

HUMAN CAPITAL AND AGRICULTURAL DEVELOPMENT IN SÃO PAULO, BRAZIL

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I. HUMAN CAPITAL AND ECONOMIC DEVELOPMENT THEORY

 Solow (1957) Y = F (K, L, t) t := technological change / "Solow residual" "technical progress"

- Johnston and Mellor (1961) define the role of agriculture in economic development in five propositions:
 - 1. Provide increased food supplies
 - 2. Enlarge agricultural exports
 - 3. Transfer of manpower from agriculture to nonagricultural sectors
 - 4. Agriculture's contributions to capital formation
 - 5. Increase rural net cash income to stimulate industrialization

I. HUMAN CAPITAL AND ECONOMIC DEVELOPMENT THEORY

- Kuznets (1964) summarizes the role of agriculture through tree types of contributions: *in* product, *in* market and *in* labor force
- Becker (1964) argues that continuous growth is not explained only by the use of capital (K/L) and land (D/L) per worker in agriculture. The *law of decreasing returns* would stop the growth process.
- Education is undervalued by rural population in a subsistence agriculture context. However, in an environment of instability and modernization, farmers will attribute priority and high value to education. They are *in front of a growth process of agribusiness.*

I. HUMAN CAPITAL AND ECONOMIC DEVELOPMENT THEORY

ECONOMIC AND SOCIAL RATES OF RETURN:

• Griliches (1964).

- In US, the internal rate of return to agricultural research investment equals to 13 US\$ per US\$ unit.
- Evenson, Pray and Rosegrant (1999).
 - Estimated the return on investment in public and private agricultural research in India: 5 rupees per unit invested
- Araújo, Schuh, Mendonça de Barros, Shirota and Nicolella (2003)
 - Estimated return on investment in agricultural research in the State of SP was R\$ 10 per monetary unit invested
- Figueiredo, Mendonça de Barros, Peres and Conceição (2012) For every R\$ 1.00 invested in citrus research; there is an increase of R\$13 on the production value of orange in the state of São Paulo.

II. HUMAN CAPITAL FOR THE STATE OF SÃO PAULO AND BRAZIL IN NUMBERS

- Human Capital for Agriculture / Agribusiness in São Paulo 2012 (USP, UNICAMP, UNESP and UFSCAR)
- Faculty Agribusiness Total % 1.387 12.585 11%
- Degrees Awarded

Undergraduate

Graduate

	Agribusiness		MS	Phd
4 Universities	32.553	4 Universities	5.526	3.451
ESALQ/USP	12.922	ESALQ/USP	4.996	2.625
		Total	10.522	6.076

 Agronomy, Agricultural Engineering, Economics, Food Engineering, Food Sciences, Forestry, Veterinary, Zootechnics, ...

II. HUMAN CAPITAL FOR THE STATE OF SÃO PAULO AND BRAZIL IN NAMES

- Frederich Gustav Brieger (Genetics)
- Sylvio Moreira (Citrus)
- Alcides Carvalho (Coffee)
- Ruy Miller Paiva (Agricultural Economics)
- Veridiana Victoria Rossetti (Phytopathology / citrus)
- Marcilio Dias (Genetics / vegetables)
- Eurípedes Malavolta (Chemistry / Fertilizers)
- Ernesto Paterniani (Maize)

- Shiro Miyasaka (Soybean)
- João Lúcio de Azevedo (Genetics)
- Romeu Kiihl (Soybean)
- Henrique Viana de Amorim (Ethanol from sugarcane)
- Klaus Reichardt (Physics of environment)
- José Roberto Postali Parra (Entomology)
- Rodolfo Hoffmann (Econometrics / Income distribution)
- Nilson Augusto Vilanova (Agrometeorology / sugarcane)

III. RECENT FIGURES OF THE BRAZILIAN ECONOMY

- GDP, 2013
- Growth rate, 2013
- Share of Agriculture 2013 7 %
- Share of Agribusiness
- Total Population (2010)
- Rural Population
- GDP per capita
- HDI

- Brazil
- 2.171 US\$ bi
- 2.3%
- 22%
- 190 M
- 15 %
- 11.340 US\$
- 0.73

- São Paulo
- 680 US\$ bi
- 1.7 %
- 2 %
 - 19% (2008)
- 41 M
- 4 %
- 17.780 US\$
- 0.783





IV. AGRICULTURE AND AGRIBUSINESS IN BRAZIL AND SÃO PAULO

Brazilian share in world production and exports(2012)

	Production	Ranking	Exports	Ranking	Main market
Sugar	22%	1	45%	1	Russia
Ethanol	29%	2	55%	1	USA
Soybean	31%	2	42%	1	China
Soybean meal	15%	4	23%	2	Europe
Corn	9%	3	26%	3	Japan
Rice	2%	9	2%	9	Nigeria
Orange Juice	53%	1	80%	1	Europe
Coffee	40%	1	32%	1	USA
Cotton	5%	5	9%	4	China
Swine	3%	4	9%	4	Ukraine
Poultry	15%	3	35%	1	Saudi Arabia
Beef	16%	2	19%	1	Russia

Source: USDA

Definition of Agribusiness

- It is the sum of four segments:
- i. agricultural and livestock production;
- ii. inputs for agriculture;
- iii. agroindustry / processing; and,
- iv. distribution services

• (CEPEA / ESALQ , USP)

IV. AGRICULTURE AND AGRIBUSINESS IN BRAZIL AND SÃO PAULO

Inputs Industry Agriculture and Livestock Distribution O Brazilian GDP Share



IV. AGRICULTURE AND AGRIBUSINESS IN BRAZIL AND SÃO PAULO

Production in Brazil and São Paulo (000 tonnes)

	Brazil	São Paulo	
	000 to	Share (%)	
Orange	18.013	13.366	74%
Others Fruits	20.995	3.793	18%
Sugarcane	721.077	406.153	56%
Coffe (Arabic)	2.279	275	12%
Cereals and oilseeds	163.646	6.945	4%
Horticultural	32.756	3.195	10%

Source: IBGE

Exports from Brazil and São Paulo (000 US\$)

PRODUCTS	BRAZIL (US\$ th	SAO PAULO ousand)	Share SP/BR
TOTAL	242.178.649	56.317.626	23%
AGROBUSINESS	99.967.784	20.775.068	21%
JUICES	2.460.180	2.163.035	88%
DAIRY	117.728	95.641	81%
OTHER FOOD PRODUCTS	545.950	374.573	69%
SUGAR AND ALCOHOL	13.717.911	9.217.414	67%
LIVE TREES AND OTHER PLANTS	23.925	15.741	66%
OTHER ANIMAL PRODUCTS	679.546	338.107	50%
OTHER PLANT PRODUCTS	928.520	459.265	49%
OLEAGINOUS PRODUCTS (EXCLUDING SOY)	309.559	151.250	49%
FEEDING ANIMALS	217.215	74.182	34%
BEE PRODUCTS	61.434	18.743	31%
VEGETABLES, PULSES, ROOTS AND TUBERS	81.229	16.841	21%
LEATHER, LEATHER PRODUCTS	3.026.777	612.479	20%
FOREST PRODUCTS	9.634.768	1.829.950	19%
BEVERAGES	459.544	82.378	18%
MEAT	16.802.628	2.624.860	16%
COCOA AND ITS PRODUCTS	307.027	47.713	16%
COFFEE	5.275.719	724.051	14%
FRUIT (INCLUDES NUTS AND CHESTNUT)	877.606	112.039	13%
LIVE ANIMALS (OTHER THAN FISH)	782.598	44.896	6%
FIBER AND TEXTILE PRODUCTS	1.591.836	89.668	6%
SOY COMPLEX	30.961.266	1.396.624	5%
CEREALS, FLOUR AND PREPARATIONS	7.252.065	271.665	4%
TEA, MATE AND SPICES	362.613	8.724	2%
FISH	218.000	5.228	2%

Source : Secex

V. TECHNOLOGICAL CHANGES IN AGRICULTURE AND AGRIBUSINESS

- MAIN FEATURES:
- 1. Abundance of water and land, and low cost of natural resources, mainly in Northern, Northwest and Tropical savanna (*cerrado*) regions;
- 2. Technological innovation in agriculture and agribusiness;
- 3.Returns to scale in agricultural production;
- 4. Sophisticated agribusiness system: efficient management and high profitability

• (MB Agro)

V. TECHNOLOGICAL CHANGES IN AGRICULTURE AND AGRIBUSINESS

- Occupation of tropical savanna
- Adaptation of soybean and corn crops to new agricultural regions of the country.

 "Cerrado and Campos Gerais": new areas



(MB Agro)

V. TECHNOLOGICAL CHANGES IN AGRICULTURE AND AGRIBUSINESS

- No tillage and double crop system
- Returns to scale in agriculture

 Efficient and profitable changes



(MB Agro)

V. TECHNOLOGICAL CHANGES IN AGRICULTURE AND AGRIBUSINESS: Agriculture-Cattle Raising Integration



The new production system is evolving toward an integration of animal, forestry and agriculture



(MB Agro)





V. TECHNOLOGICAL CHANGES IN AGRICULTURE AND AGRIBUSINESS: the history of soybeans in Brazil



Souce: IBGE. Elaborationb MB Agro.

V. TECHNOLOGICAL CHANGES IN AGRICULTURE AND AGRIBUSINESS: HDI between 1990 and 2000, and the Soybean crop



Source: PNUD.

Average Variation in Municipal Human Development Index by State of Brazil, 1991 to 2000



V. TECHNOLOGICAL CHANGES IN AGRICULTURE AND AGRIBUSINESS: Sugar cane crop in São Paulo



V. TECHNOLOGICAL CHANGES IN AGRICULTURE AND AGRIBUSINESS:

Highlights on Brazilian Ethanol from Sugarcane

- Brazilian National Ethanol Program PROALCOOL was launched in 1975
- We produce and use sugarcane ethanol as fuel in large scale (since 2003: flex fuel cars)
- Brazil has the lowest production cost of ethanol (US\$ 0,25 / liter)
 - Result of investments in technology made in sugarcane, ethanol and sugar production: new sugarcane varieties; better agronomic controls; better fermentation processes; use of vinasse as fertilizer; greater industrial automation
- Eletric power co-generation from bagasse: ethanol mills invested in electric power co-generation from sugarcane bagasse, in order to trade electric power in markets
- Mills self-sufficient in energy

VI. Final Comments

- Brazil and the State of São Paulo have benefited with human capital investments in agriculture and agribusiness, especially those developed through public research institutes and universities in São Paulo, and more recently by EMPRAPA. Also, private institutions have increased their agribusiness activities, as well as investments in human capital.
- The agroindustrial executive decisions on production and investments facilitate the integration of urban areas, rural activities and international markets. In such a context, decisions on agricultural production will tend will be based on scientific knowledge and technological inovation. Also, high rates of TFP growth in agriculture will be dependent or strongly influenced by the so called *agroindustrial farming*.

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APPENDICES

Consequence of Tradicional Mechanization



The consequence of mechanization in traditional tropical conditions was the loss of soil by erosion



Source: MB Agro

Agricultural Trade Balance Deficits and Surpluses (billion US\$, WTO data) 1990





Brazilian Trade Balance (US\$ million)



Port of Santos – State of São Paulo – Total Exports (000 tonnes)



Agribusiness Products Exports - by Port of Santos (SP) - from States of Origin, (%)



Position of São Paulo in World Exports

(million tonnes)					
	São Paulo	SP/Brazil	Global exports	SP/Global exports	
Orange Juice	1,8	94%	2,3	78%	
Sugar	14,3	59%	55,1	26%	
Beef	0,3	32%	8,1	4%	
Coffee	0,2	11%	6,9	3%	
Poultry	0,3	7%	10,1	3%	
Pulp	1,1	12%	47,0	2%	
Soybean	1,4	4%	99,6	1%	
Soybean Meal	0,4	3%	57,5	1%	
Corn	0,6	3%	94,5	1%	

Souce Secex/USDA

Position of Port of Santos in World Exports

(million tonnes)

	Port of Santos	Port of Santos/ Brazil	Global exports	SP/Global exports
Orange Juice	1,8	96%	2,3	79%
Sugar	16,7	68%	55,1	30%
Beef	0,7	71%	8,1	9%
Coffee	1,2	75%	6,9	17%
Poultry	0,4	11%	10,1	4%
Pulp	2,0	22%	47,0	4%
Soybean	10,4	32%	99,6	10%
Soybean Meal	3,8	26%	57,5	7%
Corn	9,1	46%	94,5	10%

Souce Secex/USDA

CURRENT & FUTURE PRODUCTS FROM SUGAR CANE



Productivity Gains

Center-South Region



Eletric Power Co-Generation from Bagasse

- Mills invested in electric power co-generation from sugarcane bagasse, in order to trade electric power in the market
- Experience and know how
 - Units are self-sufficient in energy
- Main Benefits:
- Renewable and clean energy
 - Low environmental impact
 - Provide carbon credits
- Synergy with hydro production pattern
 - Bioelectricity is produced during the dry season
- Strengthen the national equipment industry and create jobs





Source: PSR, Cogen, UNICA, Elaboration: UNICA

Mitigating Global Warming: Reducing Grenhouse Gases

Estimative based on life cycle analysis shows that sugarcane ethanol reduces GHG emissions by 90% compared with gasoline

Average GHG Balance on a life-cycle basis





Source: IEA – International Energy Agency (2004). Data compiled: by Icone and Unica.

Energy Balance

Sugarcane provides the best energy balance in production of ethanol

Energy contained in ethanol/Fossil fuel used to provide it



Data compiled by Icone and Unica

Ethanol Yields



Sources: IEA – International Energy Agency (2005) e MTEC.

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