



Structural change in Brazilian agriculture

F. Bolliger FAO | Rome | Italy

DOI: 10.1481/icasVII.2016.pl3c

ABSTRACT

The paper presents prominent aspects of the changes in the structure of Brazilian agriculture. The purpose was to address the main structural changes found in Brazilian agriculture, based on census data. Data from the 1960 census and 2006 are compared. The general outline of the changes reflects the industrialization process of agriculture, where old functions are absorbed by upstream and downstream activities. It was argued that a complete view of the agriculture structure should refer to the overall agriculture value chain. The lack of data was then discussed, as well as the growing demand for statistics relating to the value chain, particularly those revealing the phenomena of integration and quasi-integration in agriculture.

Keywords: agricultural statistics, agricultural structure, Brazil

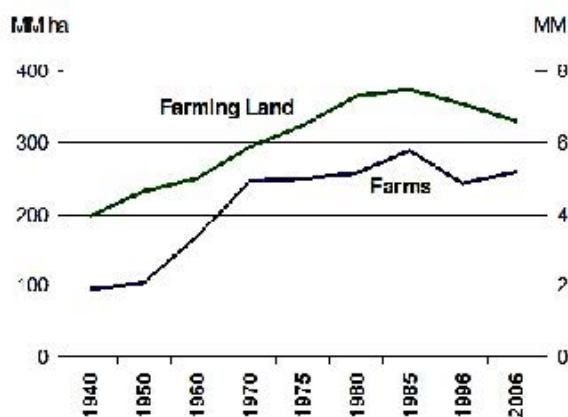
PAPER

1. Structural changes in Brazilian agriculture

Many changes in Brazilian agriculture are self-evident. They can be clearly associated with the modernisation and industrialisation processes of Brazilian agriculture that has seen a major boost since the 1960s.

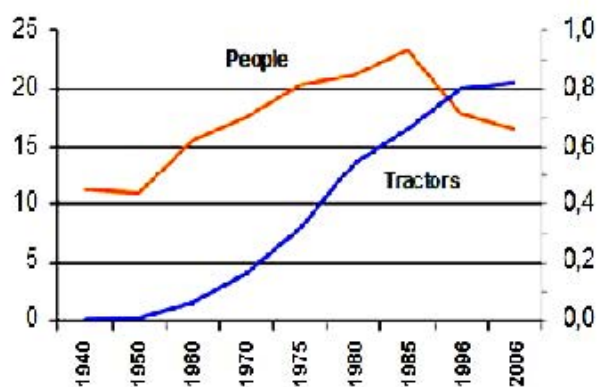
In this context the differences in scale are considerable: just considering the growth and size achieved in the activities developed there, in the course of the last fifty years. Since 1960, there was an increase in cattle herds threefold, daily production sixfold, poultry ninefold, grain production sevenfold and sugarcane production tenfold. This implied an increase of 33% in farming land, 2.7% in the cropping area, and 1.3% in pastureland, with almost another two million farms, the total number of which rose from 3.3 to 5.2 million. On the other hand, the contingent of people occupied in farming has dropped around one million from 16.6 to 15.6 million.

Graph 1: *Number of farms and farming land, Brazil, 1940-2006*



Source: IBGE – Censo Agropecuario

Graph 2: *People occupied and number of tractors, Brazil, 1940-2006*

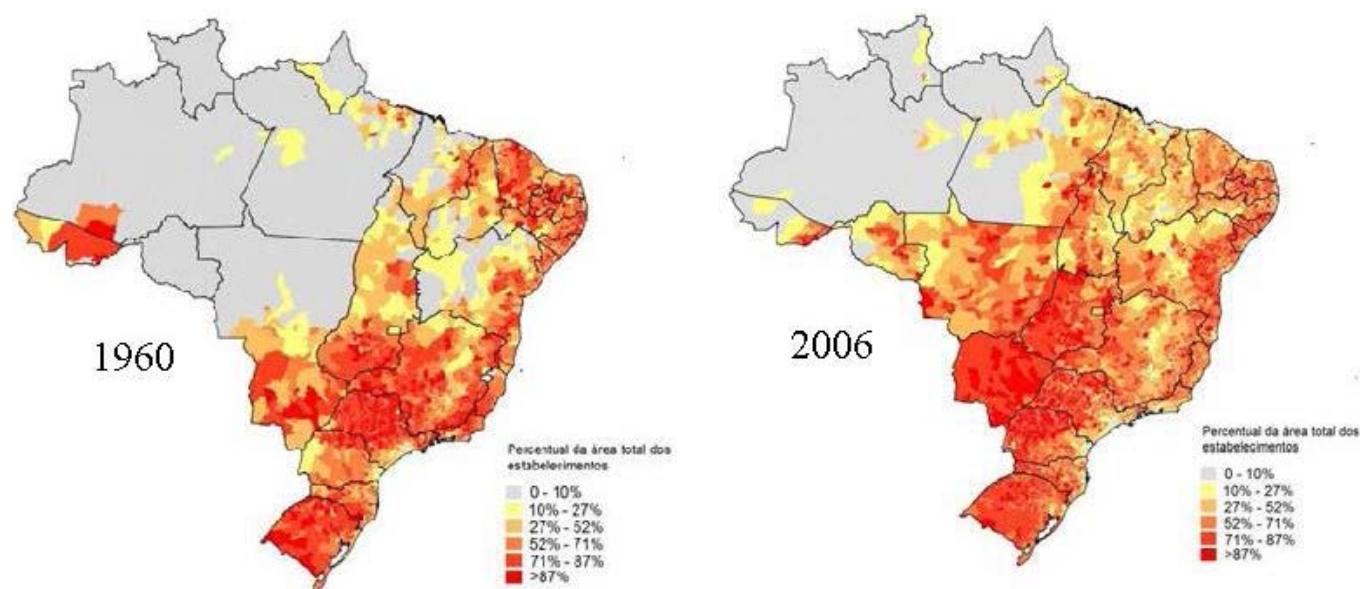


Source: IBGE – Censo Agropecuario

Expansion meant the addition of new areas and more intensified farm production. The following cartograms show changes observed in the density of agricultural exploration in national territory, noting the occupation of land by farming enterprises, intensity of cropping and cattle farming, as

well as the degree of mechanisation, expressed by the availability of tractors in relation to the total surface of each municipality. The same stratifications (legends) were used for 1960 and 2006, in order to demonstrate the changes. In 1960 large areas of land in Pará, Maranhão, Mato Grosso, Rondônia and even Bahia had a very low occupation per farming enterprise 1960, (less than 10%), and today they are considerably more appropriated and explored (Figure 1).

Figure 1 - Intensity of farming occupation - Brazil, 1960/2006



Source: IBGE – Censo Agropecuario

Note: Total area of farms over the land surface of the municipality (%).

The change in the pattern of Brazilian agriculture results in major changes to the production composition. For example, it is worth noting in the case of soybean today as one of the principal crops with 17 million hectares harvested in 2006, while in 1960 its area was not even considered worthy of census calculations. Also iconic is the fact that coffee plantations currently cover less than half the area covered in 1959.

The farming activity is still considerably concentrated in terms of space, conforming to the most suitable edaphoclimatic conditions. It is strongly intensified in São Paulo and South Brazil, especially in Paraná, with its agriculture even more concentrated in the northern part of the State and its amazing displacement towards the savannah regions, with important enclaves in Mato Grosso, Goiás and Bahia.

Intensification, displacement and spreading are much more noticeable in livestock farming. Its expansion over the last fifty years evidenced a major increase in its intensity over vast regions in Pará, Mato Grosso, Rondônia, Acre, Mato Grosso do Sul and Paraná, and the abandonment of certain regions with more profitable farming alternatives, as occurred in São Paulo. As figure 2 demonstrates, between 1985 and 2006 cattle farming was replaced by cropping in the regions more favorable to agriculture, and the intensity of both activities increases in the western and northern regions

In 2006, around 30% of farms used mechanical power for farmwork while in 1959 this percentage was scarcely more than 1%. Tractors were counted in tens of thousands and today are hundreds of thousands. In the 1960 Census, the investigated maximum power limit of tractors was 50 CV and in the 2006 Census the minimum limit was 100 CV. The types of equipment researched have diversified and almost doubled in number, considering that the current models have more power and in general are mechanically driven.

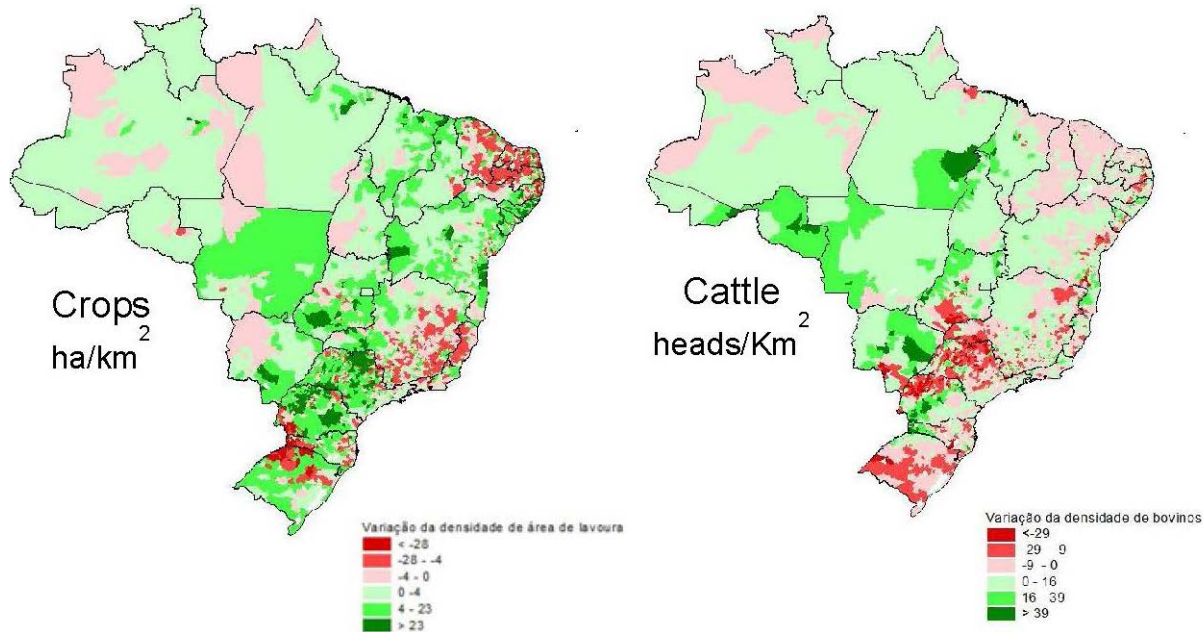
Figure 3 shows the generalisation of the tractor's presence in the Brazilian countryside today, compared to the shortage prevailing in the mid-20th century. It also illustrates that the use of mechanized farming, which had been confined basically to São Paulo, spread throughout the country, although it is still highly concentrated in that State and in southern Brazil.

The use of so-called modern inputs has definitely expanded. In 1960, 157,000 farms stated that they used chemical fertilisers while in 2006 no less than 1.3 million said that they used the input. So little was used that the 1960 Census did not even inform the number of farmers using insecticides and

fungicides, while in 2006 the farmers using agrochemicals totalled 1.4 million.

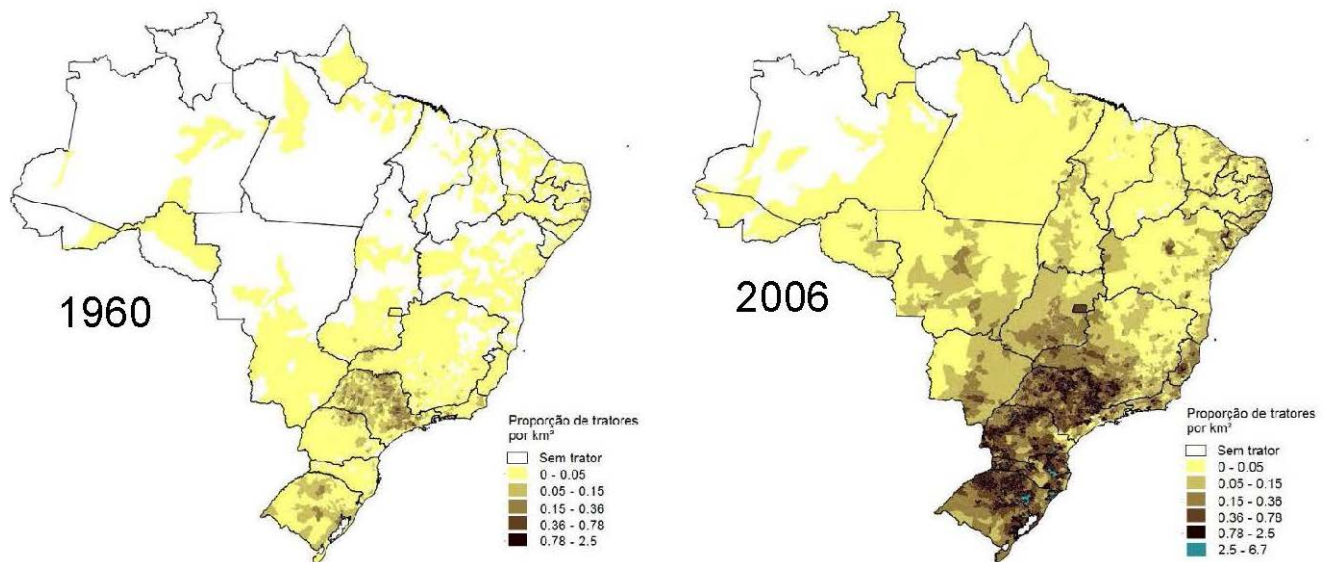
The increase in the quantities of farm instruments and agricultural inputs, whose use and availability, together with genetic improvement and the advance of agronomic techniques, explain the gains in productivity. The significant spread of some of them, due mostly to credit incentives and other farming policy instruments, has changed the aspects how Brazilian agriculture is perceived, today on a par with the world's state-of-the-art.

Figure 2 - Variation in the density of crops and cattle - Brazil, 1985-2006



Source: IBGE – Censo Agropecuario

Figure 3 - Intensity of mechanisation - Brazil, 1960/2006



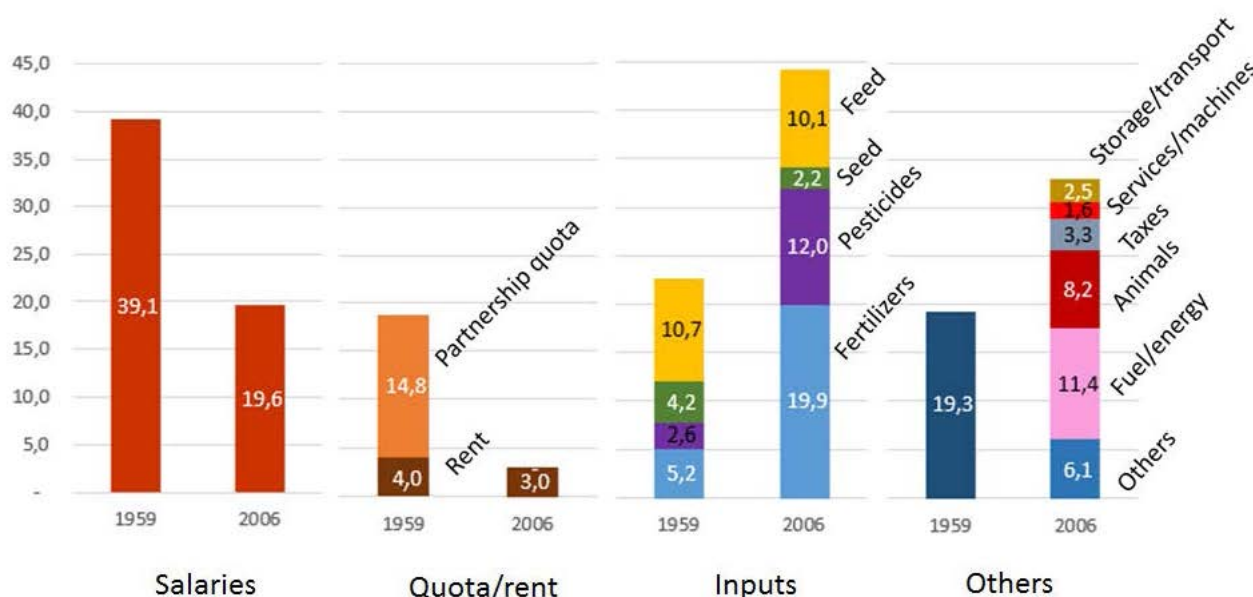
Source: IBGE – Censo Agropecuario

Note: Total number of tractors on the surface of the municipality (tractors/Km²)

The changes found in the spending pattern of farms illustrate the drastic alterations resulting from the modernisation process due to industrialisation of the production process (Graph 3). Wage expenditure, which had been the main item in expenses in 1959, representing almost 40% of the total, was now reduced to half that figure. The participation in the payment of share partners, which in 1959 was 14% of expenses, was reduced to a minimum. On the other hand, the share in inputs rose 20 percentage points, with emphasis on spending on fertilisers, correctives and agrochemicals, which were 12% of the

expenses in the mid-20th century and today they total 34% of expenditure of agricultural businesses. Moreover, other expenses such as, for example, electricity and fuel, animal procurement, storage and transport, taxation and financial costs have soared.

Graph 3 – Profile of farm expenditure – Brazil, 1959/2006



Source: IBGE – Censo Agropecuario

Major changes have also been observed in labour relations. Table 1 shows that fifty years later the contingent of occupied personnel in the a partnership relationship and another condition (residents and households), which was almost half the permanent personnel with no family ties to the farmer, has plummeted. This group, which in the past numbered the same as the permanent employees, is less than 10% today.

Table 1: Non-family permanent occupied personnel, Brazil 1960-2006

Categories	1960		2006	
	Abs.	%	Abs.	%
Non-family permanent personnel	2,801,534	100.0	1,494,957	100.0
Permanent employees	1,428,950	51.0	1,369,074	91.6
Partner / Partner employee	All	32.7	83,060	5.6
Other	916,039	16.3	42,823	2.9

Source: IBGE - Census of Agriculture

It is worth mentioning that wage-earning became more prevalent due to the drop in other forms of hiring labour, since the number of wage-earners in farming, both permanent and temporary, is lower today than half a century ago. The number of permanent employees calculated in the Census of Agriculture 2006 corresponds to 96% of those in the Census of Agriculture 1960, and only 76% of temporary employees.

Table 2: Number of farms by status of the person in charge, Brazil 1960-2006

Status of person in charge	1960	2006	Difference
Total	3,337,769	5,175,636	1,837,867
Owner	2,234,960	3,745,528	1,510,568
Settler farmer without definitive title deed	...	182,671	...
Leaseholder	327,136	221,587	-105,549
Partner	252,833	138,125	-114,708
Occupant	356,502	405,219	48,717
Administrator	166,236	227,487	61,251
Landless farmer	102	255,019	254,917

Source: IBGE - Census of Agriculture

The total number of farms in the same period increased 55%. And also in the other direction, the number of farms run by leaseholders and partner farmers has dropped, the latter diminishing to almost half of those in 1960 (table 2). The drop in the partnership and in households and residents and the increase in the use of modern technical resources occurred to a greater or lesser degree all over Brazil.

Brazilian agriculture has undergone major structural changes over recent decades, although with little change to the basic features of its constitution. Particularly with regard to the case of land distribution, a more basic structural characteristic of agriculture. In fact, despite the industrialisation of Brazilian agriculture, the pattern of inequality in land distribution has stayed very much the same. Since the 1960s the proportion of the very small and largest farms increases while the proportion of other categories decreases (see table 3), while the high value of the Gini index for land distribution was more or less stable over time, at around 0.85.

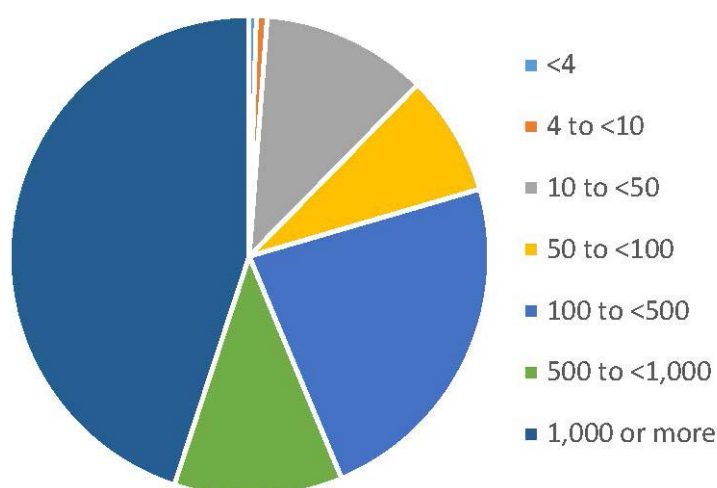
Table 3: Farms by size - Brazil, 1960-2006

Farms	1960	2006	Variation %
Number	3,333,746	4,920,617	47.6
Size (ha)	Distribution (%)		
<2	12.3	21.3	73.3
2 to <5	18.6	16.1	-13.4
5 to <10	14.0	12.9	-7.4
10 to <50	36.6	32.1	-12.1
50 to <100	8.2	7.9	-2.9
100 to <500	8.2	7.5	-8.5
500 to <1,000	1.2	1.1	-10.0
1,000 to <5,000	0.9	0.8	-1.5
5,000 or more	0.1	0.1	4.9
Total	100.0	100.0	...

Source: IBGE - Census of Agriculture
 Note: Landless farm holding is not included

Nowadays half the land in Brazil is managed in large farms over 1000 ha in size, and more than three quarters of the land belongs to farms over a 100 ha. The millions of small farms, as say, in the case of Brazil, with less than 10 ha, control a very **marginal proportion** of farm land (Graph 4tra). Moreover, three quarters of the land is managed by non-family farms and over 30% by hired managers.

Graph 4 – Farm land distribution, by size – Brazil, 2006



Source: IBGE – Censo Agropecuario

Alberto Passos Guimarães (1963) in the middle of last century foresaw the occurrence of the following processes: landownership concentration, small-scale landownership fragmentation, substitution of landholding crops for extensive cattle farming and the (slow) introduction of advanced techniques (chemical and mechanical) and of capitalist wage-earning. A situation reflecting the crises of the first half of the 20th century and the capitalist development of the country and Brazilian agriculture,

which mean the downfall of the old landownership system and the coming on stage (formation) of the “capitalist property”. Some iconic references in his work are the substitution of the *bangüê* (traditional sugarmills) by the central industrial plant and the emergence of the new “coffee barons”, converting landowners in millowners or “manufacturers”, concentrating land and offering better commercial, farming and industrial organisation. The majority that fail to pursue this path become suppliers, sell their land or take refuge in extensive cattefarming. If we assume the proxy suggested by Guimarães according to which the extreme classes of “less than five hectares” and “more than 1000 ha” represent the small-scale farms and large estates respectively, the process he indicated has followed its course.

Guimarães compared “two agricultures: export agriculture based on the large freehold estates, and subsistence farming based on capitalist ownership and on peasant ownership”, the former being a retrograde obstacle that must be overcome and the latter holding the keys to development (Guimarães, 1981, p. 208).

The movement of “capitalist transformations” as it was called at that time recalls a parallel with contemporary work that foresaw a “new phase” of Brazilian farming, according to which large-scale productive and technological efficiency is a requirement for the survival of farms: on one hand “a very small group of extremely able farmers” capable of accounting for the entire farm production, including exports and expanding their activities, and on the other “the vast majority of low-income farmers, ... small and medium in size”, whose development process will become “redundant” and, therefore, destitute and dependent on a public policy to survive (BUAINAIN et al, 2013, p.114).

It is worth mentioning that in the mid-20th century the partnership-based *latifundio* was predominant. The absentee landlord farmer would keep the countryside lagging behind and curb development. Although still incipient or restricted to certain regions, it was foreseeable that the freehold farmer and director of the modernising enterprise with capitalist relations would change the face of the Brazilian countryside.

Today, the modern freehold farmer predominates. New competitive demands appear to demand absolute liaison with markets and financial and technological capacity. Although embryonic, there are signs of corporate farmer protagonism or agricultural entrepreneur free from land ownership. The share owner is now the minority partner and, in addition to being absentee, is merely a rentier. The landowner, ditto, operates under contract regulations and standards in new partnerships (Bolliger, 2014)

The structural changes in Brazilian agriculture reflect the known industrialising process of agriculture. A phenomenon marked by so-called modernisation of agriculture with emphasis on mechanisation, agrochemicals, genetic improvement and, more recently, microinformation technology, telecommunications, genetic modification and biotechnology. New technologies are now seen to reach remote regions, different farming activities and large and small farms. In this process, primitive farming, characterised by fully integrated systems, has also undergone gradual disintegration of its functions, making way for an intricate supply chain of inputs and services (Rehber, 2000)

Added to this is the striking transformation process of the agrifood sector at a global level at which open markets have been replaced by strongly structured agrifood chains.

It is acknowledged that the combination of these kinds of changes is associated with a trend toward greater professionalism in conducting the different productive segments of agriculture in Brazil. On one hand, the displacement of the former large landowner, holder of large explored areas with low productivity and, on the other, larger numbers of small farmers integrated in market, or through agroindustrial businesses or public policies.

Therefore, today the farming structure can no longer be addressed without reference to agribusiness or, more specifically, the agricultural value chain. This is clearly true for Brazil: some of the biggest agroindustrial enterprises are Brazilian and a large part of the top global corporations operating in the agroindustrial chain are present in Brazil. However, as we will see below, it seems to be the same in most countries.

These facts were once linked to the well-known phenomenon of a change in the profile of demand and marketing process of agricultural production verified over the past century when direct selling to the consumer and middlemen and commercial networks lost ground to the agroindustries, cooperatives and more recently to supermarket chains.

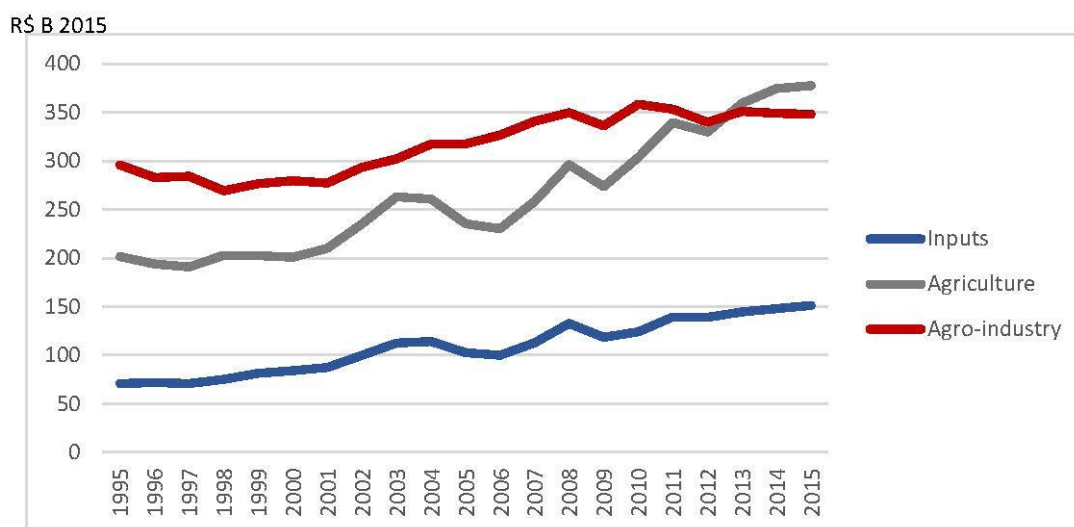
2. Brazilian agricultural value chain data

National Accounts present a set of concepts and data fully in favour of preparing analyses relating to the value chain. There are many studies therefore on the topic based on the national accounts relating to dimensioning and dynamics of the agricultural chains and complexes and on the economic relationships between sectors and sub-sectors of the activity, particularly analysing the effects of backward and forward linkages in the matrix of inter-industrial relationships.

The most commented data by analysts and policy drivers merely concern the relevance of the overall agrifood chain whole. The aim is to highlight the importance of the set of related activities, very often with political motivation and not uncommonly with some exaggeration .

The IBGE, the institute responsible for Brazilian official statistics, has never adopted the task of creating satellite accounts related to the agroindustrial complex. The Advanced Studies Centre in Applied Economics (CEPEA, ESALQ/USP) demonstrates a series of data for the Agribusiness GDP, which goes back to 1995 and is regularly updated, based on national accounts data. Countless studies are being carried out in the country to analyse the relationships and dynamics of the Brazilian agroindustrial complex based on the same data. Their main restriction concerns the level of aggregation provided by the accounts data. Given the nature of the national accounts data, the information is simply too clustered. Efforts have been made to obtain estimates with pieces of interest, such as, for example, the book on the Family Farming GDP (2007), published by the Ministry of Land Development, but which inevitably depend, however, on many assumptions.

Graph 5 – Value added - Agribusiness – Brazil, 1995-2015



Source: USP-CEPEA

On the other hand, a multiplicity of studies on particular agroindustrial chains and/or regional segments of specific chains are undertaken by university centres and economic research institutes. Many of them analyse in detail the relationships and functioning of the links in the chain, collecting their own data. In general, with firm basis on qualitative research, many are quite restricted case studies. Important ones can be found in an Agribusiness Studies Centre named PENSA at the University of São Paulo and others in the Contract Framing Resource Centre maintained by FAO .

Therefore, a complete view of the farming structure now requires the broader perspective of the production chain in which it is incorporated: in actual fact, both services and flows downstream and upstream from agriculture. In the literature on agricultural economy, this view is provided by analysing the agricultural value chain. However, official statistics have yet to follow the same path.

REFERENCES

Bolliger, F (2014) Brasil agropecuário: duas fotografias de um tempo que passou, in: O mundo rurak no Brasil do século 21: a formação de um novo padrão agrario e agricola. Brasília: Embrapa. Available at: https://www3.eco.unicamp.br/nea/images/arquivos/O_MUNDO_RURAL_2014.pdf [accessed Oct 12, 2016].

Bolliger, F. (2016) Income Generation in the Perspective of Effective Demand and its Measuring. (Unpublished). Available at: https://www.researchgate.net/publication/311367099_INCOME_GENERATION_IN_THE_PERSPECTIVE_OF_EFFECTIVE_DEMAND_AND_ITS_MEASURING [accessed Dec, 2016].

GUIMARÃES, A. P. (1963) Quatro séculos de latifúndio. Rio de Janeiro, Paz e Terra.

GUIMARÃES, A. P. (1981) Quatro séculos de latifúndio. 5ª ed. Rio de Janeiro, Paz e Terra, 1981. 255p. (Estudos brasileiros, v. 24)

PIB Agro CEPEA-USP/CNA. Centro de Estudos Avançados em Economia Aplicada - Esalq/Usp. Availible from: <http://www.cepea.esalq.usp.br/pib/> [accessed Oct 12, 2016]

PIB da Agricultura familiar : Brasil-Estados. Brasília : MDA, 2007. 172 p. (NEAD Estudos 19).