

SUSTAINABLE FOOD CHAINS: THE ROLE OF COLLECTIVE ACTION AND GOVERNMENT INCENTIVES

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Abstract

We examine the role of collective actions as supporting elements of a long-lasting sustainable food supply chain. This article's main contribution is to link the idea of sustainable supply chains and the collective action problem (horizontal coordination) that may be required in order to deal with externalities related to the provision of sustainable products. In addition, we analyze how the presence or absence of government incentives shapes collective action in the food industry. We base our analysis in a simple formal argument inspired by case studies regarding sustainable farming in Brazil and the Netherlands. Results show that horizontal mechanisms of cooperation maintain positive levels of sustainability, even in the absence of direct payments by the government.

Keywords: Sustainability. Food chain. Collective action. Institution. Incentives.

SISTEMAS AGROINDUSTRIAIS SUSTENTÁVEIS: O PAPEL DAS AÇÕES COLETIVAS E DOS INCENTIVOS GOVERNAMENTAIS

Resumo

O papel das ações coletivas como elementos de suporte para a manutenção de sistemas agroindustriais sustentáveis é analisado nesta pesquisa. A principal contribuição está em relacionar a ideia de uma cadeia de suprimento e o problema das ações coletivas (coordenação horizontal) que podem ser requeridas para lidar com a externalidade envolvida na provisão de produtos sustentáveis. Adicionalmente, analisa-se como a presença ou a ausência de incentivos governamentais impactam as ações coletivas neste setor. Para tanto, desenvolve-se um argumento formal simples inspirado em estudos de caso relacionados com a produção agrícola sustentável no Brasil e na Holanda. Os resultados apontam que mecanismos de cooperação horizontal sustentam níveis positivos de sustentabilidade, mesmo na ausência de pagamentos diretos feitos pelo governo.

Palavras-chave: Sustentabilidade. Cadeia produtiva. Ações coletivas. Instituições. Incentivos.

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Introduction

The governance of sustainable supply chains is not a trivial issue (CARTER; ROGERS, 2008). Since sustainable products are difficult to verify and to measure (BÉNABOU; TIROLE, 2010) and because they demand specific investments to be produced (CALEMAN et al., 2013; SARKIS; ZHU; LAI, 2011), transaction costs become pervasive. Perhaps more importantly, a rural producer within the supply chain must not only be concerned about his or her own sustainability efforts but also must consider the initiatives and associated potential negative externalities generated by other producers. If a single producer within a sustainable supply chain fails to comply with sustainability rules, all producers may suffer the reputational effects.

Considering this general background, we examine the role of collective actions as supporting elements of a long-lasting sustainable food supply chain. This article's main contribution is to link the idea of sustainable supply chains and the collective action problem (horizontal coordination) that may be required in order to deal with externalities related to the provision of sustainable products. In addition, we analyze how the presence or absence of government incentives shapes collective action in the food industry.

According to Ostrom (2009), collective action happens when more than one individual join efforts in order to achieve an outcome. In the specific case of rural production, the most intuitive expression of a collective action is the building of a producers' association (i.e., horizontal coordination among producers). According to Meinzen-Dick and Di Gregorio (2004), collective action is becoming cornerstone to achieving success at the farm level, although it is often undervalued and misunderstood. The purpose of developing collective actions in rural production is threefold: (i) to influence policy formulation and advocacy; (ii) to provide easier access to production services (e.g., credit) and inputs (e.g., fertilizers); and (iii) to encourage local development (RONDOT; COLLION, 2001). Additionally, there is evidence that acting collectively represents a means for rural producers to enhance their bargaining power (CROOK; COMBS, 2007; MARKELOVA et al., 2009).

Nevertheless, the effective role of collective actions in the structuring of sustainable chains is an open issue. Hagedorn (2002), for instance, argues that among other elements, collective actions offer selective incentives to avoid free riding in the management of common pool resources in cooperatives. According to Hagedorn (2002, p. 20), "agri-environmental co-operatives become an additional element in the institutional environment of farms and in the networks within existing rural areas". However, *what are the particular factors at work?*

To obtain new insights into this issue, we examine and compare the role of collective actions in two distinct settings: the Netherlands and Brazil. Based on comparative assessment of the case studies, we then sketch a simple formal argument. We focus on the structuring of an incentive system given the possibility of hold-up in the transaction between rural producers and a processing industry under different government incentive regimes. Our results support the general idea that horizontal mechanisms of cooperation are capable of supporting positive levels of sustainability, even in the presence of potential hold-up and in the absence of direct support from the government.

Literature review

The definition of a sustainable supply chain is not a trivial one, as it varies according to the theoretical lenses applied to investigate it. In general terms, a sustainable supply chain encompasses "the strategic, transparent integration and achievement of an organization's social, environmental, and economic goals in the systemic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual company and its supply chains" (CARTER; ROGERS, 2008, p. 368).

Seuring and Muller (2008) stress the external pressure set by different stakeholders (e.g., ONGs, customers, and government agencies) in order for companies to design a sustainable supply chain. Particularly important is the role of organized pressure groups: they function as central triggers because companies fear consumer boycotts, something that may also lead to reputation loss. As a consequence, companies have incentives to behave as coordinators, demanding their vertically related suppliers perform according to environmental and social rules. This, however, is not a trivial task since sustainability encompasses a multiplicity of dimensions, as well as conflicting interests about the ends and the means of sustainability production (DIXIT, 2002).

Besides the building of vertical relations and the identification of focal companies which behave as coordinators, the role of horizontal coordination among producers is becoming a cornerstone to achieving success in sustainable food supply chains (MEINZEN-DICK; DI GREGORIO, 2004). Horizontal coordination could be exemplified by a collective action among producers represented either by farmers engaging in a formal cooperative organization or rural producers becoming members of a production association¹.

The term collective action encompasses a broad set of concepts derived from different approaches. Meinen-Dick and Di Gregorio (2004) argue that a collective endeavor is often narrowly taken as a formal arrangement but its definition might be more general, involving all voluntary action taken by a group to achieve common targets. Ostrom (2009) assumes that collective action happens when more than one individual joins efforts in order to achieve an outcome. Specifically in the case of rural production, a collective action may be expressed by actions such as joint sowing and/or harvesting of the land, use of common facilities to market the product, maintenance of natural resources with common pool initiatives, among others.

It is interesting to note that authors who are keen on studying formal organizations in rural areas prefer to adopt the term "farmers' organization" when referring to collective actions (e.g., REARDON; BARRETT; BERDEGUÉ, 2009; HELLIN; LUNDY; MEIJER, 2009; STOCKBRIDGE; DORWARD; KYDD, 2003). The main focus of the studies associated with this tradition is on examining the mechanisms for enhancing market access and agro-processing facilities, reducing information asymmetry and protecting specific investments made by producers in face of the need of adding value along a productive chain². Also, in this broad concept of collective actions, the cooperatives as a formal organizational structure are part of a relevant branch of research. It seems that the main point to consider an action as a collective one is the joint engagement of independent actors, be it through a common property regime or through coordinated activities across individual entities (HELLIN; LUNDY; MEIJER, 2009).

Markelova et al. (2009) examine three broad categories of factors that are likely to affect collective actions: (i) the group characteristics, (ii) the type of product and market; and (iii) the institutional arrangement. The latter encompasses the type of organizational structure as well as the rules and the monitoring and enforcement tools that are relevant to ensure the sustainability of the collective action.

The role of institutions in exerting pressure towards sustainable practices in a supply chain should not be neglected. Sarkis, Zhu e Lai (2011) argue that in developed countries incentives set by law and regulations improve environmental awareness and management practices. For instance, the Common Agriculture Policy (CAP) regulates farming in the European Union and aims to improve agricultural sector competitiveness and its sustainability over the long term. Among a set of policy instruments, compensation for farmers who pursue environmentally friendly practices is a particularly important one.

1 Menard and Klein (2004) points out that collaborative or network organization, such as cooperatives, joint ventures or other hybrid forms, implies a decision of pooling resources which often rely on relational contracts, even though they do establish some formal mechanisms for coordination.

2 Rondot and Collion (2001) use the term "producer" rather than "farmer" in order to cover all types of agricultural production, including livestock and fisheries.

Based on this theoretical background, in the next section we present two cases of collective actions in sustainable food supply chains. We compare a case from the Netherlands and one from Brazil. We also highlight the differences in government incentives between the two countries.

Sustainable food supply chains: two experiences

The Netherlands

The Dutch case illustrates a scenario in which government incentives (i.e., direct payment), aligned with the benefits of cooperation, represent a strong mechanism toward the maintenance of long-term sustainability efforts.

Government incentives

Farming in Europe is ruled by the Common Agriculture Policy (CAP), which was created in 1962 after signature of the Treaty of Rome. In 1992, CAP drivers moved from product to producer support and the focus turned to be on farmer income and not on product price. Also in 1992, CAP incorporated aspects of sustainability, offering compensation to farmers who pursue environmentally friendly practices.

In its last version, CAP has the explicit aim of improving the European agricultural sector competitiveness and its sustainability. According to the European Commission (2013), the CAP reform 2014-2020 continues the reform path by reinforcing the role of providing a policy framework to support and orient European producers into three long-term objectives: (i) viable food production; (ii) sustainable management of natural resource and climate action; and (iii) balanced territorial development. In order to achieve these objectives, a new policy is offered. Sustainability will be achieved by the combined and complementary effects of a set of instruments in order to have agricultural lands eligible for *green direct payments*³.

The green direct payment, the major pillar towards sustainability under CAP, rewards farmers for meeting three mandatory agricultural greening practices or the equivalent: (i) maintenance of permanent grassland; (ii) ecological focus areas; and (iii) crop diversification. As the green payment is compulsory, it can stimulate producers to adopt good practices.

In the Netherlands, the legal framework supporting agriculture and livestock sustainability policies is even stricter than the legal framework under the CAP. Animal welfare is also a major concern. Statutory regulations and Government requirements, like the new Dutch Animal Act⁴, establish the rules for animal treatment. Specifically in regard to farm animals, the majority of welfare rules are related to housing and transportation. Examples are the abandonment of battery cages in 2012 and the government's restriction on long-distance animal transport within the EU (MINISTRY OF ECONOMIC AFFAIRS, 2014).

FrieslandCampina: a case of producers' cooperation

FrieslandCampina is a cooperative formed by the merger of two dairy cooperatives – Royal Friesland Food and Campina. The cooperative is one of the world's five largest

³ The instruments are: (a) cross compliance (regulatory): farmers are obliged to keep the lands in good agricultural and environmental conditions; (b) greening (mandatory with financial support), with decoupled "green" payment per hectare; and (c) rural development (voluntary), with compensation for cost incurred and forgone income.

⁴ Act of May 19, 2011, containing an integrated framework for rules on animals kept and related subjects (Law animals).

dairy companies with annual revenue of 11.4 billion euro⁵, counting on 19,487 members. The company has a global profile, supplying around 1 billion consumers in more than 100 countries in Europe, Asia and Africa with dairy-based beverages, infant nutrition, cheese and desserts. Apart from final consumers, the company also supplies manufacturers of infant nutrition, the food industry and pharmaceutical companies with ingredients and half-finished products (FRIESLANDCAMPINA, 2012).

The cooperative is fully committed to high quality, sustainability and transparency standards. The concept "from grass to glass", as stated on the cooperative website, highlights the awareness of value chain management and covers a wide range of concerns from global warming to animal welfare. Sustainability is a major issue to be considered in the value chain. The aim of lower CO₂ emission and more renewable energy, a more rational use of scarce natural resources like land and water, and the maintenance of nature conservation and biodiversity is present throughout the whole chain. Besides this, there are also social concerns such as the aging of farmers and the necessity to offer a positive perspective to young ones alongside the challenge of food security and safety.

The cooperative is also recognized for its Corporate Social Responsibility (CSR) which embraces four pillars: nutrition and health (combating nutrient deficiency); efficient and sustainable product chains (improving resource utilization); dairy development in Asia and Africa (helping small farmers in Asia and Africa); and sustainable dairy farming (setting the standards) (FRIESLANDCAMPINA, 2012).

In order to achieve these goals, the cooperative has to build a comprehensive work of principles for sustainable dairy among farmers. Regarding milk price, FrieslandCampina pays a guaranteed price to farmers, plus a bonus that depends on the annual cooperative performance. According to Riel and Ederer (2011), the guaranteed price is determined by averaging the price paid by competitors and by the quality of the milk supplied by farmers (measured by the amount of fat and proteins).

Regarding sustainable dairy farming, FrieslandCampina encourages dairy farmers to generate energy from renewable sources and to graze their herds outdoors by paying an outdoor grazing premium. Also, in order to improve animal health and welfare, there is a concern about the level of antibiotics used in farming activities. The aim is to reduce the level of antibiotics by 50% before 2020 and at the same time to increase the use of sustainable dairy housing to 5% (RIEL; EDERER, 2011).

Accordingly, sustainability is clearly a part of the cooperative aim and it is thoroughly inserted in its strategy. The members are encouraged to adopt sustainable practices and, as a consequence, market access is guaranteed. The point is that farmer members of FrieslandCampina have strong incentives to adopt and maintain long-term sustainable practices, with incentives either provided by the Agriculture European legislation (CAP) or the cooperative (FrieslandCampina). Both sources of incentives represent a virtuous incentive scheme for farmers to go green.

The case of FrieslandCampina in the Netherlands sheds lights on the scenario of government incentive combined with horizontal coordination. The next case, a beef producers' association in Brazil, illustrates a case of the absence of government incentives combined with collective action.

Brazil

Government incentives

The current Brazilian Agriculture Policy (BAP) involves multiple aspects and objectives. According to Barros (2010), the BAP's main objective is to help the country achieve economic and social development. Specifically, the aims are the assurance of food, fiber and energy, the generation of foreign exchange to sustain the national trade balance, and the assurance of farmers' income and social development.

⁵ FrieslandCampina website: <<http://www.frieslandcampina.com/english/about-us/frieslandcampina-and-you.aspx>>.

According to Barros (2010), in the beginning of the 1960s, the BAP was focused on credit, minimum prices and a deliberate policy of grain storage. The objective was to enhance the adoption of technology via the offer of cheap credit and minimum price. Agricultural development was clearly anchored in the mechanization of production and the adoption of high performance inputs like fertilizers, seeds, pesticides; all inputs related to modern agriculture. In the 1990s, Brazilian agriculture faced a huge change due to the liberalization of domestic and foreign markets along with the deregulation of domestic markets. The levels of governments' support decreased and new policy instruments were created with the participation of private sources of financing. Farmers had to cope with a production environment characterized by less intervention in the market, less government spending and increased pressure for efficiency gains.

Accordingly, when compared to other countries, Brazil has a low level of official support for farmers and the majority of government payments to farmers are made in the form of credit subsidies, which are low in relation to the value of production (OECD, 2011).

Sustainability is another issue of great importance to Brazilian agriculture. Brazil holds a worldwide-recognized rich biodiversity with extensive areas in ecological hotspots (e.g., Amazon Rain Forest, Cerrado and Pantanal). The country is also an important international player in the agriculture and livestock commodity markets. These facts explain why Brazil draws a lot of attention concerning the issue of sustainability (FERREIRA et al., 2012).

According to OECD (2011), Brazilian agricultural policy is increasingly adopting environmental and sustainable criteria to guide the application of funding. Examples include agricultural zoning laws that farmers must respect in order to apply for credit and price supports, the Forest Code which determines legal protection for native vegetation, and a range of specific programs like the "Low carbon agriculture program". Some sustainable practices are already applied in Brazil, for instance no-till planting, integrated crop-livestock-forest systems, reduced deforestation, biological nitrogen fixing, pasture recovery and the treatment of animal residues.

It is worth noting that Brazil is making huge efforts to meet the objective of deforestation reduction and to turn to a more sustainable agriculture and livestock production. However, it is also noticeable that Brazilian agriculture policy toward sustainability is less developed than its European counterpart. There is not a source of direct payments to farmers regarding green production in Brazil.

ABPO (Brazilian Association of Organic Livestock): a case of beef producers' cooperation

The Brazilian beef supply chain has faced several demands concerning its sustainability. In 2009, the Greenpeace report called *Slaughtering the Amazon* accused the beef sector of being responsible for most of the deforestation of the Brazilian Amazon. This report was a cornerstone in the discussion of beef sustainability in Brazil and has generated a set of demands and initiatives. The association between illegal deforestation of the rain forest (Amazon Forest) and cattle ranching in Brazil led the Brazilian meatpacking industry and retailers to sign a commitment agreement with the Brazilian Federal Public Attorney regarding sustainable livestock practices. The agreement involved the non-acquisition of cattle from deforested areas and from farms with social and/or environmental debts. Retailers required the guarantee that the beef sold by them did not originate in deforested areas.

It is under this context that the Brazilian Roundtable on Sustainable Livestock (GTPS⁶) was formally constituted in June 2009. Under the scope of GTPS, there are two main types of sustainable beef supply chains in Brazil: (i) one organized with farmers that operate independently; and (ii) the one in which farmers operate through collective actions. Both have to conform to a set of rules, such as the Forest Code

⁶ "Grupo de Trabalho da Pecuária Sustentável" (in Portuguese).

and the Brazilian Labor law. The Brazilian Association of Organic Livestock (ABPO⁷), founded in 2001, is an example of sustainable beef supply chains in which producers are engaged in collective actions.

The farmers participating in the association have a long-term relationship and share the production challenges in a region of difficult access, subjected to floods and with several specific issues related to the singularity of a fragile ecosystem with great biodiversity (the Pantanal Area). The farmers and local communities also have historical connections (properties are usually managed by several generations of the same family) and share habits and customs of the so-called "homem pantaneiro" ("man from the wetlands").

The relation between ABPO and an international well-known slaughterhouse was an example of a sustainable chain until 2013. The final product was organic cattle beef, commercialized under the coordination of the slaughterhouse. The beef was marketed with a specific label. From an organizational perspective, ABPO negotiated contract terms for supplying cattle for slaughtering; however, contracts were established individually between the farmers and the company. The contractual terms defined the duration of the commercial relation between the parties (usually 3 years), the price to be paid (5% to 10% above the average market price) and the criteria for classification of the slaughtered animal (weight, age and fat layers). In general terms, farmers and the meatpacking company maintained a long-term relationship, establishing formal, long-lasting contracts.

The contract between ABPO and the slaughterhouse prescribed a mutual exclusivity and the obligation of supplying 290 animals per month, beyond meeting all the rules established by the meatpacking industry for raising cattle.

In 2013, the contract was not renewed and the farmers had to bear the risk of selling animals on the spot market, and so lost the value generated by the investments in sustainable practices (hold-up event). With the emergence of this new scenario, ABPO started to look for new partners to maintain its core activity. The producers' association has established a new agreement with another company and the value of sustainability has not completely vanished.

Regarding the institutional environment that permeates this productive system, it is possible to clearly observe the influence of production rules (including specific legislation⁸) that must be followed by all members, as well as formal contracts and informal guarantees (cultural and historical values). In addition, the partnership accounts for the existence of audited stamps that certifies the origin and the quality of the cattle.

Perhaps more importantly, BAP does not provide any fixed payment to farmers in order to adopt sustainable practices. As there is not a direct incentive, when the meatpacking firm decided not to keep the contract with ABPO, there was a risk of value loss. Farmers could have decided to sell the animals as commodity goods on the spot market. In the end, sustainability was at stake. The collective effort of establishing a new agreement with another partner has guaranteed the maintenance of long-term sustainability. It is also important to stress that at this moment, ABPO is negotiating the price to be paid and the scale of production to meet the new partner's demand. Nonetheless, the farmers continue to follow production requirements to supply sustainable beef. This is only possible because producers recognize that there are gains in remaining sustainable once they are members of a producers' association.

Based on the comparative assessment of the case studies discussed above, in the next section we design a simple formal argument. We consider the transaction between farmers and a downstream agent (processing firm), which involves the potential payment of a premium for sustainability (i.e., bonus). Each farmer has to decide whether he or she will become a member of a producers' organization (collective action). The processing firm, on the other hand, can opportunistically refrain from paying bonuses to the farms.

⁷ Associação Brasileira de Pecuária Orgânica – ABPO (Brazilian Association of Organic Livestock).

⁸ See law n. 10.831, December 23, 2003.

The sustainability of sustainable supply chains

In line with Caleman et al. (2013), we start from the assumption that the provision of sustainability requires specific assets. That is to say, investments in sustainable assets – or sustainable modes of production – present a potential loss of value if the product is not transacted as a “sustainable good”. For example, to certify to the customer that a particular food product comes from agricultural areas following sustainable practices, a company and other agents in the production chain must invest in dedicated monitoring facilities and certification practices. In this case, there is the possibility of opportunistic behavior of one or more parties involved in the transaction, with the resulting efficiency loss in the economic exchange.

First, we assume that farmers produce a sustainable product but do not engage in horizontal cooperation (i.e., he or she is not a member of a producers’ association). In this setting, we define that the farmer’s utility function depends on the market price for the product (p), the premium paid by the processor due to the delivery of sustainability attributes ($b_f(s)$), and the costs incurred for the production of the sustainable product ($c_f(s)$). For simplicity, we assume that the costs associated with other aspects except the provision of sustainability are zero. Formally:

$$U = p + b_f(s) - c_f(s) \quad (1)$$

Where $s \in [0,1]$ accounts for the level of sustainability that the farmer decides to deliver to the processor.

When $s = 0$ the product does not present sustainability attributes, meaning that $b_f(0) = c_f(0) = 0$. In this case, the farmer will produce a non-specific product, receiving only the market price (p), which we assume to be determined in a perfectly competitive setting. We also assume that $b_f(s) > c_f(s)$ for $\forall s \in (0,1]$.

The processing firm, in turn, faces a profit function that depends on the product price on the retail market (p_R), the bonus received for delivering a sustainable good to consumers (b_p), the specific costs incurred in the marketing of a sustainable product (c_p), and the payment made to the farmers $p + b_f(s)$. Formally:

$$\pi = p_R + b_p(s) - c_p(s) - [p + b_f(s)] \quad (2)$$

We assume that the retail price (p_R) is determined in a perfectly competitive environment, so that in the absence of sustainability attributes the firm transacts a non-specific product, whose price the firm is unable to influence. A characteristic of the model is that the premium b_p and the cost c_p depend on the sustainability level delivered by the farmer. We assume that $b_p(0) = c_p(0) = 0$, $b_p(s) > c_p(s)$ for $\forall s \in (0,1]$, and $p_R \geq p$.

It is worth noting that within the market structure defined above, sustainability is described as a differentiating element capable of reducing the competitive pressure faced by the supply chain (producers + processing firm). Specifically, we consider that both the *total price* received by the farmer and the *total price* received by the processing firm consist of two elements: a basic component set by the competitive market forces (p and p_R , respectively) and a differentiating component, a bonus ($b_f(s)$ and $b_p(s)$). Because the premium depends on the level of sustainability (s), the farmer is able to influence its income, thus departing from the perfect competitive result. The processing firm may design an incentive system in order to induce the producer to deliver some level of sustainability, so that it can also earn positive rents.

Accordingly, we examine the situation in which the processing firm can establish a contract with the farmer specifying the sustainability level to maximize the value

created in the transaction. Considering a sequential game framework, the processor knows that the farmer will supply a level of sustainability for which marginal benefit equals the marginal costs: $b'_f(s) = c'_f(s)$. Accordingly, the processing firm's profit maximization condition can be written as:

$$b'_p(s^*) = c'_p(s^*) + c'_f(s^*) \quad (3)$$

Equation (3) describes the dynamics of the equilibrium of the model. The processing firm will offer the farmer an incentive contract in which s/he demands the sustainability level s^* and pays the premium $b'_f(s^*)$. The farmer will accept the contract provided that the institutional environment is strong, so that the contract will be enforced and the producer will not act in an opportunistic manner (WILLIAMSON, 1985). Point A in Figure 1 illustrates this equilibrium. It is assumed that the marginal cost function is an increasing function of the sustainability level and that the consumer is willing to pay a positive premium, which decreases as the level of sustainability increases (i.e., decreasing marginal utility)⁹.

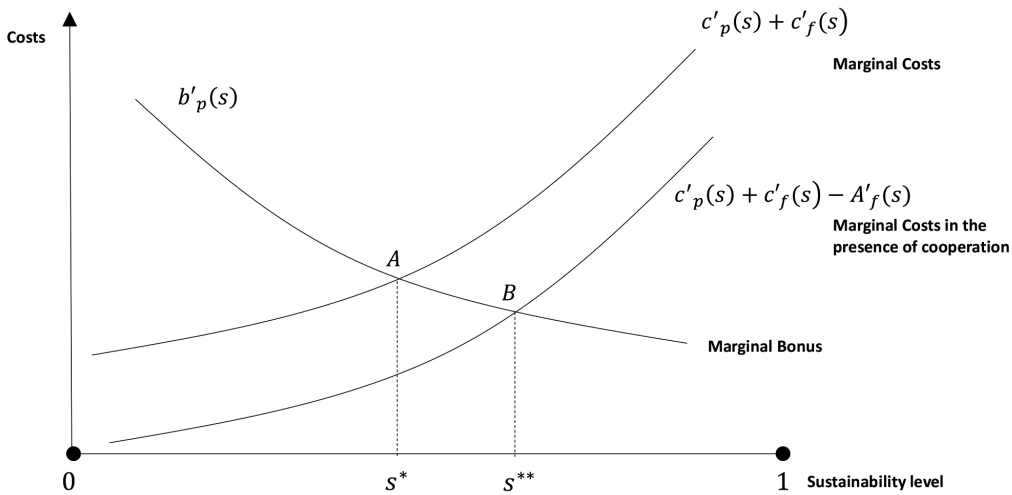


Figure 1 – Sustainability level.

Source: The authors.

Opportunistic behavior and the role of government incentives

The preceding results are based on the assumption that the processing firm does not have incentives to behave opportunistically. If this is not the case, however, the firm may find incentives not to pay the premium $b_p(s)$ to the farmer once the sustainability level had been delivered. In such a situation, the farmer will have a disutility equivalent to $p - c_f(s) < 0$, while the firm will have an increase in its profits.

Under a sequential game framework, the processing firm will act opportunistically as long as the short-term gain from breaking the contract is higher than the net present value of its profit under the contract. Formally:

$$\left(p_R + b_p(s) - c_p(s) - p \right) + \frac{(p_R - p)}{\varphi} > \frac{p_R + b_p(s) - c_p(s) - (p + b_f(s))}{\varphi} \quad (4)$$

⁹ With increasing sustainability, consumers will pay a positive premium. However, the consumer willingness to pay will decrease as sustainability increases because he or she may eventually be satisfied.

$$\frac{b_p(s) - c_p(s) - b_f(s)}{b_p(s) - c_p(s) + p_R - p} < \varphi \quad (5)$$

Where φ represents the discount rate.

It is interesting to note that the contract will be self-enforceable for a lower range of discount rates if the transaction is embedded in a weak institutional environment. In general, the existence of a legal apparatus is important because it establishes the rules to be followed by the parties in a transaction. Such rules – and its enforcement – interfere with the way transactions are carried out because they create incentives or transaction costs. When the institutional environment is weak, “episodes of economic and political instability induce high discount rates, which make the reputational costs of renegeing less relevant” (MANZANO; MONALDI, 2008, p. 76).

Aside from the general quality of the institutional environment, the government incentive policy towards sustainable production can influence contract stability. Let us suppose that the government sets an agriculture public policy according to which farmers receive a fixed payment (t) for each level of sustainability that he or she delivers to the processor. The utility function of the farmer and the first order condition can then be expressed, respectively, as:

$$U = p + b_f(s) - c_f(s) + t.s \quad (6)$$

$$b'_f(s) = c'_f(s) - t \quad (7)$$

As a general consequence, in the presence of a fixed payment, the incentive provided by the processor (i.e., the amount of bonus paid to farmers) could be lower. The reason is that under the government policy, part of the costs undertaken by farmers to adopt a sustainable production could be covered by the fixed payment. In this case, the farmer may provide a positive level of sustainability even if opportunistic behavior is possible. That is to say, there is a premium $b'_f(s) < b_f(s)$ so that:

$$\frac{b_p(s) - c_p(s) - b_f(s)}{b_p(s) - c_p(s) + p_R - p} < \varphi < \frac{b_p(s) - c_p(s) - b'_f(s)}{b_p(s) - c_p(s) + p_R - p} \quad (8)$$

Farmers will operate under such an arrangement as long as their indifference condition is satisfied:

$$b_f(s) = b'_f(s) + t.s \quad (9)$$

Farmers' horizontal coordination

Let us now suppose that the farmer is a member of a producers' association (collective action). When farmers engage in horizontal cooperation, some positive externalities emerge ($e(s)$). One possibility is the occurrence of sub-additive costs related to the share of strategic information (ZYLBERSZTAJN; FARINA, 2010) regarding the production of sustainable products; another possibility is the enforcement of pro-sustainability efforts through informal institutions (OSTROM, 1990) in a way that reputation increases at low cost when compared to independent farmers. Particularly, we assume that the positive externality generated by a producers' association is an increasing function of the level of sustainability.

As a counterpart, when farmers structure a horizontal coordination mechanism, they have to bear the costs of internal governance $c_G(s)$, which encompasses the cost associated with the writing of compliance agreements, the cost of member entrance,

the cost of controlling free riding, etc. The existence of positive governance costs casts a shadow on the effective appropriation of the positive externalities of collective actions. For instance, free riding could be present and be so costly that the net value of the horizontal arrangement becomes negative. If the governance cost is higher than the benefit of horizontal coordination, there is no room (or no need) for farmers to adopt a collective action. Regarding our results, other incentives like pure premium prices and/or a strong institutional environment must be present in order to sustain a sustainable food chain¹⁰.

We assume that the cost of governance is also an increasing function of the level of sustainability. The higher the sustainability level that the producers intend to deliver, the higher the demand for control over all association members. Thus, the utility function of the farmer can be rewritten as:

$$U_A = p + b_f(s) - c_f(s) + A_f(s) \quad (10)$$

Where $A_f(s) = e(s) - c_G(s)$ is the net individual benefit generated by the producers' association, assuming that the benefits and costs of the collective organization are equally shared among producers. The first order condition can then be expressed as:

$$b'_f(s) = c'_f(s) - A'_f(s) \quad (11)$$

Following the same reasoning presented above, the equilibrium is achieved when the processing firm offers the farmer an incentive contract in which s/he demands the sustainability level s^{**} and pays a premium $b_f(s^{**})$ that satisfies condition (11):

$$b'_p(s^{**}) = c'_p(s^{**}) + c'_f(s^{**}) - A'_f(s^{**}) \quad (12)$$

Assuming that $A'_f(s) > 0$ ¹¹, it follows that $s^{**} > s^*$. That is, the producers' association creates incentives for the farmers to produce a higher level of sustainable products. This happens because horizontal coordination reduces the marginal cost of sustainability production as indicated by point B in Figure 1. It is worth noting that this result does not depend on the presence of an incentive policy set by the government.

On the other hand, in the presence of an incentive policy and under the cooperation arrangement, the costs undertaken by farmers to adopt a sustainable production could be lowered by the fixed payment defined by the government and the gains from cooperation. Accordingly, the farmer's indifference condition would take the form: $b_f(s) = b'_f(s) + t.s = b'^{t,A}_f(s) + t.s + A_f(s)$, where $b_f(s) > b'_f(s) > b'^{t,A}_f(s)$.

Discussion: reassessing the case studies

Based on the description made in the previous sections, it is possible to perform a more complete comparative analysis of the strategic variables and the coordination forms that characterize the case studies regarding the Netherlands and Brazil. The aim of this section is to highlight the roles of collective actions and government policy in supporting a sustainable supply chain. Table 1 presents the comparison between both cases.

¹⁰ In more general terms, if free riding cannot be controlled at some minimal level, the whole foundation of the analysis is destroyed and the concept of equilibrium, and hence of the provision of sustainability, becomes meaningless.

¹¹ This condition is satisfied as long as $\frac{\partial e}{\partial s} > \frac{\partial c_G}{\partial s}$.

Table 1 – Case comparison.

Model Variable	ABPO (Brazil)	FrieslandCampina (The Netherlands)
Type of farmers' collective action	Farmer's association	Agriculture cooperative
Institutional environment (pro sustainability aspects)	Brazilian Forest Code; "Low carbon agriculture Program"	CAP (Greening pillar); Dutch Animal Act
Incentive structure	<ul style="list-style-type: none"> Premium: $b_f(s) > 0$ Net individual benefit generated by collective action: $A_f(s) > 0$ Government incentive policy: $t = 0$ 	<ul style="list-style-type: none"> Premium: $b_f(s) > 0$ Net individual benefit generated by collective action: $A_f(s) > 0$ Government incentive policy: $t > 0$
Premium paid by the processor due to the delivery of sustainability attributes ($b_f(s)$)	5% to 10% above the average market price for the product	Guaranteed price plus a bonus that depends on the quality of the milk and the annual cooperative performance.
Government incentive policy: fixed payment for each level of sustainability	$t = 0$ No direct payments	$t > 0$ The green direct payment under CAP legislation
Externalities of farmers' collective action ($e(s)$)	$e(s) > 0$ (technical support; bargaining power to negotiate contracts with processors; differentiated prices)	$e(s) > 0$ (technical support; differentiated prices; outdoor grazing premium; CSR awareness throughout the whole supply chain)
Hold-up event	Yes (Contract breach in 2013)	No
Maintenance of the sustainable Supply Chain	Yes	Yes

Source: The authors.

It is clear the role collective action plays in Brazil regarding sustainable beef. ABPO is a producer association where the pooling of farmers' resources is at stake. In other words, ABPO exemplifies an effort in which collective action emerges as an important outcome to come up with sustainable practices. From our theoretical propositions, the existence of a collective action would be necessary to support a sustainable chain as long as: (i) the production of organic beef demands specific investments, opening up room for opportunistic behavior and hold-up events; (ii) the institutional environment in Brazil might be considered weak. Moreover, positive externalities are involved ($e(s) > 0$); there is the emergence of bargaining power to negotiate with the processing industries to the benefit of farmers' income as well as the existence of a set of technical advice at the farm level that represent marginal benefits to farmers. Thus, despite not receiving direct incentives from the Brazilian government ($t = 0$) and facing the possibility of not being rewarded by the processing industry ($b_f(s) = 0$), farmers tend to accept the maintenance of a sustainable food chain by means of cooperative efforts.

The ABPO case presented here highlights the importance of cooperation in order to keep sustainability in face of hold-ups with the meatpacking firm. In 2013, the meatpacking industry did not renew the contract with the association, and farmers had to sell the organic beef at lower prices to the market. Long-term sustainability was certainly at risk. However, ABPO started to look for new partners to maintain the

value generated by the farmers. New agreements were established which guarantee the continuity of the sustainable supply chain, now with a different meatpacking industry. The point is: Would it be possible if farmers were not collectively organized? To put it differently, would it be possible in the absence of $A_f(s) > 0$? We doubt it. This event shows us that sustainability might not be maintained in the absence of the farmers' association.

Accordingly, it is also reasonable to say that collective action among farmers is less decisive in keeping sustainable practices over the long term when strong incentives are provided by the government (i.e., $t > 0$). The actual importance of the horizontal cooperation in the presence of strong incentives offered by formal institutions (e.g., agriculture policies) depends on the amount of the direct payments provided by legislation to compensate for specific investments made by farmers to go greener.

This scenario is aligned with the dairy Dutch case. Direct payments provided from the European government and a widespread concern about sustainability in Europe – and particularly in the Netherlands – offer the background for sustainable farming. Also, cooperation is the pattern of agriculture production in the Netherlands, especially in the dairy sector (FRENKEN, 2014). With all these in mind, it is quite reasonable to assume that a sustainable food chain is far easier to achieve and maintain in the Netherlands when compared to Brazil. This result is aligned with our theoretical discussion, which asserts that in face of a strong institutional environment, incentives provided by collective action might not be so decisive.

Concluding remarks

This paper investigates the incentive system through which a sustainable food chain might be built in order to enhance long-term sustainability. It considers the possibility of a hold-up event in the transaction between producers and the processing industry. The research is drawn from the perspective that sustainable practices demand an incentive system in order to generate and maintain value along the supply chain. The role of producers' collective action and government policy are particularly addressed.

The main results show that sustainability is highly dependent on incentives. Not considering intangible incentives like beliefs and self-commitments, it is clear that if a reward scheme is not built throughout the supply chain, the efforts to achieve sustainability at the farm level could not be sustained over the long term. The incentive scheme encompasses not only the reward paid by the processing industry to farmers but also the positive externalities that producers can gain by acting collectively. Yet an institutional environment that clearly motivates producers to adopt sustainable practices is another important dimension of the incentive scheme. Therefore, these three dimensions might operate jointly to build an incentive scheme towards sustainability.

It comes as a corollary that the maintenance of a sustainable food chain under an institutional environment with no direct incentives towards sustainability is threatened when farmers are not organized in collective action. When facing a hold-up event – for instance, the non-payment of premium prices to farmers by the processing industry – there is the risk that farmers would not continue to adopt long-term sustainable practices. Such risk is attenuated when the benefits provided by farmers' collective action are at least enough to cover the governance costs of the internal organization plus the specific investments made by farmers to go greener. Considering an institutional environment with direct payments, the role of collective action is counterbalanced by the incentives (direct payments) offered by institutions, and farmers' pro-sustainability efforts are more likely to be maintained over the long term.

Comparing Brazil to the Netherlands, the importance of cooperation among farmers to face the possibility of a hold-up event regarding non-payment of a bonus by the processing industry becomes even clearer. The BAP does not comprehend a formal incentive (i.e., monetary reward) towards sustainability when compared to the European legislation – or even more, when compared to Dutch regulations. Building effective collective actions among farmers is a way to promote and to sustain sustainability at the farm level over the long term in Brazil.

Considering the broader investigation of the role of the institutional environment and collective actions in promoting a sustainable food chain, some issues might have been left out in this research. The impact of penalties for not adopting sustainable practices, the failures of incentive transmission along the chain, the result of repeated interactions among players, the insertion of different possible hold-ups along the chain (for instance, consumers not willing to pay premium prices), the pattern and the cost of internal governance of producers' organizations and the role of informal institutions (e.g., beliefs and culture backgrounds) are some aspects that were not considered. These aspects give shape for a future research agenda.

Ultimately, a sustainable food chain is a complex arrangement. The results drawn from this paper can be applied to investigate other complexities besides sustainability. Quality attributes, food security, social and environment concerns, new technologies with diffuse property rights, traceability and others topics that characterize complex arrangements, and which involve the development of an incentive system, could benefit from this research.

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