

Review Article

A comparative analysis of the effectiveness of four supply chain initiatives to reduce deforestation

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Abstract

Deforestation and forest degradation account for around 12-15% of global greenhouse gas emissions and are largely driven by agricultural expansion. In the absence of formal regulation, voluntary initiatives have been established to meet demands from consumers and environmental NGOs. This paper examines what explains the effectiveness of supply chain initiatives to reduce deforestation, comparing four supply chain initiatives in two countries: the Roundtable on Sustainable Palm Oil in Indonesia and the Roundtable on Responsible Soy, the Soy Moratorium and the Cattle Agreement in Brazil. The first two are certification schemes, incentivizing more sustainable production, while the latter two are moratoria under which certain actors no longer purchased from companies that engaged in deforestation after a certain date. The moratoria benefitted from a concentration of power among actors risking loss of customers and able to demand changes in behavior from their suppliers. Certification schemes of multi-stakeholder initiatives are based on consensus and have lower requirements for reducing deforestation. For all initiatives a risk of leakage – deforestation by others, for other purposes, or elsewhere – remains. Little seems to be known regarding the possibilities farmers have to alter production practices, potentially hampering the development of public policies to complement the private initiatives.

Keywords: supply chain initiatives, deforestation, Indonesia, Brazil

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Introduction

Deforestation and forest degradation account for 12-15% of global greenhouse gas emissions [1, 2]. Every year, 4-5 million hectares (ha) of forest area are lost (0.1-0.15% of global forest cover) [3]. For the period 2005-2010, about half of this deforestation occurred in the two countries with the largest deforestation rates: Brazil and Indonesia [3]. Brazil had a forest area reduction of around 2 million ha per year and Indonesia of around 700 thousand ha per year [3]. Demand for forest and agricultural products, particularly palm oil, soy, beef and leather, and timber, pulp and paper, is the major driving force for deforestation [4-8].

In the absence of well-enforced public policies and regulations to reduce deforestation, voluntary initiatives have been established to reduce deforestation by influencing the production practices of consumer goods. These initiatives are referred to in this paper as 'supply chain initiatives'. In order to further reduce deforestation and to develop effective public policies to curb it, it is essential to determine whether supply chain initiatives are likely to have a significant impact on deforestation and how the functioning of voluntary supply chain initiatives can be enhanced.

The processes of the establishment of these voluntary supply chain initiatives, and their effectiveness, have been discussed in the literature for palm oil [e.g. 9, 10], soy [11-13] and cattle ranching [e.g. 14]. Walker et al. [15] and Rautner, Legget and Davis [7] discuss for various products the characteristics of various demand-side and supply chain initiatives, the challenges they face, and further measures that can be taken. While the journal and grey literature available contain valuable information on the effectiveness of initiatives to reduce deforestation and discuss various factors contributing to or hampering this effectiveness, a structured and comparative analysis is not available. Newton, Agrawal and Wollenberg [16] stress the need for, and lack of, a "*comparative analysis across commodities, cases and countries.*" This paper compares four private-sector initiatives in two countries: the Roundtable on Sustainable Palm Oil (RSPO) in Indonesia, and the Roundtable on Responsible Soy (RTRS), the Soy Moratorium, and the Cattle Agreement in Brazil, to assess the effectiveness of such initiatives under various different circumstances.

Methods

To determine what factors determine the effectiveness of supply chain initiatives to reduce deforestation, two steps were taken:

1. Identification of factors influencing the effectiveness of supply chain initiatives to reduce deforestation

A supply chain initiative is here considered effective when it contributes to reducing deforestation. To assess effectiveness of policies, three effectiveness levels are distinguished [17]. The ultimate societal result, in this case reduced deforestation, is in effectiveness literature referred to as 'impact' effectiveness. To achieve this, behavioral change is required of the actors that currently deforest, which is referred to as 'outcome' effectiveness. Supply chain initiatives aim to influence this behavioral change through setting ambitious targets with regard to reducing deforestation. This is referred to as 'output' effectiveness. The aim of this paper is to understand whether supply chain initiatives can influence the behavior of companies in relation to deforestation, and therefore the focus is on outcome and output levels of effectiveness.

The ambitiousness or strictness of the standards of the supply chain initiative with regard to deforestation is taken as indicator of output effectiveness. Outcome effectiveness should be reflected by the part of the sector that changes behavior. High compliance of the sector with deforestation criteria forms one component of this. However, companies that require little or no

changes in production practices in order to comply with criteria will be more inclined to join an initiative than companies for which compliance would require large changes or high investments. This was observed for adoption of the Forest Stewardship Council (FSC) certification scheme [18]. This means that high compliance does not guarantee behavioral change. Therefore, as indicator of outcome effectiveness, this paper uses the part of the sector adopting the standards, in combination with a qualitative indication of whether adoption was likely to have required a change in behavior.

Starting from the incentives for companies to change production practices, explanatory variables for both outcome and output effectiveness are derived through an analysis of literature on voluntary sustainability initiatives by the private sector. Attention is paid to factors pertaining to the sector, the national governance setting in the producing country and the characteristics of the supply chain initiative.

The main reason why high outcome effectiveness would not lead to high impact effectiveness is leakage. Leakage refers to the situation where reductions in deforestation lead to an increase in deforestation by others, for other purposes, or elsewhere [e.g. 19]. The risk of leakage is addressed in the discussion section.

2. Comparative analysis of four supply chain initiatives

Case selection

This paper examines four supply chain initiatives to reduce deforestation that have been operational for a couple of years: the Roundtable of Sustainable Palm Oil (RSPO) in Indonesia, the Roundtable of Responsible Soy (RTRS) in Brazil, the Soy Moratorium in Brazil, and the Cattle Agreement in Brazil. The RSPO and RTRS are certification schemes, with which farmers can voluntarily comply in exchange for receiving a price premium or selling credits. The Soy Moratorium and Cattle Agreement are moratoria, with which compliance by farmers is also voluntary, but non-compliance would result in being taken off the suppliers list of major processors and traders. The RTRS, Soy Moratorium and Cattle Agreement are all in Brazil, which means that the national governance setting is the same, allowing for a better comparison of the other aspects. For the RTRS and Soy Moratorium, which both regulate soy production, the sectoral and market conditions are the same as well, allowing for a further comparison of the initiatives.

Brief background on the four initiatives

The first steps to establish the *RSPO* were taken by the World Wide Fund for Nature (WWF) in 2002, leading to the establishment of the RSPO in 2004. The first set of "Principles and Criteria" were issued in 2007, with an update in 2013 [20, 21]. The first "Certified Sustainable Palm Oil" (CSPO) came on the market in 2008. With initial meetings organised by WWF, a group of companies: Grupo Maggi, Cordaid, COOP, Fetra-Sul and Unilever, together initiated the *RTRS* from 2004 onwards. The official establishment followed in 2006, and the Standards for Production [22] became available in 2010. The first soy was certified in 2011. The *Soy Moratorium* was established in 2006 as well. The Greenpeace publication 'Eating up the Amazon' [23] was seen as a major trigger for this [12]. In this report Greenpeace particularly accuses U.S. companies and the European livestock industry of inducing deforestation for soy production. In response to the Greenpeace campaign and report, the Soy Moratorium was signed between ABIOVE and the National Grain Exporters Association (ANEC) in July 2006, only three months after the publication of the Greenpeace report. The *Cattle Agreement* was established in 2009. Two reports were instrumental to the initiation of private sector action in the cattle sector: "Slaughtering the Amazon" [24] and "Time to pay the bill" by Amigos da Terra – Amazônia

Brasileira, published around the same time as each other [14, 25]. In their report, Greenpeace connected global brands with Brazilian beef and leather producers and deforestation. As a result of the publication, Brazil's three largest supermarket chains, Wal-Mart, Carrefour and Pão de Açúcar, announced they were suspending contracts with suppliers found to be involved in Amazon deforestation [26]. The World Bank threatened to withdraw a USD 90 million loan to Bertin. As a result, four large meat packers JBS-Friboi, Bertin, Minerva and Marfrig, signed the 'G4 - Cattle Agreement' in October 2009, within 3 months of publication of the Greenpeace report.

Data

For the comparative analysis, information has been collected on all explanatory factors and effectiveness indicators of the four initiatives (the RSPO in Indonesia, and the RTRS, Soy Moratorium and Cattle Agreement in Brazil). This description of the initiatives uses published material in journal articles, reports and data provided by the roundtables on their websites. Discussions have been held with a limited number of persons to check findings and fill in gaps. An overview of the data sources can be found in Appendix 2. Factors have been assessed at the level of the initiative and the sector; individual company decisions have not been considered in detailed. A summary of the assessment of output and outcome effectiveness and the explanatory factors is included in Appendix 1, a more detailed description can be found in Meijer [27].

Three comparisons

1. Comparison of certification schemes with moratoria (where particularly the RTRS and Soy Moratorium are interesting to compare because they concern the same commodity in the same country)
2. Comparison of the two moratoria (for different commodities in the same country)
3. Comparison of the two certification schemes (for different commodities and in different countries).

Results

Factors influencing the effectiveness of supply chain initiatives to reduce deforestation

Outcome effectiveness of a supply-chain initiative requires that companies change their production practices. If there is no (risk of) formal regulation or of depletion of resources, a major trigger for companies to adopt more sustainable production practices will be (perceived) consumer demands. Whether this is an attractive strategy for companies depends on several factors, which are discussed below. Terms in italics are included as explanatory variables in the comparative analysis in the next section and in the description of the four supply chain initiatives in Appendix 1.

Demand for low-deforestation products can result in *benefits* for companies that adopt low-deforestation practices. These benefits can have the form of the prevention of loss of market share or higher prices for certified products (through a price premium or through selling credits). A certification scheme informs consumers (including processors, manufacturers and retailers) that the products meet the desired standards. In addition, consumers will need to accept the ways through which compliance is assessed (auditing and *monitoring*) along with how non-compliance is dealt with (*sanctioning*) [28].

A company will balance the perceived benefits of changed production practices and certification with the associated costs. The costs will depend on the *required changes to meet criteria*. The required changes are a combination of the *level of the standards* and the current practices, which are also the result of *existing forest protection laws* in the production country and the extent to which these laws are enforced. Lower allowed deforestation may mean that less land can be

brought to production and less income can be obtained from timber yields, or investments may need to be made to intensify production on less land. High standards may therefore result in high costs and hamper participation in a supply chain initiative and ultimately lead to lower impacts [29]. In addition, in the case of roundtables and certification processes, memberships and regular audits may cost money. Often, these costs are borne by the producer.

Even when benefits outweigh costs, it may be difficult for companies to adopt sustainable practices when they do not possess the resources or the capacity to do so, particularly if the required changes are *technically complex*. Companies will therefore need resources if they are to become involved in initiatives; besides financial resources, knowledge and capacity are also required. Generally, larger companies have such resources at their disposal more easily than smaller companies, which explains a higher involvement in supply chain initiatives of large-scale companies than of smaller ones [e.g. 30, 31]. At the same time, access to resources – particularly knowledge – can be a reason for (particularly smaller) companies to join initiatives [18]. In such cases farmers may benefit from higher yields or lower operation costs through increased knowledge of agricultural practices, raising their net company benefit while adopting low-deforestation production practices.

In addition, local governance arrangements may be counterproductive and provide *institutional obstacles for compliance*. For example, in Indonesia, companies can delineate areas within their concession area as conservation set-asides, and choose not to deforest them. However, these areas remain subject to land-use taxes, and companies may therefore choose to rather return these parts of their concession [32]. Also, companies may be obliged under their contract to develop the area for which they have a concession within a certain number of years. If this is not done, the government has the right to allocate the land to others [9, 31].

Large actors have often been the target of NGO campaigns in the past years [e.g. 23, 24, 33]. Such actors with *high visibility* may be sensitive to negative publicity that targets them directly. This negative publicity – referred to by some as ‘blackwashing’ [34] – may trigger targeted companies to change their behavior – or influence their suppliers - without an explicit direct demand from consumers for sustainable products. Visibility is higher when a supply chain is short and transparent or when there are legal requirements regarding traceability [35]. The adoption of standards by companies can thus also be influenced by the structure of the supply chain, which may differ across sectors. If the sector has a high *vertical chain integration*, there is a high degree of ownership of upstream suppliers and downstream buyers in a value chain, or close and long-term cooperation [36]. In such a case, downstream actors which are closer to consumers can influence upstream suppliers to produce more sustainably [35]. Another characteristic of the supply chain is the level of *horizontal concentration*, which indicates the number of actors at a certain level in the supply chain. With high concentration, a few powerful actors dominate a crucial step in the supply chain, which means they have, as a group, high leverage over other actors in the supply chain.

The ambitiousness of the standards of the supply chain initiative is one of the factors influencing the outcome effectiveness, but is also in itself a measure of the output effectiveness of the initiative. The formulation of the standards can be assumed to be influenced by *expectations and knowledge* regarding costs, benefits and feasibility of a supply-chain initiative among the actors participating in the forum which establishes the initiative. The *composition of the forum* and the *power relations* among actors in the supply chain in this forum are thus relevant factors for the output effectiveness of supply chain initiatives.

Comparative analysis

Comparing moratoria and certification schemes

With regard to output effectiveness, moratoria have been more effective in developing ambitious standards to reduce deforestation than certification schemes. Neither of the certification schemes allows the clearance of primary (RSPO) [21] or native (RTRS) [22] forests or of areas of high conservation value (HCV). However, these forest types represent only part of the total forest area, and also forests not classified as primary or native can have a climate and biodiversity value [10, 33]. Moreover, the assessment of which forest areas are primary, native, or HCV is considered ambiguous [10, 33]. Moratoria ban the procurement of soy and cattle respectively from suppliers that can be linked to deforestation [37, 38]. In this sense, the moratoria can be considered to have stricter criteria.

Of the factors assumed to influence the ambitiousness of the supply chain initiative, particularly the composition of the forum differs between the certification schemes and the moratoria. The certification schemes were set-up as multi-stakeholder platforms while in the establishment of the moratoria only a limited number of actors at the processing and trading level of the supply chain participated. As a result, also the expectations regarding the costs and benefits of the initiative for the participants in the forum would have varied: The strictness of deforestation criteria under the moratoria can be seen as low risk for the participating partners for two reasons: First of all, they are not producers themselves and do not have to bear the costs of changing behavior, while the benefits for them are high, since they are trading with partners that have environmental concerns. Second, they control large parts of the market which means that they do not lose their competitive position. Both in the RSPO and in the RTRS, producers who will have to bear the costs with uncertain benefits in return are members and take part in decision-making on the criteria. The consensus rule of the multi-stakeholder partnerships [39, 40] logically results in compromise standards. With regard to the other factors that were assumed to lead to differences in strictness of the criteria – the availability of knowledge, ideas, and resources, vertical integration, horizontal concentration, and visibility of actors, there seem to be less pronounced differences between the certification schemes and the moratoria. In fact, it may be surprising that many factors are the same for the two initiatives for soy, the Soy Moratorium and the RTRS, with a different result. Perhaps the focus on the Amazon area – a confined, though large spatial area – allowed bringing together all actors at a certain supply chain level active in this area.

At the outcome level, compliance with voluntary criteria seems to be relatively high under the two moratoria in comparison with the certification schemes. The actors involved in the soy moratorium control 90% of the Brazilian market [12] and those involved in the cattle agreement 40% [14]. Compliance with the soy moratorium is understood to be high [12, 41], and also the Cattle Agreement seemed effective [14], but actual compliance levels in terms of percentage of producers meeting the criteria are not known. In comparison, 10% of palm oil production from Indonesia is RSPO certified [42, 43], and 0.5% of soy production from Brazil is RTRS certified [43, 44]. However, it should be noted that the RTRS is not the only sustainability label for soy. At the global level, 1.3 million metric tons of soy were RTRS certified in 2014 [40], while 2.9 metric tons of soy were ProTerra certified in 2014, with 95% originating from Brazil [45], accounting for 3% of Brazil's soy production in 2013 [43]. ProTerra poses restrictions on deforestation similar to those of the RTRS [46].

With regard to compliance without actually changing production practices, it has been suggested that instead of changing the location of a palm oil plantation, smallholders would seek certification if their plantations already meet criteria [47]. Actual reductions in deforestation

were observed in the Amazon [41, 48], which gives the impression that compliance without changing behavior has not limited the effect of the Soy Moratorium and the Cattle Agreement. With regard to the RTRS no information was found.

The structure of the sector, with high leverage of the actors involved in the moratoria over producers, combined with the ambitious standards of the moratoria and strict monitoring can explain the difference in outcome effectiveness. The benefits for producers to comply with the moratoria are high, because they risk losing the ability to sell their produce. Such a risk does not exist for those not certified under the certification schemes; at least for palm oil it is clear that producers have little problem selling uncertified palm oil [9]. Having production practices certified could lead to financial benefits through the possibility to receive price premium for certified produce (RTRS), or through the possibility to sell certificates (RSPO and RTRS). However, the price premium for RSPO certified palm oil is considered to be low [49]. For all initiatives, the costs of changing behavior are borne by the producers. With regard to the national governance setting, both Brazil and Indonesia have laws in place that restrict where (Indonesia) and how much (Brazil) deforestation is allowed. In both cases, these laws have not been well enforced [25, 32, 50, 51], and deforestation has taken place illegally. A difference is that the bilateral agreement between Norway and Brazil has induced stronger law enforcement of the Brazilian Forest Code. In fact, it has been suggested that the combination of public and private actions have contributed to the reduced deforestation that was observed in Brazil [25, 48]. For the RTRS and the Soy Moratorium, both in Brazil in this research, the national governance setting is the same and thus cannot explain the differences in outcome.

Comparing the two moratoria

The two moratoria have very similar characteristics: both the factors influencing the functioning and the functioning itself are similar. In both cases, a limited number of visible and powerful actors decided to (temporarily) ban suppliers that deforested after the signing of the agreement. The situation in Brazil may be unique with a lot of deforestation in the Amazon region already illegal under Brazilian laws, good possibilities for monitoring through remote sensing, financial incentives through bilateral results-based aid, and an environmentally concerned civil society [14, 25, 48]. According to Boucher, Roquemoire and Fitzhugh [25] the funds provided by Norway do not fully cover the opportunity costs of the reduced deforestation, but Brazil, as an emerging economy, considers the additional costs part of its own efforts to reduce its emissions. Under the moratoria, the government does not compensate the sector for possible lower income.

Comparing the two certification schemes

The ambitiousness of the standards are similar for the RSPO and the RTRS, but adoption is higher for the RSPO in Indonesia than for the RTRS in Brazil, and in fact the same is true at the global level. There are no clear differences between the two certification schemes with regard to the explanatory factors. In both cases, the financial benefits of certification to producers are considered to be low, which can in both cases be the result of a low demand for products certified by the initiative. It is unclear whether low demand is the result of lack of concern about deforestation among customers, or rather the result of a lack of trust in the ability of the certification schemes to reduce deforestation. The RSPO has been criticized for the fact that deforestation is not banned more strictly in RSPO standards, the limited ability of the RSPO to monitor compliance, and the limited sanctioning of non-compliance [10, 33]. This criticism may have negatively influenced the image of the RSPO and the demand for RSPO certified produce. For the RTRS, the reason for the low certification may be different. There seems to be less criticism in the literature. Rather, it has been suggested that farmers show little interest in becoming certified, because of the administrative hassles, while they think that the Brazilian

environmental laws already regulate matters sufficiently [52]. Moreover, as mentioned above, large volumes of soy have been certified under other certification schemes.

Discussion

Risk of leakage

The effectiveness of supply chain initiatives can be compromised when it leads to leakage: increases in deforestation elsewhere, by others, or for another purpose. Certification of companies rather than areas limits the risk of leakage through relocation, but the risk of leakage through deforestation by others is still present. This has been mentioned as a risk for palm oil in Indonesia, where a larger plantation reportedly chose to sell the part of its concession that would be non-certifiable [47], in which case the area sold may have been allocated to and deforested by others. Under moratoria, the risk of deforestation by others is small. Relocation is possible, and no clear answer is yet available as to whether this has happened. In Brazil, soy farmers have turned to acquiring land that was already deforested, which contributed to low deforestation rates during the moratoria [11, 41]. This may have displaced pasture use, although the Cattle Agreement may have constrained this [11]. Another possibility is that farmers shift to commodities for which no deforestation criteria apply. For example, Gibbs et al. [11] indicate that in the Amazon, the Forest Code, which does not allow the deforestation of more than 20% of private forest areas, has been violated more frequently than the Soy moratorium, and they attributed this to deforestation for other purposes. It is not known whether this is due to a shift from soy to other products or that this deforestation would have taken place anyway, but it shows that the extent to which a commodity-related supply chain initiative can reduce deforestation is limited.

The findings of this paper indicate that private sector initiatives can contribute to reducing deforestation, but a higher participation of the sector and a broader coverage of commodities is required to prevent leakage.

Reputational risk is a major driving force for changing deforestation practices

The risk of losing market played a significant role in company involvement in supply chain initiatives, which was most clear for the Cattle Agreement – with threats of withdrawals of both purchase orders and financial credits [25], but also for the other initiatives. It is interesting that the soy moratorium was established because of negative publicity, while at the same time the adoption of RTRS-certified soy is low. Perhaps, the perceived risk resulting from being negatively exposed to consumers may have been more important than the actual market share concerned about sustainability. To maintain low-deforestation production practices on the long term it is probably important to increase actual demand. The credibility of an initiative will be of importance to achieve this. Each of the four supply chain initiatives analyzed have such monitoring and sanctioning mechanisms in place to support credibility. Despite this, there may still be lack of trust among customers, because of perceptions of limited actual sanctioning. Particularly the RSPO has been accused of both these shortcomings [10, 33]. Whether this criticism regarding the certification process plays a role in the low uptake of certified sustainable palm oil remains an open question. At the same time, a higher market uptake may create incentives to further strengthen the RSPO, although a reason for parties leaving the RSPO has reportedly been the frequent changing of the rules [31].

Limited knowledge of producer's options

None of the four initiatives seemed to have discussed in detail the complexity, costs and benefits for farmers to reduce deforestation. The moratoria were a quick response to a threat, without involving producers, and it seems unlikely that possibilities and consequences for farmers were

analysed in detail. The standards of the two roundtables evolved through interaction between stakeholders [9, 13]. Nikoloyuk, Burns and De Man [9] mention that getting acquainted with new ideas was a reason for the long process to establish RSPO standards, which suggests a substantive discourse. According to Elgert [13] the development of the RTRS standards was presented and initiated as based on technical knowledge, but over time turned out to be a political process with little substantive discourse. There seems to be little insight into the possibilities for farmers to maintain or expand production while meeting criteria for any of the four initiatives. Would farmers be required to produce on less land, or to expand production onto already deforested land? Will the benefits outweigh the costs? If complexity, costs and benefits were better understood, public actions could focus on providing incentives to support changes in production practices and types of land on which agricultural expansion takes place. For example, researchers mention the availability of “degraded lands” in Indonesia and argue that such land is available to develop different sorts of activities while protecting forests [53, 54]. These degraded lands are often already deforested but not yet allocated to agriculture. Although it is important to know what is technically possible, little information is provided regarding the economic, social and institutional possibilities – what is the suitability of these lands for palm oil production and what is their current use and ownership?

A role for public policies?

Public policies can support the development of private initiatives. Boucher, Roquemore and Fitzhugh [25] and Nepstad et al. [48] attribute Brazil’s success in reducing deforestation to a combination of public and private initiatives. It was apparently the combination of existing laws, monitoring possibilities, international financial incentives and pressures from NGOs and civil society rather than one of those alone that has reduced deforestation in Brazil over the past decade. This is in line with other research on certification schemes which suggests that private initiatives alone are unlikely to prevent deforestation [55, 56]. As mentioned above, the development of effective public policies could benefit from enhanced insights in the possibilities and constraints of producers to reduce deforestation. In addition, public policies can help raise the demand for low-deforestation products. As part of a potential solution, Laurance et al. [10] mention the mandatory and explicit labelling of the use of palm oil in products to increase transparency for consumers. As of December 2014, this is indeed the case in the European Union.

Implications for conservation

A set of factors were identified to explain differences in effectiveness of supply chain initiatives. Of these factors, particularly the powerful position of a limited group of actors with high leverage over producers was found to lead to more ambitious standards with regard to deforestation and higher adoption of these standards. Other factors played a less pronounced role in explaining differences between the effectiveness of supply chain initiatives to reduce deforestation. For all initiatives the (perceived) demand for low-deforestation products played an important role in the establishment of the initiative and the adoption of the standards, and for all initiatives leakage can compromise the impacts on actual deforestation.

Conclusions drawn for other private sustainability initiatives are valid here as well: the initiatives play a role in raising awareness among producers and consumers and contribute to improved production practices, but are unlikely by themselves to largely reduce deforestation. As has been suggested by others as well, international governmental and non-governmental parties should continue to combine the promotion of sustainable products in consumer countries with support in producer countries to better enforce laws and change contra-productive regulations and incentives. More insight in the options farmers have and related costs and benefits will be conducive in this regard.

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Appendix 1: Overview of the assessment of the initiatives

	RSPO – Indonesia	RTRS – Brazil	Soy Moratorium – Brazil	Cattle Agreement – Brazil
<i>Entry into force/ first certification</i>	Established 2004, criteria 2007, first certification 2008 [20, 21].	Established 2006, criteria 2010 [22], first certification 2011.	2006 [37]	2009 [38]
Characteristics of the initiative (for RSPO and RTRS in general, not specific for respectively Indonesia and Brazil)				
<i>Deforestation criteria</i>	No replacement of primary forests and areas of High Conservation Value, avoid plantations on peat [21].	No replacement of native habitat, unless certain criteria are met [22].	No trade in soy from deforested areas in Amazon [37].	No cattle from ranches from deforested areas in Amazon [38].
<i>Composition of the forum</i>	All components of supply chain, 12% of whom are producers [57].	All components of supply chain, 16% of whom are producers [40].	2 associations of grain traders/processors.	4 slaughterhouses.
<i>Expectations regarding the costs and benefits of the initiative for participants in the forum</i>	Varying – members have different roles in supply chain.	Varying – members have different roles in supply chain.	Risk of losing international market [12].	Risk of losing finance and markets [25].
<i>Power relations in the forum</i>	At start, Unilever and Indonesian/Malaysian growers Nikoloyuk, Burns [9]. Consensus rule for decision-making [39].	Because of imbalances, major associations and smallholder groups left (although individual members stayed) [13, 52, 58]. Consensus rule for decision-making [40].	Forum consisted of powerful actors only.	Forum consisted of powerful actors only.
<i>Knowledge, ideas, resources</i>	“The slow development process has respected the fact that participants need time to become comfortable with the ideas being proposed.” [9] gives impression of substantive discourse. Knowledge from participation in RSPO has helped smallholders obtain higher yields and reduce pesticide use [47].	Discourse considered not substantive [13].	Establishment in 3 month period suggests little substantive discourse.	Establishment in 3 month period suggests little substantive discourse.
<i>Monitoring and enforcement of the initiative</i>	Certification by specific independent certification bodies [39]. Sanctioning limited, RSPO prefers dialogue to keep actors on board [47].	Certification by specific independent certification bodies[40].	Remote sensing [12].	Remote sensing [14].
Sector characteristics				
<i>Vertical integration</i>	Many different actors for different steps.	Many different actors for different steps.		Many different actors for different steps.
<i>Horizontal concentration</i>	Some concentration at level of mills	Some concentration at the level of traders [7].		High concentration at the level of slaughterhouses.
<i>Visibility of actors</i>	Producers and manufacturers mentioned by name in	Major producers/traders mentioned by name in campaigns [e.g. 23].		Major slaughterhouses mentioned by names in campaigns [e.g. 24].

	campaigns [e.g. 33].			
National governance setting influencing deforestation				
<i>Forest protection laws</i>	Zoning to determine which areas may be developed [32]. Land use regulations restrict plantation development in areas with over 30% peat deeper than 3 m [32]. Indonesian Sustainable Palm Oil (ISPO) standards focus on compliance with Indonesian law mandatory [31] Forest Moratorium (extended to 2015) to protect additional 22.5 million ha of peat and forest area [59] [50].	Forest Code allows for only 20% of land on private properties to be deforested [51]. Not well enforced, recent amnesty for large part of illegally deforested land. Agreement with Norway considered an additional factor that has strengthened enforcement of the Forest Code [25].		
<i>Institutional obstacles for compliances</i>	Hampered by the requirement to develop land for which concessions are obtained [9, 31].	No specific policies mentioned in literature analysed.		
Incentives for implementation				
<i>Demand</i>	Certified oil not fully taken up by market, many markets accept lower standards, price premium low [7, 9, 10].	Unclear. Competition from other standards [60].	Demand triggered through exposure of major actors by NGOs	Demand triggered through exposure of major actors by NGOs
<i>Benefits of compliance</i>	Low price premium [10, 49].	Price of certificates unknown.	Avoiding the loss of market/purchasers.	Avoiding the loss of market/purchasers/credits.
<i>Required changes to meet criteria</i>	Requirements by law, not always well enforced, peat presence not always based on good assessments. [32].	FC focuses on percentage of land, RTRS on types of forests. Overlaps unclear. Criteria do not demand a lot from participating partners in terms of altering production practices [13].	Stricter than Forest Code (FC) which allows 20% clearance, but FC not well enforced.	
<i>Technical complexity for compliance</i>	Meeting the criteria is hampered by lack of knowledge, lack of motivation and lack of governance capacity within companies [9, 32]. "Degraded lands" suggested for palm oil development [53, 54] but unclear how attractive to producers.	Unclear how farmers needed to adjust operations.	Unclear how farmers have responded.	Unclear how cattle ranchers have responded. Possibilities to increase cattle productivity, which is currently estimated at 32-34% of potential [61].
<i>Costs of compliance</i>	Borne by producers.	Borne by producers.	Borne by producers.	Borne by producers.
Effectiveness				
<i>Output: strictness of criteria</i>	Assessment of HCV areas ambiguous and forest other than primary or HCV areas can still have climate and biodiversity value.	Assessment of native habitats and native forest ambiguous, and other forests can still have climate and biodiversity value.	No deforestation allowed within the Amazon biome for the purpose of soy production as of the cut-off date.	No deforestation allowed within the Amazon biome for the purpose of cattle production as of the cut-off date. However indirect suppliers are not fully controlled.
<i>Outcome: part of the sector implementing</i>	2013: 10% of palm oil production (in tons) in Indonesia is RSPO certified [42, 43] versus 16% globally [62].	2013: 0.5% of soy production (in tons) in Brazil is RTRS certified versus 0.4% globally [40].	90% of Brazilian market is controlled by moratorium establishments and hence assumed to comply [12].	40% of Brazilian market is controlled by moratorium establishments and hence assumed to comply, but no actual assessment available [15].
<i>Outcome: indication of no change of</i>	Suggested that	No information	Reductions in deforestation in Amazon suggest that behavior	

<i>behavior?</i>	certification only sought when requirements already met [47]		was changed
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Appendix 2: list of sources for assessment of four supply chain initiatives

Online information on certified and non-certified production is obtained from three websites:

- www.rspo.org – website of the Roundtable on Sustainable Palm Oil
- www.responsiblesoy.org – website of the Roundtable on Responsible Soy
- faostat3.fao.org – website of the Statistics Division of the Food and Agricultural Organization of the United Nations

Personal communication:

On the RSPO:

- Inke van der Sluis, European Secretariat of the RSPO, The Netherlands, September 2, 2014.
- Eddy Esselink, Netherlands Fats and Oil Industry, The Netherlands, September 2, 2014.

On soy:

- Tamara Mohr, Both ENDS, The Netherlands, September 4, 2014.

On cattle:

- Nathalie Walker, National Wildlife Federation, United States, October 7, 2014.