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Agency costs and organizational architecture of large corporate farms: evidence from Brazil

Special issue: Agroholdings and mega-farms in a global context

CASE STUDY

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Abstract

Drawing inspiration from American institutionalism and new institutional economics, this paper discusses the rise of large corporate farms as the transition from the classic capitalist firm to the corporate form of organization based on the separation of ownership and control. Three case studies from the Brazilian cerrado show the rise of large corporate farms to be enabled and impelled by the advance of agricultural production technologies and the search for scale economies. The key finding from the case studies is that complex technology not only necessitates large-scale farming but also generates technical and organizational solutions to the potentially pervasive agency problems. In addition to the use of sound corporate governance practices, these solutions include organizational architecture encompassing computer-aided accounting and budgeting systems, incentive-based compensation, clear definition of performance goals, and delegation of operational decisions to farm managers. Furthermore, organizational architecture has been shown to promote a culture of trust and accountability, which counteract the opportunistic tendencies of farm managers and workers.

Keywords: corporate farms, separation of ownership and control, organizational architecture, corporate governance.
JEL code: D23, L22, Q13

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1. Introduction

The rise of large industrialized corporate farms is a well-documented trend in the evolution of agricultural organization all over the world. These farms are not only quite visible today but will likely become even more widespread and important in the future. The driving forces of this trend in different parts of the world vary and include, for example, food price volatility, technical change facilitating the supervision of the production process, existence of benefits from horizontal and vertical integration, deficiencies of public infrastructure, requirements of certification and traceability, as well as inelastic labor supply (Deininger and Byerlee, 2012). For all their heterogeneity, these forces lead to the same effect: they facilitate and indeed require large-scale business organization. This effect is known to cut the ground from under the prevalent transaction cost economics argument about the superiority of family farms (Allen and Lueck, 1998; Pollak, 1985). Large corporate farms evidently do not enjoy the transaction cost advantages of family loyalty in the organization of agricultural production activities that are very costly to supervise.

Drawing on an extensive literature review, Deininger and Byerlee (2012: 706) identify three advantages of this kind in traditional family farms. First, family members involved in the farm business have strong incentives to do their best since they are also residual claims to profits (and losses). Second, they benefit from 'an intimate knowledge of local soil and climate, often accumulated over generations.' And finally they can flexibly adjust their labor supply to the seasonally contingent conditions of production (cf. Allen and Lueck, 1998; Pollak, 1985; Valentinov, 2007). It is clear that the rise of the large-scale industrial agriculture poses a challenge to these arguments. The advantages of the owner-managed family farm may be real, but the driving forces behind the recent rise of large corporate farms may decrease the relevance of such advantages over time. Interestingly, the issue of the transaction cost advantages of large farms surfaced in the agricultural economics literature more than a decade ago in the context of the agricultural restructuring in the Central and Eastern Europe (cf. Rozelle and Swinnen, 2004). Valentinov and Curtiss (2005) related some of these advantages to the broader institutional environment of agriculture, while noting that the traditional rationale for family farming tends to be based on intra-organizational terms.

This argument seems to remain relevant today, with the qualification that institutional environment factors must be seen to be acting in concert with the evolution of technology, very much along the lines of Hodgson's (1988) observation that both institutions and technology present exogenous parameters that are likely to be neglected by orthodox economics. The essential institutional environment factors that were conducive to the rise of the modern large-scale farms include 'market failures related to availability of infrastructure, technology, and property rights' (Deininger and Byerlee, 2012: 701), but also the failures of capital and credit markets. The effects of these factors are further enhanced by the technological developments that helped to obviate the need for close supervision of hired labor. Far from being theoretically predetermined, the comparative efficiency of small and large farms thus emerges to be contingent not only on the intra-organizational considerations but also on the state of the broader institutional environment and technology.

Acknowledging this contingence, however, does not mean denying the importance of the agency problems that must be faced by large corporate farms. Even if innovative technologies indeed largely reduce the transaction cost advantages of family farms, it is still not clear how large corporate farms manage to achieve effective organization of their production activities. In contrast to corporate farms, family farms embody the ideal of the classic owner-managed capitalist firm which creates stronger incentives for owners to internalize the wealth effects of their actions than alternative firm types do, such as corporations, public firms, and non-profits (Alchian and Demsetz, 1972; Furubotn and Pejovich, 1972; Valentinov *et al.*, 2015). The organization of corporate farms obviously rests on the separation of ownership and control, and thus on the divergence of interests between owners and managers (Berle and Means, 1932). This divergence is bound to cause agency problems posing a serious challenge to the viability and efficiency of corporate farms. These problems, however, are not necessarily fatal and can be addressed by appropriate governance instruments. The aim of this paper is to draw on three case studies of large Brazilian corporate farms in order to explain the governance instruments allowing these farms to keep their agency problems in check.

The case studies have been inspired by the idea that the mitigation of agency costs is a challenge that is faced not only by corporate farms but also more generally by corporations which present the dominant form of business organization in the Western world (Hansmann, 1996). The rise of corporations has been a premier field of study by American institutional economists throughout the twentieth century. While Berle and Means (1932) acknowledged that corporations are radically different from classic capitalist firms, Galbraith (1967) attributed the rise of corporations to technological imperatives, and more specifically to the tendency of modern technology to require large-scale business organization. As Allan Gruchy (1972: 142) put it, 'the large corporation must plan to minimize risk by controlling its sources of supply, the demand for its products, the sources of its capital, and fluctuations in its prices'.

It is true that the planning required of large corporate farms must deal with additional agriculture-specific issues such as site and season specificity of production, tacit knowledge, imperfections of capital and risk markets, environmental and labor regulatory contexts, as well as pioneering and developing costs. Yet, the institutionalist emphasis on the role of technology still seems to retain its validity in the agricultural context too. If the benefits of corporate planning are not attainable without the separation of ownership and control, then ownership may be seen as a 'ceremony' hindering the advance the progressive technologies (cf. Gruchy, 1972; Hodgson, 2004; Samuels, 1995). In this line, Clarence Ayres (1978), a classic of American institutionalism, argued that the logic of technological development calls for the weakening of the institution of ownership if this institution becomes obstructive. He saw the rise of corporations as a crucial manifestation of this weakening: 'so great has been the proliferation of technical instruments and skills in modern business that 'management' has come to play a constantly increasing part in its conduct, and 'ownership' a correspondingly decreasing part' (*ibid*: 199). The case studies in the present paper demonstrate that the Ayresian dialectics of 'management' and 'ownership', despite its radical flavor, lines up remarkably well with the current governance practices of Brazilian large corporate farms.

In interpreting corporations as an institutional response to technological imperatives, American institutionalists unfortunately paid less attention to the micro-analytic issues of agency costs and opportunistic behavior more generally, leaving this terrain to new institutional economics. The present paper draws on both of these schools of thought in order to make the case that the technological imperatives not only give a boost to the separation of ownership and control but also facilitate the emergence of governance instruments that are able to mitigate the agency problems resulting therefrom. These governance mechanisms will be referred to as 'organizational architecture' and will be shown to play a crucial enabling role in the operation of large corporate farms. Based on case studies of three of such farms operating in the Brazilian agricultural frontier with different types of potential agency problems between owners, managers, and farm workers, the paper describes how these problems are mitigated by organizational architectures.

2. The context: agricultural development in the Brazilian cerrado

Before describing the structures of large corporate farms, it is important to understand the context from which they emerged. This section provides a brief analysis of agricultural development in the Brazilian agricultural frontier and how the structure of agricultural production evolved over time. Brazilian agriculture has experienced significant growth in the last four decades. Between 1975 and 2010, total agricultural production in Brazil grew fourfold, making it a top-five producer of 36 commodities globally by 2008 (Rada and Buccola, 2012). As a result of impressive productivity gains, which averaged 3.0% per year since 1975, Brazil was able to achieve food security, real food prices decreased, and the country became one of the main agricultural producers and exporters in the world.

This agricultural production growth occurred primarily in the cerrado region. The cerrado is a savannah-like vegetation of low trees, scrub brush and grasses. It occurs entirely within Brazil and covers 204 million hectares or 23% of Brazil's land area. Until the 1970s, the cerrado was considered to be of limited value for agricultural production. Major constraints to agricultural production in the cerrado included acidic soils with low natural fertility and high biological pressure of pests, diseases and weeds. The development of the Brazilian

cerrado into productive agricultural land required a portfolio of technologies, including the introduction of new plant varieties and hybrids adapted to low latitudes, investments in soil fertility improvements, strategies to control diseases, pests and weeds, use of no-tillage systems, and integrated crop and livestock production systems. These technologies developed over the last 40 years removed the constraints to producing high-yield crops and livestock in the poor, acid soils of the cerrado under tropical conditions.

Following these agricultural technology developments, the cerrado was opened up to agriculture and new land was brought into production. Between 1975 and 1996, the area in planted pastures soared from 18 to 49 million hectares and the area used for row crop production increased from 9 to 13 million hectares. As a result, about 40% of the cerrado had been converted to agricultural land by 1995. The development of the cerrado into new agricultural land was responsible for the largest share in food production between 1970 and 1990. Since then, most of the production increases in the cerrado was due to yield growth. Grain production in the cerrado increased from 8 million tons in 1970 to 48 million tons in 2006. In 2006, the cerrado produced 89% of the cotton, 69% of the sorghum, 55% of the beef, 53% of the soybeans, 48% of the coffee, 37% of the rice and 30% of the corn produced in Brazil (Mueller and Martha Jr., 2008).

Since the cerrado is such a vast biome, this paper focuses on how agriculture developed in the state of Mato Grosso, which has become the leading crop producer in the country in the last decade. Table 1 shows the evolution of farming in Mato Grosso since the 1970s. In 1975 total land in farms was about 22 million hectares or 24% of the state's landmass. But only 12 million ha or 54% of the land in farms were actually cleared of natural forests and used in production, of which 8.6 million ha were in natural pastures, 2.6 million ha in planted pastures and 500,000 ha in temporary and permanent crops. At that time the state did not have adequate infrastructure and was isolated from the rest of the country. In addition, the agricultural technologies adapted to the tropics developed by Embrapa and other research institutes were yet to be developed and disseminated. Thus farming activities in the state of Mato Grosso were predominantly extensive cattle ranching and staple crops for subsistence both with low levels of productivity.

This situation started to change with a set of policies implemented by the military regime that aimed to integrate the Legal Amazon[1] to the rest of the country with the enactment of the National Integration Plan (PIN) in 1970. These policies included infrastructure development (primarily roads), tax exemptions for enterprises investing in the region and subsidized credit. The early beneficiaries of these policies were cattle development projects. In addition to large-scale cattle ranching projects, PIN also included development initiatives as a response to a widespread drought in the Northeast region, which increased the incidence of poverty and famine among peasant farmers. State-led colonization projects were designed to settle poor

[1] In order to implement its development policy, the Brazilian military government created the Legal Amazon, a region that includes the states of Acre, Amapá, Amazonas, Pará, Roraima, Mato Grosso, Tocantins, and Maranhão west of the 44th meridian.

Table 1. Evolution of agriculture in Mato Grosso, Brazil (IBGE, 2006).

	1975	1985	1995-1996	2006
Number of farm establishments	56,118	77,921	78,762	112,987
Total land in farms (ha)	21,949,146	37,835,651	49,839,631	48,688,711
Area cleared in establishments (ha)	11,767,758	18,559,984	24,471,635	28,559,105
Permanent crops (ha)	42,174	136,605	169,734	408,550
Temporary crops (ha)	459,093	1,992,838	2,782,011	6,018,182
Natural pastures (ha)	8,640,861	9,685,306	6,189,573	4,404,283
Planted pastures (ha)	2,602,607	6,719,064	15,262,488	17,658,375
Number of employed farm workers	263,179	359,221	326,767	358,336
Number of tractors	2,643	19,534	32,752	42,330
Number of beef cattle	3,110,119	6,545,956	14,438,135	20,666,147

farmers and landless individuals in the Legal Amazon. Major state-led colonization projects settling more than 5 million hectares were implemented in the 1970s and 1980s.

Private colonization projects organized by colonization firms and cooperatives were also relevant agents of agricultural development in the Legal Amazon. These private colonization entities surveyed, demarcated and occupied land, built infrastructure, opened roads, developed urban areas, and provided basic health and education services to smallholders that migrated primarily from the southern region. Thirty-five private enterprises organized 104 settlement projects and colonized almost 4 million hectares of farmland in Mato Grosso between 1970 and 1990. Private colonization in Mato Grosso represented 39% of the total area colonized in the Legal Amazon. Jepson (2006a,b) provides detailed accounts about the role of private colonization projects in the Legal Amazon. She concludes that, 'state incentives were, in fact, insufficient to cause the frontier expansion. Central to Brazil's frontier historical geography are private colonization cooperatives and firms, both of which developed into critical organizations in the process of agricultural expansion' (Jepson, 2006a: 858).

As a result of these policies to develop the Legal Amazon, the number of farm establishments in Mato Grosso increased from 56 to 78 thousand and the total land in farms almost doubled from 22 to 38 million hectares between 1975 and 1985 (Table 1). During this period, the area actually used in production increased from 11.7 to 18.5 million hectares with notable increases in planted pastures (from 2.6 to 6.7 million ha) and temporary crops (from 460,000 to 2 million ha). Many critics of these policies argue that this first phase of agricultural development in the cerrado led to excessive land clearing, environmental degradation and increased land concentration (Klink and Machado, 2005). The poor soils of the cerrado could not sustain adequate levels of productivity after three years of being used in production. Without investments in soil fertility, natural pastures would degrade and row crops would not produce enough to cover costs, leading famers to abandon the land.

The integration and development policies initiated by the military government were, however, short lived. In 1979 Brazil experienced the effects of the second oil crisis, which severely affected the ability of the government to invest in proactive development policies. Government expenditures in agricultural policy reached their peak in the 1980s and were significantly reduced after that (Chaddad and Jank, 2006). Following restoration of democracy in 1985, subsequent policies related to the development of the Amazon region cut subsidies and tax incentives to agricultural projects and started to pay more attention to environmental issues, the protection of indigenous land rights, and land reform. Substantial tracts of cerrado and tropical rain forests in the Legal Amazon are now off limits to agricultural expansion and remain protected in nature conservation units and indigenous reserves. Land reform settlements also started to be implemented in the 1990s to address the issue of land concentration.

A second major push to agricultural development in the cerrado occurred after the economic reforms of the 1990s. The Real Plan of 1994 played a critical role in agricultural development throughout the country with currency stabilization and the control of inflation. Initially, the Real Plan led to a crisis in agriculture as a result of an overvalued currency but the currency devaluation of 1999 under a free-floating exchange rate policy – coupled with increased international demand for agricultural commodities in the 2000s – provided a massive boost to agricultural development. Also, since the mid-1980s, new agricultural technologies started to become available to farmers in the cerrado, which led to the development of commercial agriculture and ranching with increasing levels of productivity.

Between 1985 and 2006, the area with planted pastures in Mato Grosso increased from 6.7 to 17.6 million hectares and the number of beef cattle increased from 6.5 to 20.6 million head (Table 1). The beef cattle herd reached 28 million head in 2014 with beef production representing 20% of the state's gross value of agricultural production. The improvement of forages, coupled with appropriate soil management practices, solved the issue of pasture degradation and significantly improved the economic prospects of cattle ranching

in the region. With the expansion and increased productivity of cattle herds in the cerrado, Brazil has become the second largest producer and the leading exporter of beef in the world.

Even more impressive than the growth of the livestock sector has been crop production expansion – in particular, soybean, corn and cotton. Between 1985 and 2006, the area planted with temporary crops in Mato Grosso tripled from 2 to 6 million hectares (Table 1). Recent data show that crops continued to expand in the state, with planted area reaching 13 million hectares and total crop production of almost 48 million tons in 2014 (Table 2). Agricultural production growth resulted from planted area expansion and productivity gains, which increased from 1.4 tons per hectare in 1977 to 3.6 tons per ha in 2014. Mato Grosso surpassed Paraná as the country's largest producer and currently accounts for 25% of the domestic grain and oilseed production. The state produces 30% of the Brazilian soybean crop, 23% of the corn crop, and 58% of the cotton crop. In 2014 crop production represented 74% of the state's gross value of agricultural production, with soybeans alone accounting for 50% of the total value.

In what follows, we take a closer look at the organization of agricultural production in Mato Grosso. Initially, smallholders who migrated from southern Brazil formed colonization and production cooperatives to address the market failures and transaction costs they faced in the frontier. These cooperatives are analyzed in section 2.1. Subsequently we discuss the structural changes that occurred in Brazilian agriculture since the 1990s and how they led to the demise of most cooperatives. Without the services provided by cooperatives, most family farmers found themselves in a difficult situation to access credit and technology, store and market production and cope with the market failures and lack of infrastructure typical of agricultural frontiers. Intense competition for land and commodity price volatility further undermined family farm survival. The gap left behind by cooperative failures was partially addressed with the emergence of large family groups, corporate farming structures and new generation cooperatives.

The first wave of cooperatives in Mato Grosso (1975-1995)

Mato Grosso attracted a large number of migrants from several parts of the country – but primarily from the southern and southeastern regions – in the 1970s and 1980s. These pioneers were smallholders who sold small farms in their region of origin to pursue the dream of becoming commercial farmers in the agricultural frontier. However, they faced several constraints in the frontier, including poor infrastructure, missing services, market failures and high transaction costs to obtain farm inputs and market production.

Table 2. Evolution of crop production in Brazil and Mato Grosso (Conab, 2015).[1]

	1976/77	1984/85	1994/95	2004/05	2013/14
Brazil					
Planted area (1000 ha)	37,314	39,693	38,539	49,068	56,988
Crop production (1000 tons)	46,943	58,143	81,065	114,695	193,386
Productivity (kg/ha)	1,258	1,465	2,103	2,339	3,393
Mato Grosso					
Planted area (1000 ha)	2,238	1,561	3,278	8,564	13,323
Crop production (1000 tons)	3,046	2,642	7,617	24,731	47,703
Productivity (kg/ha)	1,361	1,693	2,324	2,878	3,580

[1] Includes 15 crops.

Based on case studies of a private colonization firm (called CONAGRO) and a colonization cooperative (called COOPERCOL), Jepson (2006b: 301) concludes that:

> private colonization projects provided the initial conditions of settlement by accessing state subsidies and securing property rights in the region. Moreover, private colonization lowered the risks and transaction costs of frontier settlement through financial support during unproductive years. It was the promise of secure titles (and lower enforcement costs), combined with access to state loans, that made it economically feasible for smallholders to invest in mechanized commercial agriculture in a frontier region.

These private colonization organizations played a critical role in providing the initial conditions for families to migrate from the south to the agricultural frontier. However, poor transportation infrastructure, distance to markets, insufficient grain storage, and high transaction costs to obtain credit and farm inputs were common challenges of the early colonists. Consequently, they decided to organize an agricultural cooperative to overcome these market failures and provide the missing services they needed to be successful (cf. Valentinov, 2009).

Founded in 1975, COOPERCANA played a central economic role in regional development as follows (Jepson, 2006b). First, it invested in warehouses and grain storage facilities across the region. The cooperative stored the grain, initially rice, and marketed the production to the government under the minimum price program. In doing so, it enabled the farmers to have access to governmental subsidies, which they otherwise would not have. The cooperative also assisted the farmers in accessing subsidized credit from Banco do Brasil. The state bank funneled the total value of loans to the cooperative, which then redistributed the funds to the farmers. COOPERCANA also provided farmers with agricultural inputs and agronomic services to plant and harvest rice. Inputs were supplied at a discount for cooperative members, which reduced the need for farmers to travel to Barra do Garças, the main local market located 300 km away from the settlements. COOPERCANA also disseminated information about suitable agricultural practices for production on poor cerrado soils. Lastly, the cooperative provided emergency flights on its DC-3 to Barra do Garças during the rainy season, when the main unpaved road (BR-158) connecting the settlements to the town was flooded.

In the early 1980s, COOPERCANA was instrumental in helping the farmers improve soil fertility and thus decrease dependence on rice with production diversification. Based on agronomic recommendations from Embrapa, the cooperative provided lime, chemical fertilizers and technical advice to encourage farmers to invest in soil fertility and avoid soil degradation. As farmers invested in soil fertility, the cooperative introduced new crops in the region. The cooperative technical staff experimented with new soybean and corn cultivars and tested their yields under different growing conditions. In collaboration with Embrapa research staff, COOPERCANA implemented crop experiments and provided important agronomic information to farmers. New technologies were disseminated to farmers in field days and educational programs. With the availability of adapted cultivars and credit for soil improvement, agricultural production and productivity in the region increased dramatically. Between 1983 and 1993, soybean area increased from 5,000 hectares to 40,000 hectares, while corn area increased from 700 hectares to 3,000 hectares.

Production growth and agricultural development in eastern Mato Grosso provided the impetus for the growth of COOPERCANA in the 1980s. In addition to the services provided to farmers explained above, the cooperative diversified and engaged in several vertical integration projects upstream and downstream in the value chain. These growth projects included the following: lime processing and marketing; corn, rice and soybean seed production and marketing with own brand name; seed quality laboratory to test seeds from third party vendors; a network of supermarkets and gas service stations; and a livestock processing plant to become a local supplier of beef and pork.

COOPERCANA was not a unique example. Several multipurpose, local cooperatives were formed in the 1970s and 1980s across Mato Grosso by the early pioneers. Because these pioneers came mostly from the

southern region, the cooperatives they formed followed the traditional model of the cooperatives they knew or were members of in southern Brazil. This first wave of cooperative development in the cerrado was also influenced by increased federal intervention in cooperatives that lasted until 1988. Federal law 5764 of 1971 established the institutional framework within which the Brazilian cooperative system operates until today. The 1971 law defined the legal status of cooperatives and set strict rules for their formation and functioning. Between 1966 and 1988, a state agency known as Instituto Nacional de Colonização e Reforma Agrária regulated and controlled agricultural cooperatives.

Despite their early successes, COOPERCANA and most of the first wave cooperatives formed across Mato Grosso went bankrupt in the early 1990s. There were several exogenous and endogenous factors that led to their demise. With unsustainable debt levels, these cooperatives could not survive the period of hyperinflation of the late 1980s and the economic liberalization and macroeconomic reforms introduced in the early 1990s. Farmers, in turn, also suffered from the economic crisis and the end of agricultural subsidies and many were forced to exit agriculture. In addition, there were some serious management and governance issues that prevented these cooperatives from taking the necessary steps to reinvent and survive the crisis (cf. Valentinov and Vacekova, 2015).

Structural changes and the emergence of corporate farms (1990-2015)

With the failure of cooperatives and the consequent exit of farmers in large numbers in the 1990s, the structure of farming became increasingly concentrated in Mato Grosso. Data from the last Census of Agriculture show that the average farm size in the state is 431 hectares (Table 3), which is significantly higher than the national average of 64 hectares. About 70% of the producers in the state farm less than 100 hectares. These farm establishments include traditional smallholders and peasants who were settled in land reform projects since 1995. The total land in smallholder farms adds up to 2.6 million hectares, equivalent to 5% of the total agricultural land in the state. Among commercial producers, there are three size categories: small (100-500 ha), medium (500-2,500 ha) and large (above 2,500 ha). The 35,000 commercial producers in Mato Grosso farm 45 million hectares or 95% of the agricultural land in the state.

There are about 10,000 commercial producers in Mato Grosso farming an average of 1,100 hectares (Table 3). They are family farmers that were able to survive several crises since the 1980s and establish themselves as commercial producers. Our field research in Mato Grosso suggests that 500 hectares is the minimum efficient scale that a producer needs to farm to be able to acquire the machinery, build the on-farm infrastructure and have access to modern inputs to make a living in commodity agriculture in the cerrado. These small and medium-sized family farmers overcame collective action problems and the negative consequences of the cooperative failures of the 1990s and formed 43 new cooperatives since then. These second-wave cooperatives are structurally different from the traditional cooperatives of the 1970s and 1980s and focus on organizing producer pools to buy farm inputs and market agricultural commodities with larger volumes. They have a limited effect on market structure and performance due to their limited scale and resources (Chaddad, 2016).

Table 3. Farm structure in Mato Grosso (2006) (IBGE, 2006).

	Number of establishments		Area		
	n	Share (%)	Total area (ha)	Share (%)	Average area (ha)
0-100 ha	77,786	68.8	2,641,168	5.4	34
100-500 ha	21,334	18.9	4,503,981	9.3	211
500-2,500 ha	10,052	8.9	11,316,022	23.2	1,126
>2,500 ha	3,815	3.4	30,227,539	62.1	7,923
Total	112,987	100.0	48,688,710	100.0	431

Other producers, however, were able to achieve a much larger scale than this. Table 3 shows that there are about 4,000 large commercial producers in Mato Grosso with an average farm size of 8,000 ha. These large producers farm about 30 million hectares or 62% of the land in farms in the state. According to primary data collected by Agroconsult, a consultancy firm, there are 38 'mega producers' farming more than 30,000 hectares in the cerrado region with several of them farming more than 100,000 hectares. A recent phenomenon that is changing the structure of agricultural production in the Brazilian cerrado is the emergence of corporate farms since the commodity super cycle started in 2005. These new players include publicly traded companies, privately held companies controlled by private equity funds, and subsidiaries of multinational trading companies. These corporate farms with diverse ownership arrangements have three characteristics in common – very large scale, professional management and access to capital markets (Chaddad, 2014).

3. Case studies of family groups and corporate farms

There are two basic types of very large producers operating in the Brazilian cerrado: family groups and corporate farms. The dominant form is the family group, where multiple family members farm together in areas ranging from 5,000 to 250,000 ha. These family groups were developed since the 1990s by the second and third generation sons and daughters of the first generation pioneers as an organizational response to pool resources and cope with the market failures, transaction costs, poor infrastructure, market volatility and lack of credit in the agricultural frontier. On the other hand, corporate farms financed by public and private equity markets were formed in the mid- to late-2000s to benefit from the commodity boom of the time.

In what follows, the paper describes three case studies – one family group (Produzir), one publicly traded corporation (BrasilAgro) and one privately-held corporation controlled by private equity funds (Agrifirma)[2]. The ownership structures are different but all involve the separation of ownership and control in the sense that owners are not involved in operating and managing the farms. The case studies also describe how these very large producers attempt to ameliorate agency problems with organizational architecture. The case studies were developed based on personal interviews with corporate managers (chief executive officers (CEOs), chief financial officers (CFOs), chief operating officers (COOs)), farm managers who run the farms and several visits to farms in Mato Grosso and western Bahia. The personal interviews were complemented with information from company documents, such as incorporation statutes and bylaws, annual financial reports (when available) and presentations to investors.

Produzir S.A.

Eugênio Pinesso was the son of an Italian immigrant couple that arrived in southern Brazil in the 1930s to work as sharecroppers on coffee plantations. Eugênio grew on the farm in northern Paraná state and, despite not going to school, was a shrewd businessman who was an early adopter of several new technologies. He learned how to bring low-fertile soils in to production. With hard work and a bit of luck, he was able to make it as a commercial farmer in southern Brazil in the 1960s and 1970s. In 1983 Eugênio took the bold decision to exchange 5 farms totaling 1,500 hectares in Paraná for 2 farms with 19,600 hectares in Campo Verde, MT located 100 km to the east of Cuiabá, the state capital. The farms were not yet developed so family members worked hard to clear the land and bring it into production. Eugênio had 6 daughters and sons and most family members were involved in agriculture. They worked as a team. While some family members worked in developing land into crop production in Mato Grosso, other family members stayed in

[2] Since we conducted the personal interviews and collected data to write these case studies in 2014, a lot has changed in Brazil. In 2015, the country entered a deep recession with high inflation and currency devaluation. Some farm operators who were leveraged in dollar-denominated debt found themselves in financial distress. Many had to declare bankruptcy, merge with another entity or liquidate. The economic crisis persisted in 2016 with high political risk because Congress started an impeachment process against the President that was only resolved in August. At the same time, farmers in western Bahia suffered three years of drought that significantly affected yields. And, for the first time many farmers in Mato Grosso also had poor soybean yields due to lack of rain. One of the three corporate firms described in this paper was forced to liquidate not because of the financial and production risks described above, but simply because one of their majority shareholders decided to cash in and leave the partnership. Suddenly, the managers of the firm were left without funding to carry out the business plan for the 2015-2016 crop year and thus the company was folded. This story highlights the importance of a robust capital structure to the survival of start-up farm corporations.

Mato Grosso do Sul focusing on livestock production, including hogs and beef. One of the key features of large producers in the cerrado is that they developed as family groups, pooling resources from many family members under the leadership of one trusted individual. With the passing of his wife in 1986, Eugênio started to groom one his sons, Gilson Pinesso, to take over his role as the family leader.

In 1993 the Pinesso Group took another bold step with the acquisition of a 61,000-hectare farm in Nova Ubiratã, MT located 150 km to the east of Sorriso in an area without any infrastructure, including roads and electricity. The land was developed over time and required investments in basic infrastructure, including building more than 200 km of roads, bridges, housing, electricity and a school for rural workers and their families. In 2014 the district developed by the Pinesso Group had a population of 2,000 with a school, health center, pharmacy, supermarket and service station. The farm currently produces soybeans, corn, cotton, sunflower, beef cattle, and hogs.

In 2014 the Pinesso Group had 10 farms in the cerrado totaling 108,000 hectares. It also leased 48,000 hectares in the new frontier state of Piauí. Planted area with crops increased from 48,000 ha in 2005 to 117,000 ha in 2014. The area used for livestock production in planted pastures comprised 35,000 ha.

■ *Separation of ownership and control and the potential for agency problems*

In 2012 the Pinesso Group incorporated and changed its name to Produzir S.A., which literally means 'to produce.' All assets were transferred to the corporate entity and family members received shares in return. Produzir S.A. has 6 shareholders, each a limited holding company controlled by the 6 siblings (or their descendants). The family group decided to incorporate for two main reasons. The first was to give shares to family members, which would allow exit at fair value. The second was to enable the firm to adopt corporate governance practices and hire professional managers. The board of Produzir S.A. is comprised of six directors nominated by each family holding company (the shareholders) and one independent, professional director. A CEO with professional experience in finance was hired to run the business. According to one family member, 'we needed someone from outside the family to make business decisions with cold blood and without emotion.'

■ *Organizational architecture*

The CEO also plays the role of CFO and the company also hired two additional senior-level professionals – a COO to run the farming operations and a Chief Commercial Officer in charge of commercial and marketing decisions. This senior management team is assisted by 6 mid-level managers, 4 of which are responsible for managing crop operations and 2 in charge of the livestock operations. The firm has 1,050 employees with about 110 of them involved with some management or administrative function. As a result of these organizational changes, family members are no longer involved with the business. The senior management team receives incentive compensation based on clearly defined goals, including revenue growth and profits.

In a personal interview, Mr. Pinesso explained how the family (represented in the Board of Directors) was able to oversee such a large farming operation. In simple terms, he stated that, 'in agriculture, it is the eye of the owner that fattens the ox.' Even though the family is not directly involved with the business operation, family members constantly visit the farms and develop personal relationships with farm managers and workers. 'We have formed our team over the last 30 years. Today we have the sons and daughters of our first employees working in our firm. They have a sense of belonging to the group and we offer a lot of opportunities for personal growth and development.'

In addition to a strong organizational culture based on personal relationships, Produzir S.A. has adopted a control system with key performance indicators (KPIs) to monitor the performance of its production units across the cerrado. 'We benchmark the performance of each production unit relative to the others, which provides a strong incentive for the teams to perform. The managers of these production units also share information

and best practices among themselves.' The firm also introduced an incentive compensation system for farm managers based on production and productivity levels achieved by each production unit. In other words, the organizational architecture of Produzir is based on both trust built by years of relationship between family members and farm managers and workers, coupled with formal control mechanisms (benchmarking across operational units and incentive compensation).

A recent phenomenon that is changing the structure of agricultural production in the Brazilian cerrado is the emergence of corporate farms since the commodity super cycle started in 2005. Corporate farms are increasingly found in Mato Grosso, but especially in the new agricultural frontier of the cerrado known as Mapitoba, a region comprising four states – Maranhão, Piauí, Tocantins and western Bahia. These new players include publicly traded companies (e.g. SLC Agrícola, Vanguarda Agro, and BrasilAgro), privately-held companies controlled by private equity funds (e.g. Agrifirma, Agrinvest and Tiba Agro), and subsidiaries of multinational trading companies (e.g. Ceagro-Mitsubishi and XinguAgri-Multigrain). These corporate farms with diverse ownership arrangements have three characteristics in common – very large scale, professional management and access to risk capital from outside investors. In what follows, we describe these emerging corporate-style structures.

Companhia Brasileira de Propriedades Agrícolas S.A. (BrasilAgro)

BrasilAgro is a publicly traded company headquartered in São Paulo, Brazil and listed in the Bovespa stock exchange with American Depositary Receipts traded in the New York Stock Exchange. Its 2006 initial public offering (IPO) raised 584 million BRL (about 286 million USD)[3] from investors based on a business plan and a promise 'to create value by acquiring, developing and operating properties through sustainable and innovative practices.' The firm did not have any assets and employed only 2 managers at the time of listing. Since then, it has become one of the leading agricultural land development and farming companies in South America.

The core business of BrasilAgro is the acquisition, development, operation and sale of rural properties suitable for agricultural production. Once BrasilAgro acquires a rural property, it invests in infrastructure, facilities and technology necessary for efficient agricultural production. It then engages in high productivity agricultural operations aiming to maximize cash flow per area. BrasilAgro selectively divests of a farm when it reaches its optimal value to capture capital gains. The company combines the returns generated from land value appreciation and farming operations, while mitigating production risks with geographic diversification. Its vision is 'to be the leading platform for investing in and developing farmland in Brazil.'

With the capital raised in the IPO, BrasilAgro acquired 11 farms in agricultural frontier regions throughout the cerrado. After taking possession of its first farm in July 2007, the firm planted 22,000 hectares in its first year of operation. The planted area increased every year since then reaching 80,000 hectares in the 2013/2014 crop year. In 2014 BrasilAgro had a land portfolio of 8 farms with 180,000 hectares with an estimated market value of 1.3 billion BRL (about 381.8 million USD). Three farms had already been sold allowing the firm to realize considerable capital gains.

■ *Separation of ownership and control and the potential for agency problems*

The idea for the formation of BrasilAgro came from a group of investors led by Cresud, a diversified real estate development firm in Argentina with a business unit in farming. Cresud is currently the controlling shareholder in BrasilAgro with a 39.6% stake in the company. The remaining shares are traded in the Bovespa stock exchange and are held by minority shareholders. BrasilAgro is listed in Bovespa's New Market, which requires high levels of corporate governance practices and transparency. With the decision to list in

[3] BRL = Brazilian Real; conversion to USD calculated on the basis of the exchange rate on November 30, 2016.

the New Market, BrasilAgro was able to raise capital at a competitive cost as it offered more security and transparency to investors.

Corporate governance practices attempt to ameliorate the potential agency costs between shareholders and corporate managers. The Board of BrasilAgro is composed of nine directors, of which three are independent. Together, the Board of Directors and the Board of Executive Officers are responsible for managing BrasilAgro. The Board of Directors is responsible for establishing long-term strategies and setting general business policies and guidelines. Professional executive officers are delegated responsibility for the day-to-day management of BrasilAgro's business following the resolutions of the Board of Directors. The Board of Executive Officers is comprised of four professional managers led by Mr. Julio Piza Neto, the firm's CEO.

The cornerstone of the business model developed by BrasilAgro is its large size, which enables it to benefit from economies of scale. According to Julio, economies of scale are realized at two levels: the farm level and the corporate level. Farm-level economies of scale include the following: fixed cost dilution (such as overhead expenses and compliance costs with labor, environmental and tax laws that were exceedingly high in Brazil); ability to attract and retain professional managers and experienced technical staff to run each farm; efficient use of on-farm facilities and infrastructure; and operational efficiencies of modern farm equipment. Economies of scale at the corporate level include commercial advantages in buying farm inputs (e.g. volume discounts) and in negotiating commodity prices or forward contracts (due to higher bargaining power). Its size and access to capital allow BrasilAgro to invest in modern information and communication systems and to develop knowledge to make better commercial and risk management decisions. Perhaps more importantly, size and scale lead to a lower cost of capital and the reduction of price and production risk due to geographic and product diversification.

■ *Organizational architecture*

To benefit from these potential economies of scale, the major challenge confronting large corporate farms like BrasilAgro is that the owners (shareholders) are not involved in the major operations and are distant from the farms. This separation of ownership and control gives rise to conflicts of interest and agency costs between owners, managers and farm workers. These agency costs are potentially very severe in agriculture because of the unpredictable effects of Mother Nature. Julio believes that it is possible for a corporate farm to overcome agency costs and thereby achieve high performance by means of a well-designed organizational architecture. The organizational architecture of BrasilAgro includes a hierarchical structure with well-defined responsibilities and communication channels between the corporate team in São Paulo and managers at each farm, formal control systems, and incentive compensation based on key performance indicators.

The formal organizational structure of BrasilAgro comprises the central office (headquarters) in São Paulo and local offices in each farm. The central office includes the top management team and staff organized by function. Each farm is a separate business unit and profit center with its own budget and performance goals. Each farm office is headed by a farm manager, with decision making authority over farming operations, assisted by a deputy farm manager, an administrative officer and a chief of field operations overseeing a team of field staff. In decentralizing operational decisions to farm managers, the company attempts to benefit from effective and timely use of local, specific knowledge. However, decentralization of decision-making requires effective coordination and communication between farm managers and staff at the central office.

The organizational architecture of BrasilAgro is designed to facilitate seamless coordination between the central office and each farm manager. Information and computer technologies allow direct, real time communication between farm managers and staff in the central office. Each farm has a scale to weigh everything arriving at (e.g. fertilizers, chemicals) and leaving (e.g. grains) the farm gate to enforce a strict control of inventories of farm inputs and output. The key feature of BrasilAgro's architecture is a control system called PGP (an acronym for production planning and management), which provided the basis for evaluating performance, incentivizing and holding employees accountable.

At the core of the organizational architecture is a focus on formal systems and processes geared to foster a culture of accountability and meritocracy. The Chief Administration Officer and his team are in charge of developing a management control system based on formal processes and protocols called the PGP. In the PGP system, each activity conducted by the firm, from land acquisition to land development and farming, is standardized in a formal process with steps and KPIs. For example, KPIs for a corn field includes distance between seeds, number of seeds planted per row meter, fertilizer weight applied per row meter, number of drops per cm^2 (for pest control) and corn weight loss per hectare. This formalization and standardization of all farming activities serve as the basis for planning, budgeting, control, incentive and performance evaluation systems.

Planning of farm operations is the first step in the PGP system, which is the responsibility of the top management team with input from farm managers. First, the COO and the chief technology officer plan operations for each farm from a technical perspective following best agronomy practices. The first draft of the plan is discussed with farm managers to receive their input and buy-in. From this interactive, participatory process emerges the operational plan for each plot on each farm along with a budget. The operational plan and budget for each farm then receives the input from the CEO and the head of BrasilAgro's new business development team. They review the technical plan from a strategic perspective focusing on expected margins and profitability for each crop. In other words, they consider economic variables to maximize expected returns on each farm. The outcome is an operational plan and budget that seeks to maximize cash flow generation for each plot in each farm considering the constraints imposed by technical feasibility. The operational plan includes the crops to be planted in each plot, the use of inputs and technology, and a detailed agenda (with dates and KPIs) for each activity to be performed on a field from soil preparation to harvesting.

Each farm manager leads a team of field staff responsible for the execution of farming operations following the operational plan and the budget. According to Julio, 'the beauty of our PGP system is that each farm plot has an owner.' He does not mean that workers own land but rather that all activities performed on a farm plot are traced back to a single person who is held accountable for her actions. Since the PGP describes operations and KPIs for each farm plot, he believes that BrasilAgro is able to monitor and control from a distance the effort and efficiency of each worker and thus minimize potential agency costs.

Execution of the plan is monitored in real time by the central office staff with the use of information and communication technologies. When an operation is performed, the responsible field staff for that operation updates the PGP system. As a result, the central office in the city of São Paulo has real time information about operations carried out in every plot of every farm across the country. Field staff is also responsible for making decisions on the field if any change to the operational plan is required. For example, if weather is not appropriate for a certain scheduled operation, field staff has the decision-making authority to postpone it – for example, to delay crop spraying when it rains. But a decision to change the operational plan due to some unforeseen contingency must be justified in the PGP system. Since BrasilAgro has weather stations in each farm plot, the central office staff has up-to-date weather information to monitor and control execution of operations. Taken together, the operational plan and this control system foster a culture of accountability among field staff.

Another key feature of the PGP system is that the operational plan is tied to a budget. Each farm operation is linked to a required quantity of inputs (such as seeds, fertilizers, chemicals, fuel, etc.) and machinery use. The field staff responsible to perform an activity (e.g. corn seeding) requests the necessary materials (e.g. corn seeds, tractors, seeding machine, diesel, etc.) from the farm office to perform that operation. Based on an enterprise system developed by SAP (SAP SE, Walldorf, Germany), a German multinational firm, which integrates each farm with the central office, the use of requested materials for a given activity triggers a reduction in inventories and an update to the budget. While the PGP system enables physical control of operations, the SAP system provides a platform for financial control. The central office consolidates all these pieces of information from the PGP and SAP systems for control and reporting purposes.

The PGP system also serves as the basis for BrasilAgro's incentive system. For example, the variable pay of senior staff, farm managers and field staff is partially based on how well the operational plan and the budget are executed. More specifically, the performance of each farm manager is assessed by the executive committee based on several objective and subjective performance indicators, including: operational yield (hectares planted and productivity per hectare) compared to budget; SMS (safety, environment and health); adherence to the PGP system including participation in the planning phase, execution of activities according to the operational plan and entry of information about activities performed in the fields into the PGP system; actual vs budgeted costs; and a qualitative assessment of dedication, effort and creativity. The performance of field staff is also evaluated on the basis of safety, environment and health indicators and adherence to the PGP system. The compensation package of farm managers and field staff is based on a fixed salary (65% of total compensation) and a variable pay (35% of total compensation) based on formal performance evaluation.

Agrifirma Brasil Agropecuaria S.A.

Agrifirma was formed in 2008 with capital provided by RIT Capital Partners and Lord Rothschild, both private equity firms headquartered outside Brazil. In 2011 it received another large investment from BRZ Investimentos, a large Brazilian private equity firm. The current ownership structure of Agrifirma includes two controlling shareholders – Genagro (a holding company owned by the initial investors – RIT and Rothschild) and BRZ – and a group of minority investors. These are all 'passive investors' in the sense that Agrifirma is just one asset in their diversified portfolios. As is the case with private equity firms, they have a limited horizon of 7-8 years after which they expect to exit with considerable capital gains.

The business model adopted by Agrifirma is very similar to the BrasilAgro described above – to acquire cheap farmland in the Brazilian cerrado, make the necessary investments to bring the land in to production and then maximize cash flow from farming operations. Since 2008, Agrifirma has bought 70,000 hectares of farmland in western Bahia, in three clusters of about 20,000 hectares. In 2014, Agrifirma planted 23,200 ha including soybeans, corn and cotton.

■ *Separation of ownership and control and the potential for agency problems*

As is the case with BrasilAgro and Produzir, Agrifirma owners (shareholders) are not involved in the business. Each majority shareholder (Genagro and BRZ) appoints two directors to the Board, which also has three seats for independent directors. The board of directors meets on a quarterly basis to set policy and monitor business performance, but they are not involved in managing the business. Despite not being a listed company, Agrifirma follows corporate governance rules in terms of transparency and disclosure to minimize conflicts of interest between shareholders and senior management.

■ *Organizational architecture*

The corporate structure based in São Paulo is comprised of the board of directors and a senior management team of 4 professionals (CEO, CFO, COO and legal counsel) assisted by support staff. The firm estimates that this corporate structure costs about USD 60 per hectare and serves the purpose of providing a governance structure to attract investor capital at low cost. As the firm grows with the acquisition of more farmland, this corporate cost is expected to be diluted. 'Our corporate costs are heavy given the current size of our farming operations. This is why growth is crucial for Agrifirma in the future,' according to Fabiano Costa, the CFO.

The COO, Rodrigo Rodrigues, oversees all farming operations conducted in the three clusters in western Bahia. The field staff includes 30 managers responsible for basic administrative functions (e.g. human resources, accounting, finance, commercial, etc.) and 450 farm managers and workers. Each farm cluster is managed by one farm manager, who reports directly to the COO. The organizational architecture at the farm level is very similar to BrasilAgro, including a hierarchical structure, formal budgeting and control

systems, and performance-based compensation. According to Rodrigo, the major challenge of Agrifirma is to recruit, develop and incentivize human resources.

> Agriculture is not a one-man show. You have to develop a good team to execute the business plan laid out by the board of directors. Unfortunately in Brazil, especially in remote frontier regions like western Bahia, talent is a scarce resource. It will take time, patience and commitment to form a team and an organizational culture focused on delivering results to shareholders.

Agrifirma estimates that overhead costs associated with farming operations are about USD 100-120 per hectare. According to Rodrigo,

> organizational architecture is the backbone of any large scale, corporate farming entity. It is a substitute for the personal ties and informal organization of traditional family farms. However, it takes time to develop because there is a learning curve. The difference is that formal organizational architecture is scalable. Once you make it work, there is no limit to how large you can grow.

4. Discussion

Table 4 summarizes the main organizational characteristics of the three case studies from the Brazilian cerrado. First, despite the fact that each firm adopts a different ownership structure, they all share the same common characteristic – the separation of ownership and control. The owners provide risk capital but are not involved in management decisions. The separation of ownership and control allows these large corporate farms to access risk capital from outside investors – e.g. capital markets, private equity firms – and to hire professional managers. However, it introduces conflicts of interest between owners and managers – i.e. the classic principal-agent problem.

The second organizational characteristic shared by corporate farms is that they adopt sound corporate governance practices, including a board with independent directors, the separation of the roles of Board Chair and CEO, and transparency. The objective of corporate governance is to assure investors that they will receive a return on investment (Shleifer and Vishny, 1997) and to minimize conflicts of interest between owners and corporate managers. Consequently, the firm is able to raise equity capital from investors at a lower cost.

A third common organizational characteristic is that corporate managers delegate operational decisions to farm managers and workers. Although discretion of farm managers might be limited by a budget and operational plan, there is significant scope for opportunistic behavior as pointed out in the literature (e.g. Allen and Lueck, 1998). Hierarchies, formal control systems, performance evaluation and incentive compensation are used in combination to mitigate such agency costs between workers, farm managers and corporate managers. In the case of the family-owned corporation Produzir, informal mechanisms based on personal relationships appear to complement more formal control mechanisms. It remains to be seen whether a strong corporate culture based on trust is a substitute or complement to formal organizational architecture.

Corporate governance and organizational architecture are necessary to reduce agency costs in corporate farms, but they cost money. In fact, they constitute fixed costs that are not found in the traditional family farm. Managers of these corporate farms are constantly monitoring such 'bureaucratic' costs (Williamson, 1991) on a per hectare basis and benchmark against competitors to keep them as low as possible. The presence of bureaucratic costs in corporate farms is a major incentive for them to grow to dilute these costs over more hectares.

In the broad spectrum of the institutionalist literature, J.K. Galbraith's vision of industrial corporations stands out as a particularly useful contrast with the organizational characteristics of Brazilian large farms. As in the case with corporations studied by Galbraith, the rise of large farms is enabled and impelled by the emergence of complex production technologies. Another similarity with Galbraith's story is that the large

Table 4. Summary of case studies.

	BrasilAgro	Agrifirma	Produzir
Ownership structure	• Publicly traded corporation • One majority shareholder	• Privately-held corporation • Controlled by 2 private equity funds	• Family-owned corporation • 6 family trusts are the only shareholders
Corporate governance	• Listed on BOVESPA new market • Chairman of the Board is not the CEO • 3 independent directors	• Company is not listed but follows best practices in corporate governance and transparency • Chairman of the Board is not the CEO • 3 independent directors	• Board comprised of 1 representative from each family plus 1 independent director • Board delegates management decisions to professional managers
Organizational architecture	• Team of professional managers runs the firm • Operational decisions delegated to farm managers • Discretion of farm managers limited by budget and operational plan • Clearly-defined performance goals • Incentive compensation	• Team of professional managers runs the firm • Operational decisions delegated to farm managers • Discretion of farm managers limited by budget and operational plan • Clearly-defined performance goals • Incentive compensation	• Team of professional managers runs the firm • Operational decisions delegated to farm managers • Organizational culture based on personal relationships • Introduction of benchmarking between operational units and incentive compensation to complement informal control mechanisms
Planted area (2014)	• 80,000 hectares	• 23,000 hectares	• 108,000 hectares

farm size and the complexity of technology led to a shift in the power structure away from owners toward professional managers, whom Galbraith designated as the 'technostructure'. These similarities are reflected in the first above-mentioned organizational characteristic related to the hiring of professional managers. It is also important to point out that the emergence of large corporate farms in the Brazilian cerrado is also a response to the strong competitive pressures (e.g. competition for land) and complexities (e.g. high transaction costs, pervasive market failures, inefficient credit markets, poor infrastructure and market volatility) of farming in the agricultural frontier, thousands of kilometers away from markets. The challenges of farming in the cerrado, coupled with the demise of most agricultural cooperatives in the 1990s, make it increasing difficult for the traditional family farm to survive and prosper.

In contrast to other institutionalists (e.g. Ayres, 1978; Berle and Means, 1932; Gruchy, 1972), Galbraith tended to assume a harmonious relation between the corporation and the technostructure, whose 'members seek to adapt the goals of the corporation more closely with their own; by extension the corporation seeks to adapt social attitudes and goals to those of the members of its technostructure' (Galbraith, 1967: 217). In addition, he did not see a serious conflict potential in the relationships between the technostructure and the workers. In Brazilian corporate farms, the potential for conflicts of interest and opportunistic behavior between owners, managers, and workers is apparently present but can be controlled through organizational characteristics related to corporate governance, organizational architecture and informal control mechanisms. While corporate governance installs a system of checks and balances to control the actual power of the 'technostructure', organizational architecture creates disincentives for workers to shirk from the careful fulfillment of their duties. It is noteworthy though that organizational architecture is by no means inconsistent with organizational culture based on accountability and trustful personal relationships, thus providing support for Galbraith's vision of the convergence of various individual goals within the corporation. Corporate managers' ambitions

to cut bureaucratic costs through constant production growth are indicative of the forces of circular cumulative causation, which likewise play a major role in Galbraith's evolutionary account of corporations.

5. Conclusions

Agricultural economists tend to frame their discussions of very large farms by the conceptual dichotomies of 'small size' versus 'large size' or family labor versus hired labor. The present paper informs the study of very large farms by invoking a further conceptual perspective inspired by American institutionalism and new institutional economics. According to this perspective, very large farms embody the supersession of the classic capitalist firm (i.e. the traditional family farm), resting on the identity of the owner-manager, by the corporate form based on the separation of ownership and control. As a result, large corporate farms face the critical challenge of coping with the potentially pervasive agency costs. Firms adopt different organizational architectures to cope with agency costs, including personal relationships and trust, delegation of decision making to farm managers, performance evaluation systems, incentive compensation programs and formal control mechanisms.

In line with the institutionalist perspective, the case studies from the Brazilian cerrado show the advance of agricultural technology to be a key determinant of the rise of very large farms. The key finding from the case studies is that complex technology not only necessitates large-scale corporate farming but also generates technical solutions to the potentially arising agency problems. In addition to the use of sound corporate governance and supply of outside capital, these solutions are presented by organizational architecture encompassing computer-aided accounting and budgeting systems, incentive-based compensation, clear definition of performance goals, as well as the delegation of operational decisions to farm managers. Paradoxically, a crucial outcome of organizational architecture is a culture of trust and accountability that is seemingly at odds with Allen and Lueck's (1998) assumption of opportunistic propensities of hired agricultural labor. Our case study findings lend empirical support to the institutionalist theory of self-enforcing technological imperatives but also call attention to the institutionalist concerns about their societal effects that may be particularly disruptive in rural areas.

Finally, our analysis informs the organization and management of large-scale farms. The introduction of new technologies and the opportunity to benefit from economies of scale and access external finance at lower cost to fund land development costs and production growth are the major drivers of the separation of ownership and control. Yet, farm managers need to be aware that capital providers require sound corporate governance practices and transparency, including board independence, the presence of external directors and the adoption of generally accepted accounting principles (GAAP) accounting rules. Additionally, farm managers must face the fact that agriculture requires the use of local, specific knowledge so that farm workers can quickly adapt agronomic practices to changes in local conditions. Large-scale farms, therefore, delegate decision-making authority to farm managers and workers, which introduces the classic principal-agent problem. The article describes some informal and formal organizational solutions that can be adopted by farm managers seeking to control this problem. While these solutions have proved to be quite effective so far, it is nevertheless well to remember that the emergence of large-scale corporate farms in Brazil is a recent phenomenon. Only time will tell if these solutions will remain effective in the longer term.

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