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# The Brazil-China Nexus in Agrofood

## What Is at Stake in the Future of the Animal Protein Sector

John Wilkinson, Fabiano Escher, Ana Garcia

### Abstract

For over a decade China has supplanted Europe as the principal stimulus for the production and export of soy from Brazil, overwhelmingly in the form of whole beans rather than meal. Medium-term projections, whether from the United States Department of Agriculture (USDA) or Brazil's Ministry of Agriculture, Livestock and Supply (MAPA), suggest that this dynamic will continue, while China's Ministry of Agriculture and Rural Affairs (MARA) forecasts are somewhat more modest. In this article, a range of new factors are taken into account, which point to a more uncertain future. These include: Brazil's alignment in the US-China trade war and the tensions this is creating both diplomatically and within the soy sector itself; the measures China is adopting to diversify its agricultural commodity supply bases; China's increasing commitment to global climate goals; the impact of food innovation and consumer trends on global meat consumption; and the policies China is putting into place to increase domestic capacity. All these factors, it is argued, may call into question the current dynamism of the Brazil-China soy nexus over the medium term, with the unintended consequence of easing of the pressure on Brazil's fragile Cerrados and Amazon ecosystems.

**Keywords:** Brazil, China, soy nexus, diplomacy, trade, climate commitments, global meat innovation, consumption, food security

### Introduction

Many publications have analysed the extraordinary expansion of soy production in Brazil and the central role of Chinese demand in that expansion over the last two decades.<sup>1</sup> Various aspects of this dynamic have been examined, with particularly important contributions coming increasingly from Chinese scholars.<sup>2</sup> Among the issues of direct relevance to our present contribution are:

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the composition of Brazilian soy exports within the context of the downgrading and reprimarisation debates; Chinese strategies for establishing increasing control over the soy complex; the modernisation of the Chinese agrofood system; conflicts over the sustainability of soy on the Brazilian agricultural frontier; and the issues soy poses as a key component of the animal protein dietary transition and food security. While the Brazil-China soy nexus has been recognised to be complex and conflict-ridden, the idea that it will remain central to the global agrofood system over the medium and long term is a view that has been reinforced by global projections of demand and Brazilian projections of its capacity to respond to that demand.

The above issues are revisited in the course of this article but are now analysed in light of a very changed conjuncture that has become evident over the last five years or so. In the next section, we look again at the consolidation of the Brazil-China soy nexus and the debate on “downgrading”, as Brazil’s exports shift from soybean meal to whole soybeans. This is followed by a discussion of the way in which global conventions on sustainability and climate change are now influencing trade relations and the extent to which China is aligning itself with these initiatives. Next, we explore the shifts in the relationship between trade and diplomacy and the extent to which China is responding through efforts to diversify its supply bases and lessen its dependence on both Brazil and the United States. New developments in both food innovation and consumption trends, which may modify current projections of animal protein demand in the medium to long term, are examined in the section that follows. Finally, we look at measures that China is taking with regard to its own animal protein sectors and that may also modify future soy demand.

The article evaluates the extent to which sustainability, food security and geopolitics/diplomacy may be shifting some of the parameters of the Brazil-China soy nexus, with China lessening its dependence on both Brazil and the United States and increasingly aligning its trade policies with climate and sustainable development goals. It also analyses the extent to which actors in Brazil are taking these factors into account and the likely impacts this may have on the advance of the Brazilian soy frontier into the native vegetation and the forests of the Cerrados and the Amazon. While any one factor cannot be singled out as decisive, the combined tendencies identified in the body of the article lead us to suggest that the dynamic of Brazil’s soy frontier may be less long lived than imagined. Given that there is no other commodity cluster on the same scale as the soy-meat complex, this would open up opportunities for the promotion of alternative forms of occupation of these strategic biomes.

1 Cf. Oliveira / Schneider 2016, Oliveira 2017, Schneider 2017, McKay et al. 2017.

2 Cf. Escher / Wilkinson 2019, Escher et al. 2018, Wilkinson et al. 2016, Zhang 2020, Zhang 2018, Yan et al. 2016.

## Brazilian soy and the shift of trade from Europe to China

By the mid-1990s the new agricultural frontier in Brazil's savannah regions, from the centre of the country towards the direction of the Amazon, was already dedicated to cattle and above all soy. EMBRAPA, Brazil's national agricultural research institute, had adapted soy varieties to this latitude and in 2003 the Brazilian government legalised the use of transgenic seeds that, along with glyphosate-resistant varieties, were now combined with a new method of "direct planting" that simplified farming methods and enabled production at scales unimaginable in the south of the country, soy's original location.<sup>3</sup> China's demand for soy was already beginning to make itself felt, but Europe initially remained the principal market for Brazilian soy, with an increasing preference for soybean meal rather than whole soybeans, as European crushing operations began downsizing.

However, European demand for soy started to slow in response to changes in demographic and income factors. Food imports were relaxed following China's entry into the WTO at the end of 2001, and in 2002 China redefined soy as an industrial input and therefore not subject to the self-sufficiency goals reserved for grains. By the middle of the 2000s the dynamic of Brazil's soy trade had totally changed both in intensity, direction and profile, dominated by China's demand for soybeans to be crushed there to supply its domestic market with oil and meal (Escher / Wilkinson 2019, Oliveira 2017, Schneider 2017).

Analyses from the global value chains (GVC) literature at this time identified a shift in commodity trade from South-North to South-South, which was seen to be accompanied by a process of "downgrading", with China demanding raw materials whereas commodity trade with Europe had been associated with increasing levels of value added (Kaplinsky et al. 2010, Wilkinson / Rocha 2009, Menezes / Bragatti 2020). This has now become an issue in Brazil and negotiations with China are underway for a phytosanitary agreement that would facilitate soy meal exports. The shift to a soy export profile based almost exclusively on whole beans, however, would seem to be equally a consequence of the Brazilian tax reform, the Kandir Law, put in place in 1996, which lifted the export tax on primary commodities. The data show that this had an immediate impact and already in the late 1990s the export of soybean meal declined sharply in favour of whole beans (Table 1).<sup>4</sup> The motive for the tax law here was

3 In fact, transgenic soy had been planted since the mid-1990s via imported clandestine seeds, known as "Maradona" seeds, from Argentina where commercialisation was authorised in 1996.

4 Whereas the United States Department of Agriculture (USDA) data for exports includes only soybeans, the Brazilian Ministry of Agriculture, Livestock and Supply (MAPA) provides disaggregated data for the soy complex as a whole. In 2020, according to MAPA, Brazil exported 74.9% of total soy production, but if only soybeans are considered, the percentage drops to 61.5%, figures slightly higher than those of the USDA. Disaggregation is important because it captures the continued importance of Brazil's soy crushing industry and of domestic demand for its globally competitive meats industry, which depends on soy for meal and feed to the animals.

Table 1: Brazil's soy complex exports by product and destination, 1997–2020

Year	Soy Complex (MMT)	Beans (%)	Meal (%)	Oil (%)	China (%)	EU (%)	Others (%)
1997	18,924	41.2	52,9	5,9	9,4	69,6	21,1
1998	20,979	43.8	49,7	6,5	11,4	68,7	19,9
1999	20,761	42.4	50,2	7,5	4,0	72,8	23,2
2000	21,922	52.5	42,6	4,9	8,7	68,8	22,7
2001	28,578	54.8	39,4	5,8	11,2	68,4	20,3
2002	30,401	52.5	41,2	6,4	14,6	63,0	22,4
2003	35,953	55.3	37,8	6,9	18,5	58,5	22,9
2004	36,138	53.0	40,0	7,0	18,2	56,3	25,5
2005	39,377	56.6	36,5	6,8	19,0	54,7	26,3
2006	39,616	62.8	31,1	6,1	27,8	48,3	23,9
2007	38,473	61.5	32,4	6,1	27,3	49,5	23,2
2008	39,089	62.7	31,4	5,9	32,1	48,3	19,6
2009	42,389	67.3	28,9	3,8	39,1	41,6	19,3
2010	44,294	65.6	30,9	3,5	45,2	35,1	19,7
2011	49,039	67.2	29,2	3,5	46,4	32,2	21,4
2012	48,945	67.2	29,2	3,6	48,4	31,7	19,9
2013	57,488	74.4	23,2	2,4	57,2	24,6	18,2
2014	60,710	75.3	22,6	2,1	54,5	24,7	20,9
2015	70,819	76.7	20,9	2,4	58,1	19,7	22,2
2016	67,276	76.7	21,5	1,9	57,7	19,7	22,6
2017	83,667	81.5	16,9	1,6	64,7	15,2	20,1
2018	101,332	82.2	16,5	1,4	67,9	13,2	18,9
2019	91,787	80.7	18,2	1,1	63,4	15,6	21,0
2020	101,040	82.1	16,8	1,1	60,2	16,6	23,3

Source: Compiled by the authors based on MAPA 2021

a macro-economic concern with promoting exports to improve the balance of payments in hard currency, rather than a sectoral strategy (Lemos et al. 2017).

The shift from meal to whole beans is better seen, therefore, as a convergence between macro-economic interests in Brazil, China's preference for processing in situ both for meal and for its edible oils market, and a global restructuring

of the soy complex around the Chinese market. Committed now to dependence on global markets, China's food security policy has become harnessed to its broader "going out" policy, and to varied strategies for establishing active control not only over trade, but over the whole global value chain involving soy and from there extending to further components of the animal protein sector, for which soybeans (meal) supply valuable feed (Schneider 2017, Sharma 2014). It should also be remembered that while soy occupies a central place, China's need for agricultural imports extends increasingly to other key staples (wheat, corn, rice and fish) and to non-food crops (cotton, tobacco, wood and pulp), as well as more recently to higher value products such as meat, milk products and wines, which have been outsourced to preserve grain self-sufficiency (Zhang 2018).

Different strategies on the part of China to ensure food security have prevailed at different times, including investments in agricultural lands, which have been widely opposed as "land grabbing" and have led to restrictive legislation in a number of key agricultural countries, including in Brazil, where such laws were specifically motivated by fears of Chinese investments (Oliveira 2017, McKay et al. 2017). On other occasions, large-scale contracts for entire harvests have been negotiated, often unsuccessfully as in both Brazil and Argentina, but also successfully in the case of wheat from the Ukraine (Wilkinson et al. 2016). A constant has been the provision of infrastructural investments – transports, energy, ports – that might involve greater direct control of supply chains or more generally improve the conditions of supply from different agricultural frontiers. In addition to its investments in port facilities in Brazil, Chinese firms such as the China Communications Construction Company (CCC) are participating in auctions for the construction of railways linking the soy frontier to Brazil's northern ports.

The extent of China's ambitions can be gauged by its interest in the construction of a roadway linking Brazil to ports in the Pacific, together with an earlier interest shown in the construction in Nicaragua of an alternative to the Panama Canal. Rather than seeing these different strategies as evolving over time, Zhang (2018) identifies the same mix but sees them as depending on the nature of the firms involved – state firms, private "dragon head" firms, firms at the local state level and state farm enterprises. As we will see below, Belt and Road Initiative (BRI) investments are opening up potential new sources of agricultural supply along China's borders with Central Asia. In terms of direct control, China's most important strategy has been that of direct foreign investment, usually via the purchase of established leading companies. The most important initiatives in the case of soy have been the purchase of Nidera and Noble by COFCO International, Fiagril by Hunan Dakang, a unit of the Shanghai Pengxin Group, and the purchase of Syngenta by ChinaChem. This, in addition to investments in ports, gives China a presence in all the stages of the supply chain

in Brazil and the Southern Cone countries. COFCO now challenges the leadership of the “Big Four” global traders – Archer Daniels Midland Co., Bunge Ltd, Cargill Inc. and Louis Dreyfus Co., known collectively as the ABCD (an acronym formed from the first letters of their names) – in this region. Syngenta Argentina has also entered, via barter arrangements with its agrichemical inputs, into the marketing of soy directly through the leading Chinese State trading firm, Sinograin (Escher / Wilkinson 2019, Wesz Jr. 2016, Oliveira / Schneider 2016, Wilkinson et al. 2016).

China’s ambitions are not limited to greater control over strategic agricultural commodities but involve a global challenge to the hegemony of the ABCD traders. This can be seen in the reestablishment of a large measure of control over the crushing industry in China, which had been virtually taken over by ABCD players in the wake of a crisis bankrupting many domestic crushing firms (Solidaridad 2016). As a logical extension of its concern for control over soy, China is also establishing a strong footing directly in the meats sector, especially in the pig supply chain, both in Argentina and the United States, as its domestic production has been decimated by swine fever and continues to be at risk, as well as for beef in the case of Australia. China is also looking to challenge the control of the Chicago Futures Market and the pricing mechanisms which still favour the Big Four, through increasing barter arrangements, greater physical control of the global supply chains, efforts to extend the convertibility of the yuan and initiatives such as the Asia Pacific Futures Exchange, in the case of palm oil.

Radical changes have also occurred on the Brazilian side of the soy complex, as exports to China have dwarfed those to Europe and other countries, accounting in 2020 for more than 70% of Brazil’s soybean exports. In the twenty years of the new millennium, Brazil’s soy production increased from 38.3 to 134 million tonnes, and productivity increased from 2.75 tonnes/hectare to 3.50 tonnes/hectare. On top of this important increase in productivity, the area cultivated with soy also increased from 13 to 38 million hectares.

By 1998 the new savannah frontier was producing more soybeans than the traditional soy producing regions in Brazil’s south and was expanding more rapidly (CONAB, 2020). In the Cerrados, the small and medium family farm model of the south – organised around cooperatives – was partially reproduced, but as lands further north were cleared this model gave way to the predominance of large farmers often cultivating thousands and even tens of thousands of hectares and marketing their product with the Big Four traders or negotiating directly on the futures market (Pereira 2016). In the most recent phase, with China also showing interest in land investments in Brazil, agricultural firms quoted on the stock exchange have been primarily responsible for opening up soy production in the savannah regions of the north and northeast (Wilkinson et al. 2016).

The scale of soy operations in the Cerrados and the importance of their export revenue for the balance of payments – in 2020 soy exports reached the value of US\$35.2 billion, without which Brazil’s trade balance would have been negative – has allowed for the emergence of powerful new farmers’ organisations, especially the APROSOJA, which, as we will discuss below, aligned itself with the current Bolsonaro Government. The scale of operations in the Cerrados has allowed for significant on-farm accumulation, leading to the emergence of agribusiness groups that have expanded backwards and forwards along the value chains – without, however, becoming more than junior partners to the global traders (Pereira 2016, Wesz Jr. 2019).

Conflicts have always characterised this expansion of the soy frontier – over the use of transgenics, the environment, indigenous populations and lands, food security implications of an agricultural frontier dedicated to exports, and the promotion of a development model unable to create employment and diversify production. The most significant mobilisation, however, was that against the encroachment of the soy frontier into the Amazon. Even before the new Forestry Law, international NGOs and the global traders agreed to a Soy Moratorium, which since 2006 has banned the trading of soy produced in recently deforested areas.<sup>5</sup> This agreement has been implemented and effectively monitored and, although limited to soy, became a significant factor in the reduction of deforestation. The focus, however, was the Amazon, and the advance of the soy frontier into the Cerrados remained largely undisturbed and strongly supported by Federal Governments and policies during this period (Wilkinson 2011).

The shift in the axis of the global soy trade towards China had profound effects on both Brazil and China. For China, as will be explored further below, control of the soy supply chain is a key component of a larger strategy for negotiating its structural and growing dependence on out-sourcing for its raw material needs in general and for securing food security in particular. The downgrading of Brazil’s soy exports from meal to whole beans was, as we have seen,

5 The new Forestry Law (Law No. 12.651/2012), which replaced the previous Forestry Code (Law No. 4.771/1965), changed the metrics of the main existing legal instruments – Permanent Preservation Areas (APPs) and Legal Reserves (RL) – and enacted new instruments for environmental management and for monitoring and combating illegal deforestation: the Rural Environmental Registry (CAR), which certifies the environmental regularisation of rural properties, and Environmental Reserve Quotas (CRAs), which allow for the creation of markets for environmental assets and liabilities. Since 2009, the proposed revision of the code has been marked by conflicts and debates involving, on the one hand, parliamentarians, ruralists and agribusinesses with productivist discourses and, on the other, environmentalists, scientists and NGOs with preservationist arguments, in addition to the government itself. In practice, the approval of the new law entailed the “amnesty” of fines and sanctions resulting from illegal deforestation carried out before 2008, which mainly favoured large landowners, and the exemption, especially for smallholders, from the obligation to restore deforested areas. Furthermore, there are numerous questions about the state’s capacity, in terms of infrastructure and human resources, to oversee and facilitate the implementation and enforcement of the law, as well as differences in the application of federal and local rules and norms. These are seen as sources of insecurity in the legal order of environmental protection and causes of the erosion of the social function of the private property of land. The strength of those who refuse to comply with the law, given the constant delays and deadline extensions for its application, have contributed to the increase in deforestation since 2012, which has further accelerated with the current “dismantling” of environmental policy (Rajão et al. 2021, Silva et al. 2016).



the result of a convergence of at least three factors – Brazil’s tax exemption for the export of raw materials, the global shift in the axis of demand that led to a relocation of the global traders’ investments to crushing facilities in China, and China’s interest in processing soybeans both for edible oils and for meal for its domestic market. China’s concern was not so much with the specific issue of concentrating the value added of trade within its borders, but with the broader issue of control over global supply chains, which were now decisive for its long term goal of food security.

In the first decade of this century, sustainability concerns in the agrofood sector were focused on the impact of sugarcane biofuels, and a diplomatically successful campaign was launched to establish the sustainability of Brazil’s ethanol, supported by a commitment not to encroach on the Amazon region and the acceptance of a zoning policy for sugarcane that had to respect areas of native vegetation and conservation (Wilkinson / Herrera 2010). The soy sector and the Cerrados frontier were largely untouched by these concerns in this period. This was to change with the repercussions of the RIO+20 Summit in 2012, when Brazil committed itself to the goal of sustainable development. At the same time, coinciding with Xi Jinping’s assumption of the presidency in 2013, China also began to shift its international position on the question of sustainable development. For both countries, the BRICS position of “differentiated responsibilities” now gave way to clear commitments to the UN’s Sustainable Development Goals (SDGs) and the Paris Agreements, issues to which we now turn (Estevo 2019, Kuhn 2019).

## Trade and sustainability

We have seen how, in the case of Brazilian soy at least, the association of a shift in trade from Europe to China, with downgrading, needs to be qualified and situated in a broader context, including Brazilian domestic policies and global agribusiness restructuring. It might be thought that this shift would also lead to less pressure for the adoption of environmental and climate change measures in the soy supply chain. Brazil and China, within the framework of the BRICS, rejected the view that the onus of climate change should be assumed by developing countries. This reluctance to assume international commitments on climate change was evident in China’s role at the Copenhagen Summit on Climate Change in 2009 (Conrad 2012). Brazil’s soy trade with Europe, on the other hand, was always subject to tensions, whether over transgenics or soy production in the Amazon.

China was exposed from the outset to the emergence of the international sustainability paradigm through its participation in the inaugural Stockholm

meeting in the 1970s, although at that time it flatly rejected any commitments that would prejudice development (Wang et al. 2014). Nevertheless, from the 1970s, protection of the environment acquired institutional status in the form of bureaus and national agencies in China and became enshrined in law. In 1990, the notion of sustainable development was adopted, and in the wake of Rio92 China prepared its Agenda 21 (Barbieri 2019).

By 2004, some 160,000 officials were working in China's Environmental Agency (Mol / Carter 2006). Conrad (2012) analyses this tension between an increasing adoption of sustainable goals in national policy and China's reluctance to commit itself to binding international agreements. Domestically, China committed itself to changing its fossil-based energy model: in the 12th Five Year Plan (2011–2015) it established for the first time the goal of emissions reductions, later transformed into concrete targets in the 13th Five Year Plan (2015–2020). In 2015, with Xi Jinping now in charge, China, in the absence of the United States, assumed a leadership position at CP21, Paris, where it committed China to peaking carbon emissions by 2030, and to a reduction of per capita carbon emissions by 60–65% in 2030 compared with 2005 (CCICED 2016).<sup>6</sup>

Following the Copenhagen Climate Change Conference in 2009, the European Union, individual European countries and global firms focused on cleaning the global supply chains of carbon emissions (European Commission 2019). The New York Declaration on Forests was launched in 2012, and by 2017 had been endorsed by 40 countries, 20 sub-units of countries, 57 global firms, 16 indigenous peoples and 65 NGOs/CSOs, which committed themselves to halving natural forest loss by 2020 with the goal of its complete elimination by 2030. Neither Brazil nor China signed this Declaration (Climate Summit 2014). The TRASE satellite and advanced technology tracking organisation was set up to assist firms and countries in identifying with precision the carbon footprint of different commodity chains, with a special focus on the issue of deforestation. In Brazil, TRASE has been able to identify, at the municipality level, individual flows of soy to their various purchasers, whether countries or firms. It has identified illegal deforestation in Brazilian soy production at the level of micro regions and has also carried out full life-cycle assessment of carbon footprints for soy for the imports of different countries and firms, allowing for detailed estimation of emissions (TRASE 2020a, 2020b, 2020c).

6 By the time of writing of this article, China's commitments for the Climate Summit in Glasgow 2021 were not public. Nevertheless, the Chinese government has announced a number of specific climate initiatives, such as the creation of a national carbon emissions trading market, a reduction in the operation of its steel plants, and the suspension of the construction of a large coal-chemical project within China. Cf. <https://www.carbonbrief.org/china-briefing-8-july-2021-xi-invited-to-cop26-largest-coal-chemical-project-suspended-new-authority-for-climate-roadmap> (accessed 20 July 2021); Eleonor Albert: Introducing China's Carbon Market. *The Diplomat*, 22 July 2021.

Specifically, in the case of China, TRASE has carried out studies demonstrating how it could decouple its Brazilian soy imports from carbon emissions based on deforestation, and in a similar study has identified the hidden deforestation in the China-Brazil beef and leather trade – this latter of particular importance, since China exports leather products to Europe (TRASE 2019, 2020c). The shift in Chinese policy towards a formal commitment to carbon emissions goals occurs precisely when Chinese firms, such as COFCO International, are establishing a leading position in the Brazilian soy complex via direct investments in established firms and investments in storage, transport and ports, together with direct contracting of soy with Brazilian farmers. In 2018, COFCO was second only to Bunge in its Brazilian soy purchases (Wesz Jr. 2019). COFCO has quickly aligned itself with the leading agribusiness associations in Brazil (the Brazilian Agribusiness Association, ABAG, and the Brazilian Vegetable Oils Industry, ABIOVE), and has positioned itself in favour of the Soy Moratorium from recently deforested areas. In a keynote speech to ABAG in 2019, COFCO's President focused almost exclusively on the need for sustainability and has set as a goal the elimination of deforestation from its suppliers by 2023.<sup>7</sup>

The issue of deforestation took a new turn in Brazil with the coming into force of the Forestry Code in 2012 and the later election of Bolsonaro, who was politically aligned with the soy producers' association, APROSOJA. As has been widely reported in the world press, the Bolsonaro government reneged on Brazil's commitments under the 2015 Paris Agreements, encouraged deforestation and mining activities in the Amazon region, shackled Brazilian bodies dedicated to controlling illegal activities in the Amazon, and attempted to discredit Brazilian institutions mapping deforestation. The Minister of the Environment, for his part, immediately blocked the Amazon Fund financed by the Norwegian and German governments and managed by the Brazilian National Development Bank (BNDES), which was a leading source of financing for social and environmental programmes in the region – largely promoted by NGOs demonised by the Bolsonaro government.<sup>8</sup>

APROSOJA – which along with ABIOVE, was a member of the Round Table on Responsible Soy (RTRS), a soy certification scheme organised by the World Wildlife Foundation (WWF), but left this organisation because of disagreement precisely over deforestation – is the principal organisation representing Brazilian

7 The visibility and reach of the BRI initiative have also been factors in China's adoption of global sustainability conventions; see Harlan 2020 and Hughes 2019. Harlan 2020 raises the issue of green washing in relation to BRI. The broader commitment to an "ecological civilisation" has led various authors to argue that while the environment is an externality, and therefore a cost, in Western economic theory, this is not the case in Chinese thought, where nature and humans are seen to form a continuum (Boyer 2017, Jullien 2018). Also on the notion of ecological civilisation, Geall / Ely 2018 show how discourses themselves influence the pathways to sustainability that are adopted

8 As an alternative, the Ministry of the Environment received US\$500 million in funding from the BRICS-led New Development Bank for the Climate Fund in 2019. Cf. <https://www.ndb.int/fundo-clima-brazil-national-climate-fund-project/> (accessed 10 August 2021).

soy farmers and is present in all the regions of soy production. As an alternative to RTRS, it has promoted a Soja Plus certification, based on the adoption of “good practices” and is very active in the promotion of training programmes. This organisation allied itself with the Bolsonaro government and is equally virulently opposed to the influence of NGOs in the soy chain, given their leading role in the Soy Moratorium. It has focused on the new situation created by the Brazilian Forestry Code to attack both the established Soy Moratorium, mentioned above, and the campaigns on deforestation. Prior to the Forestry Code there was no distinction between legal and illegal deforestation, and it was in this context that the global traders, pressured by the international NGOs Greenpeace and Friends of the Earth and the Brazilian NGO IMAFLORA, agreed to a moratorium on the purchase of any soy cultivated on land deforested after 2006. With the application of the Forestry Code, many farmers within already established soy producing regions in the Cerrados, who have forests on their farms in excess of the demanded reserve area, can now legally cut them down.

Of the established traders, only Cargill signed up to the New York Declaration on Forests, although Wilmar, a Singapore trader very active in the Chinese market and now trading in Brazil, is also a signatory (Climate Summit 2014). Nevertheless, the traders, including COFCO International, as we have seen, are increasingly committing to deforestation goals. The pressure on the soy sector has now firmly moved to the Cerrados, with the launching of the Cerrados Manifesto in 2017 against deforestation and the conversion of native vegetation, originally signed by 23 global industries in retail, fast food and final foods (Virah-Sawmy et al. 2019). The investor network FAIRR, which promotes ESG awareness in relation to the animal protein industry and has some 160 companies as members representing a value of ca. US\$23 trillion, has also supported this Manifesto. The traders are not involved in this initiative, but their alignment on issues of deforestation has led APROSOJA to break with both the Brazilian Agribusiness Association (ABAG) and the Brazilian Vegetable Oils Industry Association (ABIOVE), which are accused of being “infiltrated” by international NGOs (Canal Rural 2020).

This opposition to NGOs flies in the face of the stakeholder approach to global governance, which has become established over the last few decades, and both the New York Declaration and the Cerrados Manifesto are joint initiatives of governments, firms and civil society organisations, including in the former of these two cases representatives of indigenous communities. As China – a country where civil society organisations are often harassed when not suppressed – has moved towards specific targeted goals in relation to carbon emissions, it too has called on environmental NGOs, both international (WWF, Greenpeace, FSC) and domestic (Friends of Nature), to help in the elaboration of measurement and monitoring metrics (CCICED 2016). Although, as we have noted, China is not a signatory to either of the above initiatives, it

is increasingly committed to greening its global value chains in the framework of carbon emissions reductions. Sinograin, a leading Chinese state agricultural commodity trading firm, is the first to be certified by the Round Table on Responsible Soy (Solidaridad 2016). In 2016, the China Council for International Cooperation on Environment and Development, created in 1992 with support from the highest levels of the Chinese Communist Party, produced a Report on “China’s Role in Greening Global Value Chains”. The Report contains a specific section on soy in Brazil and South America. After noting that “250 multinational companies have committed to eliminating deforestation from their supply chains”, it concludes:

Joining global efforts on soy would strengthen China’s reputation on the international stage, its relations with producing countries, and the competitiveness of Chinese companies in the global market. It would also reduce China’s contribution to climate change – deforestation from expansion of soy and other major commodities accounts for more than 10% of global emissions. (CCICED 2016: 9)

When questioned about pressure from European governments and firms to commit to the elimination of deforestation from the soy value chains, the APROSOJA President pointed out that Europe only accounts now for 10% of Brazil’s exports and that exports to Europe could easily be terminated and substitute markets opened up. What this approach does not take into account, however, is the increasing convergence of China with global trends on the importance of eliminating deforestation as a key component in strategies for achieving the already established targets for carbon emissions reduction (Kuhn 2018, Greeven et al. 2020).

## **Trade, diplomacy and China’s initiatives to diversify its feed and animal protein supplies**

In the first years of the 2000s there was a clear convergence between the increasing importance of China as a trade destination for Brazil and the intensification of diplomatic relations between the two countries.<sup>9</sup> With the beginning of the first of Lula da Silva’s two periods in government, Brazil’s diplomacy became geared to establishing a leadership role in the developing world, and relations with China, which Lula visited three times, became consolidated through the creation in 2004 of the COSBAN, a high-level China-Brazil concertation and cooperation body coordinated by the Vice-Presidents of each country. The acronym BRIC was coined in 2001, identifying the emergence of large rapidly developing countries. Brazil, Russia, India and China quickly assumed this iden-

9 The diplomatic relations between Brazil and China date to the 1970s, and by the early 1990s a “strategic partnership” had already been established between the two countries.

tity and China promoted the inclusion of South Africa as a “gateway to Africa”, forming the BRICS, to represent the leading emerging economies across the globe (Bond / Garcia 2015; Ramos et al. 2018, Garcia 2019).

Even in this period, however, Brazil was acutely aware of the imbalances in its trade with China, both globally in its export of agricultural and mineral commodities in exchange for manufactured goods and increasingly high technology imports, and within the agricultural sector in the dominance of soybeans. In 2008, Brazil launched the “Agenda China” document, which focused on the need to increase the technology content and the share of manufacturing in its exports (Berringer / Belasques 2020).

The world financial crisis of 2008, which badly affected the Brazilian sugarcane sector, the discovery of large reserves of petroleum in Brazil’s “pre-salt” oil fields and global civil society opposition to biofuels undid Brazil’s green development strategy. Government corruption scandals and the subsequent undermining of Brazil’s leading construction and mining companies weakened the country’s international presence and diminished cooperation projects. Rather than promoting development in the Nacala savannah in Mozambique, as had been planned with the ProSavana development Project, Brazilian soy and cattle farmers preferred to move further north and northeast on the Brazilian agricultural frontier, opening up what became known as the Matopiba region (Garcia / Kato 2020, Schlesinger 2013). At the same time, with the accession of Xi Jinping, China launched the One Belt One Road (OBOR) initiative, later renamed BRI, which completely dwarfed previous international cooperation on development initiatives and positioned China as a direct challenge to the US on the global stage.

The election of Bolsonaro as President of Brazil created a dramatically different context. Already as a candidate, Bolsonaro raised the concern that China was “buying up” Brazil (Spring 2018) and chose as Minister of Foreign Affairs a person who in a similar vein repeated “while we want to sell, for example, soy and iron ore, we are not prepared to sell our soul” (Araújo 2019: 88), at a time when Chinese firms were almost alone in their willingness to invest in Brazil.<sup>10</sup> At the same time, in agreement with the President, the newly installed Minister of the Environment called into question Brazil’s international commitments on climate change, systematically undermined efforts to prevent deforestation and weakened the organs responsible for monitoring and policing illegal incursions into the Amazon. In addition, the Bolsonaro government allied

10 In the oil field auction of 2018 for the pre-salt region, two Chinese oil multinationals (CNOOC and CNODC) were the only foreign companies to participate (Rosa 2019). An important survey conducted by the China-Brazil Business Council showed that, despite the adverse political environment, the total amount of Chinese investments in Brazil actually increased by 117% in the first year of Bolsonaro’s administration. In the last 13 years (2007–2020), Brazil has received almost half of total Chinese investments in South America (48%), involving 176 projects totaling US\$ 66.1 billion. The main target sector has been electricity, followed by oil and gas and minerals. Agriculture comprises only 3% of total Chinese direct investments during this period (Cariello 2020).

itself with the US Trump administration, which had already initiated a trade war with China.

The Bolsonaro government broke with the consensus on Brazil's foreign policy with China, which despite cultural and ideological differences had traditionally been treated pragmatically since the 1970s, whatever the political alignments (Santoro 2020). Criticisms of China include fears of unfair competition and concerns about national security and cultural identity. Bolsonaro's nationalist right-wing base is composed of the military, which tends to support traditional relations with China, and the far-right "anti-globalist" groups, similar to populist movements in the US and Europe, which tend to create tensions through public statements resembling the positions on China expressed by Donald Trump.<sup>11</sup>

Despite these tensions, Brazil's vice-president and other state ministers made official visits to China in the first year of the Bolsonaro administration, and the president himself made a state visit to China and participated in G20 and BRICS meetings (MRE 2021).<sup>12</sup> On all these occasions, the interests of agribusiness have been reinforced, particularly the need to diversify and add value to Brazilian exports to China, given the excessive concentration on primary products. At the same time, bilateral partnership has been expected to ensure food security through the promotion of free trade flows in agricultural products. Different diplomatic agreements have been signed, of which the most notable were the health protocols for the export of heat-processed beef and for the export of cotton bran (MRE 2019b).<sup>13</sup>

Thus, despite tensions and contradictions between domestic groups and political orientations in the relationship with China, there has been an intense dialogue between the Brazilian Foreign Affairs Ministry and Brazil's agribusiness sector with a view to maintaining the continuity of diplomatic initiatives with the Asian nation. Agribusiness interests became firmly installed in Bolsonaro's government in the Ministry of Agriculture, whose Minister also led a delegation to China. A Department for the Promotion of Agribusiness (DPAGRO) was set

11 In line with Donald Trump and other global far-right figures, they reproduce social media posts with accusations of 5G as a technology for spying, the designation of the coronavirus as a "Chinese virus" and xenophobic expressions in relation to Chinese people.

12 In 2019, the first year of the Bolsonaro administration, Vice President Hamilton Mourão visited China for the 5th Plenary Session of COSBAN, where the Vice Presidents of both countries reaffirmed the need to diversify and add value to Brazilian exports to China. Additionally, the Minister of Agriculture, Livestock and Supply and the Minister of Mines and Energy visited the country. In that same year, Chinese authorities came to Brazil for the Brazil-China Global Strategic Dialogue (DEG) and different preparatory meetings for the BRICS heads of state summit in November 2019, when president Xi Jinping visited Brazil (MRE 2019a).

13 According to MAPA (2019), China imported US\$25 million in processed beef and US\$4 million in cotton bran for animal feed. In addition to the intergovernmental agreements, other agreements have been established between economic groups, such as the joint-venture contract between Frigorífico Minerva and Joey Foods (MRE 2021), and the Memorandum of Understanding between Embrapa and the Innovative Academy of Seed Design (INASEED) for the creation of joint laboratories for genetic research in soybean cultivation. According to MAPA, research will be carried out on germplasm characterisation, genome editing and functional genetics in soybean cultivation (MAPA 2019).

up in the Ministry of Foreign Affairs, and priority was given to agribusiness international fairs (MRE 2020a). Echoing the 2008 “Agenda China”, the National Confederation of Agriculture (CAN) issued a document “The Future is Agro (2018–2030)”, which reiterates the need to diversify Brazil’s agribusiness export profile.<sup>14</sup> This position was also reinforced in a recent document launched by the Brazil-China Business Council, which states that, despite “complementarity and co-dependence”, the excessive concentration of the trade agenda on a small number of basic commodities is not in the best interests to either China or Brazil (Rosito 2020).<sup>15</sup> In this sense, the diversification of trade in general, and agricultural trade in particular, becomes a goal in the diplomatic negotiations with China.

At the same time, Brazilian agribusiness seeks to maintain an image associated with sustainability, environmental preservation and a food supply system guaranteed to be safe. Deforestation, environmental deregulation and the widely reported fires in the Amazon and the Pantanal weakened this image in the first two years of the Bolsonaro government, with negative impacts on agribusiness international trade negotiations.<sup>16</sup> To address this concern, the Brazilian Embassy in the UK promoted a series of webinars on the theme “AgriSustainability Matters” in an attempt to offset the extremely negative images of the Amazon fires and the advance of deforestation (MRE 2020b).<sup>17</sup> As China tends to increasingly embrace the environmental agenda in its development processes, entities representing agribusiness seek to prepare for coming changes, with the

14 According to the CNA, Brazil’s participation in the Chinese market, although important, is still unsatisfactory and highly concentrated on a few products, particularly soybeans. Concentration on soybeans and the lack of a long-term strategic partnership between China and Brazil was seen to have contributed to China’s adoption of protectionist measures against Brazilian products, such as the sugar safeguard and the anti-dumping measures against chicken meat. Therefore, this entity demands a “strategic vision to diversify exports to China, decreasing the excessive concentration on the soybean chain and with the addition of new products in the export tariff” (CNA 2018: 68–69).

15 Although Brazil has a trade surplus with China, it is characterised by asymmetry and, at the same time, complementarity. While China exports diversified manufactured products to Brazil, Brazil’s exports are highly concentrated in three products: soybeans, oil and iron ore, which accounted for circa 80% of exports over the last ten years. China, for its part, concentrates more than half of the world’s crushing capacity, which would demonstrate the limits of the attempt to add value through crushing in Brazil (Rosito 2020: 93).

16 According to ABAG, the image of agribusiness has been damaged – associated with deforestation and fires, indigenous issues and agrochemicals – and is linked to the policies of the Bolsonaro government. Brazil is no longer a leader on environmental issues and is no longer part of any international commission related to the world’s socio-environmental agenda. In this sense, the “Brazil brand” has become weakened (ABAG 2020). For ABAG’s president, “agribusiness needs to speak (differently)”, which requires “changes in foreign policy, public commitments, purchasing policies and, above all, correct, scientific and timely communication” in order to respond to the socio-environmental concerns of today’s society (Brito 2020).

17 The Bolsonaro government has clashed with Europe and particularly France over deforestation in the Amazon and its association with the advance of soy into that region. France, in particular, is now committed to increasing its self-sufficiency in soy. We have already seen that APROSOJA regards the European market as of little importance, but the much more important free trade agreement signed between the Mercosur countries and the European Union includes a specific chapter on sustainability and ties trade to compliance with deforestation commitments. While the soy market may have become less important to Brazil, access to the European market as a whole is quite another question.



expectation of increasing environmental demands along the soy and meat chain, as already exist in relations with European countries (Wachholz / Dutra 2021).<sup>18</sup>

China depends on just two countries, Brazil and the United States, for 80% of its soy. When US President Trump placed tariffs on a range of Chinese imports, China retaliated with a prohibitive tariff on soy from the US. As a result, Brazilian farmers became virtually the sole source of supply. In this situation, the rising diplomatic tensions between the US and China, coupled with the latter's complete dependence on Brazilian soy, led to a bonanza for Brazil's soy farmers, reinforcing their support for Bolsonaro. At the same time, unexpected purchases of soy from the US by Brazilian firms, although in small quantities, pointed to the difficulty of supplying the domestic market in light of the huge demand for exports to China, which raised fears of domestic shortages of vegetable oils and animal feed in Brazil. While China then reached a level of agreement with the US, the tensions over trade represent the beginnings of what portends to be a long struggle for global economic and political power.

Zhang (2020) has drawn attention to the dangers for China of using food as a weapon in trade wars. In the trade dispute with the US, China was able to draw on extra supplies from Brazil, but this involved increased prices at a time when food inflationary pressures were already high as a result of the swine fever, which destroyed as much as a third of the total stock of pigs in China. It was also possible to link the extra demand for Brazilian soy with pressures to advance the soy frontier into the Amazon, identifying China with deforestation. What is clear is that China is now taking measures to diversify supplies both of feed and of meats. Syngenta and Sinograin contracted to supply 4.0 million tonnes of soy from Argentina in 2021. Argentina is also the source of increasing pork exports to China.

In 2019, 10 plants were authorised to export to China, and in 2020, a contract with a value of US\$3.8 billion was signed to build 25 more plants with a view to producing 900,000 tonnes of pork exclusively for export to China (Pig Progress 2020). Kenya and Tanzania are also reported to be exporting soy to China, and China has called for a "soybean alliance" with Russia (SCMP 2020). In the context of the BRI, "China has signed 120 bilateral and multi-lateral agreements on food trade and agricultural cooperation with over 60 countries and international organizations" (Zhang 2020: 71–72). Zhang (*ibid.*: 72) further argues that "by the end of 2018, China had accumulated overseas direct agricultural investment of US\$19 billion, with Chinese agribusinesses operating in more than one hundred countries".<sup>19</sup>

18 Wachholz and Dutra (2021) contend that Chinese political leaders and consumers are increasingly aware of climate change and the preservation of biodiversity, making environmental protection a driving force for industrial and energy modernisation. In this regard, Chinese banks and companies like COFCO tend increasingly to adopt sustainability criteria in projects and relations with direct producers.

19 Zhang (2018) draws attention to the extraordinary nature of China's measures against soy in the trade war with the US, given its overriding concern with food security and the fact that soy, key to China's dietary transition, is the product on which it is most dependent for imports. If China is prepared to take such action against the US today, can Brazil exclude the possibility of similar action tomorrow?

Recognising that it is now dependent on global supplies for an increasing range of foodstuffs, from grains to meat, dairy and other products, China, particularly through the BRI, is diversifying its supply lines and lessening its dependence on individual countries. Soy and animal protein are key here and although these initiatives will not replace China's dependence on the US and Brazil, when combined with the measures discussed above for direct control over the soy supply chain, especially in Brazil and Argentina, they may lead to a greater capacity for negotiation both of physical demand and especially of prices. If we combine these measures with further tendencies to lower the level of demand for animal protein and to promote innovations in China's domestic food production systems, the prospects for Brazilian soy and the other components of the animal protein sector may seem less "optimistic" than current projections predict. We discuss both these issues in the next two sections.

## **Food policy, food innovation and food consumption: Implications for the animal protein sector**

Whether we look to the projections of the Brazilian government (MAPA 2021), those of the Brazilian Industry for Vegetable Oils (ABIOVE 2018) or the Chinese government's China Agricultural Outlook (MARA 2020), all consider future demand for soy and animal protein on the basis of broad demographic and income variables. They do not take into account the changed dynamic of innovation in the agrofood sector, the indications of major shifts in consumer demand or the increasing intervention of public policies aimed at reducing meat consumption. Many individual examples of public policy aimed at reducing per capita meat consumption may be cited and are evident in the nutritional guidelines now adopted by many countries (Yang et al. 2018). Perhaps the most significant development in this sense was the publication of the Lancet Commission Report in 2019, whose aim is to establish targets for food consumption in the light of the SDG goals and the Paris Agreements, which mirror the targets for emissions reductions now adopted by over 190 countries (Willet et al. 2018). The EAT-Lancet Commission Report calls for a "Great Food Transformation", which in the case of red meats would require a 50% reduction in consumption by 2050. The Chinese President, Xi Jinping, has called for a similar reduction in meat consumption in the case of China. This would lead to a proportionate decline in the demand for animal feed, relieving pressure on the advance of the agricultural commodity frontiers (Pan 2020).

The last decade and a half have seen a wave of innovations in food based on advances in synthetic biology and big data, led not by traditional agribusiness interests but by Silicon Valley style start-ups financed by investment funds and venture capital and addressing food from the perspective of a global, in-

creasingly urban, society. Alternatives to meat are at the centre of these innovation concerns. Big data analysis of vegetable proteins (and soy is no longer the default option) has been able to identify the tastes, smells and functional properties that approximate those of meat, and vegetable protein alternatives for ground meats (burgers, nuggets) have now gone mainstream. Beyond Meat, one of the leading vegetable protein firms, was launched on Nasdaq in 2019 and is valued at US\$9 billion. This sub-sector raised US\$1 billion in funding in 2019 (AgFunder 2020).

“Clean meat” – cell-cultured meat using cells drawn from living animals – is also at an advanced stage of research and close to marketing. Singapore has taken the lead in regulating the use of such meats and a restaurant there has now included it on the menu. The think tank RethinkX (Tubb / Seba 2019) in its report *Rethinking Food and Agriculture: 2020–2030* argues that we are moving into a second domestication of animals and plants that is occurring now not at the level of macro-organisms, whole plants and animals, but through the direct manipulation of micro-organisms responsible for the production of proteins and amino acids, the building blocks of other nutrients. The report argues that food research is now integrated into the digital world of innovation as regards scale and costs and predicts a collapse of the traditional dairy and meat industry by the middle 2030s and a concomitant collapse in the animal feed and input industries. It remains to be seen how swiftly innovation in cultured meats will advance. A more cautious report by Choudhury et al. (2020), “The Business of Cultured Meat”, highlights the persistence of technological, regulatory and customer acceptance challenges but notes that since the first laboratory grown, cellular meat burger patty was created in 2013, some 32 clean meat companies have been identified and that publicly disclosed capital invested in clean/cultivated meat companies between 2015–2020 reached US\$320 million.

In 2017, China invested US\$300 million in Israeli laboratory meat technology companies, indicating a clear belief in the future of cultured meat (Surkes 2017). If we consider the “innovative food” category, according to the Agfunder (2020) “AgriFoodTech Investment Report”, which includes cultured meat and plant-based proteins, finance reached US\$2.3 billion in 2020, involving 260 deals.

One of the most remarkable developments in the new millennium has been the rise of vegetarianism, veganism and especially flexitarianism. The British Food Standards Agency commissioned a report on the “Future Consumer: Food and Generation Z” (Britain Thinks 2019), which reported a study of 2,000 people in supermarkets throughout Britain, of which 35% declared they were cutting down on meat consumption, 21% considered themselves flexitarian, 9.5% vegetarian and 3% vegan. Similar tendencies have been reported across Europe. An article in the *New York Times* by Londoño (2020) stated that alternative vegetarian “meat” options have now gone mainstream in Brazil, a country famous for its meat-eating culture.

In the 1960s, per capita meat consumption in China was less than 5 kilos. Since the economic reforms meat consumption has exploded and is now calculated at 63 kilos per capita, with over half of this dedicated to pork (Campbell 2021). Today, the discussion increasingly turns to the notion of “peak” meat, with 2015–2016 seeing an unprecedented two-year decline in pork consumption in China (GRO-Intelligence 2016), and there is discussion of a similar peak in beef consumption (Fickling 2019).

Since then, the combination of swine fever and COVID-19 has clouded any clear tendencies in meat consumption. A China Briefing report, on the other hand, has shown that the plant-based-meat market has been growing at an annual rate of 14.3%, well above even China’s high rates of economic growth (Percy 2019). Its market for plant-based meat was valued at US\$10 billion by Euromonitor International (Lai 2021). Surveys comparing consumer perceptions of plant-based and clean meat by country have produced varied results, but a comparative analysis for the United States, India and China showed both Chinese and Indian consumers significantly more open to purchasing clean meat and plant-based meat than their counterparts in the US (Bryant et al. 2019). While the rise of veganism and vegetarianism is important since it provides dynamic niche markets for vegetable protein innovations, the rise of flexitarianism and the tendency for mainstream consumers to cut down on meat consumption suggests that dominant projections of demand over the medium term may well be seriously over-estimated.

## **China ramps up its domestic production capacity in feed and diversifies trade in meats**

In addition to diversifying its supply bases for both feed and meats, promoting policies for cutting meat consumption, supporting innovation in alternative meats and witnessing a sharp increase in vegetarian, vegan and flexitarian eating practices, China has redoubled efforts to increase the productivity of its domestic soy and other cereals, is reconstituting its pork production post swine fever in ever larger agribusiness units, including examples of high-rise farming, and is now investing in transgenics to increase productivity.<sup>20</sup> An important measure that will affect feed demand was the decision to lower the protein content of pig feed by 1.5% and chicken feed by 1%, which it is calculated will save 11 million tonnes of soybean meal or 14 million tonnes of soybeans, and some 4 million hectares of soy (CFIIN 2018, Cowley 2020).

20 The Chinese firm Zhong Xin Kaiwei has constructed a vertical farm for pigs, twenty-six stories high with a slaughter capacity of 1.2 million pigs per year. Muyuan Foods for its part has a similar plant with a capacity for 2.1 million pigs a year (Duarte 2021).

The USDA (2020) projects that soy production in China will increase over the next decade from 9.3 to 10.1 million hectares, with production growing at an annual average of 1.5% from 17.7 to 19 million tonnes. Soy yields, it is calculated, may increase from 1.91 to 1.96 tonnes per hectare in this same period, compared with a range of between 3.4 and 3.7 tonnes per hectare for Brazil and the US. Total consumption of soy in China, however, is estimated to increase from 104.3 to 132.6 million tonnes, a 27% increase. On this calculation, imports will grow at an annual rate of 2.8%, from 86.1 to 112.5 million tonnes, a 30.7% increase. The USDA concludes, therefore, that China's soy imports will remain relatively stable with an upward trend from 83% to 85% of total consumption by 2029. The Chinese Agricultural Outlook, published by the Ministry of Agriculture and Rural Affairs (MARA 2020), has a more optimistic projection of China's domestic soy production. The expected annual growth rate is 2.1%, expanding from 18.1 to 22.2 million tonnes, a 22.7% increase.

These expectations are based on a set of government policies laid out in the new round of its Soybean Revitalisation Plan, which includes the promotion of new varieties and cultivation techniques. According to this view, total soy consumption is expected to grow at an average annual rate of 1.6%, from 102 to 119.8 million tonnes, a 15% increase, with the conclusion that imports should grow at an average annual rate of 1.2% from 92.5 to 99.5 million tonnes, only a 7.6% increase. In this scenario, dependence on soy imports will also remain relatively stable but with a somewhat decreasing trend, in contrast to the USDA's projections.

China's greater optimism coincides with its own development of genetically modified (GM) varieties of soy (and of other food and feed crops), and its advances in the regulation of plant varieties (USDA 2020a). China has grown GM cotton since 2006, and a GM papaya variety since the late 1990s. GM corn and rice varieties, for their part, have received biosafety certificates for test trials but have not yet been allowed for commercial production. In 2019, biosafety certificates were granted for GM corn and soybean varieties developed by Beijing Dabeinong Technology Group Co Ltd, by Hangzhou Ruifeng Biotech Co Ltd, Zhaijiang University and Shanghai Jiaotong University.

Dabeinong had its GM soy seeds authorised for commercialisation in Argentina in 2019, and in 2020 China authorised the import of this GM soy for industrial use in China (Global Times 2020). If we add to this the role that Syngenta can now play, it is clear that China is planning to harness GMs to its goal of increasing domestic production and productivity. In a detailed analysis of the Chinese seed industry, Gaudreau (2019) argues that China's central concern now is to ensure that the GM seed market in China is controlled by domestic firms and Chinese global players.

China has still not recovered from the swine fever that decimated its stocks. According to USDA (2021) data, China's pig stocks declined from 441.6 million

head in 2018 to 428 million in 2019 and to 310.4 million in 2020. At the same time, the trade war with the United States led China to increase the tariffs on pigs and shift trade to other suppliers. We have already seen above the huge investments underway in Argentina specifically geared to the Chinese market. Germany, Canada (which also exported 4.8 million tonnes of canola to China in 2019, a product that competes with soy) and Spain are now also looking to the Chinese market. Although China is restructuring its pig production and accelerating this sector's industrialisation, it is now increasing its relative imports of meat products, which will also lead to a corresponding decline as animal feed in the demand for soy.

## Concluding remarks

Since its decision to outsource the production of animal feed and its subsequent membership in the WTO, China has been continuously balancing its fundamental concern for food security with its increasing dependence on global resources and the global market. Chinese demand even at modest percentages has periodically sent tremors through an agricultural commodity market designed for much lower levels of demand. In terms of a single product, China's greatest demand has been for soy, and for this it has had to depend on only two players, the United States and Brazil. From the outset it has rejected passive dependence on the market and has attempted in varied manners to establish its own control of the global soy and meat supply chains. Land purchases, direct contracts and above all the growth in market share of Chinese traders, inputs suppliers and crushers, have all been put into practice to challenge the control over global markets by the traditional ABCD traders.

China's efforts to diversify sources of supply began with the new millennium as, in parallel with Brazil, it engaged in programmes of international co-operation. With the launching of the BRI, the strategies for diversifying supplies assumed a qualitatively new dimension, expressed in the huge number of bilateral and multilateral trade agreements (Zhang 2018). The involvement of food (soy) in the trade war with the US, which led China to an exclusive dependence on Brazil in a context of heightened diplomatic tensions, has certainly accelerated strategies within China to further lessen this dependence (Zhang 2020). The diversification of supply lines to include Argentina, Russia and to a much lesser extent Tanzania and Kenya,<sup>21</sup> and certainly in the future the countries integrated into the BRI and the RCEP, are a key component in this strategy but will not free China from dependence on the Americas (Zhang 2020, Makarov

21 China's declared objective of investing in Africa and transferring agricultural technology is not to promote exports but to increase production in Africa, which will in its turn relieve pressure on global agricultural commodity markets (Zhang 2020).

2018). In this light, the range of other measures that we have identified – increased domestic productivity, decline in the protein percentage of animal feed, promotion of alternatives to meats and policies to cut meat consumption – are equally important for China’s overall food security strategy. Together, they may be sufficient to relativise the current strategic, almost monopolistic role, that soy plays in China’s protein economy.

Sooner than long-term projections of demand suggest, Brazil’s soybean exports may run into more turbulent waters, as demand slackens and prices become less attractive. This may be just what Brazil needs to reduce the pressures for deforestation and encroachment on the Amazon. It may also provide the needed stimulus for the adoption of more diversified farming systems in the Cerrados and for the recovery of the region’s native vegetation. However, the present conviction that the demand for Brazil’s soy will continue indefinitely and the current government’s freeing of regulatory and institutional restraints on the expansion of agribusiness investments threaten the destruction of these biomes before global demand for these products weakens.

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