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DISCUSSION PAPER

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AGRICULTURE IN BRAZIL'S SOUTHEAST REGION: LIMITATIONS AND FUTURE CHALLENGES TO DEVELOPMENT

César Nunes de Castro



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AGRICULTURE IN BRAZIL'S SOUTHEAST REGION: LIMITATIONS AND FUTURE CHALLENGES TO DEVELOPMENT

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Federal Government of Brazil

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DISCUSSION PAPER

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ABSTRACT

Much of the recent dynamism of the Brazilian agricultural sector occurred in activities developed in Brazil's South, Southeast and Midwest regions. Specifically, the Southeast region was responsible in 2006 for approximately 34% of the value of agricultural production according to data from the 2006 Agricultural Census. The aim of this study is to assess the recent situation of agriculture in the Southeast, based on data from the 2006 Agricultural Census. Based on this diagnosis, the study aims to identify constraints to agricultural development in the region and discuss measures that can contribute to the expansion of regional agricultural production with the generation of jobs and income for the population. Among these may be mentioned some measures: improvement in logistics infrastructure; social development of rural areas through mechanisms of generating income for family farmers; the agricultural research in the region needs to provide solutions for further development of farming, promotion of productive associations, among others.

Keywords: agriculture; livestock; Southeast region; development.

SINOPSE

Grande parte do dinamismo recente do setor agropecuário brasileiro ocorreu em atividades agropecuárias desenvolvidas nas regiões Sul, Sudeste e Centro-Oeste. Especificamente, a região Sudeste foi responsável em 2006 por aproximadamente 34% do valor da produção agropecuária de acordo com dados do Censo Agropecuário 2006. O objetivo deste estudo é avaliar a situação recente da agricultura na região Sudeste, com base nos dados do Censo Agropecuário 2006. A partir desse diagnóstico, o estudo objetiva identificar limitações ao desenvolvimento da agricultura na região e debater medidas que possam contribuir para a ampliação da produção agrícola regional com geração de empregos e renda para a população. Entre essas medidas algumas podem ser citadas: melhoria na infraestrutura logística; desenvolvimento social do meio rural por meio de mecanismos de geração de renda para os agricultores familiares; e a rede de pesquisa e inovação agropecuária na região precisará fornecer soluções para o desenvolvimento da atividade agropecuária como um todo num cenário de crescente escassez de determinados recursos naturais essenciais para a atividade, como provavelmente será o caso da água, a promoção do associativismo produtivo, entre outros.

Palavras-chave: agricultura; pecuária; região Sudeste; desenvolvimento.

1 INTRODUCTION

Historically, the Brazilian agricultural sector was responsible for the colonization of most of the national territory and driving element, until the 1930s, of the national economy. From that decade, Brazil adopted as a national development strategy the industrialization of the country in a period that coincided with the decline of the agricultural sector's participation in the definition of Brazil's economic course. Despite this structural reorganization of the Brazilian economy during the twentieth century, in recent decades agricultural production in Brazil grew significantly through increase in productivity due to technological changes made to the production system and through the incorporation of new production areas to those already explored.

Much of the recent dynamism of this sector occurred in agricultural activities developed in the South, Southeast and Midwest regions of Brazil. In 1995, for example, Brazilian regions share were in the total volume of the agricultural sector: North – 4,8%; Northeast – 14,7%; Midwest – 14,3%; Southeast – 34,6%, and South – 31,4%. These data reveal the concentration in the latter two regions of more than 70% of the Brazilian agricultural production.

More recently, in 2006, the Southeast region was responsible for approximately 34% of the value of agricultural production according to data from the 2006 Agricultural Census (IBGE, 2009). Such share, approximately one third of the national agricultural production, is due to the presence of some of the largest Brazilian agricultural supply chains in the region, such as sugar cane, coffee and orange. The sole value of regional sugar cane production in 2006 exceeded the amount of R\$ 12 billion (approximately US\$ 5.8 billion as of September 2013).

The aim of this study is to assess the recent situation of agriculture in the Southeast using on data from the 2006 Agricultural Census. Based on this diagnosis, the study aims to identify constraints to agricultural development in the region and discuss measures that can contribute to the expansion of regional agricultural production with the generation of jobs and income for the population. This study follows the same structure of the work of Castro (2012a) on agriculture in the Northeast, Castro (2013a) on agriculture in the North and Castro (2013b) on agriculture in the Midwest regions of Brazil.

To achieve the proposed objectives, the text is divided into three sections, besides this introduction. The second section makes a brief diagnosis of regional agriculture. The third section debates issues that constitute constraints to agricultural development in the region, such as environmental issues, disability logistics, technological backwardness, lack of credit, lack of technical assistance, among others. The fourth section discusses some policies which can help overcome bottlenecks that impede further regional agricultural development.

2 AGRICULTURE IN THE SOUTHEAST: PRESENT

In the Southeast Region is developed the most successful and profitable agricultural production in Brazil. A region of early settlement, along with the Northeast, in Brazil's the importance of agricultural activities for the development of regional economy began to grow from the nineteenth century with the expansion of coffee plantations throughout the region. Unlike the Northeast, where since the beginning of colonization in the sixteenth century agriculture demonstrated its major role in the economy, with the implementation of the sugar cane industry, in the Southeast in the early centuries of colonization agricultural activities played a secondary economic role, growing subsistence food genres for maintenance of main economic activities such as mining of precious metals.

In the early nineteenth century, the coffee plantations in a period of a few decades radically changed Brazil's economy in a regional and national level, occupying the post of chief Brazilian export. The beginning of coffee cultivation occurred in the state of Rio de Janeiro but soon the epicenter of this new economy would be formed by the state of São Paulo, whose capital São Paulo was raised in the process from a modest provincial town to a growing metropolis inserted in the emerging national and international economic and financial network. From the state of São Paulo the coffee plantations spread throughout the nineteenth and twentieth century to the states of Minas Gerais and Espírito Santo. In the twentieth century, the presence of the coffee plantations in the state of São Paulo decreased, especially after the 1929 crisis. During this time Minas Gerais and Espírito Santo gradually assumed the position as the largest producers of coffee. In the state of São Paulo, in the same period, partially replacing areas previously occupied by coffee plantations emerged the sugar cane and orange crops.

To better understand current regional agriculture in Tables 1 and 2 are presented some data on the Southeast region's agriculture, for example, the occupied area and employed personnel (Table 1) and value of production of major crops (Table 2). This brief statistics subsidize the discussion to be held in sections 3 and 4 of this work. Whenever possible, the data will make a distinction between small farming (or family agriculture as it is called in Brazil) and agribusiness or large-scale farming in an attempt to demonstrate the importance of family farming¹ in the region. The definition of family farming used in this work is that of the Federal Government in accordance with Law 11,326 of 2006 (Presidency of the Republic, 2006). In it a family farmer (or small farmer, or small farming) is defined in the following manner:

Article 3 - For the purposes of this Act, the definition of family farmers and enterprising rural families those who practice activities in rural areas serving the following requirements:

I - does not hold in any capacity area greater than four (4) fiscal modules;²

II - uses mostly hand labor of their own family in the economic activities of their establishment or undertaking;

III - have minimum percentage of household income arising from economic activities of their establishment or enterprise, as defined by the Executive Power (Amended by Law No. 12,512 , 2011);

IV – manages their agricultural establishment or enterprise with their family.

1. Throughout this paper the terms small farming and family farming will be used indistinctively.

2. Fiscal module is an unit of agrarian measure used in Brazil which is defined by each municipal authorities and takes into account in its definition such criterion as the most common land use type existing in the municipality, the income generated by the most common land use and the concept of family property.

TABLE 1

Number of agricultural farms, area and personnel employed in agriculture and livestock production, small farming and agribusiness, in the Southeast region (2006)

State	Number of agricultural farms		Total area of agricultural farms (ha)		Personnel employed in the farms		
	Total	Small farms	Total	Small farms	Small farms	Agribusiness	Total
São Paulo (SP)	227,594	151,015	16,701,471	2,506,118	328,177	582,628	910,805
Rio de Janeiro (RJ)	58,480	44,145	2,045,867	470,221	91,884	65,788	157,672
Minas Gerais (MG)	551,617	437,415	32,647,547	8,845,883	1,177,116	719,808	1,896,924
Espírito Santo (ES)	84,356	67,404	2,838,178	966,797	202,169	115,390	317,559
Southeast	892,049	699,978	54,236,169	12,789,019	1,799,346	1,483,614	3,282,960
Brazil	5,175,489	4,367,902	329,941,393	80,250,453	12,730,966	2,666,296	16,567,544

Source: IBGE – Agricultural Census 2006. Drafted by the author.

Approximately 19% of the total area of agricultural establishments in the region is occupied by small farmers. This index, indicator of agrarian concentration varies from 15% for the state of São Paulo to 34% for the state of Espírito Santo. Noteworthy is the balance between the number of people employed in large scale agriculture³ and family farming in the region, quite different from what occurs in the case of Brazil as a whole (Table 1). About 55% of the staff employed in large scale farming in 2006 in Brazil worked in the Southeast, mainly in the states of São Paulo and Minas Gerais. One possible explanation for this is the large presence of permanent crops in those states with intensive use of non-skilled labor as is the case of orange, in São Paulo, and coffee, in São Paulo, Minas Gerais and Espírito Santo. In Table 2, the main agricultural products in the Southeast in terms of production value are presented.

3. Large scale farming and agribusiness will be used indistinctively as the same concept throughout the text.

TABLE 2
Production value (PV) and produced quantity of selected agricultural and livestock products in the Southeast (SE) (2006)

Product	Produced quantity in the Southeast		PV SE (x 1,000 R\$)	PV Brazil (x 1,000 R\$)	Main producer state in the SE	PV in the main producing state (x 1,000 R\$)
	Quantity	Unit				
Swine (sold)	5,657,883	Number of animals	739,468	4,335,268	MG	485,070
Corn grain	8,176,685	tons	2,383,539	11,362,642	MG	1,567,535
Soybean grain	2,414,332	tons	1,122,307	17,141,485	MG	765,382
Chicken (sold)	787,328	Number of animals (x 103)	2,106,975	5,727,570	SP	1,515,808
Colored beans	370,845	tons	345,729	1,066,803	MG	240,996
Fish (aquaculture)	22,124,139	Kg	94,011	407,281	SP	53,036
Sugar cane	259,316,089	tons	12,417,276	19,706,121	SP	10,824,219
Manioc	1,318,159	tons	287,604	3,686,632	SP	127,961
Cow's milk	7,608,176	1,000 liters	3,457,747	8,817,536	MG	2,532,881
Cheese	48,806	tons	185,660	411,018	MG	157,116
Arabica coffee	1,610,653	tons	6,543,494	7,356,140	MG	5,223,848
Canephora coffee	340,724	tons	912,894	1,210,159	ES	732,490
Roundwood for paper	13,653,000	m ³	190,847	405,308	SP	110,261
Roundwood for multiple use	13,669,000	m ³	184,284	780,199	SP	81,985
Cattle sold for breeding, rearing and fattening	2,455,255	Number of animals	1,287,759	5,282,311	SP	685,268
Cattle (male and female) with more than 24 months sold to slaughter	2,386,179	Number of animals	1,580,737	8,695,809	SP	759,479
Orange	10,199,480	tons	3,134,404	4,250,858	SP	3,037,244

Source: IBGE (2009). Drafted by the author.

The main agricultural products of the region are, in descending order, sugar cane, arabica coffee, cow milk and orange. The production of sugar cane and orange is mainly located in the state of São Paulo, the Arabica coffee is mainly concentrated in Minas Gerais and cow's milk production is spread throughout the region.

The data in Table 3 shows the total family farming and agribusiness production values in the four states of the region. While family farming has great participation in terms of number of establishments and employed personnel in the establishments (Table 1), with respect to their total production value share it is still low, around 24,3% in average for all the states of the region. While this share is approximately 15,8% in Sao Paulo it is almost 50,0% in Rio de Janeiro. With respect to products which account for most of the value of regional agricultural production, these include arabica coffee first and cow's milk in second. According to Pires (2013), family farming in the Southeast region accounts for 16% of total family farming establishments in Brazil, 15% of the area of such establishments and 20% of the gross value of production of the Brazilian family farming.

TABLE 3
Total production value (PV – measured in Brazilian Reais – R\$) of small farms and agribusiness and PV of selected small farming products in the Southeast (2006)

State	Production value				
	Total agricultural and livestock production in the Southeast (R\$ 1,000)		Small farms selected products (R\$)		
	Small farms	Agribusiness	Agricultural or livestock product with the biggest PV in the state	Agricultural or livestock product with the second biggest PV in the state	Agricultural or livestock product with the third biggest PV in the state
São Paulo	4,042,681	21,480,694	281,650,600 (corn grain)	232,436,810 (milk)	204,356,959 (arabica coffee)
Rio de Janeiro	622,111	625,773	72,097,030 (milk)	21,480,975 (manioc)	13,096,421 (arabica coffee)
Minas Gerais	5,966,845	12,872,422	1,506,681,207 (arabica coffee)	1,104,870,075 (milk)	691,317,018 (corn grain)
Espírito Santo	1,056,753	1,286,527	368,905,567 (canefora coffee)	193,046,398 (arabica coffee)	57,907,314 (milk)
Southeast	11,688,390	36,265,416			

Source: IBGE (2009). Drafted by the author.

Regarding the use of land in the properties, considerable area is destined for permanent crops in the states of São Paulo, Minas Gerais and Espírito Santo. This occurs

because of the diffusion of orange and coffee crops in those states. Specifically in Espírito Santo, the area for permanent crops is almost four times the area for temporary crops (Table 4). With regard to grazing, there is a slight predominance of pastures planted in good condition compared to grasslands.

TABLE 4
Land use in agricultural farms in the Southeast by type of use (ha)

State	Crops				Pastures		
	Permanent	Temporary	Harvesting fodder	Flower cultivation ¹	Grassland	Degraded planted	Planted in good condition
São Paulo	1,682,687	4,940,725	200,214	52,965	2,866,980	314,329	3,717,679
Rio de Janeiro	77,223	193,451	76,796	1,963	653,134	41,028	588,148
Minas Gerais	1,713,511	2,769,023	704,054	8,178	7,213,321	1,223,159	9,603,295
Espírito Santo	565,685	160,798	24,066	1,445	120,019	74,605	1,145,447
Southeast	4,039,106	8,063,997	1,005,130	64,551	10,853,454	1,653,120	15,054,569
Brazil	11,612,227	44,019,726	4,114,557	100,109	57,316,457	9,842,925	91,594,484

Source: IBGE (2009).

Note: ¹ Area for flower cultivation (including hydroponics and plasticulture), seedlings nurseries and greenhouses.

With respect to the use of land for permanent preservation areas (PPA) or legal reserve, there is a difference in the states of the region in terms of the percentage of area destined for PPA or legal reserve with respect to the total area of farming in each state. While this percentage for Brazil is 15,20% in the Southeast it is equal to 10,92%, ranging from 7,9% in the case of São Paulo to 12,6% in the case of Minas Gerais. Compared to other Brazilian regions (Castro, 2012a; Castro, 2013a; Castro 2013b) these percentages are low and indicate the environmental liabilities of the farms and of the agricultural sector in the region as a whole. Whereas only the area destined to legal reserve on a farm should be, by law, at least 20% of the total area of the property, these percentages clearly indicate the non-compliance across the region to environmental laws.

TABLE 5
Land use in agricultural farms in the Southeast region by type of use (ha)

State	Woods			Agroforestry (ha)	Aquaculture (ha)	Degraded lands (ha) ¹
	Allocated to PPA or legal reserve (ha) / total area of the agricultural farms	Woods and/ or natural forests (ha)	Planted forests with natural essences (ha)			
São Paulo	1,333,477	429,544	370,114	115,465	63,604	16,240
Rio de Janeiro	177,904	102,479	13,879	15,812	15,663	3,168
Minas Gerais	4,145,557	2,088,718	978,633	819,093	94,831	98,406
Espírito Santo	266,042	133,597	186,354	14,595	16,801	4,182
Southeast	5,922,979	2,754,337	1,548,982	964,964	190,899	121,996
Brazil	50,163,102 / 15,20	35,621,638	4,497,324	8,197,564	1,319,492	789,238

Source: IBGE (2009).

Note: ¹ Eroded, desertified, salinated.

On livestock, Table 6 presents information on the effective herd of the most commonly bred species in the region. The number of cattle, pigs and poultry are especially significant.

TABLE 6
Effective livestock in the Southeast in 31/12/2006

	Livestock effective (number of animals)			
	Cattle	Sheep	Swine	Poultry (x1000)
São Paulo	10,433,021	490,029	1,562,282	282,901,447
Rio de Janeiro	1,924,217	44,061	113,433	12,779,222
Espírito Santo	1,791,501	33,558	227,107	23,776,344
Minas Gerais	19,911,193	226,739	3,329,671	117,713,432
Southeast	34,059,932	794,387	5,232,493	437,170,445
Brazil	171,613,337	14,167,504	31,189,339	1,401,340,989

Source: IBGE (2009). Adapted by the author.

3 AGRICULTURE IN THE SOUTHEAST: LIMITATIONS

In this section, we analyze the main current limitations to agricultural development in the Southeast, including disability logistics, technological backwardness, lack of credit, lack of technical assistance, among others. Table 7 presents the number of establishments that use sustainable farming practices. The use of such practices has positive impacts such as the preservation of natural resources (soil for example) and in many cases higher

productivity per area of cultivated plants. Of the approximately 892,000 agricultural establishments in the region (Table 1), almost half (423,755, Table 7) do not use any agricultural practices listed in Table 7. No use of none of these techniques may lead to more rapid degradation of an area and thus impact on the profitability of farm production. For example, two practices that can benefit the most cultivated plant species, crop rotation and fallow land or rest are not widely used in the region.

TABLE 7

Agricultural practices used in farms in the Southeast Region by practice type

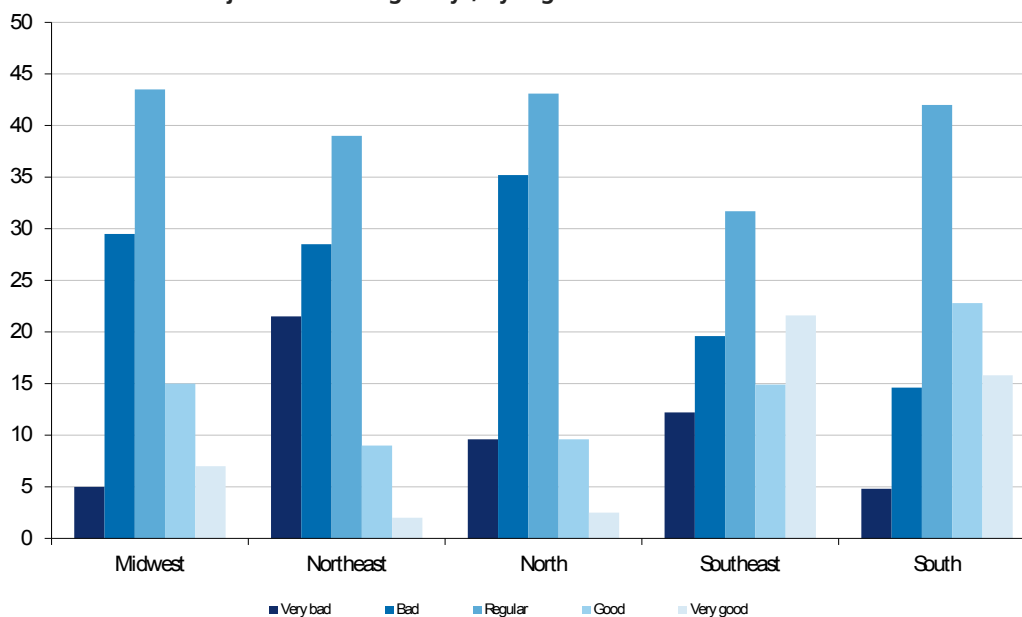
UF	Leveled planting	Use of terraces	Crop rotation	Use of crops for pasture recovery	Fallow soils	Crop or pasture burning	Slopes protection and/or conservation	None of the mentioned agricultural practices
São Paulo	102,770	22,950	21,064	12,504	9,302	4,647	19,125	99,181
Rio de Janeiro	13,917	619	8,243	2,518	2,784	1,567	1,929	33,714
Minas Gerais	187,386	15,789	45,681	34,238	29,710	15,457	47,861	263,663
Espírito Santo	45,563	928	10,606	3,415	4,665	776	8,894	27,197
Southeast	349,636	40,286	85,594	52,675	46,461	22,447	77,811	423,755
Brazil	1,513,860	194,104	641,071	270,987	331,554	702,025	296,915	2,176,757

Source: IBGE (2009).

In addition to problems related to the environmental impacts of agriculture, there are several other limitations to the further development of these activities. Among them, a serious impediment to the competitiveness of agriculture in Brazil as well as in the Southeast, is the cost of transporting goods in the country. The National Confederation of Transport (CNT in the Portuguese acronym) and the Center for Logistics (CEL) of COPPEAD - UFRJ (Federal University of Rio de Janeiro) conducted a diagnostic study of freight transportation in Brazil and identified an area in critical condition and unsustainable in the long term, if no actions are taken to reverse this situation. The dimensions used to measure the efficiency of freight transportation were: economic, transport supply, safety, energy and environment (CNT/UFRJ, 2008). The rail and waterways are appointed by experts as the most suitable for agriculture (Wanke and Fleury, 2006). However, although highway freight is the most expensive (because of the long distances and precarious roads), this mode of transport of agricultural products is the most used in the country. Since the 1950s, Brazilian governments gave priority to the development of highways, justified by smaller investments and greater flexibility (door to door service).

Only 35% of waterways are effectively used for transportation due to lack of interventions in rivers and construction of onshore infrastructure (waterway terminals). One of the factors that influence the small use of the rivers as a viable cargo transport option is the delay in the resolution of issues related to the environmental impacts of waterways. According to a study conducted by IBP/UFRJ (2007), most of the highways in Brazil is in conditions that can be classified among fair, poor and very poor, the best conditions are observed in the Southeast, and the worst in the Northern region, as shown in Figure 1. Despite being the region, along with the South, in which the roads were evaluated to be relatively in best condition, still about 30% of the main Southeastern highways were assessed as being in poor or very poor conditions.

FIGURE 1
Condition of major Brazilian highways, by region

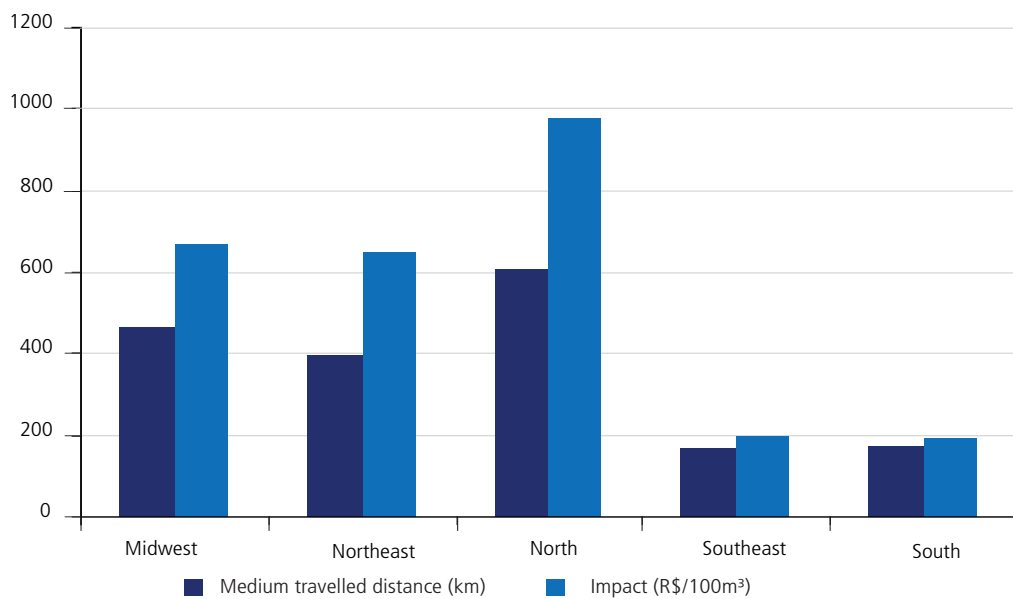


Source: IBP/UFRJ, 2007. Adapted by the author.

The poor condition of highways has great impacts on transportation costs. In relation to fixed costs (average vehicle speed reduced from 50 Km/h for highway's with good pavement conditions to 20km/h on bad conditions, allowing the conclusion of fewer trips per period) the impact is approximately 18% of the total cost. In relation to variable costs (higher spending on tires, lubricants, fuel and maintenance) the impact generated on freight is about 8% of the total cost (IBP/UFRJ, 2007).

The same study (IBP/UPRJ, 2007) also calculated the impact of fixed and variable costs considering distances to travel to different regions of the country. The results are shown in Figure 2. In this figure, it can be observed that when the conditions are better for road maintenance (Southeast and South) there is a closer relationship between costs and average distance. For the other regions, inadequate maintenance of roads has an impact on the higher costs, and without very direct relationship to the distance traveled.

FIGURE 2
Impact highway condition in freight costs
(In R\$/100 m³)



Source: IBP/UFRI, 2007. Adapted by the author.

Other frequent limitations of agriculture in the Southeast refers to technological aspects. In Tables 8 to 11, many examples of technological limitations will be addressed. With respect to the practice of fertilization (Table 8) of 892,000 properties of the region, about 50% do not apply fertilizers. Although this percentage is lower than that observed for the Northeast (Castro, 2012a), North (Castro, 2013a) and Midwest (Castro, 2013b) it is still high. The soils of the region have, on average, better natural fertility than Midwest, North and Northeast's soils yet they are not high fertility soils that support plant crops with higher yields without the addition of fertilizer. Thus, it is reasonable to assume that almost 50% of the establishments do not employ any kind of

fertilization of the land a considerable part of these would have positive impacts from existing fertilization alternatives.

TABLE 8
Farms with declaration of fertilizer use by type of fertilizer used in the Southeast (2006)

State	Farms with declaration of fertilizer use					
	Total ¹	Fertilizer type				
		Chemical nitrogen fertilizer	Non chemical nitrogen fertilizer	Manure and/or animal urine	Green fertilization	Uses, but didn't have to in 2006
São Paulo	115,977	102,387	15,967	30,718	3,540	14,389
Rio de Janeiro	23,849	16,358	3,293	14,562	1,216	1,529
Minas Gerais	251,922	206,746	46,172	89,526	3,754	17,637
Espírito Santo	56,811	52,946	8,879	11,901	523	2,541
Southeast	448,561	378,439	74,312	146,707	9,043	36,096
Brazil	1,695,246	1,325,838	244,733	627,930	139,191	143,322

Source: IBGE (2009).

Note: ¹ Including the ones that declared more than one product.

Another indication of a relative technological backwardness is represented by the number of agricultural establishments that have produce storage infrastructure in the region. According to IBGE (2009) 310,257 agricultural establishments produced a total of approximately 7.6 billion liters of cow milk in 2006, although only 33,377 establishments had milk cooling tanks in the same year with a total capacity of only 46 million liters (Table 9). This deficiency of milk storage infrastructure affects the marketing of the product, reducing the maximum period of storage without loss of quality.

TABLE 9
Number of farms which possess forage silos, grain storage silos and tanks for cooling milk in the Southeast (2006)

	Forage silos		Grain silos		Milk cooling tanks	
	Farms	Capacity (litres)	Farms	Capacity (litres)	Farms	Capacity (1,000 litres)
São Paulo	6,883	1,334,904	20,624	2,264,172	4,917	6,414
Rio de Janeiro	1,022	102,129	1,659	45,775	1,522	2,186
Espírito Santo	815	35,823	20,205	519,736	1,243	1,856
Minas Gerais	38,040	7,225,790	112,830	3,219,741	25,695	35,572
Southeast	46,760	8,698,547	155,318	6,049,425	33,377	46,029
Brazil	153,972	17,247,432	672,941	26,544,993	145,595	115,297

Source: IBGE (2009).

Regarding the availability of tractors, indicative of the degree of investment in productive capital of agricultural establishments, of the 892,049 establishments in the region (Table 1) only approximately 17% (154,707, Table 10) had at least one tractor in 2006. This percentage, though higher than in the North and Northeast, is lower than that observed for the Midwest (which is about 20%). Considerable part of the approximately 738,000 establishments in the region that did not have tractors would benefit from increased operational capacity in agricultural operations like sowing, fertilizing, pesticide application, among others, resulting from the availability of a motorized traction equipment, even if a low power one (below 100 hp).

TABLE 10
Number of farms with tractors and of available tractors in the Southeast's farms (2006)

State	Number of farms which possess at least one tractor	Number of tractors	Power	
			Less than 100 hp	More than 100 hp
São Paulo	80,015	145,345	107,204	38,141
Rio de Janeiro	5,725	7,666	5,173	2,493
Espírito Santo	9,521	11,857	9,840	2,017
Minas Gerais	59,446	92,042	66,276	25,766
Southeast	154,707	256,910	188,493	68,417
Brazil	530,337	820,673	570,647	250,026

Source: IBGE (2009).

In addition to limitations related to technological aspects, farmers in the Southeast, as well as other Brazilian regions, struggle with issues such as access to technical assistance. Even if it is assumed that all agricultural establishments who had access to this service (as shown in Table 11) received it from only one source, yet the number of establishments that received assistance is much smaller than the total number of agricultural establishments in the region. According to this assumption, the number of establishments that received technical guidance was equal to 109,807, 18,544, 152,456 and 23,459 respectively in the states of São Paulo, Rio de Janeiro, Minas Gerais and Espírito Santo. The information presented in Table 11 is supplemented by information contained in Figure 3.

TABLE 11
Technical guidance received by producers, by guidance source, in the Southeast (2006)

State	Technical guidance received by producers, by guidance source						
	Government (Federal, State or municipal)	Self-guidance	Farmers associations	Integration production companies	Private consultancies	Non governmental organizations	Other sources
São Paulo	34,634	35,185	18,433	7,098	9,433	275	4,749
Rio de Janeiro	9,434	5,346	1,708	388	957	54	657
Minas Gerais	63,171	41,745	29,795	4,692	6,809	607	5,637
Espírito Santo	11,763	4,817	3,103	1,063	2,001	76	636
Northeast	127,362	52,894	7,404	5,248	8,715	3,607	5,733
North	53,592	13,430	4,401	1,167	2,121	340	577
Southeast	34,275	35,889	9,175	5,213	14,433	375	2,383
Southeast	119,002	87,093	53,039	13,241	19,200	1,012	11,679
South	157,369	60,935	151,502	128,989	40,726	1,459	9,962
Brazil	491,600	250,241	225,521	153,858	85,195	6,793	30,374

Source: IBGE (2009).

The total number of agricultural establishments in each of these states is shown in Table 1. Comparing these figures, it is evident the poor coverage of agricultural technical assistance in all states of the region. In none of the states of the region such coverage reaches the 50% threshold. In São Paulo, the coverage is equal to 48% and Minas Gerais, the state with the largest number of agricultural establishments, the coverage is only 27.6%. These numbers indicate that even in a region that develops more efficient and profitable agricultural activities still common problems in less economically developed regions such as the North and Northeast, limit the agricultural sector.

A larger service coverage can be seen in the South and Southeast (Figure 3), but even so, in most of the Southeast less than 50% of the establishments receive this type of service. This deficit in access to technical assistance is generally higher in the case of farmers who, in the absence of free service, usually can not afford to pay for the service to private providers. This is typically the case among small farmers. Furthermore, many medium and large farmers have a closer relationship with input providing firms which, depending on the relationship with the farmer, provide technical guidance to the client. Most small farmers, due to the small volume of products purchased, rarely receive the same kind of treatment. Since the early 1990s, with the extinction of the old Embrater

(Brazilian Technical Assistance and Rural Extension), this group of farmers had their access to guidance services affected.

FIGURE 3
Percentage of farmers with technical guidance by census tract



Source: IBGE (2009).

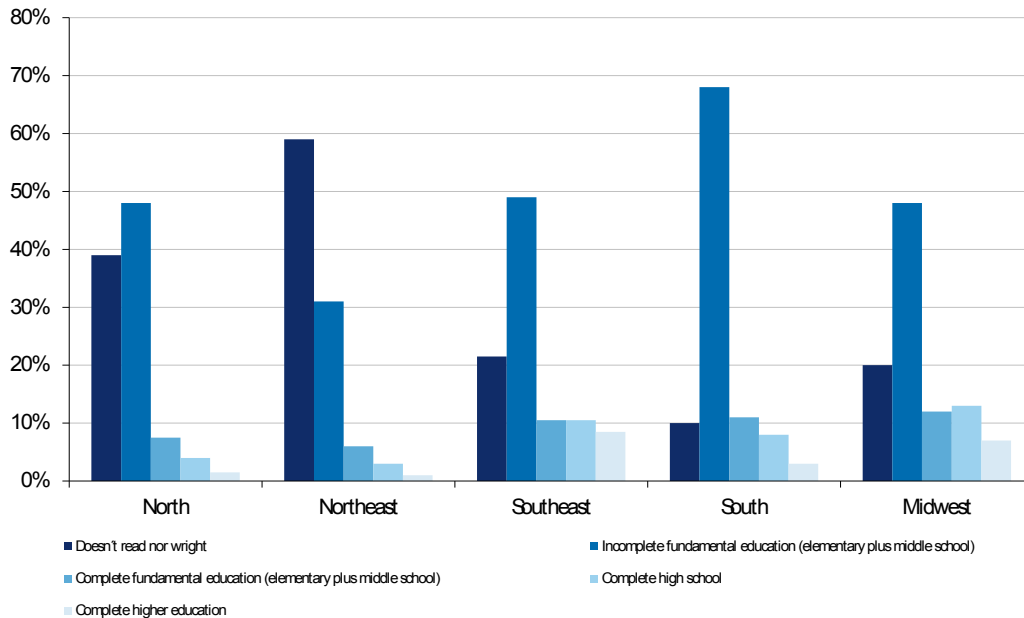
Coupled with the problem of technical assistance deficiency is the question of farmer's education level. In this aspect, by analyzing the distribution of farmers by education level (Figure 4) although the Southeast is in a comparatively better situation in the Brazilian context, it is still not very auspicious. Approximately 20 % of farmers in the region are illiterate (can't read nor write), and nearly another 50 % have not completed primary education, much of which, therefore, are possibly functionally illiterate. Although

it is not possible to assert that these farmers are not able to practice their craft, in fact most should be competent to perform daily tasks efficiently, yet, however, there is a direct relationship between the farmers' education levels and the adoption rate of new technologies that increase the efficiency of the production process and between the level of education and the innovation taking place in farming activities.

In this respect, Brazil as a whole and the Southeast in particular are at a crossroads. As shown in Figure 4, the level of education of farmers is very low, even in the Southeast. Around 20% of farmers in the region have higher education or technical education (or high school) complete. These farmers are probably better prepared to manage their properties in a more dynamic way, more innovative and open to new ways to develop their activities always aiming to increase efficiency and profitability. However, the remaining 80% are not as prepared as they could be.

Much of this group of less educated farmers are small farmers. Of the 892,049 agricultural establishments in the region, 699,978 are classified as family establishments (Table 1). The large and medium farmers have, on average, better financial conditions and therefore are able to provide quality education for their children (including higher education). Most farmers, however, do not possess such conditions and depend on public education to educate their children. It is not the purpose of this text, but only as a hypothesis, considering the level of public education in Brazilian cities, it is reasonable to assume that the quality of public education in rural areas is even worse.

FIGURE 4
Farmers' distribution by level of education, by major region (2006)



Source: IBGE (2009).

To end this section on some of the main limitations of agriculture in the Southeast, a limitation often cited in the countryside to hinder the realization of agricultural production is the lack of credit to finance agricultural production. This is an issue that affects farmers to a greater or lesser extent in all regions of Brazil (Castro, 2012a; Castro, 2013a; Castro, 2013b).

In São Paulo, the failure to obtain financing is not a common problem since the establishments which have not received funding (197,256, Table 12) most (155,553) did not need it. In Minas Gerais, on the contrary, the failure to obtain financing constituted a much more common limitation. Of the 459,195 establishments which have not received funding in the state, about 40% were for reasons such as fear of contracting debts, bureaucracy, lack of payment of previous loan, among others. Several of these reasons can be better investigated and, if possible, something could be done to overcome certain obstacles for not obtaining financing (excess of bureaucracy, for example).

TABLE 12
Farmers which have not received loans in the Southeast by the reason of the failure to obtain it (2006)

State	Number of farms	Lack of personal guarantee	Doesn't know how to obtain a loan	Bureaucracy	Lack of payment of previous loans	Fear into debt	Other motifs	Didn't need a loan
São Paulo	197,256	1,347	881	9,803	1,786	19,628	8,258	155,553
Rio de Janeiro	55,083	445	578	3,877	288	9,197	2,568	38,130
Espírito Santo	70,215	618	458	4,523	1,037	11,936	5,890	45,753
Minas Gerais	459,195	4,071	4,370	31,200	10,050	96,095	37,326	276,083
Southeast	781,749	6,481	6,287	49,403	13,161	136,856	54,042	515,519
Brazil	4,254,808	77,984	61,733	355,751	133,419	878,623	538,368	2,208,930

Source: IBGE (2009).

4 AGRICULTURE IN THE SOUTHEAST: FUTURE CHALLENGES

In the previous section, some problems that limit the development of agriculture in the Southeast were exposed, from infrastructural, environmental, technological, among others, several shortcomings reduce the productive potential of agricultural and livestock activities in the region. This section deals in an exploratory mode with possibilities to mitigate these limitations which have the potential of impacting significantly the development of regional agricultural activities.

The share of the Southeast's agriculture in the national agricultural GDP declined in recent decades (Table 13). This share fell from 34.2% in 1970 to 27.1% in 2009. In the same period, the Northeast and the South also lost share in agricultural GDP, while the share of the North and Midwest grew in the period. Nevertheless, for all years presented in Table 13 Southeastern agriculture has always led Brazil in terms of share of the sector's GDP.

TABLE 13
Distribution of agricultural GDP among Brazilian regions (1970-2009)
(In %)

Region	Regional share of agricultural GDP				
	1970	1980	1990	2000	2009
Midwest	7.4	10.7	7.5	13.0	19.5
North	4.1	5.7	11.5	7.7	9.3
Northeast	20.9	19.5	18.8	16.4	18.1
South	26.6	29.5	26.6	30.4	25.9
Southeast	34.2	34.7	35.5	32.4	27.1

Source: IBGE *apud* Ipeadata.

To obtain more dynamic agricultural activities in the Southeast a set of initiatives aimed at restricting the constraints faced by the sector need to be taken. Among these initiatives include improving logistics infrastructure, investment in innovation and technology diffusion, expanding access to rural credit, among others.

With regard to logistic infrastructure, although the region has comparatively a more appropriate infrastructure (Figure 1), the conditions are not ideal. According to Périco and Santana (2010), the Southeast's rail network, for example, which development was mainly due to the expansion of coffee, represents nowadays almost half of all railroads

in Brazil and, even with the largest network, major improvements are necessary. These authors point out that the instability is a hallmark of the national rail network as a whole, this makes the transportation of cargo via rail an almost secondary alternative.

In addition, the Southeast has about 35 % of Brazil's highways, concentrated mainly in the states of São Paulo and Minas Gerais. Compared to other regions, Southeastern highways are considered superior (as seen in the previous section), but not fully adequate. On the other hand, waterway transportation is little explored, although there are navigable stretches in rivers like the Paraná and Tietê (Périco and Santana, 2010). An idea of the possible returns that agricultural sector could obtain from infrastructure investments is given by the work of Mendes, Teixeira and Salvato (2009) which argues that investment in highways had the greatest impact among all studied variables on total factor productivity in Brazilian agriculture between 1985 and 2004.

According to Castro (2002), the relationship between the development of agriculture and transport are still poorly understood. However, the general testimonies of farmers and producers of areas ill-served with transport infrastructure leaves little doubt about the importance of these services for the smooth functioning of the activity. This author concludes for the need to expand the Brazil's transportation network to include rail and waterways, as well as storage structure and other logistics services. The recommendations of this author, valid for Brazil as a whole, are also valid for the Southeast, with the resumption of the use of the railroad and the use of navigable stretches of major rivers such as the aforementioned Tietê and Paraná.

In an attempt to direct public investment in order to boost economic growth the Federal Government launched in January 2007 the Growth Acceleration Program (PAC in the Brazilian acronym), which aims to eliminate bottlenecks to economic development by promoting investment in infrastructure, boost private investment and reduce regional and social inequalities. The total investment planned by the Program are of the order of 503.9 billion reais (approximately US\$ 210.0 billion). In March 2010, the government launched the second PAC (or PAC 2) which provides funds of R\$ 1.59 trillion in a number of sectors, such as transport, energy, culture, environment, health, housing and social policies. The total planned investment in the transportation infrastructure segment of the program are presented in Table 14.

TABLE 14
Budget investment of regional transportation of PAC

Region	Total investment (1,000,000 R\$)	% over Brazil's total
North	12,231	11.2
Northeast	39,644	36.5
Southeast	23,232	21.3
Midwest	22,131	20.3
South	11,629	10.7
Total	108,869	100.0

Source: FIESP (2012). Adapted by the author.

According to Ricardo, Rodrigues and Haag (2008) the value of PAC's investments is not enough, because the need is much greater than the R\$ 503 billion announced (considering all of the program's investments and not just those in the transportation sector). However, Ricardo, Rodrigues and Haag (2008) consider that transportation is historically a serious challenge in Brazil and even if it's partially solved it will have a positive effect both in the short and long term over the economy. Furthermore, they argue that the prospect of having once again a government planning to guide the economy, generating growth, development, employment and income is crucial for the countries success.

Until the completion of this text there weren't any available information on the possible impacts of PAC in the Southeast region's economy in general and the agricultural sector in particular. Anyway the commentary made by Périco and Santana (2010) when commenting on the PAC is worth mentioning

(...) the amount of public capital available is scarce and must be allocated in a way that generates greater economic results and positive externalities. Unmeasured changes in infrastructure capacity is not sufficient to make the region [Southeast] operate productively, they must be accompanied by analyzes of the usefulness of each type of investment, at the period under review.

Apart from infrastructure, other bottlenecks must be faced. Among these, the investment in programs to promote the use of conservation farming practices should be bigger. As seen earlier, of the region's 892,049 agricultural establishments (Table 1), approximately 47% (423,755 - Table 7) do not use any of the recommended agricultural practices to preserve soil as level planting, crop rotation, slope protection, among others.

One of these programs, which could help agriculture in the region become more environmentally sustainable, is the Low Carbon Agriculture Program (ABC in the Portuguese acronym) of the Ministry of Agriculture, Livestock and Supply. This program was established by Resolution n. 3,896 of the Central Bank of Brazil (August 17, 2010). It has several goals, including the promotion of: the reduction of emission of greenhouse gases in agriculture; the recovery of degraded pastures; deployment and expansion of integrated crop - livestock-forest cultivation systems; correction and fertilization of soils; the implementation of soil conservation practices; the restoration of the permanent preservation areas and legal reserves; the creation of incentives and resources for farmers to adopt sustainable agricultural techniques, among others.

With the ABC Plan the idea is to expand the sector's competitiveness, deepening the technological advances in the areas of sustainable production systems, soil-plant microbiology and recovery of degraded lands. The ABC program in the 2010/2011 harvest had a budget of R\$ 2 billion and in the 2011/2012 crop one of R\$ 3.15 billion. According to data from the Bureau of Agricultural Policy, of the Ministry of Agriculture, it is estimated that only 15% of the R\$ 3.15 billion were used between July 2011 and February 2012 and most contracts are located in Southern Brazil.

In 2012, however, of the R\$ 310,334,000 disbursed to the ABC program (January-October 2012), disbursements for the Southeast region exceeded those for the South (it was disbursed R\$ 107,107,000 for the Southeast region). Regarding budget execution it is still low for the ABC program as a whole. Between January and October 2012 only R\$ 310.334,000 were disbursed for the program from an available total (by adding the resources from BNDES and Banco do Brazil) equal to R\$ 1,849,847,000. Besides the benefit generated on the dynamics of agriculture in the Southeast by the improvement of transport infrastructure and measures aimed at making agricultural activities more environmentally sustainable, the agricultural sector in the region can also considerably benefit from productivity gains arising in the processes of innovation and technological diffusion. According to Siscú and Lima (2001), it is important to structure the sector of research and development (R&D) in Brazilian regions. The network of agricultural technological innovation in the region relies on the participation of federal universities, federal science and technology institutions, such as the Brazilian Agricultural Research Corporation (Embrapa – Portuguese acronym) and others.

Of all the Brazilian regions, the network of agricultural technology innovation in the Southeast has the largest number of institutions, whether federal, such as Embrapa and federal universities, or state, such as the state organizations of agricultural research⁴ and state universities. Some of the most productive universities in the field of agricultural research are located in the Southeast, for example the Federal University of Viçosa (Minas Gerais), or the University of São Paulo.

The fact of having a more favorable organizational research environment, however, does not mean that there aren't any challenges to be faced by the region's researchers in terms of innovation to overcome the regional agricultural problems. Numerous examples attest this argument. The cultivation of sugar cane in São Paulo is one example. Major agricultural production chain in the region, in terms of value of production (Table 2), it faces many challenges from the requirement of the end of burning (traditional practice used to facilitate manual harvesting of sugar cane in Brazil), enforced by recent legislation of the state of São Paulo, to issues related to enable crop productivity increase, impacted in recent years because of climatic factors.

In addition to such specific aspects, as mentioned for sugar cane, the network of agricultural research and innovation in the region needs to provide solutions for the development of agricultural activities as a whole in a scenario of increasing scarcity of certain natural resources essential for the activity as will probably be the case for water. Some river basins in the region are currently under stress due to unbalance between water availability and demand (Castro, 2012a).

Innovations by the R&D need in order to generate the expected result for society their widespread use by the agricultural sector. To do this, it is necessary the existence of a system of technical assistance and rural extension active and qualified to perform this task. As seen previously (Table 11), however, the system of technical assistance and rural extension does not attend all farmers. Since the extinction of the Brazilian Technical Assistance and Rural Extension (Embrater in the Portuguese acronym) in the early 1990s, the responsibility for this activity was left to the states and the results are varied, but overall still has much to improve.

4 Some of the most renowned among these institutions are located in the region such as the Agronomic Institute of Campinas (IAC), in the state of São Paulo.

The medium and certainly the big farms have easier access to technical assistance service offered by private companies. Thus, the challenge of research institutions, universities and social movements is to develop strategies to put into practice participatory methodologies of rural technical assistance with the objective of including small farmers from conception to implementation of technologies, transforming them into actors in the process, valuing their knowledge and meeting their demands.

The challenge to improve technical assistance service in the region is very different according to the state under consideration. Unlike regions such as the North and Northeast, where the unmet demand for this service is widespread throughout the region (Figure 3), in the Southeast coverage is quite varied. In São Paulo, the percentage of producers who received some type of assistance is higher and relatively homogeneous. In the states of Rio de Janeiro and Espírito Santo coverage is lower when compared to São Paulo, and in Minas Gerais there is a heterogeneity between the south of the state with the highest percentage of farmers attended and the north, with comparable cover percentage to the northeastern states. It is precisely in the northern state of Minas Gerais where the challenge of offering technical assistance to farmers is greater.

Another challenge for the further development of regional agriculture refers to the social development of rural areas. This is a goal rather broad and diffuse, directly or indirectly inserted between the set of objectives of various institutions whose mission is related somehow to the rural environment. To be more specific, an aspect that can contribute significantly to the social development of rural areas is the generation of income for farmers. Small farmers generally face greater challenges to market their production and, in many cases, depend on a few (oligopsony), or sometimes just one (monopsony), company to sell their production. The small production of most family farmers, combined with a large number of these producers, reduce the bargaining power they have with those few buyers. Develop ways to increase this bargaining power and allow them to gain greater income from their production constitutes a major challenge in all regions. Some ways of doing this may be mentioned, such as adding value to production (in ways to differentiate the production of one farmer to the others), the diversification of production and productive associations of producers.

Incidentally, on productive associations (especially of small farmers) their promotion should be a goal pursued by institutions linked to the development of the regional agricultural sector. The Ministry of Agriculture, which has in its structure the Department of Livestock

Development and Cooperatives, has a major role in relation to this matter. Along with Ministry of Agriculture and other public and private institutions, a comprehensive program can be done to structure a strong cooperative system and demonstrate the benefits of adherence to that system to farmers. To this extent, the large role of agricultural cooperatives in the South, not only among small farmers, can serve as an example of the advantages of joining the system.

5 FINAL REMARKS

Of the five Brazilian great regions, the Southeast has the largest share in the Brazilian agricultural production. Specifically the region was responsible in 2006 for approximately 34% of the value of agricultural production according to data from the 2006 Agricultural Census. The main agricultural products of the region considering the value of production are, in descending order, sugar cane, arabica coffee, cow milk and orange.

Although still the region with the largest share of the national agricultural GDP, this share has been declining in recent decades as a result of agricultural expansion especially in the Midwest. Part of the explanation for the decline in the share of the sectors GDP in the Southeast, besides the expansion occurred in other Brazilian regions, lies in the diverse problems that impact agricultural activities in the region, as was exposed throughout the work, such as access to credit and technical assistance.

The Southeast has competitive advantages to other Brazilian regions regarding agriculture. Among these advantages can be mentioned the network of agricultural technology innovation in the Southeast, which has the largest number of institutions whether federal, such as Embrapa and federal universities, or are state, as state agricultural research organizations and state universities.

However, these advantages alone do not ensure the continued dynamism of the sector. There are many enduring challenges such as: to improve logistics infrastructure, with the resumption of investments in regional rail network and investment in the deployment of waterways in parts of rivers suitable for this purpose; social development of rural areas through mechanisms of generating income for small family farmers; to provide solutions for the development of agricultural activities as a whole in a scenario of increasing scarcity of certain natural resources essential for the activity, as would

probably be the case for water; to promote the use of agricultural conservation practices; to promote farmers' associations, among others.

Besides these, there are also challenges specific to each agricultural production chain. These more specific challenges are beyond the scope of this work, but only as an example is the case of research to increase the yield of sugar cane, the main product of regional agriculture impacted in recent years by of climatic factors.

To maintain competitiveness of regional agricultural and possibly even increase it these challenges must be faced. The Southeast's agricultural sector is economically relevant and diverse and is able to meet the challenge. Furthermore, the regional organizational environment related to agriculture is along with that of the South the better prepared to address these demands.

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