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Strengthening Brazil's food system: can China's Belt and Road help?

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Abstract

A new wave of industrialisation is transforming South American geographies of food production. In Brazil, the region's largest and most populous nation, the availability of arable land to produce fresh food for cities and towns is diminishing as export commodities encroach on fruit and vegetable farms already threatened by urban expansion. Brazil's agricultural exports correlate with Chinese demand, where the Xi administration's policies have increased the nation's urban population to 60% and envision a further 10% by 2030. This has increased middle-class consumption of pork and beef, requiring Brazilian soybeans for animal feed. Although Brazil has not officially joined the Belt and Road Initiative (BRI), its industry associations are exploring how doing so might bring new investment into agricultural infrastructure. This chapter considers associated environmental and socio-economic concerns, as well steps that could harness BRI to support more sustainable local development.

Introduction

The slowdown of the global mining boom has seen agriculture become more prominent in Latin America's trade and investment relations with China, with implications for land use in both countries. For Brazil, the sustained growth of exports to China (from USD1 billion in 2000 to USD64 billion in 2018) has come to rely on the expansion of soybean production (UN-COMTRADE, 2019). The demand for Brazilian soy correlates with the implementation of China's New-Type Urbanization Plan, which has increased the nation's urban population to approximately 850 million people. This figure represents 60% of China's total population, and by 2030 the urban population is projected to reach 70% (Cheshmehzangi, 2016, p. 147). This process has unleashed middle-class consumption of pork and beef sustained by soy-based animal feed. A new wave of industrialisation is thus transforming geographies of production and

consumption in both countries, generating new challenges for urban food systems in the process. This chapter considers how the Belt and Road Initiative (hereafter BRI) could be harnessed to address some of these challenges by stimulating local food production alongside export agribusiness.

Around the world public concerns about the territorial, environmental and health implications of mass-produced food have stimulated efforts to develop local alternatives. Among these is urban and peri-urban agriculture (UPA), which the United Nations Food and Agriculture Organization (FAO) links with a broader sustainability agenda: “UPA is a key component of robust and resilient urban food systems... [it is] helping to build the greener, more resilient and sustainable cities of the future” (2014, p. i). Chinese cities are among those experimenting with alternative production practices, stimulated in part by recent food safety scandals including milk powder and animal feed found to contain the plastic compound melamine in 2008, pork laced with the muscle growth steroid clenbuterol in 2011, and spoiled beef imported from Brazil laden with preservatives in 2017 (Barboza, 2008; Condon, 2017; Qiao et al., 2012; Smart and Smart, 2016, p. 99). Consumer sales of organic food in China have expanded rapidly, reaching \$3.7 billion nationwide in 2017 (Global Organic, 2018).

The organic market is also booming in Brazil as citizens grow suspicious of production practices reliant on ‘agro-toxic’ pesticides and as activists seek to protect food-producing peri-urban green belts from the inward invasion of soybean plantations and the outward sprawl of real estate.

According to Brazil’s Ministry of Economy and Employment (2015), the national organic sector has grown by 20–30% per year to a current annual value of approximately \$700 million. The expansion of rural agribusiness has thus stimulated a backlash of demand for organic food, blurring the boundaries between cities and their surrounds.

Chinese state-owned enterprises and financial institutions, which together conduct the vast majority of Chinese trade and investment transactions in Brazil, are well placed to support small-scale sustainable food production in Brazil's peri-urban zones. Drawing on Chinese and Brazilian experiences of localised organic food production, this would provide much-welcomed balance to the large industrial operations of Chinese, US, European and domestic firms in soy sector. As discussed below, the evolution of the BRI to promote environmentally responsible infrastructure provides Chinese firms with an opportunity to engage in such projects. Investing in the sustainability and diversity of food systems would generate long-term benefits for Chinese and Brazilian producers and consumers. This would improve the image of Chinese firms overseas and help to substantiate the "community of shared future for China and Latin America" articulated by Chinese foreign minister Wang Yi (2017).

The context: China-Latin America agriculture relations

By 2050 more than 6 billion people will live in the world's cities, generating unprecedented challenges for sustainable food production and distribution. Technical and economic studies of urban food security conducted by the FAO (2014) and UN-Habitat (2012) show that outcomes are influenced by the degree of consensus among producers, consumers and local governments. How to overcome differences and achieve this consensus, though, is less well understood. As Brendan Gleeson writes, urbanisation is a "socio-ecological" process in which food systems play a critical but under-researched role (2013, p. 311).

Distinct pathways to growth in China and Brazil have produced structural complementarities: China is Brazil's largest trade partner largely because of its thirst for Brazilian iron ore and soybeans, while Brazil is China's largest Latin American trade partner largely because of its consumption of Chinese manufactured goods. This complementarity produced USD99 billion in

bilateral trade in 2018 (UN-COMTRADE, 2019), but also tensions as Brazilian analysts warn of growing pressure on national manufacturers and a tendency towards ‘deindustrialisation’ as Chinese enterprises allegedly seek to dominate supply chains. Researchers of Sino-Brazilian (and Sino-Latin American) relations have explored these concerns for more than a decade (e.g. Hearn and Manríquez, 2011; Myers and Wise, 2016; Strauss and Armony, 2012), finding that rising primary exports have not led to Chinese domination. As Thomas Narins writes, “The interests, activities, and actions typically associated with control and ownership of Latin American industrial sectors are more often associated with US, EU, and Brazilian actors than those originating in China” (2016, p. 35). Agriculture demonstrates the range of consequences brought by Chinese demand: the privatisation associated with reliance on unprocessed commodity exports has been accompanied by increasing industrialisation of food systems. While this has generated macro-economic benefits for Brazilian and other regional exporters, it has also incurred micro-level costs, including the replacement of family farms by soybean plantations, contamination of crops and groundwater with toxic pesticides, and displacement of young people from rural communities to cities.

BRI aims to integrate the interests of Chinese enterprises with those of their international suppliers, and therefore represents both challenges and opportunities for Brazil and its neighbours. Latin America’s soy cultivation is concentrated in the Southern Cone, where it now accounts for 45 million hectares, 90% of which are in Brazil and Argentina. The expansion of soy agribusiness has encroached on the peri-urban land previously used for fresh food production and accelerated urban-rural migration as land management becomes concentrated in fewer hands. For Brazil, 59% of the area cultivated with soybeans is managed by only 5% of producers, while in Bolivia 52% of the area is managed by only 2% of producers. By 2010, soybeans genetically

modified for resistance to the herbicide glyphosate accounted for an average of 85% of the total produced in Argentina, Bolivia and Brazil. “A clear outcome,” concludes a multilateral task force, “is the externalization of the ecological, social and public health costs deriving from soybean production” (Catacora-Vargas et al., 2012).

As Latin America’s second-largest soybean producer after Brazil, Argentina approved the cultivation of genetically modified soybeans in 1996. By 2014, the country’s annual soybean production had quadrupled from 12.4 million to more than 50 million tonnes, and the harvested area increased from 6 million to 20 million hectares (FAO, 2014, p. 84). Soy plantations have engulfed wheat and sunflower farms while displacing milk, fruit and vegetable production for the domestic market, provoking an exodus of family farmers into the cities they previously supplied. In Rosario, a city of 1.35 million people, rural-urban migrants have brought their horticultural expertise with them and found an ally in Rosario’s progressive city government, which is constructing a ‘green circuit’ to promote family and community gardens, commercial vegetable production and slum upgrading. The city of Córdoba has also become increasingly surrounded by soybeans, increasing the ‘food miles’ required to transport fresh produce to the city centre as reliance grows on productive hubs like La Plata (766 km away by road) and Misiones (1,440 km) (Giobellina, 2017, p. 15).

The destruction of peri-urban family farms is intensifying in South America, but is not a new phenomenon. In Brazil’s (and the region’s) largest city, São Paulo (population 21 million), land at the municipal boundary has been turned increasingly to export-oriented agribusiness since the 1960s, stimulated initially by a federal industrialisation policy and more recently by Chinese demand (Pereira et al., 2012). Local production of the city’s fresh food has dwindled to a few remaining small holdings and waterways, which together constitute the last remnants of São

Paulo's green belt. Although this area has been protected since 2003 as the Biosphere Reserve of the Atlantic Forest, it is under constant pressure owing to rising taxes, land speculation, illegal settlements, air and water pollution, and highways that permeate ostensibly preserved areas. Fruits and vegetables cultivated in this zone must travel 50–80 km to reach the city's supply hubs, and as in Córdoba, the 'food miles' are growing.

In 2016, Mayor Fernando Haddad (2013–16) of the Workers' Party won the USD5 million Bloomberg Mayor's Challenge for a project called Join the Dots. The project envisions an online platform and logistical infrastructure to connect family farmers on the city's outskirts with inner-city restaurants, supermarkets, fresh food stores, public schools and hospitals. The goal is to enable the retention of peri-urban farms, but Haddad's replacement by corporate magnate João Doria in 2017 – and Doria's subsequent replacement by conservative ally Bruno Covas to allow Doria to run for Governor of São Paulo – is likely to subordinate this objective to the further expansion of agribusiness and real estate development.

Balancing the state with the market has been a longstanding point of contention among Brazilian food security advisors. Many lament the continuing legacies of colonisation by Portugal and later relations with the United States, which entrenched a disadvantageous pattern of cheap commodity exports – most recently soybeans – in return for expensive manufactured imports. The need to escape from this value-eroding predicament was the thrust of Raúl Prebisch's (1950) seminal book *The Economic Development of Latin America and Its Principal Problems*, which encouraged Brazil and its neighbours to pursue import-substitution industrialisation from the 1950s until the 1980s. The continuing influence of dependency theory on governance in Brazil has underpinned longstanding academic and executive consensus that the state should be entrusted with the management of key aspects of economic development (e.g. Cardoso, 2001;

Cardoso and Faletto, 1979; Oliveira, 2006). The 2017 impeachment of President Dilma Rousseff and her replacement by conservatives Michel Temer and subsequently Jair Bolsonaro broke with this tradition, raising questions about the government's financial and management capacities, not least in food and agriculture. A case in point was the 2017 lifting of a moratorium on deforestation to permit cattle ranching and soy cultivation in an Amazonian region the size of Denmark (Gro Intelligence, 2017).

Bolsonaro's neoliberal agenda was evident in his March 2019 visit to the United States, where he and his counterpart Donald Trump committed to strengthening the United States-Brazil Commission on Economic and Trade Relations. Desperate to secure US endorsement for Brazil's accession to the OECD and to resume beef exports to the United States, which were halted after a 2017 meat processing safety scandal, Bolsonaro agreed to significant concessions. These include capping import tariffs on US wheat and permitting 750 tonnes to enter at zero rate, and commencing the phytosanitary approval process for importing US pork. A further Brazilian commitment came in the Technology Safeguards Agreement, which tightens bilateral security and military cooperation, particularly in the development of military and space technologies. Naming Brazil as a 'Major non-NATO Ally,' Trump and Bolsonaro signalled an emerging strategic alliance between the two nations, which may slow Chinese integration with Brazil's high technology sector. A report from the Woodrow Wilson Center (2019) predicts that China will consequently need to adjust its strategy in Brazil:

The symbolic approximation between Brazil and the U.S. also sends a message to China that they will have to either review part of their approach and strategy towards Brazil or their current status will start to drain away like sand in the hand.

BRI is the Chinese government's favoured platform for revitalising relations with Brazil. Just two months after Bolsonaro's visit to the White House, Brazilian Vice President Hamilton Mourao met with Xi Jinping in Beijing. Encouraged to join BRI, Mourao reportedly expressed hope that Brazil's development plans will 'connect' with the initiative (Bai, 2019). Trade friction between the United States and China was intensifying at the time, enabling Brazilian soybean farmers to further displace US competitors and consolidate their leading position in the Chinese market. To the extent that BRI could stimulate investment in Brazil's agricultural infrastructure, port facilities and logistics, it will deepen the nation's economic and political affinities with China. As Brazilian political scientist Adriana Erthal Abdenur writes, "the BRI further erodes United States hegemony and reconfigures, both politically and spatially, the dynamics of power" (2019, p. 164). Understanding the significance of this process for Brazil, she argues, requires a perspective that embeds bilateral relations with China in the broader context of BRI's global reach. This wider point of view illuminates the myriad opportunities that BRI could create for Brazilian construction, energy and infrastructure companies in Africa, Asia and particularly Greater Eurasia.

As the Brazilian government assesses BRI's economic and strategic potentials, it must simultaneously address the more immediate challenges of domestic development and inequality. Brazil is among the world's most unequal countries, with a GINI coefficient of 0.53, while Rio is on par with Brasília as the country's most unequal city, with a GINI of 0.63. According to Wen Tiejun of Renmin University of China, the inequalities that plague Brazilian cities can provide insights for China's urbanisation programme, which must avoid the negative aspects of 'Latinamericanisation.' Brazil's sprawling *favela* slums, writes Wen, have engendered

marginalisation, poverty and delinquency, which if replicated in China would slow economic growth and threaten political stability (Wen, 2005).

Brazil exhibits a clear correlation of low income with poor nutrition and rising obesity, diabetes and related cardiovascular complications (European Society of Cardiology, 2016; Governo do Brasil, 2017). A similar phenomenon is emerging in China, where heavily processed diets, fast food and limited access to fresh produce have generated health risks that are attracting the attention of medical advisors and community associations (Cheng, 2011; Liu, 2017; World Health Organization, 2016). Wen believes that a solution to this and other structural problems is a more localised and socialised food system, as predominated in China in the 1920s and 1930s (interview with author, 19 July 2016).

Examples from China and Brazil show that creative solutions are emerging to improve nutritional health in underserved communities while servicing growing demand for organic food. Cases from both countries demonstrate that productive forms of state support for localised food strategies are enabled by – and, in turn, enable – relationships between producers, consumers and municipal governments. Chinese firms that do business in Brazil can support this process, especially if they are interested in improving human and environmental outcomes. Any attempt to achieve a ‘community of shared future for China and Latin America,’ as articulated by Wang Yi, will require BRI projects to adopt this comprehensive approach.

Feeding the masses in Beijing

BRI’s focus on foreign infrastructure reflects China’s growing demand for natural resources, evident in Beijing’s need for food. With a metropolitan population of 21.5 million, Beijing shows how China’s New-Type Urbanisation Plan is transforming the nation’s demographic profile. Unveiled in March 2014, when 53.7% of the population lived in cities, the plan aims to

increase this figure to 60% (approximately 858 million people) by 2020 (Xinhua, 2014). The Chinese government's attempt to shift the economy away from agriculture, through industrial manufacturing, and towards the services sector has seen Beijing's population grow by 6 million over the past decade (CPDRC, 2008). In the context of diminishing arable land (only 105 million hectares, or 11%, of China's surface area is cultivable), food bottlenecks have stimulated a policy of large-scale commodity imports. In 2018 China purchased 66 million tonnes (worth more than USD27 billion) of soybeans from Brazil, largely for processing into animal feed to service the annual consumption of 40 million tonnes of pork in the nation's expanding cities (UN-COMTRADE, 2019).

Beijing's growing demand for food poses challenges not only for quantity but also for quality. The farm villages that surround the city, which have traditionally supplied the urban centre, have experienced an exodus of young people and diminishing capacity to safely produce fresh food. Those who remain in rural livelihoods, typically older than 60 years and burdened with growing workloads, are neither equipped nor trained to enforce quality control procedures. Consumer concerns about the safety of domestic produce, stoked by the scandals noted above, have provoked a surge of imported processed and canned products from Hong Kong, Australia and elsewhere.

Greater reliance on processed food has brought its own problems. A study by the Chinese Center for Disease Control and Prevention has found that 33% of Beijing citizens are overweight (with a body mass index between 25 and 30) and 26% are obese (body mass index above 30) (Liu, 2017). Across China, over-consumption of sugar and fat, compounded by physical inactivity, is fuelling a previously unseen rise in diabetes to nearly 10% of the population, or 110 million people (World Health Organization, 2016). Type 2 diabetes, which comprises 90% of these

cases, is directly linked to dietary health. Thirteen percent of China's medical expenditures are now incurred by treatment for diabetes, costing the national health system USD25 billion per year, while illnesses related to diabetes generate further costs and stresses to families and companies (Cheng, 2011).

Concerns about food safety and dietary health have stimulated the rise of urban and peri-urban agriculture in Beijing as residents seek out chemical-free fruits, vegetables and meat. The city has over 1,300 'agro-parks' that benefit from government-subsidised organic pesticides under the government's 2-2-1 Initiative. The first '2' of the Initiative aims to expand capacity and market size; the second '2' commits to improving technology and investment; and the '1' seeks to establish a unified information-sharing system for production, exchange and marketing of organic produce. Consumers are demanding a closer level of detail about how and where their food is produced. Organic farms have responded to this emerging market, providing corn, eggplants, tomatoes, potatoes, peppers, mushrooms, chicken and pork directly to customers' doors and to retail outlets. Such initiatives build trust between producers and consumers, and, as discussed below, could provide a basis for BRI to pioneer ecologically and socially engaged projects in collaboration with partners in Latin America.

Finding nutrition in Brazil

Chinese demand has ensured that agriculture remains a pillar of Brazil's economy well into the 21st century. The 2008 financial crisis was a turning point in the composition of Brazilian imports from China, marked that year by the growing presence of machinery and capital goods (70% of total imports) and a decline in the share of consumer products (8%). By 2012, Brazilian imports of Chinese locomotives and agricultural equipment were growing faster than any other product class (1,126% and 88%, respectively). At the same time, Brazilian exports to China of

iron ore and oil fell by 20% and 18%, respectively, while soybean exports to China increased by 45%. By 2016 soybeans had become Brazil's largest export (worth USD19.6 billion), indicating not only growing Chinese consumption but also active Chinese input into the expansion and logistics of Brazil's soy industry (WTE, 2017).

The industrialisation of soybean agribusiness is evident in territorial expansion to approximately 25 million hectares and increased use of chemical inputs to maximise yields. The unrelenting growth of soy cultivation has made Brazil the world's largest consumer of pesticides, amounting to 914,000 tonnes in 2014–15 at a cost of USD9.6 billion (ABRASCO, 2016). Export-oriented soybean, livestock and sugar estates have long characterised the states of Matto Grosso, Goiás and Minas Gerais, but they now encroach on peri-urban land previously used to feed cities across Brazil. The resulting exodus of young people from rural towns into cities is a national phenomenon, which in Rio has accelerated the city's outward growth to almost completely destroy traditional family farms – and the fresh food they produced – in the western and north-western zones.

A recent *New York Times* exposé clarifies the link between agribusiness expansion and dietary health in Brazil and other developing countries: “As multinational companies push deeper into the developing world, they are transforming local agriculture, spurring farmers to abandon subsistence crops in favour of cash commodities like sugar cane, corn and soybeans — the building blocks for many industrial food products” (Jacobs and Richtel, 2017). The report notes that in 2014 food companies donated USD158 million to members of Brazil's National Congress, led by meat giant JBS, Coca-Cola and McDonalds. The consequences of increasingly processed diets are evident in Rio, where a recent study of 5,000 children found that obesity rose from 6% to 18% between 1986 and 2016, and overweight rates from 17% to 32% (European

Society of Cardiology, 2016). These figures reflect the Brazilian Ministry of Health's findings that between 2006 and 2016 national obesity levels rose by 60%, from 11.8% to 18.9% of the population (Governo do Brasil, 2017). Land use transformations and demographic shifts associated with an increasingly industrialised food system have thus exacerbated dietary health complications, particularly in vulnerable sectors, while doing little to create jobs.

In the 1960s Brazil was still an agrarian nation with an urbanisation level of 45%, but by the early 2000s this figure had almost doubled to 84% (O'Reilly, 2014). The transformation exemplifies UN-Habitat's (2012) observation that urbanisation in Latin America is 'virtually completed': 80% of the region's population (around 500 million people) lives in cities. With a metropolitan population of 12 million, Rio is one of Latin America's many sprawling and densely populated cities. It is also one of Brazil's most unequal, where the need to improve access to basic food and employment is contributing to the expansion of urban agriculture. An experimental policy developed by the federal government and implemented by the Rio municipal council has given rise to large-scale fruit and vegetable production to improve nutrition and generate income for some of Brazil's most disadvantaged communities. A wide range of studies from around the world have found that extreme socio-economic inequality does not favour cooperation across racial, class and geographic lines (Jordahl, 2007; Uslander and Brown, 2005). Nevertheless, the common ground generated by the pursuit of sustainable organic farming has forged some unlikely alliances in Rio. The Rio Municipal government's Hortas Cariocas project, for instance, has brought together state subsidies, community activism and support from upper-middle-class consumers to transform living conditions in some of the city's most marginalised neighbourhoods (see case studies in O'Reilly, 2014; Rekow, 2015, 2016). The insights gained from this experience reveal how localised food production can accompany

industrial agriculture, inviting reflection on the capacity of foreign investment, including through BRI, to support such initiatives.

BRI and a 'community of shared values'

The demand for metals, energy and food generated by China's growing cities has sustained South America through the global economic turbulence of the past two decades. Brazilian agribusiness in particular has attracted the interest of governments around the world interested in deepening their trade with China, but it is also generating problems on both sides of the Pacific not seen with mining, gas, oil and other extractive activities (Hearn, 2013). Supply-side objections to the loss of crop diversity in rural and peri-urban zones, intensification of chemical inputs and associated environmental impacts are intertwined with demand-side suspicion of safety standards, unhealthy processed foods and personal disconnection with the productive process (Altieri, 2009; Baptista da Costa et al., 2017).

Brazil is not the only Latin American nation – and agriculture is not the only sector – to witness the environmental impacts of deepening trade and investment relations with China. A recent study of Chinese infrastructure projects in the region finds that Chinese firms “do not usually seek the highest labour, safety, and environmental standards” (Armony et al., 2018, p. x). In Ecuador, Chinese investors are backing six major energy production projects but only one of these, a wind project, representing just 1.2% of total Chinese financing for national energy projects (Garzón, 2014). The agriculture sector is equally contentious, with China identified in an Argentine study as “the only major export destination for which emissions intensity is growing...as Chinese demand continues to grow in the soy and energy sectors, Argentine authorities will need to strengthen efforts to maximize the benefits and mitigate the environmental risk” (Donaubauer et al., 2015, pp. 1, 2).

There is no single pathway for Chinese enterprises to establish themselves as environmentally responsible actors in Latin America, but the BRI provides an opportunity (Jiang and Mallimaci, 2018). The Special Declaration on the BRI produced by the second CELAC-China Forum states that “Latin American and Caribbean countries are part of the natural extension of the Maritime Silk Route and are indispensable participants in international cooperation of the Belt and Road” (CELAC, 2018). Foreign Minister Wang Yi has framed BRI’s expansion to the region in terms of “The new conception of establishing a community of common destiny for China and Latin America put forward by President Xi Jinping” (Ministry of Foreign Affairs, 2017). BRI will likely engage with a wide range of infrastructure projects in the region, not least agriculture, which the Economic Commission for Latin America and the Caribbean (ECLAC) views as an opportunity for environmentally responsible Chinese investment in Brazil (Xinhua, 2018). BRI’s statement of “Vision and Proposed Actions” commits to “conserving eco-environment, protecting biodiversity, and tackling climate change” (China Daily, 2015). An important step in doing so will be to develop guidelines for investors, potentially drawing on the Ministry of Commerce and Ministry of Environment 2013 joint declaration on the responsibilities of Chinese enterprises overseas (Ministry of Commerce, 2013). The Environment and Social Framework developed by the Asian Infrastructure Investment Bank (AIIB) to assist partner countries fulfil their commitments under the Paris Agreement provides further precedent. Uncertainty about BRI’s environmental impact will persist until such guidelines are formulated and become evident on the ground. As the subtitle of a recent article in *China Dialogue* asks, “Will the Belt and Road Initiative bring environmental devastation or a new era of Chinese global resource stewardship?” (Pike, 2017).

Seventy countries have signed Belt and Road Cooperation Agreements, four of which are in Latin America. Brazil is yet to sign such an agreement, but it is well placed to design strategies for environmental engagement with BRI given its prior collaboration with Chinese environmental initiatives and its leadership of the 1992 Earth Summit, the resulting Agenda 21 action plan, and Rio+20. The China-Brazil Earth Resources Satellite (CBERS) project to monitor Amazonian deforestation was financed 30% by Brazil and 70% by China. Similarly, the China-Brazil Center for Climate Change and Energy Technology Innovation has focussed on wind turbine and biofuel sectors. Brazilian agriculture is a focus of both projects and provides a platform for deeper cooperation on food systems sustainability. Chinese vertical greenhouse technology, developed by the Centre for Protected Agriculture and Environmental Engineering, and the Liuzhou Forest City initiative are good examples of smart infrastructure innovations relevant to Brazil. To integrate these and other projects into BRI would require Chinese enterprises to build relationships not only with Latin American national governments, but also with partners at the provincial and municipal levels. Sub-national actors are generally more attune to local environmental concerns, and working with them could help Chinese enterprises to stay abreast of public preferences and opinions.

Food system innovations in organic production, waste reduction, employment, land protection and ecological sustainability are typically led by divisions within local governments. Rio's municipal government, for instance, has overseen the installation of more than 40 organic food gardens since 2006 in some of the city's most marginalised neighbourhoods through the Hortas Cariocas programme. Such projects would benefit from linkages with China's expanding organic food movement, in which protagonists like the Shared Harvest project in Beijing are establishing international networks (Gottlieb and Ng, 2017). Facilitating technical exchange to improve the

operational dynamics of such projects could extend these networks to Brazil and build BRI's reputation as an environmentally and socially engaged actor in Latin America.

Conclusion

Although Brazil maintains an enviable annual trade surplus with China – USD29 billion in 2018 according to UN-COMTRADE (2019) – the growth of export-oriented agribusiness has incurred environmental and social consequences. These consequences, also evident among Brazil's soy-exporting neighbours, include deforestation, contamination of waterways with pesticides, loss of peri-urban family farms, unsustainable rural-urban migration and an increasingly industrialised food system whose health impacts are becoming evident.

BRI's focus on foreign infrastructure, including rail and logistical projects, could deepen these problems or help to alleviate them. At a time when industrial food production and consumption are generating distrust in agriculture and, consequently, pressure to balance the effects of commodity farming, the opportunity exists for BRI to engage this issue. While the soybean industry clearly has a role to play in feeding the world's growing cities, particularly as pork consumption increases among China's emerging middle class, it raises the challenge of ensuring crop diversity and safeguarding human health. Macro-economic growth requires international trade, but frameworks are needed to protect small- and medium-sized farms that produce fresh food for local consumption. International partnerships and the knowledge and resources they bring are critical for small farmers in their efforts to promote organic production and ensure local food security.

From the disappearance of peri-urban fresh food farms to public anxiety about toxic pesticides, the side effects of industrial food are biting home. Urban farming innovations can diminish these consequences, but systemic improvements will require agriculture trade and investment policies

that are more responsive to local concerns. BRI could pave the way to more sustainable infrastructure collaboration between China, Brazil and Latin America broadly. As a 2016 report from the Chinese Academy of Social Sciences concludes, China can use BRI to assist developing countries to build their environmental protection capacities (CASS, 2016). This will require the design and implementation of clear guidelines for BRI investors, and a disposition to cooperate not only with national governments but also with the municipal and community actors most affected by resulting projects.

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