
Literature review results related to deforestation outcomes.

Source	Peer-reviewed (Y/N)	Study area	Method	Results
Benami et al. (2018)	Y	Northeast Pará (includes nearly all known commercial oil palm plantations)	Visual inspection techniques, field and site visits and consultations	0.8% of planted oil palm involved deforestation of primary forests and 3% of secondary forests since the SPOPP started in 2010
Furumo and Aide (2017)	Y	12 Latin American countries including Brazil	Random Forest (RF) tree-based classifier in MODIS collection	Around 40% of replacement of woody vegetation since 2000
Vijay et al. (2016)	Y	Sample sites in 20 countries including Brazil	Visual inspection and linear extrapolation of sample sites	39.4% of deforestation between 1989 and 2013
Almeida et al. (2020)	Y	3 research sites in one municipality	Supervised classification and field surveys	30% of deforestation of primary forests since 1991 but only 1% since 2010 until 2013.
Agropalma, (2013)	N	Agropalma plantations	Sustainability report (company own analysis)	35% of their oil palm involved primary forests conversion until 2002

Table 4
Smallholder deforestation analysis results.

Variable	Total (ha)	Percentage
Total area of smallholder oil palm in Pará	12,418	100%
Total area of smallholder oil palm mapped	5162	42%
Smallholder area mapped overlapping with PRODES	144	2.8%
Total area of smallholder oil palm mapped analyzed with SPOT	1395	27%
Smallholder area analyzed with SPOT overlapping with PRODES	89	6.4%
Smallholder area analyzed with SPOT involving forest conversion	44	3.2%
Estimate deforestation in smallholder area mapped	69	1.3%

reasonable standard of living. Group C (precarious, 42%) consists of farmers that have not been able to fulfill productivity expectations, typically because they fail to devote the necessary labor or lacked the capacity to comply with agronomic guidelines. Finally, Group D (critical, 13%) comprises farmers that have found themselves in a critical situation. They have systemically neglected advice from extension officers and are confronted by a large yield gap or have completely abandoned their plantations. Illness, old age, and/or personal issues such as divorces, family conflicts or youth exodus typically underlie this.

As can be observed, most farmers (54%) fall into the latter two groups (precarious and critical). Company experience suggests that such farmers will likely be unable to develop economically viable oil palm operations over time and, thus, be able to fulfill their debt obligations. These results differ from Santos et al. (2014) and Homma et al. (2014), suggesting that their findings cannot be directly extrapolated to SPOPP.

Table 5
Literature review results related to smallholder inclusion outcomes.

Source	Peer-reviewed	Study area	Method	Results
Brandão et al. (2019)	Y	Northeast Pará	Data collection and descriptive stats	1313 smallholder families with contracts under SPOPP since 2010, which represents only 24% of total company commitments (4850 families)
Mota, Schmitz, Gomes, and Silva (2019)	N	Northeast Pará	Data collection and descriptive stats	Around 50% of satisfaction identified among smallholders
Homma et al. (2014)	N	Arauaí community (pilot scheme)	Data collection and descriptive stats	83.9% satisfaction identified among smallholders
Santos et al., (2014)	N	Arauaí community (pilot scheme)	Data collection and NPV analysis	Average monthly income is 4 times than minimum wage
Brandão et al. (2018)	N	Northeast Pará	Data collection and econometric analysis	Direct exclusion of credit blacklisted farmers and low-income farmers, plus indirect exclusion of land and labor constrained households.

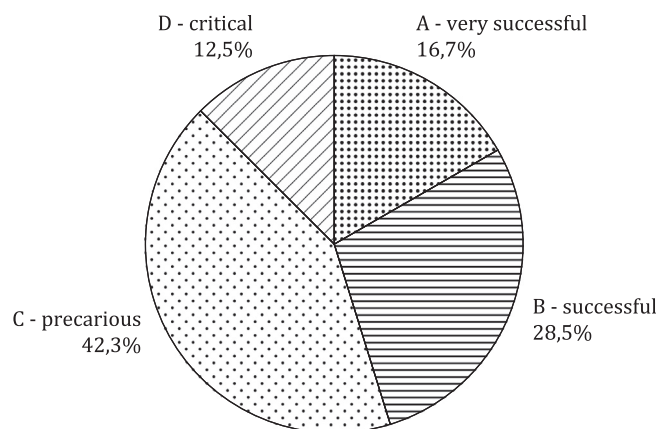


Fig. 3. Performance of SPOPP contract farmers (%). Source: Representation of own data.

4.3. Sector development and competitiveness

The literature review (Table 6) indicates the total planted area with oil palm tripled between 2006 and 2014 and doubled since the launch of SPOPP. Georeferenced data indicates a growth from 70,691 ha to 116,748 ha in 2010, and to 218,917 in 2014 (Benami et al., 2018). According to official data (Abrapalma, 2017), 207,000 ha of oil palm was planted by 2017, including areas planted by smallholders. Nevertheless, despite ambitious expansion plans, initial projections have not been met. In 2016, the three major new entrants into the sector only managed to cultivate 72% of the planned hectareage under corporate plantation and 24% of the

Table 6
Literature review results related to sectoral development.

Source	Peer-reviewed	Study area	Method	Results
Benami et al. (2018)	Y	Northeast Pará	Visual inspection techniques, field and site visits and consultations	Planted area growth from 70,691 ha to 116,748 ha in 2010, and to 218,917 in 2014
Abrapalma, (2017)	N	Northeast Pará	Collection of own data	Total area of 207,000 ha in 2016
Brandão et al. (2019)	Y	Northeast Pará	Secondary data collection	By 2016 new entrants have only managed to achieve 72% and 24% of their expansion goals in terms of own area and contract farming area. Expansion halted in 2015.

planned hectareage under smallholdings. In terms of processing, only two out of the six announced palm oil mills were in fact built by new entrants, with none of them having invested in biodiesel processing. In 2016, the sector had a processing capacity of 731 metric tons (MT) of FFBS per hour, below the 1020 MT announced in initial plans. Since 2015, expansion ceased as CPO and oil prices declined and new entrants started to explore options to divest from the sector (Brandão et al., 2019). By late 2019, two of the three companies had sold their operations.

While the limited secondary evidence suggests that sectoral expansion goals of SPOPP have largely been unfulfilled, whether sufficient expansion was realized to reduce dependency on foreign markets and develop a competitive domestic palm oil industry has not been evaluated to date. However, as Fig. 4 suggests, while production has increased in recent years (largely due to maturing trees, not expansion of hectareage), the national palm oil deficit has not been significantly reduced. Similarly, based on export figures, it neither appears that Brazilian palm oil is capable to penetrate foreign (premium) markets, with few exceptions.

Moreover, sectoral competitiveness does not appear to have improved. Our estimates of production costs suggest that the sector is hampered by some of the highest production cost in the world (Fig. 5). Production costs in Indonesia and Malaysia are generally between US\$300–400 per MT/CPO, while in Brazil companies tend to spend US\$675 per MT/CPO. This does not differ much and sometimes even exceeds global CPO prices since 2014. These high production costs can largely be attribute to the high labor costs in Brazil, which can be as high as 75% of total production costs, according to expert interviews (Yokoyama, 2017; D. Di Martino, personal communication, 2018). According to (Yokoyama, 2017), an average worker in Brazil costs US\$ 11,783 per year, while in Colombia one worker on average costs US\$ 10,250, in Malaysia US\$ 6135 and in Indonesia US\$ 2686).

Therefore, despite sectoral expansion until 2015, results suggest SPOPP expectations have not been fulfilled and Brazilian CPO cannot compete with those from other major producing countries. The vast majority of Brazilian CPO as a result merely serves domestic markets. Only differentiated products such as organic— and RSPO-certified CPO—which are still a niche activity in the Amazon—have been exported. Only one company currently sells such certified CPO.

5. Governance analysis

The above analysis of primary and secondary information suggests that oil palm expansion in the SPOPP-era involved comparatively little deforestation but failed to meaningfully involve smallholders at scale and improve sectoral competitiveness. This section seeks to attribute these outcomes to SPOPP, employing the analytical framework presented in Section 3.1. Before exploring the additionality of SPOPP for each outcome domain, we first examine how contextual factors, domestic governance, and private supply chain initiatives shape outcomes.

5.1. Explaining positive deforestation outcomes

5.1.1. Context

Oil palm investments were mostly made in landscapes with substantial availability of degraded lands and low deforestation rates (Carvalho, Silveira, Rovere, & Iwama, 2015), as is the case in most of northeast Pará. Due to the large operational costs and capital invested in milling facilities and the comparatively high labor intensiveness, oil palm plantations have to date been developed near major ports and more populous areas. Typically, many of these areas have already been deforested long ago. Frontier areas with abundant stocks of forests were not attractive to companies, partly explaining low deforestation rates.

In addition to geographic factors, socio-political dynamics also played an important role. Several influential NGOs operating in the Amazon actively monitor deforestation and confront companies complicit in deforestation. Larger companies particularly exposed to reputational risk tend to avoid activities that expose them to civil society scrutiny.

5.1.2. Supply chain initiatives

Private supply chain initiatives in the palm oil sector do not appear to have significantly shaped outcomes. In fact, only one investor has formally made a commitment to eliminate deforestation from its supply chain, which coincidentally was made before SPOPP was launched.¹ Furthermore, only one new entrant, ADM, commenced operations with a plan in place to certify under RSPO. This requires them to avoid planting activities on areas deforested since 2006. The other six large investors did not develop any zero deforestation policies. Because the lion's share of CPO supplies Brazil's domestic market, which does not require any certification and generally does not expect zero-deforestation commitments from their suppliers,² there are few supply chain pressures that demand or incentivize improved corporate environmental conduct. This suggests that most merely complied with domestic regulations, with only a few companies seeking to differentiate themselves through their environmental performance.

5.1.3. Domestic regulatory frameworks and alignment

The Brazilian Amazon in general and, in particular, the municipalities where oil palm expanded experienced a decline in deforestation rates of between 70 and 80% since 2010 (Moutinho, Guerra, & Azevedo-Ramos, 2016). That was partly a product of increased federal government commitment and action to reducing deforestation rates in the Amazon in the same period. This is reflected in hallmark regulations such as the Forest Code and the Environmental Crime Law, along with investments into a modern surveillance infrastructure by federal and state agencies. This was further strengthened by technical innovations such as the availability of satellite imagery, the implementation of the CAR

¹ Agropalma adopted a zero-deforestation commitment in 2002.

² Only Natura, among the main domestic buyers, has formalized a zero-deforestation commitment.

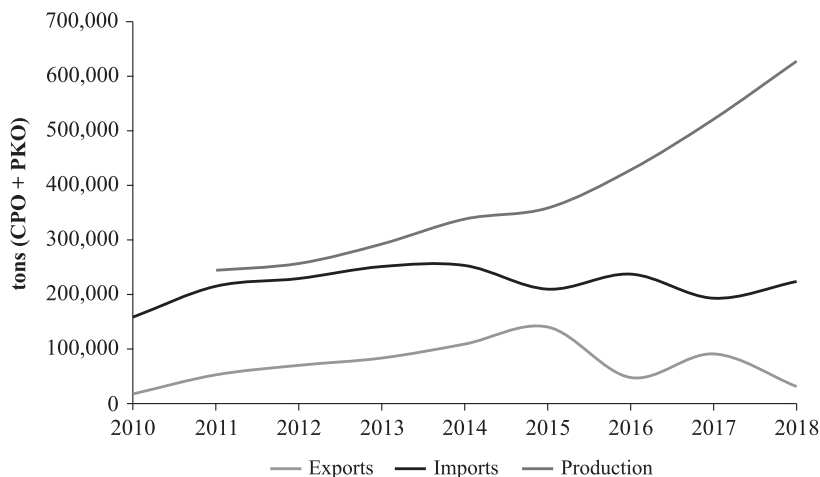


Fig. 4. Brazil's palm oil market trends 2010–18 in tons of CPO + PKO). Source: MDIC (2019) and Abrapalma (2017).

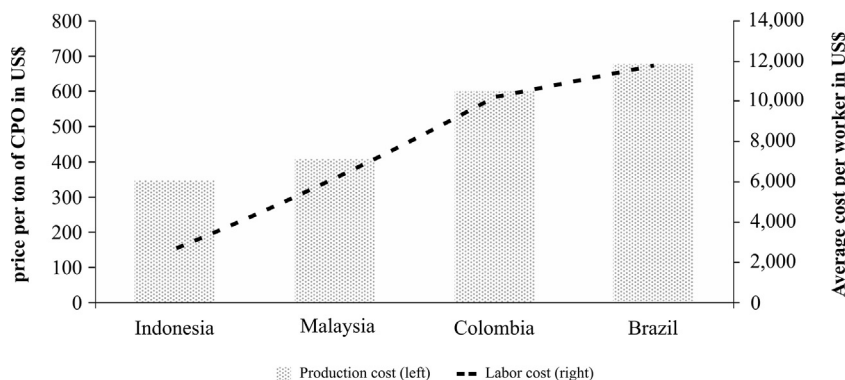


Fig. 5. Average production and labor costs between 2010 and 2015 (in US\$). Source: Fry (2016), Yokoyama (2017), Brito (2014a) and Veiga & Rodrigues (2016)

system, and capacity building of environmental agencies (Seymour & Busch, 2016). With these regulatory and technical advances, many oil palm investors, like most other landowners in the Amazon, were discouraged from flaunting new rules, given the large capital investments at stake.

5.1.4. SPOPP's additionality

While the geographic and socio-political context and domestic regulatory frameworks certainly explain low oil palm induced deforestation, SPOPP can also be credited. The design of ZAE-Palma—the SPOPP's main environmental instrument—offered clear rules on areas designated for production, which helped guide companies' land acquisition practices, according to company managers (J. Menezes, personal communication, 2017). This not only helped companies identify where production would be legally acceptable, but also encouraged expansion in low forest risk areas such as Northeast Pará.

While SPOPP merely contributed to reduced corporate deforestation rates, its role was more pronounced in the smallholder sector. Two important components were the obligation to submit a CAR to apply for PRONAF Eco and the successful passing of a Decree on ZAE-Palma that forbids credit access to those located on forested lands. Thus, SPOPP was able to directly prevent the expansion of smallholder oil palm plantations in areas that had been illegally deforested. Interviews with company managers and bank representatives fully support this conclusion (D. Di Martino, personal communication, 2018; F. Castro, personal communication, 2017). According to some respondents that asked for anonymity, the small areas that had been deforested by smallholders can

be ascribed to irregularities in the smallholder credit approval process, as some personnel perceived a pressure not to obstruct sector expansion. Several analysts in the Amazon (e.g. Assunção, Gandour, Pessoa, & Rocha, 2017) demonstrated that Brazil's environmental governance framework has limited capacity to effectively regulate smallholder deforestation. The reasons are the higher transaction costs and technical difficulties identifying small-scale deforestation through available satellite imagery. Hence, low deforestation rates by oil palm smallholders does point to the additionality of SPOPP.

5.2. Explaining the mixed smallholder scheme outcomes

5.2.1. Context

Contextual factors contributed both positively and negatively to observed outcomes. The small absolute number of contracted smallholders and the large share of farmers in a precarious or critical situation can partly be explained by three contextual factors. First, defaulting on loans is a structural problem in the region, with many households blacklisted for PRONAF Eco purposes due to failure to repay their loans under past PRONAF projects. Second, contract farming, especially through governmental intervention, was a relatively new phenomenon in the region. Given the historical distrust between private sector investors and smallholders and the intense (political) polarization of “agribusiness” and “family farming” interests (Favareto, 2016), many smallholders and unions were skeptical about being locked into long-term contracts with companies. Third, Brazil's economic slowdown and declining CPO and oil prices, particularly since 2015, along with corruption

scandals involving also major players in the palm oil sector, led to a deterioration of sectoral prospects. This resulted in a reevaluation of corporate expansion plans.

Some of the positive outcomes for smallholders can also be explained by contextual factors. Oil palm smallholders benefitted from a well-organized and dynamic smallholder movement under the National Confederation of Agricultural Workers (CONTAG), with strong ties to the ruling government and the president himself.³ Especially during the early years of SPOPP, unions not only helped craft and monitor compliance with rules on smallholder inclusion, but also mediated between smallholders and companies. In doing so, they influenced the content of contracts between individual companies and their smallholders, and the below-discussed inclusion criteria.

5.2.2. Supply chain initiatives

In addition to the official inclusion criteria, companies also adopted their own criteria that impacted expansion and scheme inclusiveness. Despite minor variations, these included criteria pertaining to: (a) access to roads, (b) proximity to mill(s), (c) location within geographic farming cluster, (d) financial and crop management capacity of smallholders, (e) availability of sufficient capable household labor, and (f) owning at least 25 ha of land. While many of these criteria were motivated by commercial interests (e.g. transaction cost management and smallholder productivity), in certain cases, companies sought to minimize negative socio-economic spillovers and reputational risks. In specific, minimum land requirements were imposed to reduce food security risks. Because PRONAF Eco only permits up to 10 ha of oil palm, companies wanted to ensure enough additional land was available to cultivate food crops. Some companies even developed planting guidelines that encouraged food intercropping between immature oil palms. These criteria partly contributed to reducing food security risks and preventing (more) households incapable of effectively producing oil palm (e.g. due to labor constraints) entering into production contracts. They also impeded the expansion of smallholder schemes and excluded more marginalized households (for both good and bad).

However, according to innumerable statements of unions and farmers, the large number of critical and vulnerable contract farmers can also be attributed to a declining quality of corporate extension support since 2015. As sector's fortunes deteriorated, companies struggled to successfully compete. Innumerable farmers complained of poor technical assistance and input provisioning, notably delayed fertilizers. This is partially a result of inefficient planning and lack of local knowledge. Several new investors had no prior experience with primary production in the Amazon. As they struggled to find the necessary number of qualified farmers and were pressured to meet expansion targets, many companies began to explore opportunities for raising eligibility rates. That included relaxing their own eligibility criteria and pressuring banks to simplify and facilitate credit approvals. In many cases, farmers that did not meet eligibility criteria were included; notably single-person and/or elderly households). This also resulted in higher degree of geographic dispersion, with many farmers scattered across the landscape, leading to increased service and input delivery and logistical costs.

5.2.3. Domestic regulatory frameworks and alignment

In the mid-2000s, the Brazilian government began to address poverty and pervasive social inequalities more comprehensively. Cash-transfer programs and policies targeting rural populations

³ Under the Lula da Silva administration, the MDA assumed greater political relevance since it represented the interests of the electoral support base of Lula's Workers Party.

such as PRONAF began to play a critical role in rural development in peripheral states. SPOPP's social inclusion objectives cannot be divorced from the federal government's more pro-poor policy stance (Burton, 2013). PRONAF Eco, for example, builds on the existing PRONAF structure, which includes a large network of banks, unions, public and private technical assistance providers. This enables PRONAF to provide credits at subsidized interest rates and with a high-risk tolerance. Inclusion under SPOPP was enabled by aligning with and leveraging these existing structures.

Governmental support was also of critical importance. The Ministry of Agrarian Development (MDA) in the first years of SPOPP was actively encouraging oil palm companies to integrate smallholders under SFS, mediating when issues arose and monitoring performance. However, this changed when the former president was impeached, and the new conservative right-wing coalition entered government. Consequently, the MDA was relegated to a lower administrative and operational level, which diminished its effective capacity to mediate and monitor. This reduced ability became especially apparent when it failed to intervene when corporate service and input delivery issues arose, and an increasing number of farmers were risking default. Smallholder organizations consequently also experienced reduced access to financial resources and political influence, which eroded their capacity to effectively represent their constituent's interests as corporate commitment to smallholder schemes began to wane.

5.2.4. SPOPP's additionality

The introduction of PRONAF Eco under SPOPP incentivized companies to contract smallholders, particularly in the early years of SPOPP. Companies were able to expand the hectareage under their control without bearing the establishment costs and default risks, which were borne by public banks instead. For the more successful farmers, the design of the smallholder scheme was also hugely important. It enabled them to develop capacities to effectively cultivate a new crop and derive a stable income, as SPOPP ensured that technical assistance was provided, prices were predictable and marketing risks low due to the 25-year guaranteed offtake contract. This helped address pervasive market failures confronting smallholders in the Amazon, who ordinarily have to contend with an absence of technical assistance, high price fluctuations and uncertain market access. Even considering lesser successful farmers, compared to other credit schemes, PRONAF Eco has comparatively low credit default rates, according to bank managers (F. Castro, personal communication, 2017; A. Pereira personal communication, 2017).⁴

However, as both companies and smallholders encountered difficulties on the ground, SPOPP failure to institute mechanisms to monitor and resolve implementation issues became increasingly apparent. Continuous fine-tuning of instruments would have been needed to collectively resolve emerging problems, but in the absence of structures to facilitate learning and dialogue SPOPP proved to be largely unresponsive. Analysis of the state and federal chambers' agendas reveal that none of the relevant issues were tabled in discussions, nor were smallholder organizations granted a space to voice emerging concerns. SPOPP would have benefitted from adaptive management strategies that provide more flexible and collaborative ways to deal with changing contexts (Wyborn, 2015).

⁴ In several cases, unsuccessful smallholder projects have been informally taken over by successful neighbors or relatives. This has been regarded as a viable alternative to prevent credit default. However, it may also promote inequality.

5.3. Explaining poor economic outcomes

5.3.1. Context

In addition to the economic and political turmoil discussed above, we also identified technological and logistical factors that have impeded sector development. Firstly, the planting material commonly available in Brazil have undermined competitiveness. The African oil palm (*Elaeis guineensis* Jacq.) is the most commonly used variety in Brazil, as it is the highest yielding (up to 7 MT of CPO per ha/year). However, publicly available data suggests that the sector in Brazil on average only attained a yield of 1.5 MT of CPO tons per ha/year in 2015 (Abrapalma, 2017). While the large area of immature palms contributes to this, even the most productive companies with predominantly mature palm only attain yields of 3.4 MT of CPO per ha/year (Agropalma, 2018). This large yield gap severely undermines competitiveness. The variety is susceptible to bud rot, a disease characterized by leaf yellowing prevalent in Latin American countries, though not in other producing regions, significantly contributes to this. While public and private R&D have enabled introduction of several varieties resistant to bud rot in the 1980s,⁵ these materials have not been able to bring significant improvements to yields, and were associated with comparatively high costs due to the need for assisted fertilization.

The second contextual factor is logistics. According to industry representatives (M. Brito, personal communication, 2017; Yokoyama, 2017), it is cheaper for Brazil's main palm oil buyers in São Paulo to source from Malaysia (even including transportations and tariffs) than from the Amazon. Many companies ascribe the comparatively high transportation costs to the lack of return loads on freight exchanges between ports. This depresses prices for domestically sourced CPO. Moreover, declining world prices since 2014 and high transportation costs in northeast Pará due to inter alia large distances between smallholders and mills, inefficient planning, and poor road quality further undermines competitiveness.

5.3.2. Supply chain initiatives

While only one company targeted premium markets through differentiated product offerings (e.g. organic and RSPO certified), the sector largely failed to adopt product differentiation strategies. Business strategies were largely premised on two assumptions: a) Brazil's biodiesel industry would continue growing, and b) global CPO prices would continue rising as Northern governments look to deliver on their bioenergy targets and fossil fuel prices continue their upwards trajectory. In practice, however, Brazilian palm oil could not compete with cheaper alternatives, notably soy, in the national auctions as CPO prices, contrary to expectations, declined and demand for biodiesel feedstock stagnated due to low fossil fuel prices. These business strategies at that time did not warrant large investments in value addition or product differentiation and failed to help position these companies to effectively compete outside the energy sector. These assumptions also deterred investments in process upgrading (e.g., mechanization, development of improved varieties). As a result, few companies were able to reduce their costs of production.

5.3.3. Domestic regulatory frameworks and alignment

The Brazilian regulatory framework also did not prove amenable to improving sectoral competitiveness and enabling more rapid expansion, especially due to Brazil labor laws and customs policies. As discussed above, owing to its comparatively progressive labor laws, labor costs in Brazil are considerably higher than

in most other palm oil producing countries. These emerged from the country's investment in institutional structures that facilitate dialogue between trade unions and companies, as well as an active and politically influential Labor Public Prosecutor Office (LPPO). The LPPO even holds companies responsible for labor irregularities on smallholder plantations.

Finally, some investors argue that custom policies also discriminate against the Brazilian sector by not imposing import tariffs on CPO from Colombia and Ecuador, despite Brazilian CPO being subjected to a 5% tariff in those countries, and decreasing the import tariff on PKO from 10% to 2% (Brito, 2014b). Although tariffs on Malaysian and Indonesian CPO are levied, they are considered insignificant to offset the cost disadvantage of Brazilian producers.⁶

5.3.4. SPOPP's additionality

SPOPP principally sought to enable sector expansion by leveraging existing biodiesel incentives and through further investments in R&D. The biodiesel incentives only worked to the extent that they attracted investors to the region but failed to create a palm-based biodiesel market. Although the National Agency of Petroleum, Natural Gas and Biofuels sets a maximum reference price for its biodiesel auction, since June 2013 (the 31st auction) the average selling price in most auctions tended to exceed the average cost of production.⁷ Under these conditions, companies lack incentives to continue targeted the energy sector, as per initial business strategies. The SFS system consequently did not apply nor incentivize further smallholder expansion, with no stamps to date having been allocated to oil palm companies. Even though these issues became apparent at an early stage, SPOPP did not address nor introduce new instruments to protect against declining investor commitment to the sector. This reflects SPOPP's dependency on incentivize structures beyond its control and failing to adequately (re)consider introducing incentivizes specific to the sector.

Additionally, planned investments in R&D that were critical to developing improved varieties to raise sector competitiveness failed to materialize. SPOPP initially announced that US\$ 18.75 million would be invested in improving plant genetics and for seedling production. However, it ended with political announcements. According to industry insiders, given the current economic situation, the budget allocated to R&D was heavily cut.⁸

6. Discussion: managing trade-offs

While evaluating outcomes in isolation helped identify why they materialized in a specific context, outcomes actually are interdependent and involve trade-offs. Anticipating such trade-offs is highly pertinent to development of new regulatory innovations by enabling proponents to resolve sources of competition, introduce safeguards and/or articulate compromises. Specifically, we identify and discuss below two particularly significant trade-offs: (1) between the viability of smallholder schemes and environmental and inclusivity objectives, and (2) between sectoral competitiveness and labor rights/conditions and environmental performance.

⁶ Recognizing this problem, there is an ongoing debate in the Federal Chamber on tariff protection with consumer industries lobbying for tariff reduction and palm oil producers for tariff increase. The sector managed to temporarily protect the sector in 2016 by increasing the import tariff for CPO from 10 to 20%, but overall, the domestic industry consumers have had more capacity to influence trade policies, according to industry insiders.

⁷ The average biodiesel selling price in the auction amounted to US\$ 0.62 per liter, while average crude palm oil (CPO) production costs (excluding transportation costs and transesterification) amount—according to Breslin & Nesadurai (2014a)—to approximately US\$ 0.67 per liter.

⁸ Some companies such as Denpasa, Marborges and Agropalma, continue to invest but mostly by their own means.

⁵ Including seven African oil palm intraspecific new cultivars and an interspecific hybrid cultivar of African oil palm and caiaué: BRS Manicoré.

6.1. Contract farming schemes viability, inclusiveness and environmentally responsible

Results show that some of the contract farming schemes failed to include more marginalized smallholders because of the introduction of eligibility criteria that were intended to reduce credit default risk for public banks and corporate transaction costs and maximize smallholder productive performance. Exclusion of black-listed, less affluent and labor and land-constrained farmers no doubt enhances the long-term viability of contract farming. However, it deprives important societal groups from benefiting from market innovations from which they particularly stand to benefit. Participation may not be a desirable livelihood option for all and may risk trapping more vulnerable groups into cycles of debt. Nonetheless, as a public intervention, more attention deserves to be paid to impact on societal inequalities and alignment with wider rural poverty alleviation objectives.

Likewise, deforestation restrictions imposed on smallholders at the property level also contributed to excluding some groups, especially those with too much forests contained on their plot to cultivate the necessary 10 ha. As such, those that have avoided deforestation in the past are penalizing. Furthermore, it limited the amount of land available for expansion and the possibility to form plantation clusters that could have reduced transportation and service and input delivery costs. Relaxing such requirements, while hypothetically socially and economically desirable, would have severely undermined the sector's environmental performance.

SPOPP could have better anticipated such dilemmas and associated perverse outcomes. Specific strategies for farmers with high risk of default or underperformance could, for example, have been devised had SPOPP proponents more actively participated in implementation. This could have entailed permitting and introducing special credit facilities for smaller plantations or alternative cropping models (e.g. oil palm agroforestry) in order to include land- and labor-constrained groups. Also, it could have explored block farming opportunities to consolidate production, improve corporate oversight and reduce transaction costs. In order to identify (the viability of) such options, SPOPP would have needed to evolve and continue learning from practice and concerned stakeholders. This not only would have required better monitoring and communications, but also investments in institutional structures that enable adaptive management. In that respect, SPOPP in hindsight was too technocratic.

6.2. Sectoral competitiveness, labor conditions and environmental responsibility

While competitiveness concerns reduced the ability of SPOPP to deliver improved social performance, social considerations beyond the scope of SPOPP did paradoxically also affect competitiveness. High labor costs in Brazil owing to its progressive labor laws have significantly undermined sectoral competitiveness vis-à-vis producers in other countries, much more so than SPOPP environmental requirements. The abundance of large previously deforested cattle ranches where oil palm can be successfully cultivated at an economic scale provide ample opportunities for further expansion, at least for domestic investors. Additionally, although they are significantly higher than in most other palm oil producing countries, environmental costs (e.g. associated with legal reserve opportunity costs and environmental regularization) tend to be residual sunk costs that mostly concern the implementation phase. Labor intensive agro-industries in Brazil can generate significant employment opportunities in areas with few off-farm livelihood options. Yet, the debilitating effects of high labor costs for oil palm in the coun-

try suggest, in contrast to soy, for example, an inherent competitive disadvantage.

Downgrading labor rights would involve a race to the bottom and would certainly not be a socially desirable strategy to build a vibrant palm oil sector. One increasingly acknowledged option by industry insiders is to address high labor costs by outsourcing more production to third parties. Especially smallholders that depend on household labor are less burdened by high labor costs. With more than 80% of the land under cultivation directly managed by companies, there certainly is significant room to ramp up external sourcing activities. However, doing so will exacerbate the aforementioned tensions between the viability of contract farming and social inclusion. Significant innovation to balance these trade-offs is however possible, as the previous reflections illustrate, and could simultaneously help resolve some of the sector's structural competitiveness challenges.

Enhancing competitiveness would also involve exploring other venues besides cost cutting. Sectoral prospects may improve organically as more biodiesel is expected to be incorporated in the national energy mix in the coming years, with the mandate increasing from 10% in 2019 to 20% in 2030. Yet, that will largely depend on the capacity to compete with soy oil and future investment in biodiesel plants (Yokoyama, 2017). Reducing dependency on the domestic biodiesel market, albeit not previously prioritized under SPOPP, will help in diversifying marketing options, and reduce the sector's exposure to developments in the energy sector. Seeing how the sector is comparatively green compared to the sector in many other countries and suppliers are largely traceable (also in contrast to many other countries), palm oil companies in Brazil are especially well-positioned to gain certification under RSPO (especially more rigorous versions such as Identity Preserved) and demonstrate their CPO is deforestation-free. Investments in developing an independent traceability system and more aggressively marketing this internationally could contribute to opening new market opportunities.

7. Conclusions and lessons for governance debates

In this paper, we sought to assess the performance of Brazil's palm oil sector, against three government outcome targets, and, in turn, attribute this to the program (SPOPP) that sought to establish the rules for sustainable sectoral development. We found that Brazil has managed to avoid deforestation typically associated with oil palm expansion. Oil palm establishment involved the conversion of 0.8% and 1.3% of primary forests for corporate and smallholder plantations, respectively. However, the Brazilian government did not manage to optimally enhance smallholder participation in the sector, as significant differences in performance were observed between farmers, ranging from very successful (17%) to highly unsuccessful (12%); and failed to achieve sectoral development and competitiveness targets. SPOPP's intentions were ambitious and commendable, and did contribute to some of the positive outcomes observed, notably preventing deforestation and setting the foundation for more smallholder-inclusive sector development. Though, the program was unable to raise sectoral competitiveness and scale promising smallholder schemes that were developed. Some of these failings can be attributed to political and economic factors or corporate strategies and decisions beyond the remit and control of SPOPP. But some arguably could have been better anticipated and responded to had SPOPP been more adapted to evolving contexts and investing in developing governance structures that facilitate multi-stakeholder dialogue and collaborative learning.

As others have done before (Garrett & Rausch, 2016; Van Vliet, Magliocca, Büchner, Cook, Rey Benayas, Ellis, Heinemann, Keys, Lee,

Liu, Mertz, Meyfroidt, Moritz, Poepflau, Robinson, Seppelt, Seto & Verburg, 2016), our results highlight the innate tensions between social, environmental, and economic objectives, as well as the challenge of reconciling these into one coherent sectoral governance model. Yet, this case study suggests that domestic governance in the sector certainly does matter. SPOPP is a valiant attempt to put in place new - and leverage the existing - domestic structures to develop a sector in coherence with national rather than transnational priorities, at the same time as alleviating deforestation and social risks more effectively. Interestingly, the sector was able to expand rapidly in countries like Malaysia and Indonesia largely because displacement of forest and indigenous peoples. Also, exploitation of the labor force was justified in the name of 'development' (Budidarsono, Susanti, & Zoomers, 2013). Yet, sectoral competitiveness in Brazil was compromised because it did not justify sacrificing these in the name of development.

This article by no means tries to make a case for downgrading socio-environmental safeguards. However, that may risk happening as right-wing populism makes a resurgence in the country. Rather, based on findings, we argue that Brazil is well-placed to leverage sectoral development principles established by SPOPP. Our analysis points to three under-explored and -exploited opportunities that can guide palm oil producing countries to build alternative governance models. These are: (1) investment in institutional arrangements that help build adaptive management capabilities; (2) departing from one-size-fits-all strategies; and (3) deriving comparative advantage from sustainability.

SPOPPs inability to respond to changing contexts and unanticipated performance challenges can partly be attributed to lack of adaptive management and multi-stakeholder participation. Investment in institutional structures with monitoring capabilities and capacity to stimulate dialogue and learning between different interest groups could enable the type of deliberative and reflexive governance structures required to continuously balance competing interests and objectives. That is also important to respond to unintended effects. In other words, institutional innovation can be an important conduit for regulation innovation (Schut, Cunha Soares, van de Ven, & Slingerland, 2014).

The rules introduced by SPOPP have enabled development of smallholder schemes that enlarged smallholder opportunities to adopt a crop with many pro-poor attributes. Yet, emerging inclusivity concerns suggest that this structure may not serve the interest of especially marginalized and vulnerable groups, as appears to be characteristic of contract farming more generally (Bellemare, 2012; Miyata, Minot, & Hu, 2009; Narayanan, 2014). Failure to adapt the design of these schemes to accommodate the needs and priorities of excluded groups partly points to a lack of adaptive management capacity, but also to excessive reliance on a singular 'one-size-fits-all' solution. As others have pointed out for the Indonesian palm oil sector (Jelsma, Schoneveld, Zoomers, & van Westen, 2017; Schoneveld et al., 2019), more explicitly accounting for smallholder heterogeneity can play an important role in devising more socially impactful intervention strategies. Alternative cropping systems or credit facilities for land- and/or labor-constrained farmers could not only help raise expansion rates, but also ensure that sectoral growth is broad-based.

Finally, the Brazilian palm oil sector is well positioned to exploit the rising demand for sustainable CPO especially in Northern countries. These opportunities have been poorly exploited in the past, with SPOPP largely conceived to help diversify the national biodiesel feedstock supply base. In this regard, the Brazilian palm oil sector has a comparative advantage over most other producer countries that can be leveraged more deliberately in future. Though, this does suggest that being blind to transnational social processes - as SPOPP (partly purposely) has been - is a risky strategy. Companies such as Agropalma, that in contrast to most others

have aligned their practices with RSPO and corporate zero deforestation commitments, are more competitive within international markets and less dependent on the domestic (energy) market and governmental protectionism. While the experience from SPOPP demonstrates the merit of bringing the state back in, in a context where supply chain relations are increasingly dictated by non-state regulation, failing to nest domestic governance innovations in transnational governance innovations risks competitively disadvantaging a sector.

CRediT authorship contribution statement

Frederico Brandão: Conceptualization, Methodology, data Curation, Writing- original draft preparation, Visualization. **George Schoneveld:** Supervision and Writing- reviewing and editing. **Pablo Pacheco:** Supervision and Writing- reviewing and editing. **Ima Vieira:** Writing- reviewing and editing. **Marc Piraux:** Writing- reviewing and editing. **Dalva Mota:** Writing- reviewing and editing.

Declaration of Competing Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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