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Smart agriculture: new impulses to the financialization of the agricultural business. Some notes on Argentina and Brazil

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ABSTRACT

Significant transformations are underway in agriculture. These shifts are driving new strategies and alliances among leading global business conglomerates. From this perspective, the article explores the characteristics of the biological-digital paradigm. It examines the diffusion of its productive, commercial, and spatial dynamics, which interact with the so-called "China effect," particularly in the Southern Cone of Latin America, especially in Argentina and Brazil. Special analytical attention is paid to *land grabbing* amid a deepening climate crisis. Finally, the study addresses new regulatory pressures that, among other aspects, result in *eco-financialization* through the development of so-called green businesses.

KEYWORDS: agriculture; new technologies; green business.

INTRODUCTION

Global trends in the contemporary agricultural cycle are evident in the composition and strategies of dominant business conglomerates. On the one hand, these trends reflect the diffusion of the biological-digital paradigm and its implications for productive, commercial, and spatial dynamics. On the other hand, the international competitive context, under the so-called "China effect," has prompted a sharp redefinition of production and commerce, particularly in the Southern Cone of Latin America. Finally, and with increasing intensity, the climate change agenda impacts natural resource-intensive activities. This pressure falls heavily on cropland and agricultural production[1].

The following sections examine these processes. This article takes the characteristics of current technological change in agriculture as its starting point. Next, it focuses on the strategies of the corporate groups that lead in international markets for agricultural commodities, inputs, and equipment. The third section links the dynamics of land grabbing to a deepening climate crisis and to new regulatory pressures. These factors, among other aspects, result in *eco-financialization* through so-called *green businesses.* Finally, the paper reflects on the process of agricultural expansion in the Southern Cone of Latin America, focusing specifically on the agricultural dynamics in Argentina and Brazil.

A NEW TECHNOLOGICAL CYCLE

Innovations in agriculture soften natural barriers, increase productivity, and accelerate capital turnover. Following da Silva's (1998) characterization, these advancements include *biological innovations* that shorten production periods or enhance the effects of chemical and mechanical innovations. They also encompass *agronomic innovations* that introduce new production methods by recombining available resources to boost labor productivity. Finally, *improvements in transportation and storage systems* reduce circulation times, further increasing capital turnover (da Silva, op. cit.).

From 1969 to 1980, the Green Revolution facilitated the spread of high-yielding varieties, increased fertilizer and agrochemical use, and expanded mechanization. By the early 1990s, as mechanization became more common and practices like direct seeding gained popularity, advances in agricultural bio-

1 Agricultural production generates 46% of greenhouse gas (GHG) emissions in Latin America and the Caribbean. Meat and dairy products account for nearly half of those emissions (ECLAC-FAO-IICA, 2021).

technology led to the development of genetically modified seeds resistant to pests and diseases. This techno-productive trajectory experienced a significant boost in agriculture-based countries, especially for soybean, corn, and cotton crops (Sztulwark and Braude, 2010; Wahren, 2020)[2].

The new technological and innovation phase, initiated in the second decade of the twenty-first century, is tied to Industry 4.0 technologies and the development of so-called "cyber-physical" systems. In these systems, physical or biological production processes are controlled or monitored by algorithms integrated with the internet. Thus, the advance of the "platform" phase is characterized by capital accumulation based on the extraction, storage, analysis, and use of data for various purposes (Kenney and Zysman, 2016; Srnicek, 2018)[3]. Its implementation cuts time and costs across production stages, increasing profits through systemic management. Meanwhile, the agrifood system is transforming. These changes foster organizational shifts and new alliances among key actors to internalize strategic capabilities.

Digital agriculture, also known as *smart agriculture* (SA), incorporates a new input, reflecting the metaphorical phrase "*data is the new soil*" www.etcgroup.org/content/food-barons-2022. This paradigm requires cross-sector convergence among global agrochemical and seed companies (Bayer, Corteva Agriscience, Syngenta Group/ChemChina, BASF), agricultural equipment manufacturers (such as John Deere), and big tech corporations (including Microsoft Azure, Amazon Web Services (AWS), and Google Cloud). These tech giants serve as the primary providers of infrastructure, cloud computing services, and data analytics. The future development of smart agriculture aims to reduce costs, increase control over agricultural tasks, and enable real-time management of large farms. This expansion relies on specific processes and dynamics: the downward price trend in equipment such as drones, sensors, and software; restrictions imposed by closed, proprietary information systems; the extent of data infrastructures and platforms; and the role of public R&D&I in spreading these technologies. (Wilkinson, 2022; Wolfert et al., 2017).

2 In this productive landscape associated with transgenic seeds, modifications are currently being observed due to the rise of gene-editing (GE) techniques. These techniques could overcome existing limitations by enabling shorter production timelines and lower costs (Sztulwark et al., 2023).

3 "Infrastructure platforms" form the core of the ecosystems operated by tech giants such as Apple, Microsoft, Meta, Google, and Amazon. They enable other platforms to function and develop through three specific Industry 4.0 technologies: Cloud Computing, Big Data, and Artificial Intelligence (Dijck, Poell, and De Waal, 2018).

The international climate agenda amplifies AI's role through communication networks, standards, and protocols that offer predictive advice on carbon savings. Croplands, cultivated or not, are revalued for their carbon offset potential, which can now be monitored and quantified with new digital technologies.

AGRIBUSINESS, INPUT PROVISION, AND AGRICULTURAL EQUIPMENT: DYNAMICS OF LEADING INTERNATIONAL FIRMS

The global agricultural model is dominated by large transnational corporations, especially after the 1980s deregulation. The WTO and the Agreement on Agriculture liberalized markets, reducing states' regulatory power. Meanwhile, global corporations expanded into industries such as machinery, agrochemicals, biotech, food processing, and retail, complementing traditional commodity trade. The financial deregulation of the 1990s brought further shifts, allowing banks and other investors to sell derivative products based on raw materials. This gave an additional impetus to commodity futures markets (agricultural, mining, and energy) and increased volatility in international price cycles. Commodity Index Funds now compete with traditional financial assets. In turn, this capital penetrates or controls specialized firms within these sectors. (Gorenstein and Ortiz, 2016; Schorr and Ortiz, 2020).

A small group of countries, including those in the Southern Cone of Latin America, accounts for most international trade in cereals, oilseeds, and their derivatives. In fact, 15 states control more than 90% of foreign sales of wheat, barley, corn, and oilseeds, with Argentina and Brazil maintaining a major share of these products, as well as of vegetable oils and fats (Comtrade, 2021 and 2022).

In this context, major operators in global markets maintain or even consolidate their relative positions during periods of stagnant or declining international prices and output. The four companies that hegemonize the international agricultural commodities market—Archer Daniels Midland (ADM), Bunge, Cargill, and Louis Dreyfus, commonly known as the ABCD, accounted for 75% of the international grain trade a decade ago, alongside a high share of other agricultural product markets, such as soybeans and derivatives (Braun et al., 2012; Gómez Oliver and Granados Sánchez, 2016). This share has been maintained over the last decade, as evidenced by indicators of their performance and capacity to internalize profits during a period marked by sharp spikes and subsequent fluctuations in international agricultural commodity prices (see Table 1).

Table 1 – Main global traders of agricultural products: indicators 2011–2023 (sales and profits in billions of dollars). FAO Price Index (2014–2016 = 100)

	Sales		Profit		Staff		Countries	
	2011	2023	2011	2023	2011	2023	2011	2023
ADM	80.7	93.9	2.04	3.5	30,000	42,000	75	+70
Bunge	58.7	59.5	0.94	2.3	32,000	23,000	40	+40
Cargill	119.5	177.0	4.2	3.8	142,000	160,000	66	+70
Louis Dreyfus & Co.	60.0	50.6	0.9	1.0	35,000	18,000	55	+100
COFCO	s/d	53,0	s/d	s/d	s/d	11,651	s/d	37

	2011	2023
Cereal Price Index (real)	128.1	125.9
Oil Price Index (real)	141	121.5

Source: Oxfam (2012), corporate data, and FAO.

With China's entry into the WTO in 2001, and even more so with the re-definition of soybeans as an industrial product no longer subject to strict self-sufficiency rules—thereby positioning soybeans as a key product in animal protein chains—China became an increasingly critical actor in world trade. Chinese soybean imports skyrocketed in the 2000s, rising from 5-10 million tons at the beginning of the decade to around 60 million tons in 2010 (Wilkinson, op. cit.) and exceeding 100 million tons in 2023 (FAOSTAT, 2025).

The state-owned *China National Cereals, Oils and Foodstuffs Corporation* (COFCO) competes in the global agricultural products market with ABCD and also disputes ChemChina's acquisition of the agrochemical company Syngenta. Founded in 1949, COFCO broke into the global commodity market over the last two decades through a strategy to ensure a stable food supply for its country. It currently has a processing capacity of nearly 30 million tons of food and trades more than 120 million tons of agricultural products annually[4].

Large global grain trading firms use financial strategies to control their competitive positions. They do this by owning investment funds and asset

4 COFCO Group is a corporate holding company that brings together sovereign wealth funds from China and Singapore, as well as private investors. Its subsidiary for the agrifood sector is COFCO International, incorporated in 1993.

management firms and receiving capital from financial institutions that invest in agricultural markets and finance futures. The scope and complexity of their operations, along with their influence on raw-material futures prices, drive the adoption and development of Agtech (digital agricultural technology) tools. This is evident in:

a) Digitization has two orientations: i) external, for customer loyalty through shared logistics info, data, market insights, or personalized supplier attention; ii) internal, through regional or cloud-based systems for commercial decisions and operational data in the field, like maritime freight systems.
b) The formation of global exchange networks: operating on farmer-to-farmer or business-to-business models. (https://investors.adm.com/financials/annual-reports/default.aspx; https://investors.bunge.com/financial-information/annual-reports).
c) Inter-firm articulations, such as the creation of Covantis, a technology company focused on international trade, in which ADM, Bunge, Cargill, LDC, and COFCO are associated.
d) The use of AI for poultry fattening based on visual and auditory animal monitoring systems. (https://www.cargill.com/story/listen-up-eavesdropping-on-chickens-may-provide-insights).
e) Faced with rising international competition, ABCD plus COFCO partner with large firms investing in food and agro-industrial inputs. Notably, few firms globally lead in R&D, including Dow-Dupont, BASF, Syngenta, and Bayer.

Another expression of shifts in the corporate economic power structure is the process of mergers and acquisitions led by major trading companies. Over the last two decades, the following movements stand out:

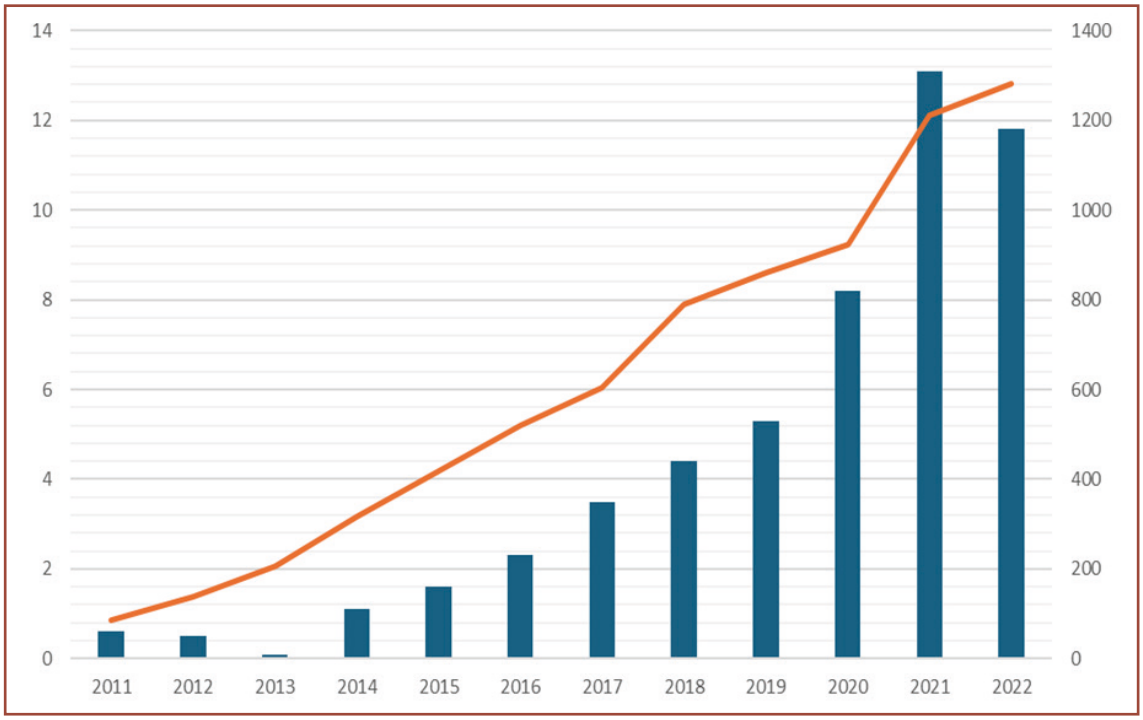
- ADM bought the German trading company Alfred C. Toepfer in two stages;
- Bunge acquired Viterra (formerly Glencore), and they are currently in a merger process;
- China's COFCO purchased assets from Noble (grain trading) and Nidera (seeds);
- ChemChina (a Chinese state company) bought Syngenta, acquired Nidera (sold by COFCO), and merged with Sinochem (a Chinese state holding of chemical and fertilizer companies), renaming the entity Syngenta Group;
- Louis Dreyfus & Co. partnered with ADQ (sovereign wealth fund of the United Arab Emirates), which went on to manage 45% of LDC & Co.;

- Louis Dreyfus & Co. bought Croda (a major producer of traditional pesticides and bio-based crop protection);
- Cargill and ADM formed a 50/50 joint venture—SoyVen—for soybean and derivative production.

These initiatives involve direct investment by large firms engaged in the production and marketing of food and inputs. They also include developing corporate venture capital (CVC) to finance startups. This approach allows them to outsource innovation efforts or bypass antitrust regulatory oversight associated with biotechnology. Examples include ADM Ventures in animal and human nutrition and the microbiome; LDC Innovations Corporate Venture Capital in proteins and water; and Bunge Ventures in biotechnology and agricultural chemicals (Benchimol, 2023).

Other acquisitions show how traditional agribusinesses integrate digital tech while maintaining control. Monsanto's acquisition of Climate Corporation, a digital agriculture company that uses AI for weather, soil, and field data analysis, is a clear example that was integrated into Bayer. Similarly, John Deere bought Bear Flag Robotics. Both use Corporate Venture Capital (CVC) to invest in startups, gaining innovation and new technologies for their operations (Sauvagerd, Mayer, and Hartmann, 2024, p. 5).

Figure 1 – Venture Capital (VC) investments in agtech startups: number of deals (right axis) and value in billions of dollars (left axis), 2011–2022



Source: Pitchbook (https://pitchbook.com/blog/agtech-and-the-future-of-sustainable-food-production).

Figure 1 shows the exponential growth of these investments over the past decade. Most are located in the United States and Europe (Table 2) and are funded by venture capital (VC) or partnered with global tech giants. Their scope includes biotechnology, remote sensing, and machinery development, AI solutions for crop management, indoor farming equipment, automation, and the Internet of Things (IoT). They also offer ag-finance software and e-commerce platforms, anchoring themselves in specialized tech at key points in the production chain. Operating at smaller volumes than traditional corporations or R&D organizations, they are a significant source of technological advances in agriculture.

Table 2 – Agtech startups: number of firms by international region (2021)

Region	Number of companies	Share of total
North America	3,037	40%
Europe	2,265	30%
Asia	1,215	16%
South America	377	5%
Oceania	332	4%
Africa	290	4%
Total	**7,516**	**100%**

Source: Malinova (2022).

The agricultural machinery (AM) industry is another primary vector for the diffusion of technological progress in agriculture. The use of ICTs initially appeared as closed packages designed to solve specific problems through two main types of devices. On the one hand, hardware was embedded directly into the machinery, the first yield monitor for a combining harvester dates back to 1992. On the other hand, proprietary management software packages were introduced to monitor farming practices (Albornoz, 2020).

Recent data records about 1,500 firms manufacturing agricultural machinery globally, 1,100 of which are based in the United States. However, only six companies achieve a truly global reach, together representing more than 40% of the international market. These are the three major multinationals—John Deere & Company, CNH Global, and AGCO—followed by Kubota, CLAAS, and Yanmar, a group of companies that expanded from a regional base to compete in global markets today (Maquinac, 2024). Other specialized or regionally relevant firms include Deutz-Fahr, Mahindra & Mahindra, Caterpillar, Iseki, Bucher Industries, and Kverneland.

Much like the ABCD traders, the largest international AM manufacturers have invested significantly in digital technology platforms. For the most part, they have forged alliances with agricultural input providers (ETC Group, 2015; Lavarello et al., 2019). John Deere offers an eloquent example. Multinational companies equip tractors with digital tools, consolidating sector dominance through integration with digital firms and investments in start-ups. Companies like CNH and AGCO go beyond selling machinery, seeds, or chemicals; they invest in big data and precision agriculture and develop or buy farm management software platforms.

In short, global input and machinery suppliers leverage agricultural platforms to strengthen their market positions through integrated digital services. They generate value by offering data-driven agricultural solution packages, multilateral marketplaces that connect startups with farmers, product-as-a-service models, and tools for monitoring agricultural carbon emissions. These technological packages serve a dual purpose: they drive crop management through precise data analysis and strategically reposition the corporate portfolio of agrochemicals and seeds, including off-patent products (Sauvagerd, Mayer, and Hartmann, op. cit., p. 10).

Thus, the platform economy framework is increasingly relevant for understanding new forms of global agricultural production organization. Alongside the large corporations listed so far—input suppliers, biotech firms, machinery producers, and Big Tech—smaller actors also play a role. These startups operate in specific niches or on localized agricultural tasks and are funded by corporate or independent venture capital, a dynamic also known as "oligopolistic platformization" (Sauvagerd, Mayer, and Hartmann, op. cit., p. 12). This differs sharply from other sectors, where digital platforms disrupted existing markets and gave rise to entirely new dominant actors. Here, collaboration between Big Tech and agribusiness multinationals raises barriers to entry for competitors. At the same time, it intensifies the power imbalance with farmers, locking them into ecosystems controlled by a few massive enterprises and increasing their dependence on solutions from oligopolistic companies.

NEW IMPULSES TO THE FINANCIALIZATION OF AGRICULTURE

Eco-Financialization

Since the 1997 implementation of the Kyoto Protocol to reduce greenhouse gas emissions, developed countries have enacted laws and public policies that have spurred the growth of new business sectors. These sectors

include biofuels and the carbon market. Carbon offsets, also known as carbon credits, are financial instruments[5]. They allow companies or countries to offset their carbon dioxide (CO2) emissions by purchasing or financing emission-reduction projects. One tonne of carbon dioxide equivalent (tCO2eq) is equivalent to one tonne of carbon dioxide, accounting for the diversity of greenhouse gases (GHGs) and the greater understanding of CO2.

Activities that generate carbon credits include agriculture, forestry, land use, waste disposal, chemical processing, industrial manufacturing, household and community devices, energy efficiency, fuel replacement, and renewable energy. In this context, land and agriculture are central to international agendas, as reflected in publications by the FAO and the United Nations:

> "While the agriculture, forestry, and other land use sectors suffer the impacts of climate change, they also contribute significantly to greenhouse gas emissions. Conversely, this grants them a unique potential to mitigate climate change by reducing or avoiding emissions and strengthening carbon sinks." (FAO, 2010)
>
> "Yes, decarbonization implies a transformational change and will require massive investments in green and blue science, technologies, and infrastructure, land and soil restoration, renewable energy, and sustainable buildings, but the return on investment will be recovered many times over through socioeconomic benefits, jobs, and well-being. And it can only be effective if behavioral changes, new policies and regulatory frameworks, the greening of financial flows, international cooperation, and radical collaboration support it." https://unfccc.int/es/news/la-descarbonizacion-no-puede-esperar Ex 20-09-24 (emphasis added).

Consequently, a functional revaluation of cropland is underway. This shift stems from its potential to generate carbon offsets, which are now more easily monitored and quantified through new digital technologies and platforms. Climate dynamics and decarbonization policies bring new actors into land markets, which favor large international investors. Digitalized property registries and platforms enable investment funds to buy land globally, secure carbon credits, and add green investments to their portfolios, managing operations "from their offices on Wall Street" (GRAIN, 2022).

The case of Bill Gates (Microsoft) is paradigmatic. Through the investment fund Cascade Investment, he has purchased land in both the US and Canada. Using his digital platform (Azure FarmBeats), he has also made these purchases. His public messages declare that agricultural land will meet "carbon

5 Another instrument for financing assets aligned with low emissions or climate resilience is the green bond. These evolved from a niche instrument piloted in 2007–2008 by the World Bank and the European Investment Bank into a mainstream fixture within the investment portfolios of private financial institutions and public entities.

neutral" objectives for sustainable investment portfolios. In Brazil, the start-up Agrobótica has installed devices to measure carbon on farmland. Concurrently, the California firm Cultivo, which specializes in "green business," has identified approximately 100,000 hectares of land for inclusion in its carbon offset projects. https://www.wsj.com/articles/storing-carbon-holds-growing-appeal-for-brazils-farmers-11625565600 Ex 7 July 2025.

These new orientations toward agricultural decarbonization disrupt rural areas in core countries. Protests by European farmers, mainly in France and Germany, reveal the socio-productive tensions unleashed by the European Green Deal, stemming from the costs of adopting regenerative agriculture. In the United States, numerous agricultural associations and members of Congress warn about rising production costs, including inputs and predictive advisory services, and the resulting challenges for small and medium-scale farms.

Another critical issue concerns the ownership and valorization of land data, such as carbon content and other attributes. This data is managed through digital intelligence operated by a few global platforms based in developed countries. Amid concerns about data access by big tech firms (GRAIN, 2022), it is claimed that companies such as Microsoft do not have direct access to this content (Expert Microsoft 2, 2023, cited in Sauvagerd, Mayer, and Hartmann, op. cit., p. 10). However, Amazon, Microsoft, and Google controlled 61% of the cloud infrastructure services market at the end of 2020. These three, along with Apple and Meta, constitute the top five firms acquiring emerging AI startups (Borrastero and Juncos, 2024; UNCTAD, *op. cit*.). Consequently, the emergence of data as an economic resource introduces a new factor into the international division of labor: "Developing countries risk becoming mere providers of raw data to global digital platforms while paying for the digital intelligence generated from their data." (UNCTAD, 2021).

Land Grabbing

Following the 2007–2008 international financial crisis and its effects on food prices[6], research focused on land grabbing. An initial phase centered on large-scale land purchases, especially in Africa, by companies and gov-

6 During this period, known as the "food crisis" due to widespread inflation in these goods, panic buying occurred as consumers attempted to stockpile rice, baked goods, and other staples. Financial speculation and the food-versus-fuel tensions introduced by biofuel production significantly influenced these dynamics.

ernments from China, South Korea, the Gulf States, and India to produce food or biofuels for export.

A decade later, the process has different connotations, especially in Latin America and the Caribbean (LAC). Borras et al. (2014) for FAO expand the concept of land grabbing to include actions by large capital to seize land and resources through various mechanisms, beyond the food crisis. The fundamental point is that land grabbing is basically a "grabbing of control." It represents the power to control key productive resources, such as land, water, and the environment, during capital accumulation. Consequently:

> "...it is an inherently relational and political phenomenon that implies political power relations and manifests in various forms, including land accumulation (that is, the capture of vast tracts of territory), the (virtual) pooling of water through the capture of aquifer resources, and 'green grabbing'" (Borras et al., 2013, p. 80).

Financial speculation played a major role in land grabbing. Agricultural investment funds multiplied tenfold between 2005 and 2018, with a quarter of them focused on land acquisition. Research by Martins Kato and Pereira Leite shows that Valoral Advisors' records of international investment funds targeting rural areas, including land and other natural resources, rose from 40 in 2005 to 609 in 2020. Meanwhile, *Calyx Agro,* a venture capital fund created in 2007 by Louis Dreyfus (one of the ABCD traders) and based in Argentina, has bought and sold land in Brazil, Argentina, Uruguay, and Paraguay[7]. This fund operates as a land bank, financed through financial strategies. It relies on a complex structure that links financial actors across the US, the UK, Asia, and Switzerland (Braz dos Santos et al., 2022).

Available data on institutional investors in the United States also show that they have doubled their agricultural landholdings since the pandemic. The value of agricultural land held by investment groups reached 16.6 billion dollars at the end of 2023, up from 7.4 billion dollars at the end of 2020 and 1.8 billion dollars in 2008, according to the National Council of Real Estate Investment Fiduciaries (NCREIF). Concurrently, cropland prices increased significantly between 2020 and 2023 (https://www.ft.com/content/c691e279-710f-42aa-8894-4dd4bd331017). In Brazil, as the agricultural frontier advanced into the Cerrado, the most fertile areas recorded land price increases (R$/ha) exceeding 600% between 2001 and 2020 (Braz dos Santos et al., op. cit.).

7 Within this strategy, Calyx Agro requested a loan of more than 30 million dollars from the World Bank's International Finance Corporation (IFC) to expand its land operations in Latin America. http://farmlandgrab.org/uploads/attachment/IFC.pdf.

The land market thus enables the issuance of securities tradable on stock exchanges. Another strategy used by firms specializing in this market is to buy land at low prices in areas with productive and environmental potential. They make targeted, productive investments to enhance their attributes and subsequently sell them at higher prices.

Agricultural expansion: some notes on Argentina and Brazil

In southern Latin America, particularly in Brazil and Argentina, a significant spatial reconfiguration occurred, marked by the displacement and expansion of cultivated land. This process of "agriculturalization" (agriculturización) has been documented both quantitatively and qualitatively by numerous studies. It resulted from productive, technological, and organizational changes that increased locational flexibility. These changes unfolded within the context of global agricultural commodity market trends, particularly those triggered by the so-called "China effect" (Martins Kato and Leite, *op. cit*.; Gorenstein and Ortiz, 2018).

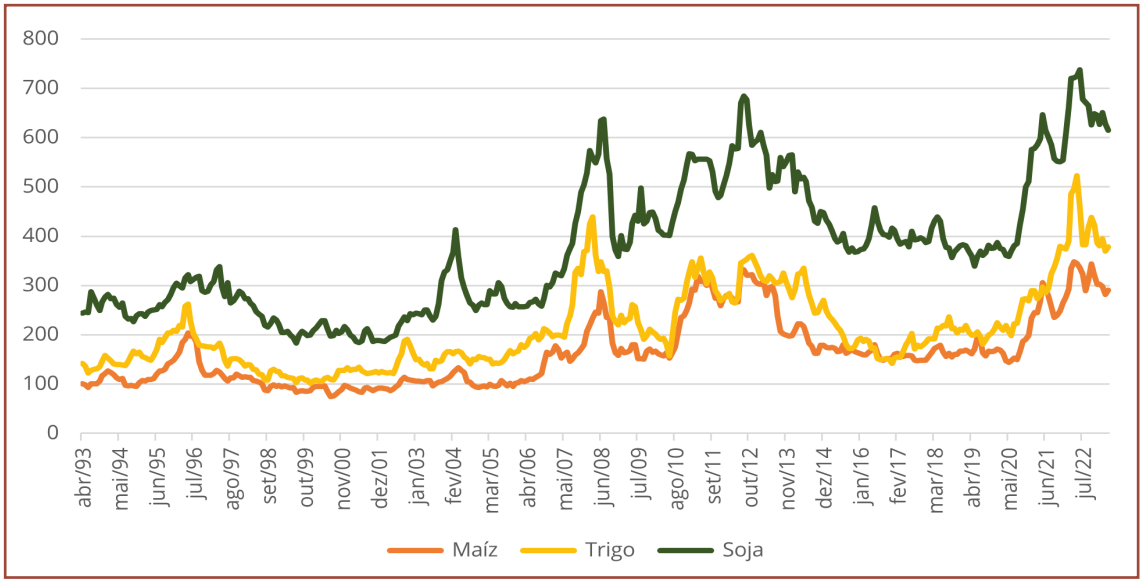
The land area cultivated with four main crops—corn, wheat, soybeans, and sunflowers—in these countries increases from an average of 19.8 million hectares during 1961–1965 to 96.4 million hectares during 2017–2021. This represents an increase of nearly 400%. (FAOSTAT, In https://www.fao.org/faostat/en/#data/QCL. Ex 04/11/2023). This dynamic closely accompanied the commodity "super-cycle." High comparative prices sustained both agricultural products and mining and energy resources until the end of the first decade of the 2000s.

Soybeans saw the highest growth since the 1990s in both cultivated areas and production volume. Domestic policies drove this trend alongside international factors. For instance, the 1994 GATT Uruguay Round placed limits on protectionism by grain-importing countries. This affected sales volumes and pushed up international prices. Additionally, China emerged as a major source of demand for domestic soybeans and derivatives starting in the mid-1990s (see Figure 2).

Over the past five years, the territorial extent of agriculturalization in the Southern Cone has remained largely unchanged, despite fluctuations during the COVID-19 pandemic and the repercussions of the Russia-Ukraine conflict. In 2019, five countries—Argentina, Bolivia, Brazil, Uruguay, and Paraguay—accounted for 48.5% of the global land area and 55% of the world's soybean production. Brazil led in grain exports, while Argentina led in soybean oil

and meal. Together, Argentina and Brazil account for 90% of the cultivated soybean area in Latin America. Over the last six cycles, the region produced more than 170 million tons, with average yields ranging from 2.8 to 3.2 tons per hectare (FAOSTAT, 2021; see Figure 3).

Figure 2 – Prices of selected cereals and oilseeds (USD; 1993-2022)



Source: Index Mundi.

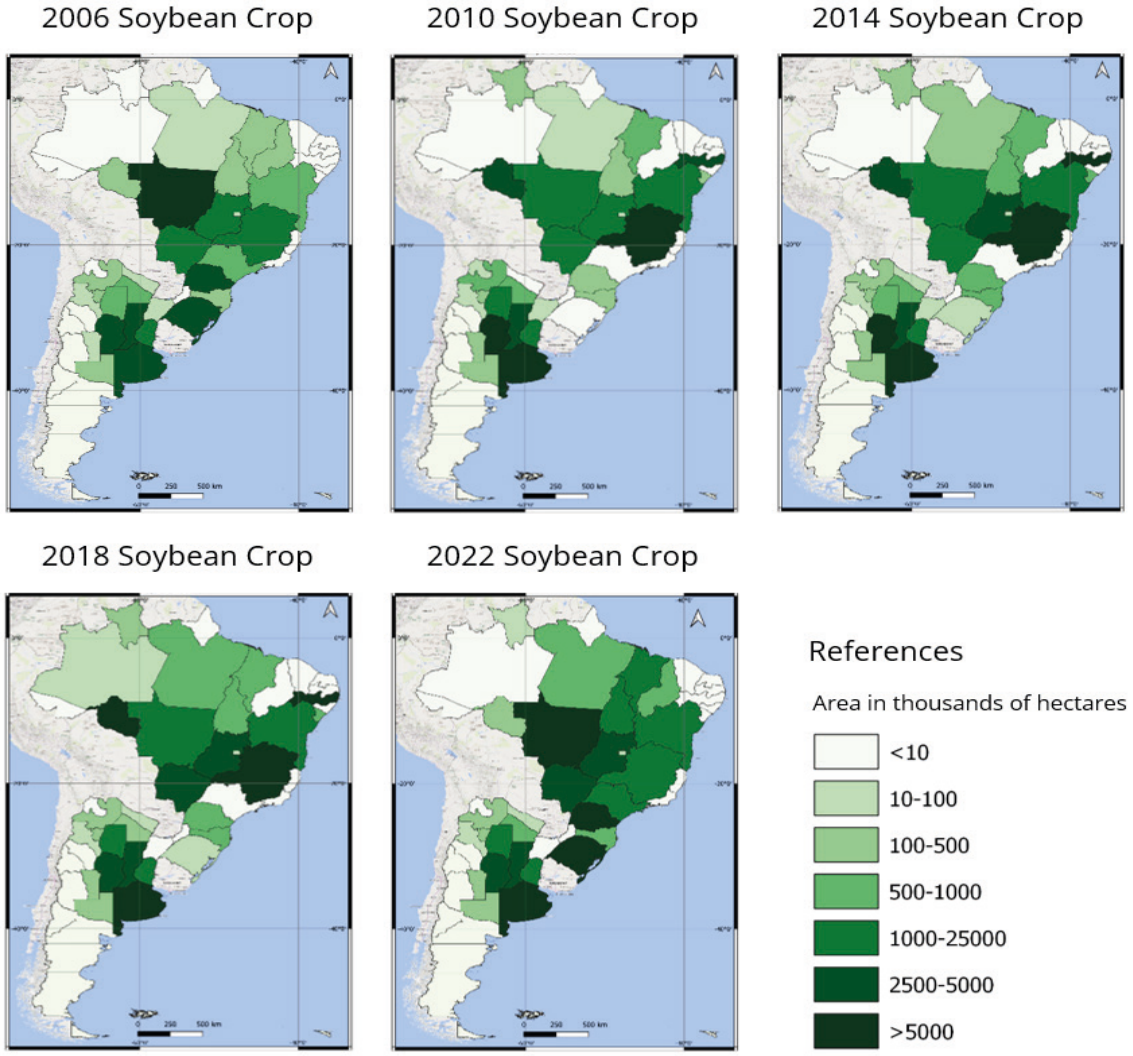
This context reflects a series of common and specific features in Argentina and Brazil:

- Corporate strategies on cultivation influence production scope, timing, prices, and land scale under lease or trade, as seen in Argentina's Pampean region, where land value surged—from $3,003/ha in 2003 to $12,206 in 2011, then dropped to $5,500 in 2023. Meanwhile, corn-producing land rose from a low of 8,000 USD in mid-2003 to 28,500 USD in late 2011, then fell to 14,000 USD in 2023 https://www.crea.org.ar/agroseriesapp/#p_precios.Ex31/03/2023. In Brazil, recent studies report increases in the period 2006-2017 that exceed 428% and reach 598% for productive land areas in the Matopiba within the Cerrado region (Flexor and Leite 2017; Martins Kato and Leite, op. cit.: 468).
- Extensive leasing mechanisms offer flexibility in land use and reduce the rotation time of invested capital based on harvest projections. Argentine agribusiness groups occupying croplands in other Southern Cone countries reached a peak of 243,568 hectares over 30 years, but this fell below 200,000 hectares in 2020–2022 due to the dissolution of El Tejar and declines in Cresud, Los Grobo, and MSU. In Brazil,

land market expansion through new agricultural frontiers allowed investment funds and foreign investors to buy low-value land, cultivate it, and resell it at high prices. A study in Brazil identifies three investment approaches.

> "Strategies vary from those involving land purchase to profit from leasing out (own-lease out approach), land purchase to invest in a productive project (own-operate approach), and land purchase solely for financial gains without interest in agricultural production, where the land may be leased to others for production (lease-operate approach)" (Fairbairn, 2014, cited in Martins Kato and Pereira Leite, 2023, p. 466).

Figura 3 – Evolución del cultivo de soja en Argentina y Brasil, por provincia y estado respectivamente (años seleccionados)



Source: FAOSTAT.

The actions of large agribusiness groups not only affect the income externalized and recycled in the agro-rural territories where they operate, but also both countries record episodes of social conflict associated

with the displacement of Indigenous populations and smallholders. They employ various corporate strategies to secure control of local croplands. (Valdemar, Wesz Junior, and Bühler, 2022; Gorenstein, Landriscini, and Ortiz, 2019). In Argentina, recent data shows the displacement of small and medium-scale family farms, with over 80,000 agricultural units disappearing between 2002 and 2018. This led to the conversion of medium-scale producers, displaced from active farming but still landowners, fueling agricultural absenteeism and land-rentism. (Azcuy Ameghino and Fernández, 2019; Cloquell and Azcuy Ameghino, 2005).

Agribusiness' economic and political power manifests in various ways. Through institutional structures, agricultural associations coordinate action beyond the local level to defend interests, influencing state sectors, environmental regulations, and planning. They also impact macroeconomic policies, as seen in Argentina's 'network' and 'value chain' paradigm and Brazil's pressure for state guarantees in land transactions. Kato and Leite (2020) note the emphasis on 'legal certainty' by investment funds in Brazil, expressed via formal government letters.

FINAL THOUGHTS

At the international level, Global North monopolizes most R&D&I investments, driven by decision-making centers of major corporate players. These actors control inputs, technology, VC or CVC financing, equipment, data storage, land for production and sequestration, and align operations with international climate finance mandates.

Within this framework, the nations of the Global South serve as providers of raw cropland data amid the progressive diffusion of smart agriculture. New investment strategies show that institutional financial actors play an important role in land control dynamics. This role operates through partnerships for land purchase, control via leasing, and "green grabbing" (involving aquifers, planted forests, biofuel production, carbon credits, and regenerative agriculture).

The traditional presence of the ABCD traders as controllers of international agricultural commodity trade is now accompanied by the rapid growth of Chinese companies, particularly in the Global South. These Chinese firms focus on capturing a share of trade while managing facilities, logistics, and ports to ensure supply for a growing Asian market.

In sum, the current agricultural model reflects characteristics associated with the diffusion of the biological-digital paradigm. This paradigm is led by

global corporate actors and supported in various forms by financial capital. New questions remain for future studies regarding the scope of these dynamics within the agro-rural productive fabric of our countries. Among other elements, future research should address the impacts of investments in decarbonization and regenerative agriculture, their expressions across different territories, and the resulting social tensions. ●

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Silvia Gorenstein: theoretical and methodological structuring, analysis of results, and final drafting of the manuscript.
Ricardo Ortiz: data collection and systematization, critical interpretation of the data, review of progress, and final editing of the text.

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