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Sustainability gridlock in a global agricultural commodity chain: Reframing the soy–meat food system

Malika Virah-Sawmy^{a,b,*}, America P. Duran^{b,c,d}, Jonathan M.H. Green^{b,e}, Angela M. Guerrero^{b,f}, Duan Biggs^{f,g,h}, Chris D. West^e^a Humboldt-Universität zu Berlin. Department of Geography, Rudower Chaussee 16, 12489, Berlin Germany^b Luc Hoffmann Institute, WWF International, Rue Mauverney 28, 1196 Gland, Switzerland^c United Nations Environment World Conservation Monitoring Centre, 219 Huntingdon Rd., Cambridge CB3 0DL, UK^d Department of Zoology, University of Cambridge, The David Attenborough Building, Pembroke Street, Cambridge, CB2 3QZ, UK^e Stockholm Environment Institute, York Centre, Environment Department, University of York, YO10 5NG, UK^f ARC Centre of Excellence for Environmental Decisions, Centre for Biodiversity & Conservation Science, School of Biological Sciences, University of Queensland, Brisbane, Queensland 4072, Australia^g Environmental Futures Research Institute, Griffith University, Nathan Queensland, 4111, Australia^h Department of Conservation Ecology and Entomology, Stellenbosch University, Private Bag X1, Matieland 7602, South Africa

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ABSTRACT

Market governance is viewed as a potentially effective mechanism to achieve more sustainable global production-to-consumption systems when state regulation between production and consumption regions is uncoordinated. Through examining a key global food sector, the soy–meat value chain, we assess how effective market governance is. In this sector, numerous supply chain approaches have proliferated ranging from the first deforestation-free supply chain sectoral standard, to eco-labelling, and collective actions on various topics.

To assess how effective these policy instruments are, we examine the choices in sustainability made by lead companies in the sector and then analyse how coordinated these initiatives are across the supply chain. We assess then which supply chain actors are creating ‘rules of the game’ for sustainability, and the impacts of these on coordination and ground impacts through a literature review.

We show that companies along the soy–meat value chain have made different sustainability commitments probably because they are facing very different risk factors: those upstream such as soy traders are concerned mainly with international pressures on deforestation, whilst those further downstream in the supply chain have from very loose to very ambitious sustainability objectives on various topics associated with the sector including animal welfare, climate change and human-health.

We found that these supply chain initiatives are not addressing sufficiently the cause and effect of key drivers of sectoral impacts such as land appreciation and global demand for cheap meat. Further, because the soy–meat sector is vertically integrated both upstream and downstream, this may result in comparable bargaining power among business actors such that none of these actors may be able to impose sustainability norms without inferring cost onto themselves or causing perverse outcomes.

Lack of coordination in market governance is translating into a lack of uptake in various instruments (e.g. certification) or transference of cost and responsibilities onto soy producers (e.g. deforestation free standard such as the Soy Moratorium). Perverse outcomes of the latter are displacement of impacts onto other regions and commodities. In light of these challenges in market governance, we encourage more emphasis on network governance, which involves more social interactions that build trust, vision and exchanges of information and resources (e.g. between Brazil and China and Europe), these being more important in early phases of system transitions for systems facing sustainability gridlock.

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1. Introduction

The globalisation of food systems has increased the spatial disconnect between the consumption of agricultural commodities and the location of their production, where many of the

* Corresponding author at: Humboldt-Universität zu Berlin. Department of Geography, Rudower Chaussee 16, 12489, Berlin Germany.

E-mail address: malikavs@gmail.com (M. Virah-Sawmy).

environmental impacts of agriculture are felt (Oosterveer, 2007; Oosterveer and Sonnenfeld, 2012). Soybean and palm oil are often cited as examples of this disconnect: both are grown in the tropics to supply northern markets including Europe and China. They are also key drivers of local and global environmental and social change (Fearnside, 2001; García-López and Arizpe, 2010; Gibbs et al., 2010; Meyfroidt et al., 2010; Nepstad et al., 2006; Sayer et al., 2012). This spatial disconnect between production and consumption regions is manifested by a lack of coordination in state regulation on sustainability issues and as a result, market governance has emerged to coordinate new rules in international supply chains (Eberlein et al., 2012; Table 1).

In this paper, we assess how effective supply chain initiatives are, a key policy instrument of market governance, in coordinating sustainable production and consumption by analysing the soy–meat sector. In this sector, numerous supply chain approaches (Table 1b for definitions) have proliferated in the last decades ranging from the first supply chain led deforestation-free standard, to eco-labelling and collective actions on various topics (Table 2). For this, we examine the choices in sustainability made by lead companies in the sector and analyse how coordinated these initiatives are across the supply chain. We assess then which supply chain actors are creating ‘rules of the game’ for sustainability, and the impacts of these on coordination and ground impacts through a literature review, which can help highlight strengths and weaknesses in market governance for a particular sector.

Market governance is viewed as a potentially effective mechanism to achieve more sustainable global production-to-consumption systems when state regulation between production and consumption regions is uncoordinated (Eberlein et al., 2012; Table 1). The rationale for market governance is that individual actors and countries cannot, in isolation, address problems which result from complex interactions between market conditions, socio-environmental contexts, and different regulatory environments (Bitzer and Glasbergen, 2015; Glasbergen, 2011; Kolk, 2013). In market governance, businesses in predominance, often transnational companies operating in producing and consuming countries, create incentives and ‘rules of the game’, but let other supply chain actors choose freely (Table 1). Policy instrument for market governance includes eco-labelling of products, incentives or vice versa market exclusion and brand leadership positioning through sustainability commitments (Table 1). However, to date, little work is ongoing how effective policy instruments within market governance are, not only on ground impacts which where most research is concentrated on, but on coordination for sustainable production and consumption to be linked as a framework for market governance.

We do so by asking:

- (i) Which specific groups in the soy–meat food sector are participating in existing sustainability initiatives?
- (ii) How are these identified groups setting the agenda in the formation and implementation of sustainability rules and norms across the soy chain?
- (iii) What are the coordination implications and ground impacts of these supply chain initiatives?

We focus on the soy trade linkages between Europe and South American, in particular in Brazil, as this region is the primary producer for the soy export market and companies operating there are leading the design and implementation of supply chain initiatives. Most soy produced in Brazil and elsewhere is destined for animal feed, hence why we identify the value chain as a soy–meat complex.

2. Materials and methods

We first examine the sustainability commitments of different supply chain groups with major market shares (the five top companies in the different supply chain groups including retailers, traders, and meat producers). Market data was obtained from three main platforms: (1) 2015 market data on soy traded for export from Brazil excluding for domestic consumption from the Trase platform <https://trase.earth/>; (2) for feed and meat sectors, data on market for 2015/2016 was available from commercial data provided by <http://www.wattagnet.com>. (3) For retail sectors, data on market concentration for 2015/2016 was available from <https://www.statista.com/>. Data on commitments and actions was retrieved in the period of April to August 2017 from the lead company's website. We used the most updated public reports on the company's Corporate Social Responsibility available online on the company's website. We classify their sustainability commitments from the public reports according to: (1) natural resource management achieved upstream in the value chain through approaches such as adopting standards, e.g. geographical ones such as the Soy Moratorium, certification tools including Proterra, RTRS, GMO free soy, or committing to collective actions or individual pledges for zero deforestation; (2) company initiatives and activities to tackle social, climate, water, human health and animal stewardship (Table 3).

Secondly, we apply a regulatory governance assessment, focusing on who is participating, who is setting the agenda, rules, and norms and issues with rule formation and implementation (see Eberlein et al., 2012; Table 2). Information over this came from a literature review conducted from April 2017 to April 2018 on the different policy instruments used in market governance in the soy–meat sector. Information regarding factors relating to who is participating, who is setting the agenda, rules, and norms and issues with rule formation and implementation is referenced in Table 2. This analysis helps to assess qualitatively the role these supply chain actors play in setting the agenda for the formation and implementation of sustainability rules and norms across the soy chain and the impacts of these on coordination and on the ground.

2.1. Literature review of the different policy instruments

We classify supply chain initiatives under four categories: (1) sectoral market standards; (2) collective actions; (3) eco-labelling, also known as voluntary certification, and last (4) individual business actions

The first category among the supply chain initiatives, sectoral market standards, are used to align value chain actors on commonly agreed-on practices. Here, the Soy Moratorium stands out as a ‘geographically-framed supply side’ initiative. It is a market exclusion agreement in the Brazilian Amazon, considered as the first global ‘voluntary zero-deforestation agreement’ (Gibbs et al., 2015). It is a market approach in the sense that downstream actors make commitments and take actions to trade only with upstream actors that are able to deliver the desired environmental product (deforestation-free or habitat-conversion-free soy). The summary of our literature review of the Soy Moratorium is summarised in Table 2.

Broader (not geographic) sectoral market standards are also emerging. This include the European Feed Manufacturers' Federation (FEFAC) guidelines, which cover specific social and environmental issues that must be met by other standards for export to the major European feed producers who adhere to the guidelines (FEFAC, 2016). Recently, in 2017, the China Meat Association, also a sectoral standard, announced the Chinese Sustainable Meat Declaration, which involves commitments for concerted efforts towards promoting sustainable meat production, trade and consumption

Table 1aDifferent policy paradigms in Sustainable Production and Consumption (based on [Geels et al. \(2015\)](#))

	Market governance	State governance	Interactive network governance
Characterisation of relationships	Business in predominance creates 'rules of the game'	Government either sets goals and enforces implementation or creates incentives and 'rules of the game' for the market, but let business actors choose freely, a market-based approach	Mutually dependent interactions
Characterisation of coordination processes	Rules of the games initiated by some business actors is thought to lead to self-organisation of other actors through market interactions	Government coordinates through regulations, goals, targets, price and incentives.	Coordination happens through social interactions to build trust and vision and to exchange information and resources.
Foundational scientific disciplines	Neo-classical economy	Classic political science and Neo-classical economy.	Sociology and governance
Policy instruments	Sectoral market standards, collective actions; eco-labelling, and individual business actions	Formal rules, regulations and laws, incentives and prices	Trust and vision building exercises, demonstration projects and experiments, knowledge transfer policies.
Examples in the soy–meat sector	Soy Moratorium European Feed Manufacturers' Federation (FEFAC) guidelines Chinese Sustainable Meat Declaration The Round Table for Responsible Soy (RTRS) Collective action by the Consumer Goods Forum on deforestation-free supply chains	Netherlands' Soy Coalition Deforestation free Collective action by the Consumer Goods Forum on deforestation-free supply chains involving both government and businesses	

(WWF, 2017a). However, exact criteria for sustainable meat production are yet to be developed, although the declaration covers a range of issues from continuously moving towards better natural resource management, increasing resource efficiency, reducing negative impacts such as GHG emissions and pollution (Table 2). It was signed 64 Chinese company members.

The second category among supply chain initiatives in the soy–meat sector are collective actions. These include deforestation-free commitments made by several governments and consumer goods companies as part of the New York Declaration on Forests in 2012. These companies or countries have made pledges to halve deforestation by 2020 and end it by 2030 (New York Declaration on Forests and Action Agenda, 2014). Collective action groupings, including the Consumer Goods Forum (CGF) which is a global alliance of 400 large companies with global sales of \$3 trillion, have pledged to eliminate deforestation from consumer goods supply chains by 2020 (New York Declaration on Forests and Action Agenda, 2014). In this, each company or government develops its own strategy and tool to achieve deforestation-free commitments, but they work collectively on the agenda (Table 2).

Another prominent initiative in the soy sector, which forms a third category, is voluntary certification of supply chains that aim to reduce environmental and social impacts (Potts et al., 2014). In market governance, certification initiatives (eco-labelling) are typically considered to be a voluntary price signal (see Pirard, 2012) in the sense that they send a market signal to consumers that the environmental impacts are positive (in relative terms) and consequently the product often gains a premium on the base-line market price. Today, certification is also a tool that not-for-profits, investors and governments are using to identify, and support businesses committed to sustainability or vice versa, and in this way place upward pressure on sector-wide practices (Auld and Gulbrandsen, 2010); therefore, they are used in brand leadership positioning or vice versa in finger pointing. In the soy–meat sector, some of these certification schemes, especially the Danube Soy Initiative and ProTerra, have been focusing on GMO free soy, whereas

the Round Table on Responsible Soy (RTRS) aims to produce soy using what they have defined as '*environmentally-sound and social equitable practices*' (RTRS, 2018; Potts et al., 2014). The Round Table for Responsible Soy (RTRS), a multi-stakeholder led eco-label that certifies responsible soy (defined by the RTRS as socially equitable, economically feasible and environmentally sound soy), was formed in Switzerland in 2006 by WWF and other founding members at the same time as when the Soy Moratorium was being signed (July 2006). The ProTerra certification programme on the other hand had already begun in 2004 by Cert ID (Potts et al., 2014). The Danube Soy Initiative is more recent, having been set up in 2012 to promote the certification of non-GM soy production (Potts et al., 2014). Today, ProTerra and the RTRS are the largest and most influential soy certification schemes. However, certified soy accounts for less than 2% of global production (Potts et al., 2014). The weak market position of RTRS or ProTerra contrasts significantly with other commodities that have leveraged voluntary sustainability standards to achieve mainstream. The summary of our literature review of impacts and issues with certification in the soy–meat sector is summarised in Table 2.

The last category of market governance is individual business actions. Information regarding this is captured by our analysis on the sustainability commitments of different supply chain groups with major market shares.

3. Results and discussion

We discuss here how coordinated market initiatives are across the supply chain by examining the sustainability commitments and actions of different supply chain groups. We then discuss what types of 'rules of the game' have been created and the impacts of these on coordination and on the ground, which can help highlight strengths and weaknesses in market governance for a particular sector.

Table 1b

Definition of terms relevant to supply chain initiatives.

Term	Definition
Agribusiness	Agribusiness is the growing phenomenon since WWII of increasing interdependency and coordination between the agricultural production sector and the pre and post-farm gate business world (Davis, 1956). It has been described as the “ <i>sum total of all operations involved in the manufacture and distribution of farm supplies; production operations on the farm; and the storage, processing, and distribution of the resulting farm commodities and items</i> ” (Davis and Goldberg, 1957, p 2).
Downstream actors	This is a relative term, but often refers to those involved in transporting and processing the harvested/extracted commodity (Gereffi et al., 2005). The downstream stage also includes the sale and distribution of that product to other businesses, governments or individuals, commonly known as consumer-facing companies.
Market-based approaches	The frontier between market-based and other types of instrument remains blurred, and the use of the term ‘markets’ can sometimes give the impression that such approaches are not part of regulation (see Pirard (2012)) for a thorough discussion of market-based approaches). For simplicity here, we use the term to refer to approaches that harness factors such as price, taxes, permits, and other economic tools and mechanisms to provide economic incentives for reducing or eliminating negative environmental and social impacts.
Market governance Regulatory governance	Market governance refers to non-state governance, especially regarding companies which conduct operations in several countries with varying degrees of coordination and integration of strategy and operations This refers to state and non-state governance and is the ‘ <i>organized and sustained attempts to change the behavior of targeted actors to address a collective problem or attain a collective end, through a combination of rules or norms and means for their implementation and enforcement</i> ’ (Eberlein et al., 2012, p 6).
Transnational companies	Transnational companies conduct operations in several countries with varying degrees of coordination and integration of strategy and operations (Eberlein et al., 2012).
Upstream actors	This describes actors within the supply chain that are, relatively, closer to the production of the raw commodity (Gereffi et al., 2005). It is often used to describe the actors directly involved in the harvest of raw materials (e.g. agricultural production of soybean) but not involved in processing the raw material (e.g. manufacturing of soybean meal).
Supply chain initiatives	Supply chain initiatives refer to voluntary actions, commitments and policies taken by companies that aims to result in better social, economic and environmental impacts. They are generally considered as market governance. Supply chain initiatives range from company pledges and actions, to the use of more complex market-based approaches such as eco-labelling, ecosystem services and land agreements, and sectoral standards and collective actions such as the Soy Moratorium.
Vertical integration	Vertical integration is the merging of two businesses that are at different stages in the supply or value chain, for example, a food manufacturer and a supermarket chain. Vertical integration is different to horizontal integration — the merging together of businesses that are at the same stage of the supply chain such as two supermarkets, or two food manufacturers (Investopedia, online).

3.1. Lack of coordination in sustainability initiatives across the soy-meat supply chain

Retailers’ commitments span the broad spectrum of the sustainability agenda and initiatives, probably responding to consumer demands and reputation needs (Table 3). The initiatives they participate in range from natural resource management, to addressing social issues in the supply chain such as eliminating child and bondage labour, waste and water management, reducing greenhouse gas (GHG) emissions, animal welfare and tackling consumer health concerns. These commitments also reflect the value chain as a soy-meat complex, and therefore, sustainability issues that retailers have to tackle reflect not only deforestation from

soy production, but also over animal welfare and the combined environmental-health dimension of industrial meat production such as the health impacts of anti-biotics use and heavy metals contamination (Kearney, 2015; Table 3). In this, local, organic and GM-free soy and meat appear to be an important strategy for retailers to respond to the environmental-health concern of customers over meat. Indeed, the rise in organic meat places a strong emphasis on environmental protection, animal welfare and health benefits (Kearney, 2015). In line with this, we therefore see as commitments that many European retailers (especially in Germany, Table 3) are targeting to transition towards organic and GM-free soy in their meat supply chain (Potts et al., 2014, Table 3). In sum, sustainability commitments by retailers reflect various

Table 2

Regulatory governance assessment of supply chain initiatives in the soy sector.

Initiative	Who is participating? Who is setting the rules, agenda and norms?	What norms are changing?	Issues with rule formation, norms and implementation
Sectoral standards			
Soy Moratorium A deforestation free standard in a specific biome, the Amazon. A market demand approach (Pirard, 2012) in the sense that downstream actors (retailers, traders, global good corporations) make commitments and take actions to trade only with upstream actors (farmers) able to deliver the desired environmental product (deforestation-free soy).	By exposing the links between deforestation in the Amazon and the soy used in products sold by major brands such as McDonalds, campaigns by Greenpeace gained international attention (Greenpeace, 2016) leading the way to the soy moratorium. This prompted McDonalds to collaborate with several large European companies importing soybeans from Brazil to establish the European Soy Consumers Group in putting pressure on their Brazilian suppliers (Greenpeace, 2016). This Soy Moratorium was signed in July 2006 by members of ABIOVE (Brazilian Vegetable Oil Industry Association) and ANEC (National Association of Cereal Exporters), whose members control 92% of soybean production in Brazil. The moratorium was originally supported by eight local and international non-government organisations. Since 2008, Brazil's Ministry of the Environment has also been part of the initiative.	It propelled downstream European actors to take a prominent stance on sustainability in the soy putting pressure on their upstream. The Brazilian government in cooperation with several environmental groups as a result actively participated in the Soybean Working Group (GTS), in order to ensure the implementation and monitoring of the agreement. Governmental commitment has been reflected in the creation of incentives such as PRODES, a system to monitor annual deforestation and soy production. Since the soy moratorium operates as a "market exclusion" policy maintained by traders, farmers, producers have had to comply with the soy moratorium in order to not lose market access.	Norms are changing but only in the Amazon. For example, almost 60% of companies in the soy sector have forest policies but they are geographically limited, with the majority only covering the Amazon (Rogerson, 2017). It treats the problem as a single commodity issue (Brown and Koeppe, 2013) creating incentives for leakage in other sectors such as cattle ranching and other regions. Leakage in other sectors: Under the Soy Moratorium, on-property leakage may still occur as soy farmers continue to deforest for non-soy land uses such as cattle ranching (Gibbs et al., 2015). Leakage in other regions: Under the Soy Moratorium, there is some evidence that producers may have moved production from the Amazon where the Soy Moratorium applies, to other forest frontiers in the states of Bahia, Maranhão, Piauí, and Tocantins (Macedo et al., 2012). It reinforces captive state between soy producers and soy traders (this paper). In other words, the Soy Moratorium works by requiring changes of behaviour and therefore transfers the cost onto farmers, so that this instrument adopts a classically perceived production transfer of problem. The Soy Moratorium is known to trigger emotions that hinder dialogue among soy producers because the concept of a moratorium is negatively perceived by soy producers, associating it with "lack of control over their own land" and "lack of voice and freedom" (pers comm).

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sustainability issues important for them in the soy–meat value chain.

Soy traders, on the other hand, are participating and leading principally on sectoral standards initiatives regarding natural resource management, e.g. the Soy Moratorium. Many have also made company pledges to eliminate deforestation from their supply chains but definitions of what is meant by forest, zero deforestation, cut-off dates and target dates for implementation and deforestation reduction are still being negotiated (Lambin et al., 2018).

Feed and meat producers, by contrast, are making very few sustainability commitments (Table 3). When they do, these relate more to energy, water and waste management and animal welfare concerns (Table 3). These commitments are made actionable through internal company policies that are potentially more difficult to evaluate in contrast to collective sustainability initiatives that we have described in Table 3.

Overall, supply chain actors in the soy–meat food sector are making very different sustainability commitments and adopting different types of initiatives (ranging from sectoral agreements, company actions, collective actions, certification), reflecting possibly very different risks faced by supply chain actors. These risks include NGO pressures, brand reputation, customer concerns and certain exposures to risks regarding the degree of the visibility of the raw ingredient in the end market products of the supplier. In this, consumer facing companies are the most exposed to brand reputation and customer concerns, hence why they may be participating in a broad range of sustainability initiatives, whilst soy traders, although not consumer facing, have soy as the most visible in their end market products and in this way are exposed to some risk. Feed and animal producers, with meat as end products and soy as an invisible ingredient and with no pressures from consumers, face none of these risks and hence they may explain why they make less significant sustainability commitments. These differences in

Table 2 (continued).

Initiative	Who is participating? Who is setting the rules, agenda and norms?	What norms are changing?	Issues with rule formation, norms and implementation
<p>Cerrado Manifesto</p> <p>A zero conversion approach in a specific biome, the Cerrado.</p> <p>A market demand approach (Pirard, 2012) in the sense that downstream actors (retailers, traders, global good corporations) make commitments and take actions to trade only with upstream actors (farmers) able to deliver the desired environmental product (conversion-free soy).</p>	<p>In response to the enormous scale of destruction in the Cerrado, more than 40 Brazilian environmental organisations co-signed in September 2017 the Cerrado Manifesto this past September to “call for immediate action in defense of the Cerrado by companies that purchase soy and meat from within the biome” (WWF, 2017b).</p> <p>One month later, twenty-three global companies, signed a statement of support (SOS) to this call for commitment. These include: Ahold Delhaize NV, Ajinomoto Co, Carrefour, Sainsburys, Kellogg Company, Lidl, McDonald's Corporation, METRO AG, Marks and Spencer Group Plc, Nando's Chickenland Ltd, Nestlé S.A., Nutreco NV, Norges Gruppen, ASA Tesco Stores Plc, Unilever, Waitrose Ltd, Walmart Stores.</p>	<p>According to Global Canopy (2017), 18 of the 23 signatory companies in the Cerrado Manifesto are already included in the Forest 500 (Rogerson, 2017), an assessment of companies with exposure to soy in their supply chains. Nearly 80% already have specific policies to procure sustainably produced soy, including measures that apply to the Cerrado. This means that signatories have already set policies to achieve this prior to the Cerrado Manifesto. The agreement does not appear to have promoted laggards to participate so far, though it is early days.</p>	<p>The Cerrado Manifesto is likely to face similar issues with rule formation, norms and implementation, as with the Soy Moratorium in the Amazon. This includes maintaining captive states between traders and farmers, leakage issues, uncoordinated agendas and norms among supply chain actors.</p> <p>The Cerrado Manifesto will strengthen the coverage of the Cerrado but is not relevant to other geographies.</p>
<p>FEFAC Soy Sourcing Guideline</p> <p>The European Feed Manufacturers' Federation (FEFAC) has developed the Soy Sourcing Guidelines, Verification Requirements and Benchmark Tool to support responsible soy sourcing policies among its members.</p>	<p>The European Feed Manufacturers' Federation (FEFAC) representing the European compound feed industry is setting the rules what they define as sustainability in the soy sector. They have produced in 2015 a sourcing guideline for soy sustainability for the feed industry.</p> <p>The FEFAC guideline covers several social and environmental issues that must be addressed by soy programs or standards. Owners of standards or programs for soy can apply for formal approval for fulfilling this benchmark. For example, owners of multi-stakeholder standards such RTRS, Danube Soy, Pro Terra as well as companies' programs for responsible soy such as Cargill's Triple Soy, ADM's responsible soy standard and Bunge's Pro-S have been recognised as fulfilling the guidelines.</p>	<p>The FEFAC guideline can be seen as a radical change in how norms are set. In this case, the norm has been set by FEFAC itself, i.e. the feed importing companies in Europe, and standards and programs have to apply for conformance to the scheme.</p> <p>FEFAC guidelines address important international agreed conventions on human and land rights and social issues such as fair wages, no child labour, prior informed consent and grievance mechanisms but weaker on the environmental guidelines, especially in the area of zero deforestation, not going beyond national laws (see next column).</p> <p>Only nine of its members have been actively participating and using the voluntary guidelines (FEFAC, 2016).</p>	<p>FEFAC guidelines is the weakest on environmental issues. For example, it takes no stand on legal deforestation, an important issue for many NGOs, retailers, nor on the management greenhouse gas (GHG) emissions activities is not defined well. For example, FEFAC decided not to add complex GHG calculations to the guidelines.</p>

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risks and subsequently reflected in commitments have probably resulted in sustainability initiatives that are uncoordinated among supply chain actors creating inertia in the system. Interviews with business actors conducted through another related project also confirms that business actors see the lack of coordinated actions in the soy–meat supply chain as a key issue (Guerrero et al., 2018a,b).

In addition, the changing market for Brazilian soy originally destined for the Soviet Union, to then the EU and increasingly China could have also re-shaped norms and expectations about sustainability requirements among different supply chain actors probably exacerbating the lack of coordination.

3.2. Those setting the agenda in the formation and implementation of sustainability rules and norms are not having enough influence in coordinated actions

The soy–meat value chain reflects the broader trend of globalisation in the agri-food sector, both downstream in consuming

countries and upstream in producing countries. Downstream in the value chain, there has been increasing consolidation of supermarkets in the retail sector and agribusinesses in meat production with a shift away from small-scale farming, especially in the poultry and pig sectors (Table 3). Similarly, upstream, there has been a consolidation of activities by soy traders who have vertically integrated activities in the soy supply chain to process soybean from Brazil to Europe (Table 3).

The soy–meat value chain is thus highly concentrated with some of the highest sector concentration especially downstream in the supply chain. Indeed, there has also been an intensification of activities in the retail industry over the last 50 years (Kearney, 2015). For example, the five leading retailers analysed here capture 76% of the market in both the Netherlands and the United Kingdom and 72% in Germany (Table 3). Despite high sector concentration among retailers, they have not been able to encourage coordinated actions for deforestation-free commitments across the feed or meat producer sector (Table 3).

Table 2 (continued).

Initiative	Who is participating? Who is setting the rules, agenda and norms?	What norms are changing?	Issues with rule formation, norms and implementation
Chinese Sustainable Meat Declaration China Meat Association (CMA) and 64 Chinese company members, together with WWF have been working together on the Chinese Sustainable Meat Declaration. It should send a strong market signal.	Although the exact criteria for sustainable meat production and implementation framework are yet to be developed, the range of issues in the declaration from continuously move towards better natural resource management, increase resource efficiency, reduce negative impacts such as GHG emissions and pollution is a very bold move for Chinese meat companies and the China Meat Association.	It is expected that if China adopts norms for sustainability in meat production, the entire supply chain would need to follow suit.	
Collective actions			
The New York Declaration on Forests and implementation by the Consumer Good Forum Deforestation free approach for all regions and for all commodities (for signatories). It is also a market demand approach. In addition, it also gives a government signal.	The New York Declaration on Forests is a non-legally binding political declaration that emerged from dialogue among governments, companies and civil society in 2014 (New York Declaration on Forests and Action Agenda, 2014). For the first time, it secured government and corporate commitments to end deforestation. Members of the Consumer Goods Forum, a global industry network that pledges to help achieve zero net deforestation by 2020, have signed the Declaration. Thirty-seven governments are also signatories to the Declaration, which calls for the end of deforestation by 2030.	The government and corporate commitments as part of the New York Declaration on Forests indicate that deforestation and deforestation-free supply chains is of profile right. Agri-companies associated with soy committing to deforestation-free supply chains that have signed the declaration include: Cargill, Carrefour, McDonald's, Marfrig Global Foods S.A. Nestle, Unilever, Walmart Signatory countries associated with the soy value chain committing to deforestation-free supply chains: USA, UK, Netherlands and Norway. However, countries associated with soy expansion have not signed the declaration (South America countries such as Argentina, Bolivia, Brazil, and Paraguay).	Definitions of what is meant by forest, zero deforestation, cut-off dates and target dates for implementation and deforestation reduction are rarely specified (Lambin et al., 2018). As of 2016, only 20%–25% of the member companies of the Consumer Goods Forum have developed quantified and time-bound action plan implementation strategies to ensure the business and suppliers adhere to the zero deforestation policies (Lambin et al., 2018). Other sustainability issues such as pollution, water stewardship, labour rights, social equity etc., which are important aspects for bottom-up movements, are neglected. Risk of leakage to other sectors and regions, especially non-forested landscapes.
Dutch soy coalition Conceived for supporting RTRS certification by downstream actors and NGOs in the Netherlands. It acts as a market signal.	The Netherlands plays a central role in the soy sector as the world's second largest importer of soy after China and a central point of processing and distribution into Europe. A group of Netherlands' NGOs joined forces to create the Dutch Soy Coalition in 2003. Part of their work focuses on reducing the impacts of current soy production, for example through better management practices or enabling the production of certified soy. They are aiming to achieve this by asking governments and companies to take steps to reduce the negative impacts of soy production and trade. The Dutch Soy Coalition was disbanded in 2017.	The Dutch soy coalition has raised awareness of the issue and has been successful at engaging actors. In 2011, Netherlands' actors in the soy value chain signed a letter of intent that by 2015, 100 percent of their soy would be from RTRS certified or equivalent sources. The Netherlands' dairy sector reached the 100 percent target, suggesting that norms and values in the Netherlands' dairy sector did shift (WWF, 2016). Most feed, meat and egg companies backed out of an earlier national commitment to achieve 100% RTRS soy by 2015 (WWF, 2016).	The Netherlands' feed, meat and egg companies backed out of an earlier national commitment to achieve 100% RTRS soy by 2015 suggest issues with implementation. Criticism of RTRS by several NGOs led to supermarkets committing to source from RTRS certification choosing not to communicate the RTRS label on the product. Further, the Netherlands' dairy industry may not have also benefited from some common market-related benefits of certification such as preferential market access in Europe, for the reason that soy is an invisible ingredient and consumers are not aware that Netherlands' dairy have used certified soy (and is greener). They have also not benefited from procurement-related benefits upstream with producers in South America such as supply chain security because these relationships may be mediated by traders.

(continued on next page)

Table 2 (continued).

Initiative	Who is participating? Who is setting the rules, agenda and norms?	What norms are changing?	Issues with rule formation, norms and implementation
Certification			
<p>Certification in the soy sector</p> <p>Certification is considered a voluntary price signal market-based approach in the sense that it sends a market signal to consumers and businesses that the environmental impacts are positive (in relative terms) and consequently the product often gains a premium on the market price (Pirard, 2012).</p> <p>However because soy is an invisible ingredient in meat, consumers are not aware of this market signal. Therefore it works more as direct market approach.</p>	<p>The Round Table for Responsible Soy (RTRS), a multi-stakeholder led eco-label that certifies responsible soy (defined by the RTRS as socially equitable, economically feasible and environmentally sound soy), was formed in Switzerland in 2006 by WWF and other founding members around the same time as the Soy Moratorium was being signed (July 2006).</p> <p>The ProTerra certification programme also started in 2006. The ProTerra Standard is based on the Basel Criteria for Responsible Soy (created by Coop Switzerland and WWF), which also constitutes the basis for the RTRS standard. The Pro Terra also certifies non GMO soy.</p> <p>Donau Soy Initiative is more recent, having been set up in 2012 to promote the certification of non-GM soy production in the wider Danube region of Europe for both feed and food production. Donau Soja has its members along the value chain all the way from soybean production to food marketing using a trade mark. Today, ProTerra and the RTRS are the largest and most influential soy certification schemes. However, certified soy accounts for less than 2% of global production (Potts et al., 2014).</p>	<p>Only a few retail companies have committed to the RTRS and these include, from the Netherlands (Jumbo Supermarkten, Superunie, Royal Ahold); the UK (Marks & Spencer, Waitrose); several in Sweden and Switzerland (Migros and Coop) and some global companies, including McDonalds Europe (WWF, 2016).</p> <p>Except for the Netherlands dairy industry and some Netherlands meat companies, most non consumer-facing companies involved in soy have not committed to RTRS certification. Exceptions in Europe have included: Netherlands (De Heus Group), Denmark (BioMar) Sweden (Lantmännen, HKScan Sweden, Kronfägel, Scandi Standard) and Finland (Raisio Group, HKScan) involved in dairy and meat sectors (WWF, 2016). The retail industry is playing an important role in shifting the meat and dairy industry norms with its commitments to transition towards the use of non GMOs and it is likely that initiative such as the Danau Soy Initiative or Pro Terra will be important vehicles for this agenda (Potts et al. 2012). Retailers such as REWE Group, Lidl, Edeka in Germany, Carrefour in France, and Waitrose in the United Kingdom have committed to transition their supply chain to certified GMO-free and using a new scheme known as Danube Soy Initiative or Pro Terra label for this (Potts et al., 2014).</p>	<p>Only a handful of companies are committing to the RTRS certification. The market position of RTRS soy contrasts significantly with other commodities where voluntary sustainability standards have had successful mainstream adoption (Potts et al., 2014).</p> <p>Consumers who are concerned with sustainability of meat may be switching either to organic or GMO free meat or to non-meat products. In this, the combined environmental-health issues may play or will play an important role in sustainability agenda of meat (Kearney, 2015).</p>

Soy traders also have high sector concentration and thus high leverage onto other supply chain actors. For example, the five leading soy traders in Brazil analysed here capture 32% of the market. However, like retailers, they have not been able to transfer their sustainability commitments with deforestation-free supply chain downstream onto feed and meat producers. For example, four out of the five major traders have committed to a deforestation-free supply chain (Table 3), which requires going beyond the Forest Code's legal deforestation requirements in Brazil. Instead, it is the feed industry in Europe that has been able to impose their sustainability norms (FEFAC guidelines) on soy traders making traders apply for conformance of their private schemes to the FEFAC guidelines for soy export to Europe (Table 3).

The role and power that soy farmers have in sustainability and value chain governance is on the other hand very complex. On one hand, they appear as a captive supply chain actor explaining why soy traders can adopt a 'wait and see' approach with soy producers i.e. only purchasing when the market is right (KPMG, 2013; Turzi, 2011), a phenomenon often defined as buyer bargaining power, or why imposing sustainability directives on deforestation requirements have worked via the Soy Moratorium. At the same time, the relationships between soy farmers and soy traders are somehow complex because soy traders also provide credit and inputs to soy farmers (e.g. Garrett et al., 2012) and therefore soy producers are treated as clients. Also, soy producers are increasingly well

organised with huge political capita. Imposing sustainability requirements onto them by the market may have resulted in perverse consequences (see next section).

In summary, not only do supply chain actors along the soy-meat value chain face very different risks therefore commit to very different sustainability initiatives. Moreover, they are also not able to transfer sustainability norms and actions onto each other along the soy-meat value chain probably as vertical integration is high resulting in comparable bargaining power. More quantitative studies such as with social network analysis in the soy-meat supply chain would help shed more light on the impacts of vertical integration on coordination in sustainability.

3.3. Market governance is not sufficient as a mechanism for sustainability in soy-meat sector

The environmental, social and economic implications of companies' choices over sustainability initiatives and norms in the soy-meat sector are varied and complex. Effects of their choices may include: (a) transferring cost upstream onto soy farmers which is having perverse effects; (b) certain instruments requiring cost sharing among supply chain actors are not scaling which is creating inertia in the system, (c) these instruments insufficiently tackling the drivers of environmental change, frustrating bottom-up movements

Table 3

Commitments and actions of supply chain actors. Details on commitments marked by the numbers ranging from 3 to 77 can be seen in Supplementary Material. Data used: 1: Data on revenues and date of establishment from company's website or from Forest 500 <https://forest500.org/rankings/companies/>. Data on 2015 market data on soy traded for export from Brazil excluding for domestic consumption from the Trase platform <https://trase.earth/>. For feed and meat sectors, data on market concentration for 2015/2016 was available from commercial data provided by <http://www.wattagnet.com>. For retail sectors, data on market concentration for 2015/2016 was available from <https://www.statista.com/> 2: Data on commitment and action from company's website and their Corporate Social Responsibility Reports available online on the company's website. Note that for the social issue criteria, we defined it as social issues pertinent along the supply chain rather only at company level.

Company profile ¹			Natural resource stewardship commitment pledges ²				Social, climate, water, human health and animal stewardship pledges ²			
Categories (headquarters/total revenue in million in 2015 or 2016)	Date of company's establishment	Market share (2015 or 2016)	Public commitment on deforestation free supply chain	Public commitment on Soy Moratorium, Amazon	Public commitment on Cerrado Manifesto	Public commitment on RTRS or Proterra or GMO free soy certification	Public commitment on social issues along supply chain	Public commitment to GHG reduction	Public commitment for water, waste and nutrient stewardship	Public commitment for human health and animal welfare
TRADERS Although described as soy traders, defined as companies that source, store, trade, process and distribute soy, most soy traders extend their activities across the soy value chain from upstream including for some in soy production and provision of products and services (e.g. seeds, fertilisers, credit) to farmer's, and downstream with activities such as manufacturing of feed and other consumer goods. Traders are also involved in trading and manufacturing in other commodity sectors. Except for Bungee, traders are relatively new in Brazil, establishing themselves post WWII. The top 5 companies in Brazil have export market concentration of 53%										
Bunge (US, US\$ 43,455)	1905 (Brazil)	16% (Brazil)	Yes ³	Yes	No	No	(PRO-S) ⁴	No	(Yes)	No
Cargill (US, US\$ 107,200)	1942 (Brazil)	13% (Brazil)	Yes ⁴	Yes	No	No	(Triple-S) ⁵	No	No	No
Archer Daniels	1997 (Brazil)	10% (Brazil)	Yes ⁶	Yes	No	No	Yes ⁷	No	No	No
Midland (US, US\$ 67,702)										
Louis Dreyfus Company (Netherlands, US\$ 55,700)	1942 (Brazil)	7% (Brazil)	No	Yes	No	No	No	No	No	No
Grupo Andre Maggi (Brazil, US\$ 3, 800)	1980 (Brazil)	7% (Brazil)	Yes ⁸	Yes	No	Yes (RTRS, Proterra) ⁹	Yes ¹⁰	No	No	No
FEED SECTOR Feed industry produces animal feeds, premixes, concentrates, mineral mixes, additives for the animal feed industry. Many offer specialized services. e.g., in nutritional solutions for livestock farmers, integrators, feed mills, distributors and growers. Given its position in the value chain, the feed industry plays an important role in the production of meat, egg and dairy products. As feed markets have stabilised in Europe, many are diversifying internationally. The feed sector in Europe has a long history.										
ForFarmers N.V. (Netherlands, Euro 3, 269)	1896, exist as this after different mergers.	6% (EU-28)	No	No	No	Yes (FEFAC) ¹¹	No	Yes ¹²	Yes ¹³	Yes ¹⁴
Agrifirm group (Netherlands, US\$ 2,306)	1870, cooperative owned by Dutch farmers	4% (EU-28)	No ¹⁵	No	No	No	No	Yes ¹⁶	No	No
De Heus (Netherlands, data on revenues not available)	1911	4% (EU-28)	? ¹⁷	No	No	(RTRS partially) ¹⁸	No	No	No	Yes ¹⁹
SHV Holdings, owns Nutreco (Netherlands, US\$ 19,313)	1896, SHV holdings works in different sectors	4% (EU-28)	No	No	No	No	No	No	No	No

(continued on next page)

Table 3 (continued).

DLG Group (Denmark, \$9,906)	1969 after merger	4% (EU-28)	No	No	No	No	Yes ²⁰	No	No	No
MEAT PRODUCERS										
Demand for meat has been a key driver for the rapid expansion of soy production in recent decades. Meat production has changed radically in recent decades and is now more industrialised accounting for 40% of world meat production. Industrial meat, also known as intensive animal farming, is characterised generally by livestock being kept almost entirely indoors and in restricted outdoor settings, and meat production, packing, preservation and marketing generally integrated. Meat sector is changing with increasing market concentration and they have been consolidating and merging activities.										
Poultry sector										
LDC Groupe (France, Euro 3, 600)	1968 after merger	8% (EU-28)	No ²¹	No	No	No	No	Yes ²²	Yes ²³	Yes ²⁴
Plukon food group (Netherlands, Euro 1,300)	1978 after merger	6% (EU-28)	No	No	No	No	No	No	No	Yes ²⁵
Gruppo Veronesi, owned by Agricola Italiana Alimentare (Italy, Euro 2,500)	1958	6% (EU-28)	No	No	No	No	No	No	No	No
PHW Group (German, Euro 2,480)	1965	6% (EU-28)	No	No	No	No	No	No	No	No
Agricola Italiana Alimentare (Italy, Euro 2,500)	1958	6% (EU-28)	No	No	No	No	No	No	No	No
Pig (swine) sector										
Danish crown (Denmark, DKK 6,000)	1887	9% (EU-28)	No ²⁶	No	No	No	No	Yes ²⁷	Yes ²⁸	Yes ²⁹
Tonnies (Germany, Euro 6,300)	1971	7% (EU-28)	No	No	No	No	No	No	No	Yes ³⁰
Vion Food Group Ltd, Netherlands (Netherlands, Euro 7,000)	2003, after merger	6% (EU-28)	No	No	No	No	No	No	No	Yes ³¹
Coren Group, Spain (~Euro 9,800)	1959	4% (EU-28)	No ³²	No	No	No	No	Yes ³³	Yes ³⁴	No
Vion Food Group Ltd. Germany (Germany, Euro 7, 000 for all Vion group ltd)	2003, after merger	4% (EU-28)	No	No	No	No	No	No	No	Yes ³¹
Retailers represent the most prominent consumer facing companies in the food sector. The top 5 supermarkets have market concentration of 76% in the UK and Netherlands and 72% in Germany and they face high competition among each other.										
UK retail sector										
Tesco (UK, US\$ \$69,616)	1931	28% (UK)	Yes ³²	Yes	Yes	No	Yes ³³	Yes ³⁴	Yes ³⁵	Yes ³⁶
Sainsbury's (UK, US\$ 33, 423)	1869	16% (UK)	Yes ³⁷	Yes	Yes	No	No	Yes ³⁸	Yes ³⁹	Yes ⁴⁰
Asda (owned by Walmart Stores) (UK, US\$ 485,873 for Walmart Stores)	1949	15% (UK)	Yes ⁴¹	Yes	Yes	No	No	Yes ⁴²	Yes ⁴³	Yes ⁴⁴

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Table 3 (continued).

Morrisons (UK, GBP 16,317)	1899	10% (UK)	No	No	No	No ⁴⁵	Yes ⁴⁶	Yes ⁴⁷	No	Yes ⁴⁸
Aldi (UK, US\$ 30,021 for all stores)	1933 in Germany	7% (UK)	No	No	No	No ⁴⁹ Yes (GMO free) ⁵⁰	Yes ^{51, 52}	Yes ⁵³	Yes ⁵⁴	Yes ^{55, 56}
Netherlands retail sector										
Albert Heijn, owned by Ahold	1887 for subsidiary	35% (Netherl ands)	Yes ⁵⁷	Yes	Yes	(RTRS Partially) ⁵⁸	Yes ⁵⁹	Yes ⁶⁰	Yes ⁶¹	Yes ^{62, 63}
Delhaize (Netherlands, Euro 63 3000 for Ahold)	Albert Heijn									
Jumbo Supermarkten (Netherlands, ?)	1979	17% (Netherl ands)	No? ⁶⁴	Yes	No	(RTRS Partially) ⁶⁵	?	?	?	?
Lidl, owned by Swartz Gruppe (Germany, Euro 90, 000 for Swartz Gruppe)	1930	10% (Netherl ands)	No	No	No	No ⁶⁶	No	No	No	No
Aldi (Germany, US\$ 30,021 for all stores)	1933 in Germany	7% (Netherl ands)	No	No	No	No ⁴⁹ Yes (GMO free) ⁵⁰	Yes ^{51, 52}	Yes ⁵³	Yes ⁵⁴	Yes ^{55, 56}
Plus (rebranded into Netto, owned by Edeka Group)	1972	6% (Netherl ands)	No	No	No	No	No	Yes ⁶⁷	No	No
German retail sector										
Edeka group (Germany, ~US\$ 58, 000)	1898	25% (Germa ny)	No	No	No	Yes (RTRS + GMO-free, ProTerra or Danube soya) ⁶⁸	No	Yes ⁶⁷	No	Yes ⁶⁹
Schwarz Group (Germany, ~ Euro 90,000)	1930	15% (Germa ny)	No	No	No	No	No	Yes ⁷⁰	Yes ⁷⁰	Yes ⁶⁹
Aldi (South and North, US\$ 30,021 for all stores)	1933	15% (Germa ny)	No	No	No	No ⁴⁹ Yes (GMO free) ⁵⁰	Yes ^{51, 52}	Yes ⁵³	Yes ⁵⁴	Yes ^{55, 69}
Rewe Group (Germany, Euro 50,000)	1927	12% (Germa ny)	No	No	No	Yes(GMO free) ^{71, 72}	Yes ⁷³	Yes ⁷⁴	Yes ⁷⁵	Yes ⁶⁹
Metro Ag (Germany, Euro 58,000)	1964	5% (Germa ny)	No	No	No	No	Yes ⁷⁶	yes ⁷⁷	No	No

3.3.1. Instruments transferring cost upstream onto farmers leading to perverse outcomes

When Greenpeace campaigns exposed the links between deforestation in the Amazon and the soy used in products sold by major brands, consumer-facing companies such as McDonalds started to put pressure on their Brazilian suppliers (Greenpeace, 2016, Table 2). This culminated with the Soy Moratorium, which allowed traders and end users such as McDonald's Europe to develop and adopt sourcing policies for deforestation-free supply chains in the Amazon (Table 2). Soy traders then applied pressure further upwards in the supply chain on producers by not buying soy or giving access to credit from farmers who cleared rainforest to expand production (Garrett, 2011). This was supported by cross-sector

partnerships between traders, environmental NGOs and government which enabled monitoring of newly deforested land and the market exclusion of farmers producing on newly deforested land (Brown and Koeppe, 2013; Gibbs et al., 2015). The disincentives worked particularly well, because farmers expected to lose market access and important sources of credit for seeds and fertilisers if they did not comply (Brown and Koeppe, 2013; Gibbs et al., 2015).

As pointed out by Gibbs et al. (2015, p 378), 'the success of the Soy Moratorium is due to an array of factors, including (i) a limited number of soy buyers that exert considerable control over soy purchase and finance; (ii) simple requirements for compliance; (iii) streamlined and transparent monitoring and enforcement systems; (iv) simultaneous efforts by the Brazilian government to reduce deforestation; and (v) active participation by NGOs and government agencies'. In this way,

farmers were dissuaded from deforesting land for soy because of market exclusion by downstream actors, facilitated both by state and non-state institutions which provided monitoring information. Yet, for these farmers, it was an ambivalent situation. While the risk of being tracked might affect them if they violate deforestation agreements, the growing and shifting markets for soy and land appreciation may not have altered incentives or cultural norms to deforest.

Perverse consequences of the Soy Moratorium may have included leakage in other sectors and regions. For example, there is evidence that some producers may have moved production from the Amazon where the Soy Moratorium applies, to the Cerrado biome, particularly in the states of Bahia, Maranhão, Piauí, and Tocantins (Gibbs et al., 2015; Macedo et al., 2012). The movement of farmers appear to be mainly for the purchase of land for future agricultural investment (see Richards, 2015). Richards (2015) found that in-migrating farmers sought to carve new farms at the forest frontiers. As land values rose, farmers purchased cheaper land in the forest frontiers and there 'landowners solidified their claims on land by deforesting or opened their land to increase their property values' (Richards, 2015, p12). Further, on-property leakage may have occurred when soy farmers continue to deforest for non-soy land uses such as cattle ranching, corn etc. (Gibbs et al., 2015; Rausch and Gibbs, 2016).

Indeed, these are the real risks posed by zero deforestation commitments and actions, presented by the New York Declaration on Forests signed in 2014. The New York Declaration is a non-legally binding political declaration that emerged from dialogue among governments, companies and civil society in 2014 (New York Declaration on Forests and Action Agenda, 2014). For the first time, it secured government and corporate commitments to end deforestation. While progress has been slow, with evidence suggesting that only 20%–25% members of the Consumer Good Forum have developed their own quantified and time-bound action plan (Lambin et al., 2018), the lessons from the soy–meat value chain point to considerable leakage risks onto other regions and commodities. Companies might displace deforestation elsewhere onto other important biodiverse non-forest land (e.g. savanna land) or allow other companies or sectors to deforest before taking hold of forest land, and avoid other important sustainability issues such as pollution, water stewardship, labour rights, social equity, soil conservation (Table 2).

3.3.2. Instruments involving cost commitment among downstream actors unable to scale

The weak market position of Proterra or the Round Table for Responsible Soy (RTRS) – a multi-stakeholder led eco-label that certifies responsible soy, which has defined itself as producing socially equitable, economically feasible and environmentally sound soy – contrasts significantly with other commodities where voluntary sustainability standards have had successful mainstream adoption (e.g. palm oil, cocoa, coffee) (Potts et al., 2014). Today, certified soy accounts for less than 2% of global production (Potts et al., 2014). By contrast, certified palm oil accounts for 15% of global production and certified coffee, 40% (Potts et al., 2014).

In this, Proterra or RTRS soy may not have worked as a 'voluntary price signal' (definition in Pirard, 2012) to customers in the sense that they cannot send a market signal that the environmental impacts are positive (in relative terms) and consequently gain a premium on the market price. This is because soy is an invisible ingredient to consumers, being embedded in the meat they eat.

Soy certification has the potential to work more as a direct market approach (definition in Pirard, 2012) in which downstream actors (retailers, feed companies, meat producers) use certification to trade only with certified upstream producers. However, even as a direct market approach, this certification system appears to have

had limited success as reflected by the low commitments by all actors to the supply and purchase of RTRS or Proterra soy (Table 3). Exceptions are commitment by the dairy and retail sector in the Netherlands, thanks to efforts of the Soy Dutch Coalition (Table 2), and Edeka in Germany who have signed up publicly to several options from RTRS, Proterra to Danube Soy produced in Europe.

Many reasons may explain this poor market demand in RTRS or Pro Terra. A critical flaw is that, as we pointed out, soy is an invisible ingredient. Palm oil, however, is also an invisible ingredient and palm oil certification has scaled up. In the soy sector, however, because large volumes of soy are needed for producing meat, switching to certified soy requires substantial cost commitment for what is a largely 'invisible' commodity embedded in meat supply chains. As the value chain downstream involves large buyers and suppliers, none of these companies may have been able to impose sustainability demands on the rest of the supply chain, without incurring costs themselves. A possible consequence of this has been few clear commitments by consumer facing companies for certification (Table 3), which has translated into a lack of preferential market access for RTRS or Proterra certified soy. Instead, sectoral standards, such as Soy Moratorium, associated with transference of cost of sustainability upstream have been used by many consumers facing companies to manage their reputational risk associated with deforestation-linked soy. At the same time, potentially insufficient price premiums for soy certification in the absence of clear market signals might also have dis-incentivised soy farmers from investing further in certification.

Finally, the controversy over RTRS efficacy in achieving multiple sustainability aims, given its focus on industrial agriculture, might itself have also not helped the sector mainstream certification, whether upstream with production or downstream with market signals. For example, Oxfam publicly announced it was not getting directly involved in the RTRS because it felt that "there was little attention paid in the development of the RTRS standard to land rights and social and environmental impacts, and as a result there was little support from local civil society organisations in Argentina and Brazil, two of the largest soy producing countries" (OXFAM, 2015). Further, bottom-up movements have opposed the RTRS as an attempt to legitimise environmentally and socially destructive practices of soy expansion (García-López and Arizpe, 2010). RTRS soy has also been criticised because of its association with GMO Soy. For example, in 2012, multinational food retailer Ahold as well as other supermarkets that committed to RTRS received the signatures of 26,000 people across Europe 'demanding an end to greenwash projects like RTRS... In a discussion that took place earlier that day Hugo Byrnes of Ahold agreed that the RTRS has a long way to go and the current certification scheme cannot be called sustainable. For that reason, the supermarkets have chosen not to communicate the RTRS label on the product' (Global Forest Coalition, 2012). Thus, different agendas and priorities in the soy–meat sector for sustainability might have contributed in making the eco-label RTRS a liability for reputation-seeking front facing companies.

3.3.3. Market governance not tackling enough the drivers of environmental change

Demand for meat has been a key driver for the rapid expansion of soy production in recent decades. This is because meat production has changed radically and is now industrial, accounting for 40% of the world meat production, and protein-feed such as soy and cereal-feed play an important role in this type of production (Nierenberg and Mastny, 2005). Soy as a protein-rich feed, in particular, is preferred by meat producers as they help bring animals to market weight faster and also, because they are often cheaper than other feed proteins (WWF, 2014). Indeed, three-quarters of the world's soy are crushed to produce protein-rich soy meal used primarily as a protein feed for driving industrial meat production

(WWF, 2014). Despite the demand in meat being a key driver of change in Brazil and other soy producing countries in the region, feed and meat producers are so far very little engaged in market governance, as we have shown, probably because soy is an invisible ingredient of their product and with no pressures from consumers, face little business risks.

Further, locally, the soy problem can also be framed as a Brazilian land opportunity challenge, in that, as soy became profitable and the land value increased, farmers and investors are incentivised to look for more land, which is leading to huge ecological and social impacts on biodiversity, and indigenous and local communities. These social impacts include increasing income inequality between soy farmers, often coming from the elite class from the South of Brazil, and local farmers from the Amazon and Cerrado, whose ancestry includes indigenous Amazon, Southern European and African elements (Weinhold et al., 2013). Second, with the macroeconomic and policy shifts in Brazil from the 1980's, only soy farms above 500+ hectares became profitable which led to a significant number of small-scale family farms going out of business especially those in the South (EnREDando, 2008; García-López and Arizpe, 2010). Thirdly, soy expansion in Brazil and Argentina has led to massive land concentration ownership and displacement of local communities from these lands. The consequences of this are varied and complex and it is an important area of concern for bottom-up initiatives against soy farming (García-López and Arizpe, 2010). Our examination of supply chain initiatives points to none of them addressing sufficiently the social impacts of the sector reflecting that the latter is not factor of sufficient concern for companies engaged in the soy–meat sector (Table 2).

On the other hand, the local environmental impacts attributed to soy such as increased deforestation, water pollution, soil degradation, and loss of agro-biodiversity (e.g. Fearnside, 2001; Nepstad et al., 2006; García-López and Arizpe, 2010), have received much public attention, and is reflected in the range of supply chain initiatives. There is increasing consensus though that soy is an indirect rather than a direct driver of land-use changes in mixed agriculture–forest landscapes through land appreciation but more of a direct driver of deforestation at the forest frontiers (Fearnside, 1983; Chomitz and Thomas, 2001; Ozorio de Almeida and Campari, 1995; Bowman et al., 2012; Richards, 2015). In other words, the drivers of change in soy production are complex and are inter-linked to land opportunity demands and regulations in Brazil and internationally with the global 'cheap meat' demand.

4. Conclusions

The novelty of the paper is the mapping of sustainability commitments across a supply chain as an indicator for coordination or vice versa gridlock for sustainability. Such a broad mapping of sustainability commitments and actions can provide institutions involved as change agents with a good indicator of differences and similarities in agendas across the supply chain. Ideally, this should be validated by business actors themselves. Another novel aspect of the paper is to examine the impacts of vertical integration on norm creation and coordination in sustainability. Ideally, more quantitative governance analysis, e.g. though social network analysis, would shed more light on its impacts on coordination.

Overall, we have shown caveats in market governance in the soy–meat sector. Firstly, business actors in the sector are prioritising very different sustainability initiatives and those setting the agenda in the formation and implementation of sustainability rules and norms are not having enough influence in coordinating other supply chain actors. These very different sustainability commitments and initiatives adopted by different supply chain actors possibly reflect very different risks faced by supply chain actors. These risks may include NGO pressures, brand reputation,

customer concerns and certain exposures to risks regarding the degree of the visibility of the raw ingredient in the end market products of the supplier.

Secondly, market governance appears not able by itself to tackle enough the drivers of environmental change. For example, impacts in the soy–meat sector are mainly driven by the global demand for 'cheap meat' and without therefore the joint commitments of upstream actors such as customers, retailers, and meat and feed producers, it is likely that responsibilities for sustainability will continue to be transferred onto soy producers in producing countries. Further, locally, the soy problem can also be framed as a Brazilian land opportunity challenge, in that, as soy became profitable and the land value increased, farmers and investors are incentivised to look for more land, which is leading to huge ecological and social impacts on biodiversity, indigenous and local communities. None of the supply chain initiatives have delved sufficiently how to address this cause and effect of land appreciation and global demand for cheap meat. Our conclusion corroborates with other studies that increasingly show some limitations of market governance in addressing the complex social and ecological challenges of production and consumption (e.g. Bitzer and Glasbergen, 2015; Cashore, 2002; Glasbergen, 2011; Kolk, 2013; Oosterveer, 2007).

In light of these challenges, we encourage change agents in the soy–meat supply chain to put more emphasis right now on network governance rather than the continued push for more state and market governance (Table 1). In network governance, coordination is reinforced not through implementation of rules and norms but through social interactions that helps build trust and vision and exchanges of information and resources (Geels et al., 2015; Table 1). Instruments for network governance include vision and scenario building together, demonstration projects and experiments, and knowledge transfer policies (Geels et al., 2015; Table 1). In particular, these activities are likely to be most important in early phases of system transitions, which are characterised by uncertainty, open-ended learning, and the need for network building (Geels et al., 2015). In later phases, when there is more clarity and hence less gridlock for coordinated actions, other more traditional policy instruments within market and state governance would become more important, aimed at widespread deployment and uptake.

Uncited references

Arima et al. (2011), Barona et al. (2010), Boehlje (1999), Brown et al. (2005), Bruinsma (2009), Cattaneo (2008), Curran et al. (2004), Eberlein et al. (2014), Goldsmith and Hirsch (2006), Helfand and Castro de Rezende (2004), Kaimowitz and Smith (2001), Kearney (2010), Mueller (2016), Navarro and Campos (2013), Nepstad et al. (2008), OECD-FAO (2017), Oliveira et al. (2014), Richards (2011), Richards et al. (2015), Rueda et al. (2017), Steward (2007), Théry (1999), Trase (2018), VanWey et al. (2013), Warnken (1999), Zanon and Saes (2010)

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Appendix A. Supplementary data

Supplementary material related to this article can be found online at <https://doi.org/10.1016/j.spc.2019.01.003>.

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