Agricultural Outlook Forum 2003 Presented: Thursday, February 20, 2003

TRANSPORTATION AND LOGISTICS IN BRAZILIAN AGRICULTURE[1]

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Transportation infrastructure can determine the competitive success of an agricultural enterprises or entire agricultural sector. The Brazilian Government has proposed investment in large projects to improve the transportation infrastructure of the country's Center-West and North regions. These projects intend explicitly to develop the commodity delivery system in those regions, which should stimulate the expansion of soybean cultivation into northern areas. The highway freight market is not under government control, meaning that freight prices are formed through free negotiation determined by supply and demand for the transport service. Carriers have to stay current on changes in every shipping cost variable to negotiate efficiently with shippers. These demanders, except under certain very specific circumstances, have the negotiation power to exert strong pressure on carriers to obtain freight transport discounts. The new deregulated railway system shows good potential, especially for the shipment of grains. Transportation using waterway systems, considered to be the most economical one for bulk volumes, has generated a lot of expectations due to projects such as the Madeira waterway system. It is hoped that this waterway system will efficiently reduce the transportation costs for grains produced in Brazil's Center-West region. The ports of Santos and Paranaguá are still the preferred embarkation points, but the ports of Itaqui, Vitoria, Ilhéus, São Francisco do Sul and Rio Grande can be considered very good alternatives. The present and future Brazilian transportation system, in particular the location of and access to efficient transportation corridors, has been a crucial variable in the determination of processing plant location by private investors.

Introduction

One of the most striking phenomena observed in the Brazilian agricultural economics in the past decades, and in an accelerated way in recent years, is the transformation in its spatial arrangement. The agricultural businesses have occupied new frontier areas such as the North and Center-North, in addition to large areas in the Northeast, usually through activities combining modern production technologies. Similarly, input suppliers, storage and processing industries have clustered around production zones, focusing especially on minimizing the transportation costs involved.

The basic motivation for the search of such optimization is the need for augmenting the competitiveness of national products. This has already implied a clear reduction of costs in exporting operations.

This paper presents the main characteristics of the Brazilian cargo transportation matrix, detailing some aspects of the country's agricultural freight market. A discussion about the new transportation corridors (including the ones in the Amazon region) is also included.

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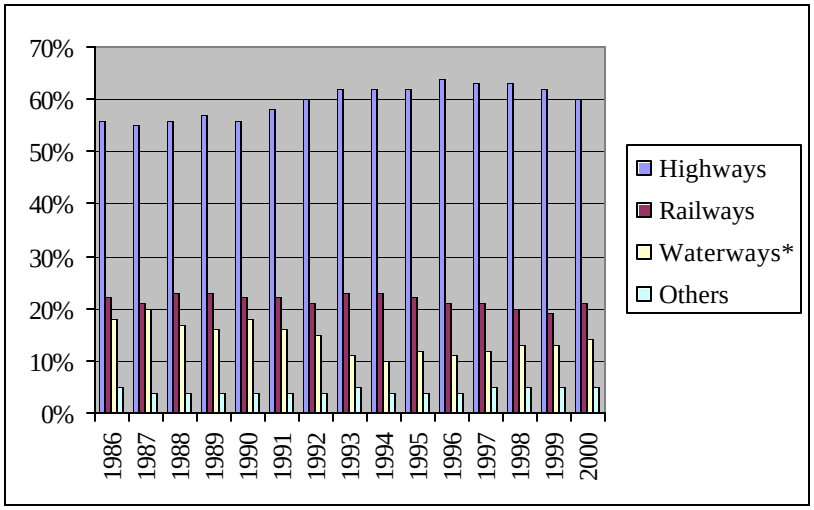
[1] Paper presented at the Panel "Brazil: Competition in Global Markets" of the Agricultural Outlook Forum 2003, that took place in Arlington (VA) in February 20-21, sponsored by the United States Department of Agriculture (USDA). The author acknowledges the assistance of Lilian Maluf de Lima, Claudirene Romero de Oliveira, Rodrigo Dametto Faria Santos.

On the Brazilian matrix of cargo transportation

The highway transportation modality has accounted for approximately 60% of the cargo transportation in Brazil, *versus* 20% of the railway system and 15% of the waterway system (see Fig. 1). Such predominance of the highway mode (see Fig. 2) can be explained by the larger extension of highways installed (increasing 160,000 km of paved roads *versus* decreasing 30,000 km of railways), as well as by the difficulties that the other transport categories face in order to efficiently meet increasing demands in farther areas in the country. These remote areas are not necessarily provided with rail or waterways.



* waterways = cabotage + river transportation

Figure 1 – General cargo transported, in tons-kilometer, per transportation mode (Source: GEIPOT, 2001).

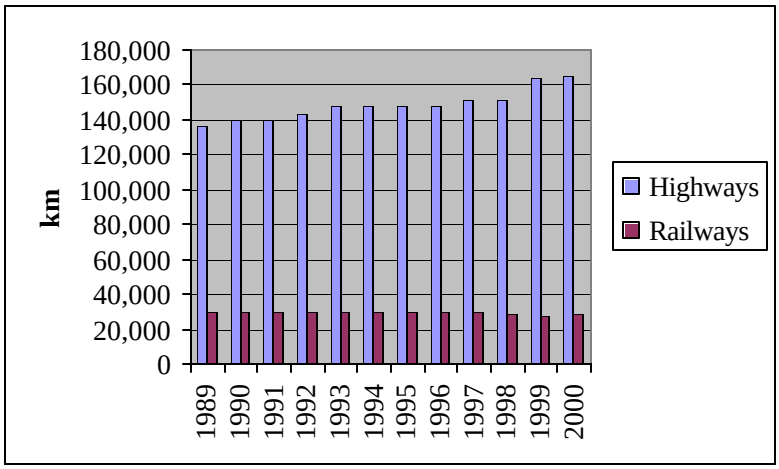


Figure 2 – Magnitude of the Brazilian transportation system (Source: GEIPOT, 2001).

Nevertheless, while analyzing the branching of the Brazilian highway system, the density coefficients are noticed to be very conservative (see Table 1), with a Brazilian average of 19 km of highways per 1,000 km^2 *versus* an average of 397 km of highways per 1,000 km^2 in the U.S.A. (a continental

dimension country such as Brazil). The State of São Paulo presents the highest density of highways in the country, as shown in Table 2: 106 km of paved roads per 1,000 km^2.

Table 1 – Transportation density of selected countries
(Source: GEIPOT, 2001).

	km highways / 1,000 km^2 area
Germany	1,390 (1)
Brazil	19 (5)
United States	397 (3)
France	1,491 (1)
Japan	2,117 (1)
Mexico	49 (2)

Note: data referring to the years 1993 (1), 1995 (2), 1996 (3), 1998 (4), 2000 (5).

Table 2 – Transportation densities in selected Brazilian regions, 2000
(Source: GEIPOT, 2001).

	km highways / 1,000 km^2 area
North	3.20
Center-West	12.90
North-East	29.03
South	56.07
South-East	58.47
São Paulo State	106.01

According to data from SIFRECA (Information System for Agricultural Freights, of ESALQ/USP), the highway distances traveled by agricultural bulk solids can be relatively high (see Table 3). Especially for grains, they have to nearly cross the country in view of the long distances separating the concentrated areas of production from the various consumption markets.

Recent development plans in the scope of the Brazilian Federal Government (for instance, “Brazil in Action” and “Advance Brazil”) have resulted in the identification and financing of a series of projects in the infrastructure of transport. These projects, basically, focus on four aspects: the intermodal model, the decentralization of the federal highway network, the continental integration and privatization of the port operation.

Table 3 – Examples of highway routes traveled in Brazil, per product, 2002
(Source: SIFRECA).

Product	Origin	Destination	Distance (km)	Freight (US$/t)
soybean	Campo Novo (RS)	Porto Velho (RO)	3,283	11.02
corn	Nova Mutum (MT)	Maraú (RS)	2,037	16.01
sugar	Barra do Bugres (MT)	Santos (SP)	1,801	9.92
rice	Bagé (RS)	Ilhéus (BA)	3,017	32.95
beef	Itaporã (MS)	Recife (PE)	3,595	39.02
cotton	Diamantino (MT)	Natal (RN)	3,616	19.62
fertilizer	Paranaguá (PR)	Nova Olímpia (MT)	2,013	12.16

Several examples stand out: the successful ending of the concession process of the Federal Railway Network; the privatization of a number of highways; the public and private investments to expand navigability in several water basins of the country; the modernization policy of the national port system; the advance of the coastal navigation (cabotage); incentives to a higher frequency of ground transportation of containers.

A great deal of new projects on transport infrastructure is based on projections of movement of soybeans and byproducts, both in traditional regions and in the new agricultural frontier regions. To a certain extent, there is a dependency relationship of the viability/success of such new undertaking towards a typically monocultural business. On the other hand, the concerns and actions of the soybean complex companies are clear regarding logistic issues.

In this sense, it is important to have the behavior of the post-harvest values practiced in the soybean complex analyzed, as shown in Table 4. Considered the main 'villain' in the so-called "Brazil Cost" (focal points of inefficiencies and distortions jamming the competitiveness of the domestic production and the attraction towards capital inversion in the Brazilian economy), the post-harvest costs observed in the Brazilian soybean complex have already become competitive to the values practiced in the U.S. economy.

Table 4 – Comparative values (US$/t) for the soybean complex
(Sources: SIFRECA, 2002; Baumel & McVey, 2000).

	U.S.A.	Brazil
In-land freight rate	17	19
Port costs	2	7
Ocean freight rate to Rotterdam	12	14
Total	31	40

Data of SIFRECA (Information System for Agricultural Freights, of ESALQ/USP) for the freight rates practiced in the movement of bulk soybean help illustrate a number of interesting situations. For instance, on Table 5, a few representative highway routes for soybean, in the past years, are presented.

Table 5 – Variation of the highway freight rate (US$/t) of bulk soybean for selected routes (Source: SIFRECA).

Origin	Destination	km	1999	2000	2001	2002
Sorriso (MT)	Paranaguá (PR)	2,179	42.48	48.99	40.09	39.90
Rio Verde (GO)	Paranaguá (PR)	1,243	23.89	24.65	24.26	23.29
Balsas (MA)	São Luís (MA)	1,010	20.78	19.08	16.64	17.26
Cascavel (PR)	Paranaguá (PR)	557	12.08	13.05	13.75	11.61
Primavera do Leste (MT)	Santos (SP)	1,549	33.75	39.52	35.15	33.38

The use of the rail and waterway modes, in a unimodal way or combined with the highway mode, certifies the competitiveness-related advantages. As shown in Fig. 3, to move soybeans for long distances, the railway unit freight (US$/t.km) was 29% lower than the highway one, while the waterway represented savings of 45% in relation to the highway mode. Comparing the rail and waterway modes, one observes savings of 22% towards the latter.

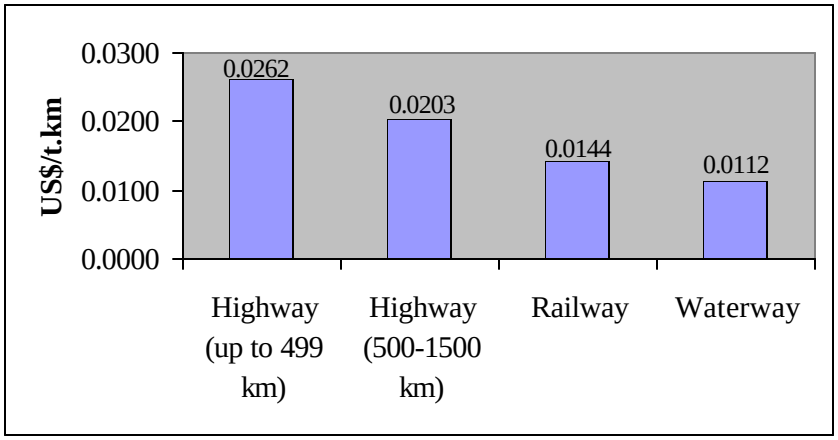


Figure 3 – Mean unit freight values practiced in the movement of soybean, 2002 (Source: SIFRECA).

As emphasized by Oliveira & Caixeta-Filho (1997), however, rail and waterway modes must be combined with other modes so that the several origin and destination points can be reached. Thus, the comparison between the transportation modes will be more consistent with reality when considering the availability of both intermodal and unimodal alternatives to connect a pair of origin and destination.

Transportation corridors in the North, Center-West and Northeast of the country

Helfand & Rezende (1998) report that a major soybean price differential factor in the Brazilian domestic market has been the critical transportation infrastructure in frontier regions.

As soybean production reaches regions that are farther and farther from consumption centers and from exporting ports of the South and Southeast, the development of corridors towards the North of the country became necessary. These corridors are not new and have been used for quite a long time for the

regional commerce of northern States. However, they have only just recently been given attention, mainly because of the private investments carried out.

In regions where the transportation infrastructure allows grain exports through the North, this has effectively been achieved, as it is the case of the Carajás railway and Madeira river waterway. Otherwise, the production follows its traditional flow up to the ports of the South and Southeast or up to the closest agroindustries. At the 2002 season, 1.850 million tons were delivered through these two corridors, of which 1.200 million went by the Madeira river and 650 thousand by the Itaqui port (MA).

There is a clear interdependence between transportation and agricultural production, and reductions in transportation costs denote growth of such production. Helfand & Rezende (1998), while analyzing the agricultural price differentials in selected regions of the country, suggest that a considerable reduction in costs of production could occur as a result of shifting the animal production from the Southeast to the Center-West. According to the same authors, however, that could not be said about shifting the animal production from the South to the Center-West. Especially in the case of the South, the reduction of feed cost is not enough to make up for the higher transportation cost between the Center-West and the consumption markets in the Southeast.

Lima et al. (2000) enumerate the main multimodal transportation corridors analyzed in more recent studies (see, particularly, Lício & Corbucci, 1996), emphasizing:

? Center-West and North Regions:
    - Madeira waterway corridor, to carry out the transportation of grains from Mato Grosso by highway until Porto Velho (RO), then by the Madeira river up to the city of Itacoatiara, in the Amazon river, and then by ocean ships to the rest of the world;
    - Ferronorte railway corridor, to carry out the transportation of grains from Mato Grosso by the Ferronorte up to the southeastern ports, mainly to the port of Santos. The railway is already operating in the city of Alto Taquari (MT), with an on-going expansion of the network up to the city of Cuiabá, the State capital;
    - multimodal Center-North corridor, to carry out the transportation of grains from Goiás, from Tocantins, from Pará, and part of northeastern Mato Grosso by the Araguaia river up to the city of Xambioá (TO), and then, by road, going up to the city of Estreito (MA). From Estreito, the grains would follow by the North-South and Carajás railways up to the port of Itaqui, in São Luiz, the capital of Maranhão. Furthermore, the use of the Tocantins river between Miracema (TO) and Estreito (MA), and North-South and Carajás railways for grain transportation from eastern Tocantins and southern Maranhão are predicted;
    - Cuiabá-Santarém highway corridor, to carry out the transportation of grains from Pará and, additionally, from northern Mato Grosso up to the port of Santarém;
    - Teles Pires/Tapajós waterway corridor, to carry out the transportation of grains from Mato Grosso by highway up to the border with Pará, then by rivers Teles Pires and Tapajós up to the city of Santarém (PA), source of the Tapajós river into the Amazon river, and then by ocean ships to the rest of the world;
    - Paraná-Paraguay waterway corridor, to carry out the transportation of grains from Mato Grosso by waterway starting in Cáceres (MT) through the Pantanal region up to the Argentine and Paraguayan ports, where soybean could be crushed before proceeding by ocean ships to the rest of the world.
? Northeast Region:

- the São Francisco waterway corridor, to carry out the transportation of grains up to Juazeiro (BA), then proceeding by train up to the port of Salvador (BA) or Petrolina (PE), and by train (Transnordestina railway) up to the ports of Suape (PE) or Pecém (CE). Likewise, this corridor would carry out the transportation of grains for domestic consumption to the Northeast region.

? South and Southeast Regions:

- For these regions, the projects usually developed refer to the renovation of the existing railways, highways and port terminals.

Logistic strategies in the highway freight market

The increase in grain production (particularly soybean) in Brazil, chiefly destined to export, has resulted in an increased demand for freight from the central regions of Brazil up to the main ports.

In addition, the recent mergers and acquisitions processes involving agricultural input and food companies, as well as the privatization processes of the Brazilian railway networks and private investments in waterways, have signed towards the consolidation of a new paradigm: the fact that the "cargo's owner" has also become the "logistics' owner". With larger volumes to be moved, shippers necessarily become more concerned about the logistics to be hired, which in many cases ends up justifying the vertical integration of the transportation services.

In that sense, a number of strategies viewing the optimization of both in-bound and out-bound logistics have been observed and go from designing new vehicles that have already become a reference to the transportation of bulk solids (e.g., highway double-trailers) up to the facilitation of hiring back-hauling operations.

The increased demand for freights to deliver grains, starting in the Center-West region of Brazil (mainly Mato Grosso) has also provided greater back-hauling opportunities. Especially for the flows of manure and fertilizers, highway carriers are willing to make the way back from the ports up to the interior of the country.

In this context, the agroindustries and traders are the great supporters of this increased flow of export, although not necessarily the only ones to use the back-hauling freights. This benefit is available to all companies willing to import and transport their fertilizers to grain producing regions. The formal hiring mechanisms of freights do not establish that the same trucks used for export by a given company have to be used by that same company to return to the Center-West region.

However, the bargaining power of shippers when negotiating soybean, manure and fertilizer freights with highway carriers is higher and higher, especially because of the large scale involved. Moreover, an agroindustry operating with both soybeans and fertilizers – classic examples for a good load-matching operation – will certainly be more likely to increase its logistical efficiency.

In the 2002 season, a larger set of routes of manure and fertilizers had its freight value cheaper than the one practiced for soybeans in similar distances. Nevertheless, it is interesting to note that hiring the back-hauling operation from ports has involved routes now starting at 600 km (see Figure 4), which has also reflected on the flows observed for similar distance ranges but originated in fertilizer-producing regions.

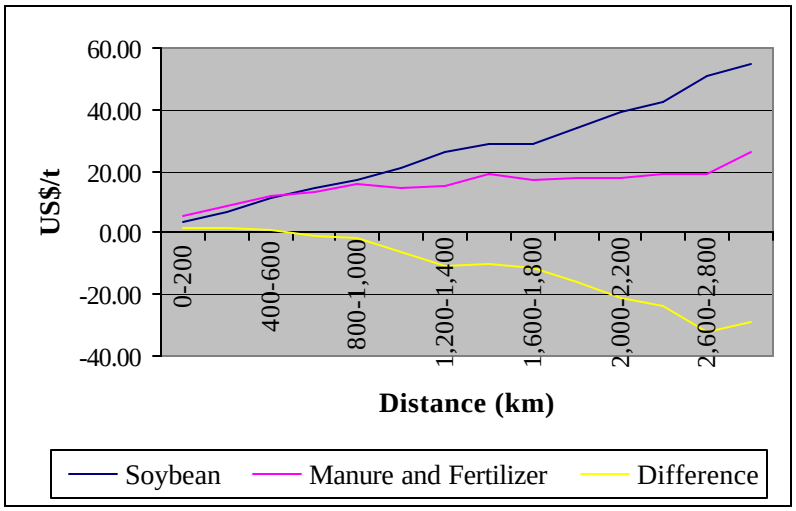


Figure 4 - Behavior of highway freight for soybeans, manure and fertilizer, according to the distance traveled, 2002 (Source: SIFRECA).

Since fertilizers imports have grown greatly using back-hauling freights, the intermediary fertilizer carrier companies had to reduce their freight (as in the cases of flows starting in the Triângulo Mineiro region and in the State of Paraná) to compete with the imports.

Back-hauling freight actually makes sense if combined with cargo hiring in the main course. It is, therefore, a concerning issue to the carrier's economic-financial health, the process that has been observed in some regions of the country: the simple fact of having a flow (any sort of cargo) in the North-South course already characterizes a back-hauling operation, implying accepting a cheaper freight value.

With regard to some selected products, unitary highway freight values for representative distances are illustrated (Fig. 5) as well as the participation of the highway freight on the value of the products (Fig. 6). Some of these behaviors stand out, as in the case of corn, a low value-added product, with a low freight value, although with one of the most striking freight on its commercial value. Coffee, a high value-added product, undergoes the lowest relative participation of the freight value.

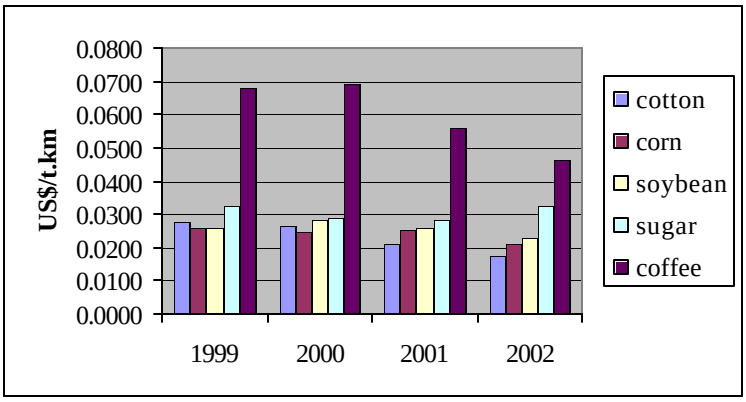


Figure 5 - Mean values of unitary freights (US$/t.km) per product, 1999-2002 (Source: SIFRECA).

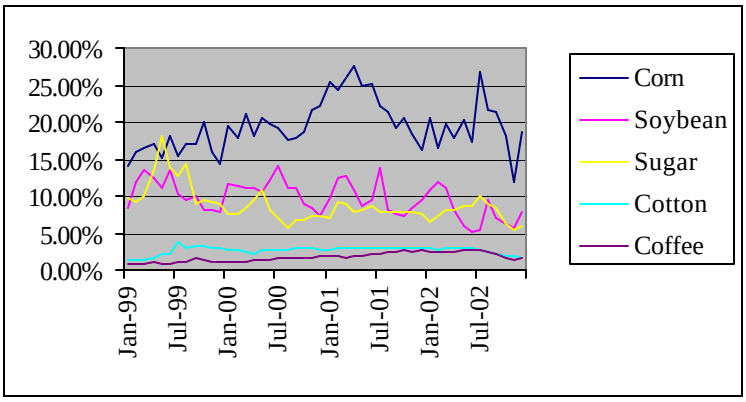


Figure 6 - Relative participation of the highway freight value (%) on the product's value, 1999-2002 (Source: SIFRECA).

The advance of the agricultural frontier in the Amazonian region

With the consolidation of the *cerrado* (virgin savannah land) border in the 1990s, the agricultural expansion has entered the last Brazilian frontier, the Amazonian region. These new areas have been incorporated into the productive process quite quickly, especially when taking into account the improved transportation infrastructure. This has not only increased competitiveness among the already producing regions but has also made viable areas originally considered economically inaccessible for grain production.

Costa et al. (2001) emphasize that the main factors affecting the expansion of soybeans in the Amazon involve: closeness to ports; high yields; areas without forests; areas close to waterways or railways; areas with plenty of highways.

An example of a recent initiative is the project of a crushing unit in Santarém (PA). This unit would crush soybean from northern Mato Grosso and western Pará. Passos (1999) endorses that Cargill and Companhia Docas do Pará (CDP) have signed a lease contract in an area of 45 thousand square meters around Santarém. With a duration of 25 years, the contract includes funds to be destined to the construction of a 250 m pier, silos, warehouses and other necessary equipment for grain exporting.

This polarization around Santarém will certainly help establish a new axis for the movement of soybeans in the country. Since the North region has had a very modest participation as an exporting zone among the five physical-political Brazilian regions, this will also contribute for a better balancing between the destination regions of agricultural bulk solids in Brazil.

This new bordering region presents extremely peculiar characteristics in terms of transportation infrastructure. For instance, it holds the waterway basin with the largest navigable extension in the country, although just recently it has drawn attention to the movement of agricultural cargoes.

As to the Amazonian States, Mato Grosso has been consolidating as the main soybean producer not only of the region but also of Brazil, with a quite significant difference to other States. On a second block,

Pará, Maranhão and Tocantins have very similar participation, with Pará presenting an important producing region in the axis along highway BR 163.

Particularly regarding the paving of BR 163, such work tends to generate quite a significant impact on the advance of soybeans over the forest, once it will allow the access to little developed areas of Mato Grosso, Pará and Amazonas.

Logistics expectations of the market

Several consultations and interviews have been carried out along with representative agents of the transportation and agroindustrial sectors in order to verify the main concerns regarding the logistic future they will face.

Among other consensus observed, the low expectation with respect to the highway system as a whole is notorious. The discredit of public investments in highways is probably the reason leading to such expectancy, even knowing that the process of private concession of several highways can bring on significant advances.

Another important aspect that can help explain the low satisfaction with the highway services is the situation faced by the highway cargo transportation companies. They undergo a significant cut in the profits, especially considering the transportation of products of low specificity value such as grains. Well-structured carriers that effectively know their costs even interrupt their operations because of the low price paid by demanders. Those who cannot afford it, do not necessarily interrupt or review their activities, taking the chance of leaving the market in the long run. As a result, one observes a picture made up of deteriorated and devaluated equipment, with a precarious maintenance.

In the specific case of back-hauling for agricultural carriers, the recommendation already made by several agents of the transport and agroindustrial sectors is reinforced: there is a need for setting up a new policy, making the release of production funding available during harvesting. This way, such a measure would favor the acquisition of agricultural raw materials in time to be transported as a back-hauling operation, thus reducing the freight costs in transport-combined operations.

The transportation carried out exclusively by the highway mode is not desirable, due to the resulting higher energy consumption. However, it is extremely important that the physical structure of the highways be in full condition for use, once this mode is the only one allowing the door-to-door transportation, an extremely important function.

There is also the expectation that the privatization of the roads will mean better inspection of highways (higher number of tolls and rigor at the scales). The predicted gradual drop of diesel subsidies will also affect the value of highway freights, which could lose a good part of its business to the railways.

Regarding the railway networks, although they are highly desirable in future scenarios, they face a great challenge with the new grantees: the rescue of credibility, lost during the public monopoly period of its management. In this sense, although there is a predominance of the participation of skilled and respectable companies in the composition of shares of these new grantees, one must monitor whether the eventual occurrence of mergers and acquisition processes between these new grantees will culminate in a private monopoly management model.

At the interviews carried out, the waterways were also considered as highly desirable for future scenarios, especially Tietê-Paraná and Madeira. In practical terms, the waterway system has only proved to be competitive as a cargo mover in regions with severe transport supply deficiencies. Comparing the influence regions of the Madeira waterway and that of Tietê-Paraná, the former is characterized by the existence of nearly a single transportation system, involving the waterway; in the latter, there is a tight competition among highways, railways and the waterway itself.

Nevertheless, the main reason preventing Brazil from having a waterway system capable of solving the transportation problem, as occurs in the U.S.A., is the fact that there are no navigable rivers disemboguing into the ocean. The Brazilian rivers, except for the Tietê-Paraná system, do not make connections between important economic centers. This requires several transshipment operations so that the product can reach the final destination. These operations imply additional costs and losses that discourage the use of the waterway. This way, in many cases, it is more rational for decision-makers to place the cargo on a truck with no transshipments, using then a door-to-door service.

The set up of new intermodal terminals and the construction and finalization of complementary works (such as those involving a number of locks) along the Brazilian waterways, also in a minimum middle-term scenario, are expected as alternatives to increment the viability of the waterway transportation.

Regarding the ports, the declarations collected have also revealed that those who have given signs of greater probabilities of incrementing the efficiency in future scenarios were Paranaguá, Santos, Itaqui, Vitoria, Ilhéus, São Francisco do Sul and Rio Grande (see examples of current port rates in these ports in Table 6). In the port of Santos, where an intense modernization process is observed, many issues remain between the service rendering companies and the unions, unlike what is observed in Paranaguá.

Table 6 – Port rates to move bulk solids in selected Brazilian ports
(Source: Brazilian trading companies).

Port	US$/t
Ilhéus (BA)	7.00
Itaqui (MA)	8.00
Paranaguá (PR)	5.00
Rio Grande (RS)	5.00
Santos (SP)	7.00
São Francisco do Sul (SC)	5.00
Vitoria (ES)	4.50

In terms of new paradigms to be observed, there is a highly positive expectation regarding the technological advances in the transportation sector. Assuming that the highway network will still be fundamental for the delivery of commodities - even at medium term - the measures regarding transportation cost reduction, in a short term, must have to do with the increased productivity of highway vehicles. This will improve the processes of loading and unloading, as well as the safety and management of back-hauling operations.

The higher professionalism of the highway sector should also be encouraged through measures favoring the release of specific banking credit lines and the implementation of better strategies for a systematic maintenance of the highways.

With regard to the latter aspect, a definitive (and not merely palliative) solution is urgently required for road maintenance, since the problem's cycle is very well known by authorities and agents involved: trucks come and go with visible cargo excess in highways with extremely deficient inspection and without a minimum number of scales. They deteriorate the highways with this excessive weight. This results in more fuel being consumed, more worn out tires and higher consumption of lubricants. The solutions arising with toll resources can mean a heavy load to the carrier's costs, or incentive carriers to not use these well-conserved highways, but using the vicinal ones with inadequate capacity to support them. And the cycle goes on.

As to the railway sector, it is essential to provide: effective measures viewing the systematic follow-up of operational and financial performance indicators of railway companies; specific credit lines for the modernization of vehicles and infrastructure; support towards easier articulation among distinct railway systems and between railways and ports.

With respect to the waterway transportation, its effectiveness and viability should be slower than that of other modes. Brazil has to go through a process of waterway "acculturation", which will involve, among other measures: suitable location and better operational capacity of waterway terminals; evaluation and redefinition of what has been so far considered within the scope of the 'waterway-viable cargoes', usually of low added value; evaluation and redesign of lock systems.

As to the marine ports, measures reinforcing its modernization and stimulating its increase in capacity and efficiency are expected, also going through the expansion of the activities related to the cabotage movement. In this sense, the enforcement of the Port Modernization Law has to prevail, including the staff's schedule to move the cargoes according to the Hand Labor Managing Organ (OGMO), and no longer exclusively by the unions.

It is worth remembering that a new storage structure – physical and operational – has gradually been set up in the country, offering higher possibilities of gains to the producer, who can avoid the selling transaction immediately after the season and operate according to the effective reality of the international market. In this context, Rezende (2002) stresses a very important fact to the agents involved in storing in Brazil: the Law N^{o} 9973, of May 29, 2000, about the storing system of agricultural products, regulated by the Decree 2855, of July 2001, replacing the former Law of Storing, of 1903. Also, the Federal Government, in a consistent way, started to encourage and finance the construction of on-farm storage systems.

Another very important paradigm related to that is the role to be exerted by a coordinating agent of the transportation sector. The management of transport systems in Brazil, especially that of cargoes, has always been characterized by a generalized diversity of responsibilities. Probably because of the flexibility of the prevailing highway transportation, which is not necessarily (and it does not have to be) under any sort of centralized coordination, the managerial authorities of the several transportation modes are in large numbers, not integrated and with no common strategic policy.

This way, formatting (and duly implementing) the National Transportation Agency (now split as ANTT – National Terrestrial Transports Agency, and ANTAQ – National Aquatic Transports Agency), with the objective of regulating the transport sector as a whole, is of fundamental importance. However, regulating policies must not impose excessive costs. Examples of important regulations include safety and environmental rules, as well as specific and clear rules regarding service taxation (VAT, for instance) in intra- and interstate movements.

For the shipper, the main goal is related to delivering the cargo in good condition, at the destination stipulated, within the scheduled deadline, and at a competitive price. For the grain market, particularly, one expects that lower railway and waterway freight values will actually appear when making the transportation decision.

Therefore, in general, a competitive and efficient transport sector is fundamental to the Brazilian economic growth, so strategies to integrate the transport modes are vital to increase the efficiency of the movement of agricultural cargoes.

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TRANSPORTATION AND LOGISTICS IN BRAZILIAN AGRICULTURE

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EDUCATIONAL RECORD

Bachelor in Civil Engineering

Polytechnic School at University of São Paulo
Brazil, 1980-84

Master in Economics

Department of Agricultural Economics and Business Management
University of New England, Armidale, NSW
Australia, 1988-89
Course stream: *use of spatial equilibrium analysis for the investigation of storage, handling and transportation of commodities*

PhD in Engineering

Department of Transport Engineering
Polytechnic School at University of São Paulo
Brazil, 1990-93
Course stream: *modeling structures for harvesting schedules*

Post-Doctoral Studies

Department of Agricultural Economics
Christian-Albrechts-Universität zu Kiel
Germany, 1993-94
Course stream: *modeling structures for transportation problems*

OUTLINE OF THIS PRESENTATION

- introducing the theme
- transportation matrix and agricultural freight market
- new transportation corridors
- logistic strategies in the highway freight market
- outlook for the Amazon region
- logistic expectations of the market

NEW BRAZILIAN AGRICULTURAL FRONTIER

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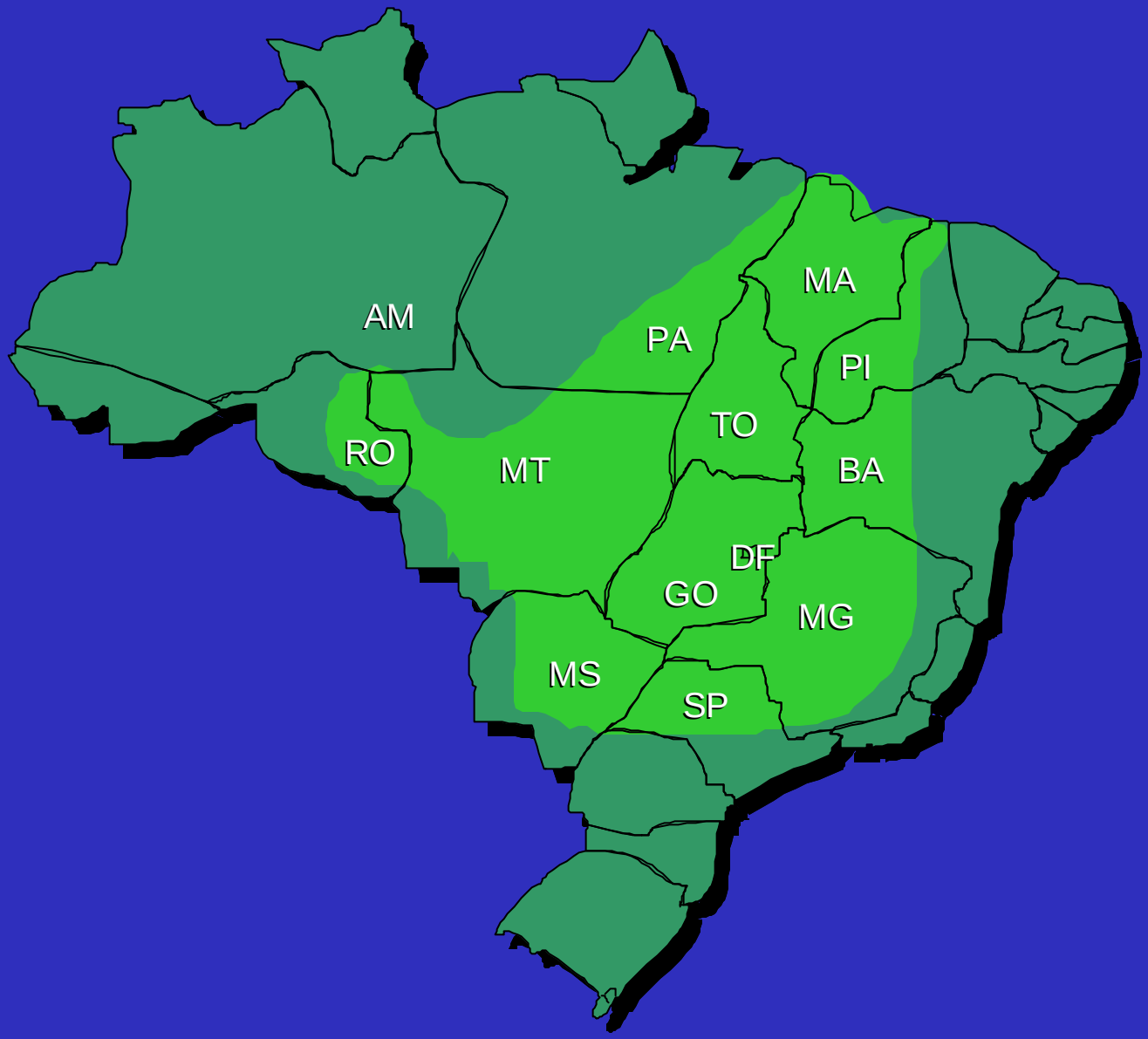

AM
PA
MA
PI
TO
RO
MT
BA
DF
GO
MG
MS
SP

BRAZIL

x

USA

Prof. Dr. José Vicente Caixeta Filho

COMPARATIVE VALUES (US$/T) FOR THE SOYBEAN COMPLEX

(Sources: SIFRECA, 2002; Baumel & McVey, 2000)

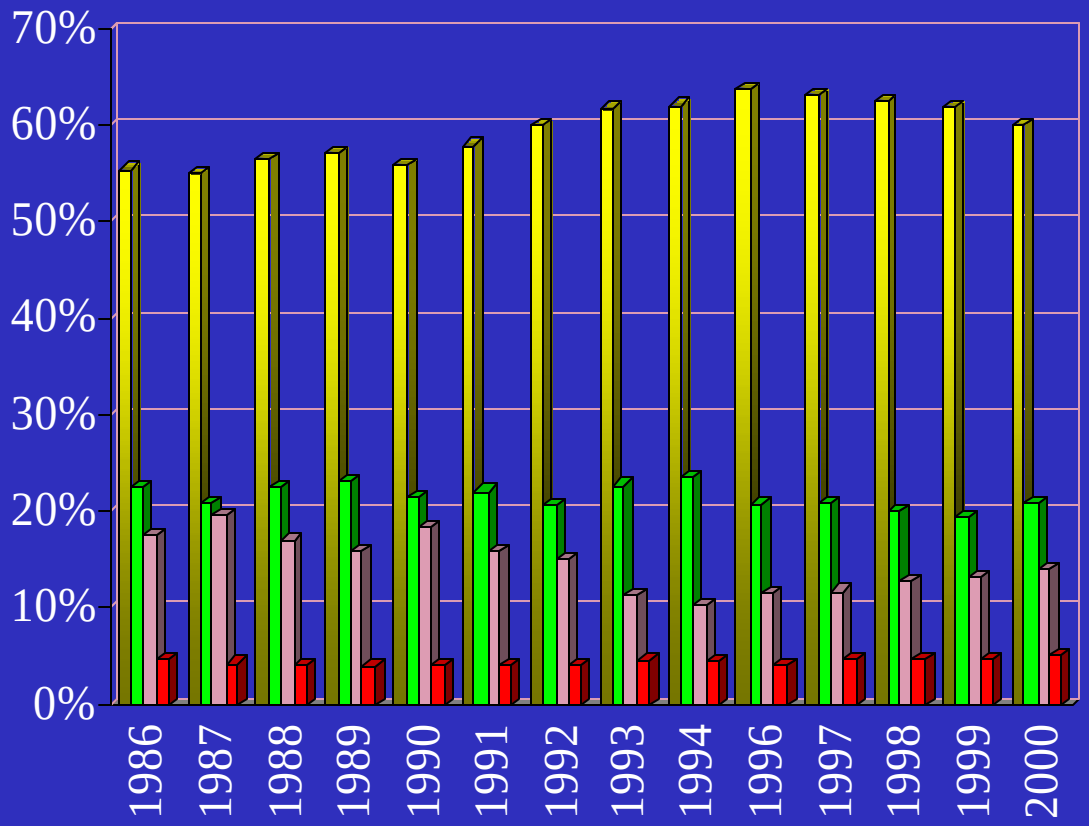
	U.S.A.	BRAZIL
In-land freight rate	17	19
Port costs	2	7
Ocean freight rate to Rotterdam	12	14
Total	31	40

BRAZILIAN MATRIX OF CARGO TRANSPORTATION

Prof. Dr. José Vicente Caixeta Filho

GENERAL CARGO TRANSPORTED, IN TONS-KILOMETER, PER TRANSPORTATION MODE

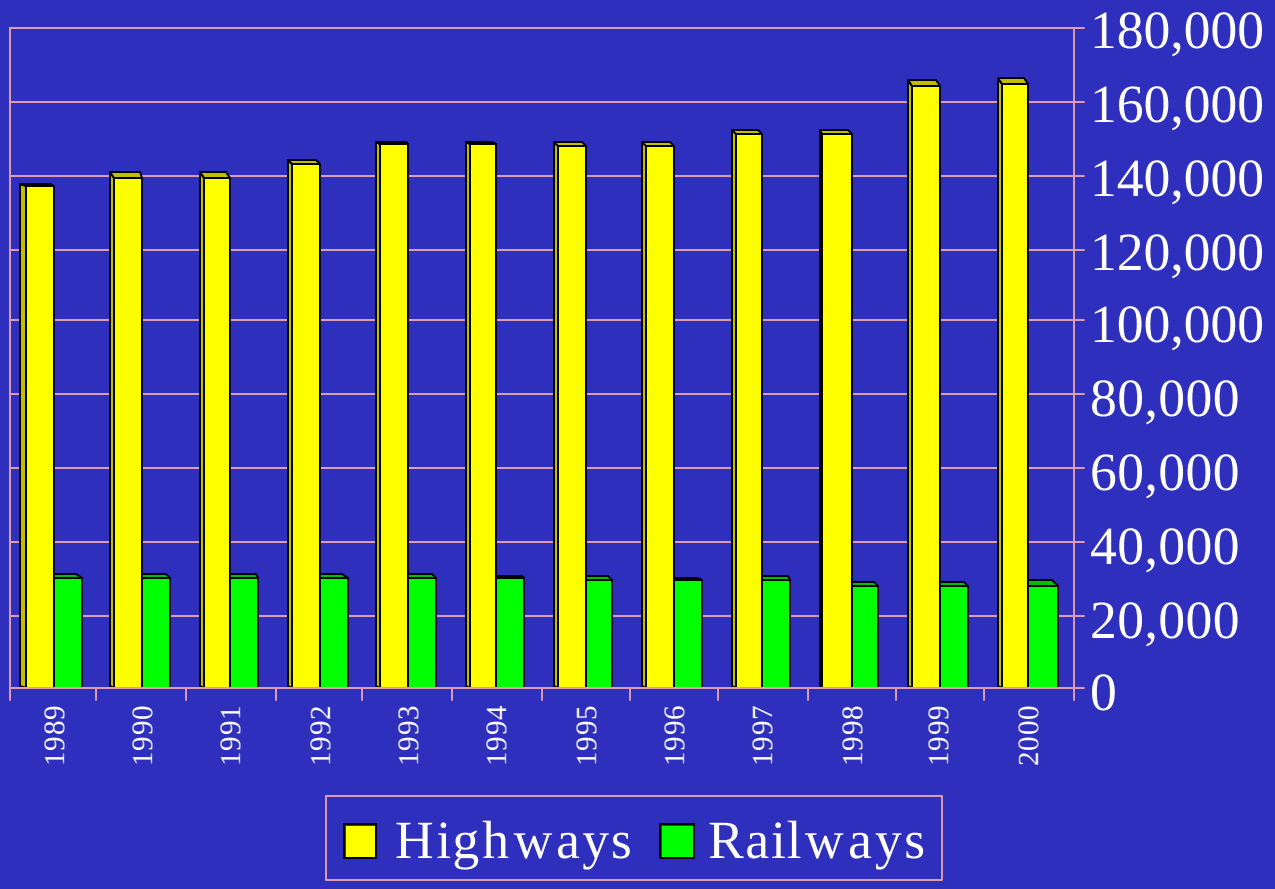
(Source: GEIPOT, 2001)



* waterways = cabotage + river transportation

MAGNITUDE (KM) OF THE BRAZILIAN TRANSPORTATION SYSTEM

(Source: GEIPOT, 2001)



RECENT STRUCTURAL CHANGES:

- privatization of a number of highways;
- concession of Federal Railway network;
- expansion of the navigability of several water basins;
- modernization of the national port system.

NEW DOMESTIC TRANSPORTATION CORRIDORS

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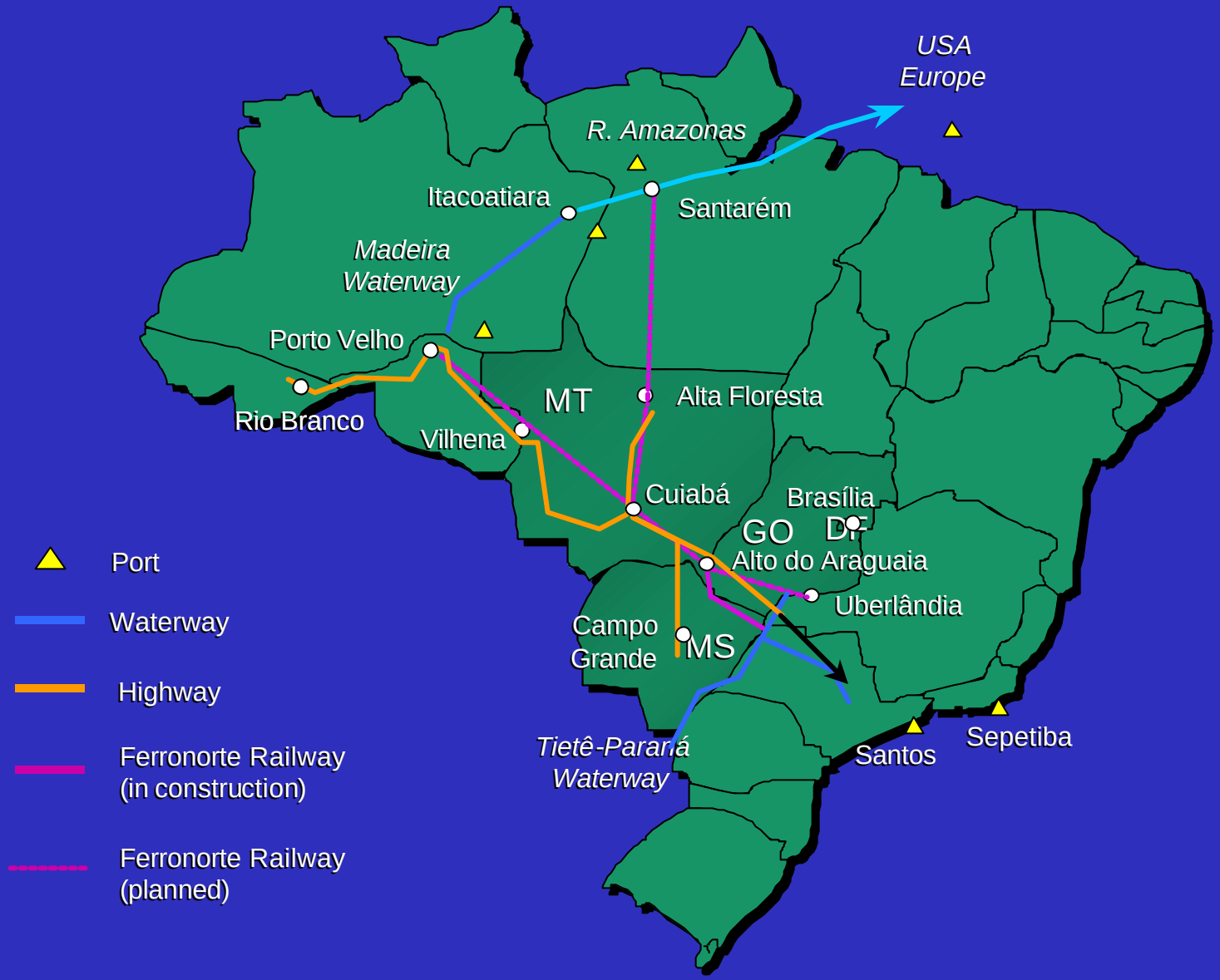
NORTH

Prof. Dr. José Vicente Caixeta Filho

CENTER-WEST



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NORTHEAST

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SOUTH AND SOUTHEAST

Prof. Dr. José Vicente Caixeta Filho


Caracas
Guri
Georgetown
Caiena
BR-174
Paramaribo
Boa Vista
USA
Europe
Macapá
R. Amazonas
Belém
Itaqui
Santarém
Manaus
Hidrovia do Madeira
Tucuruí
PECÉM
Fortaleza
Natal
João Pessoa
Recife
SUAPE
Maceió
Itaituba
Marabá
Estreito
Petrolina
XINGÓ
Porto Velho
Alta Floresta
Miracema
Rio Branco
Vilhena
BR-163
Aracajú
Salvador
Cuiabá
Aruanã
BOLÍVIA
BR-364/070
Uberlândia
Belo Horizonte
Corumbá
Tietê
Campos
Rio Grande
Campo Grande
PARAGUAI
Sepetiba
São Paulo
Santos
Itaipú
Hidrovia
Tietê-Paraná
Paranaguá
Florianópolis
Porto
Alegre
Osório
ARGENTINA
URUGUAI
PORTS
RAILWAY
WATERWAY
HIGHWAY
ACCESSES

VARIATION OF THE HIGHWAY FREIGHT RATE (US$/T) OF BULK SOYBEAN FOR SELECTED ROUTES

Origin	Destination	km	1999	2000	2001	2002
Sorriso (MT)	Paranaguá (PR)	2,179	42.48	48.99	40.09	39.90
Rio Verde (GO)	Paranaguá (PR)	1,243	23.89	24.65	24.26	23.29
Balsas (MA)	São Luís (MA)	1,010	20.78	19.08	16.64	17.26
Cascavel (PR)	Paranaguá (PR)	557	12.08	13.05	13.75	11.61
Primavera do Leste (MT)	Santos (SP)	1,549	33.75	39.52	35.15	33.38

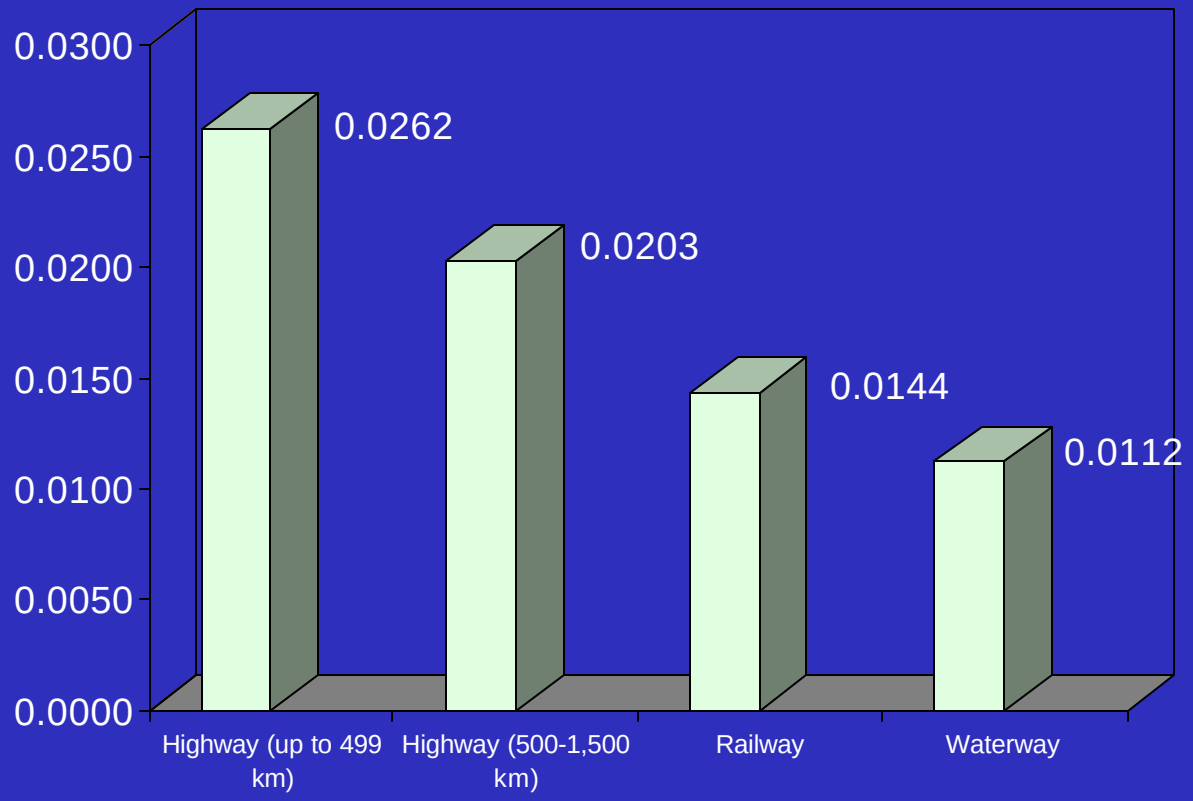
Source: Sifreca

RATES TO MOVE BULK SOLIDS IN SELECTED BRAZILIAN PORTS

(Source: Brazilian trading companies)

PORT	US$ / t
Ilhéus (BA)	7.00
Itaqui (MA)	8.00
Paranaguá (PR)	5.00
Rio Grande (RS)	5.00
Santos (SP)	7.00
São Francisco do Sul (SC)	5.00
Vitoria (ES)	4.50

MEAN UNIT FREIGHT VALUES (US$/T.KM) PRACTICED IN THE MOVEMENT OF SOYBEAN, 2002



Source: Sifreca

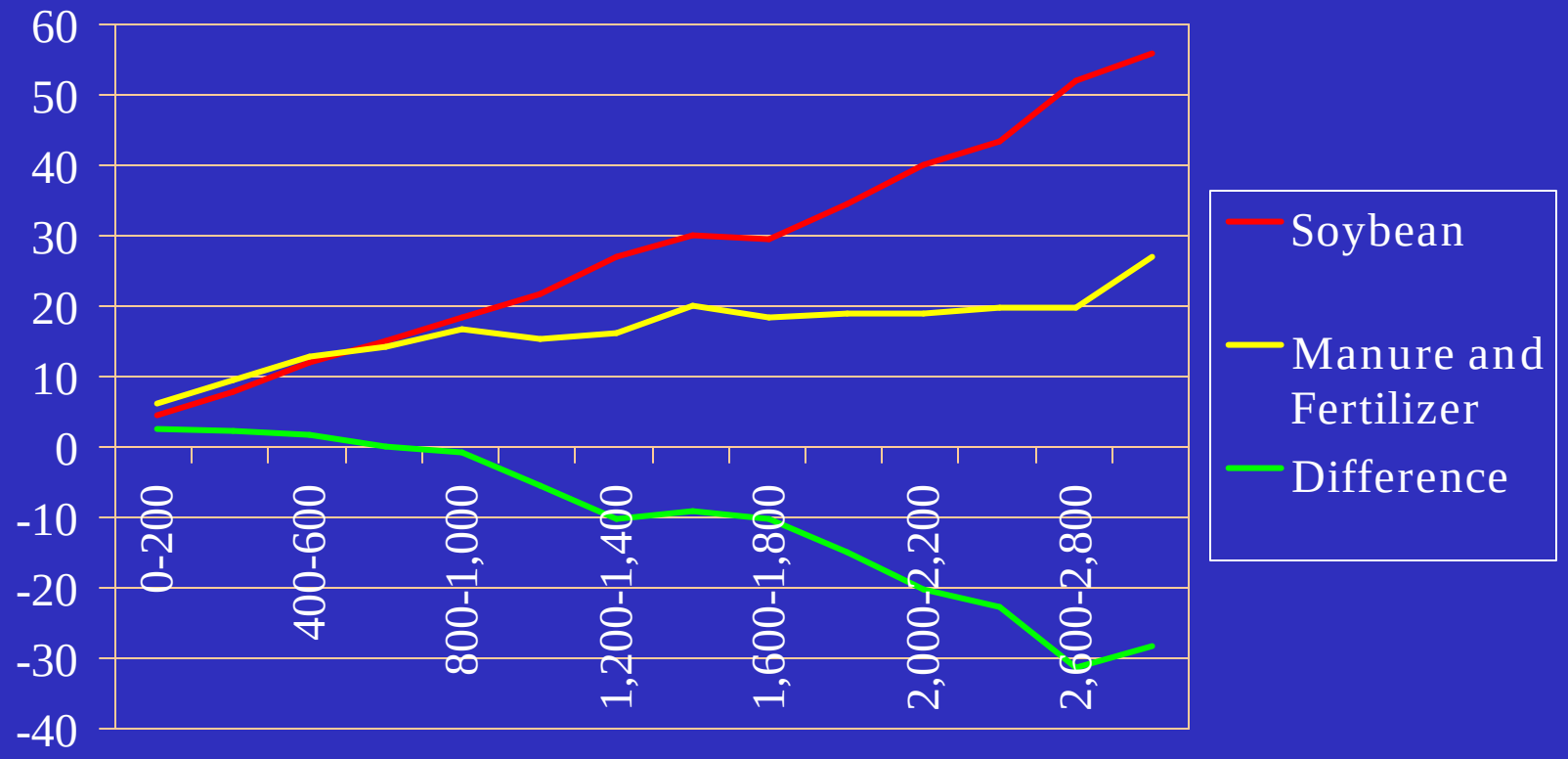
LOGISTIC STRATEGIES IN THE HIGHWAY FREIGHT MARKET

Prof. Dr. José Vicente Caixeta Filho

MAIN HIGHLIGHTS...

- cargo's owner = logistics' owner;
- higher bargaining power of the shippers over the carriers;
- greater frequency of back-hauling operations

BEHAVIOR OF HIGHWAY FREIGHT FOR SOYBEANS, MANURE AND FERTILIZER, ACCORDING TO THE DISTANCE TRAVELED, 2002

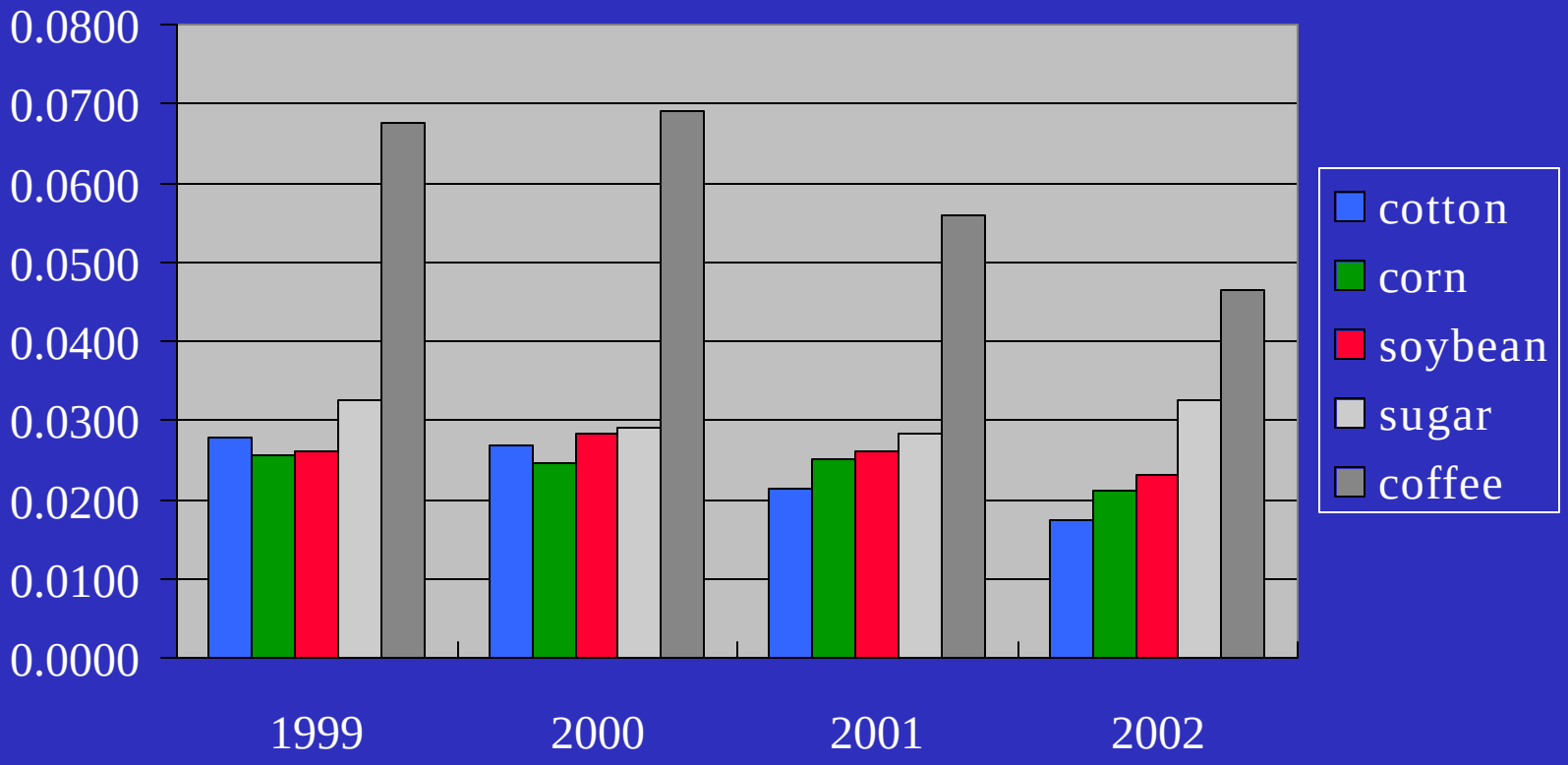


Source: Sifreca

LOGISTIC ATTRIBUTES OF AGRICULTURAL PRODUCTS...

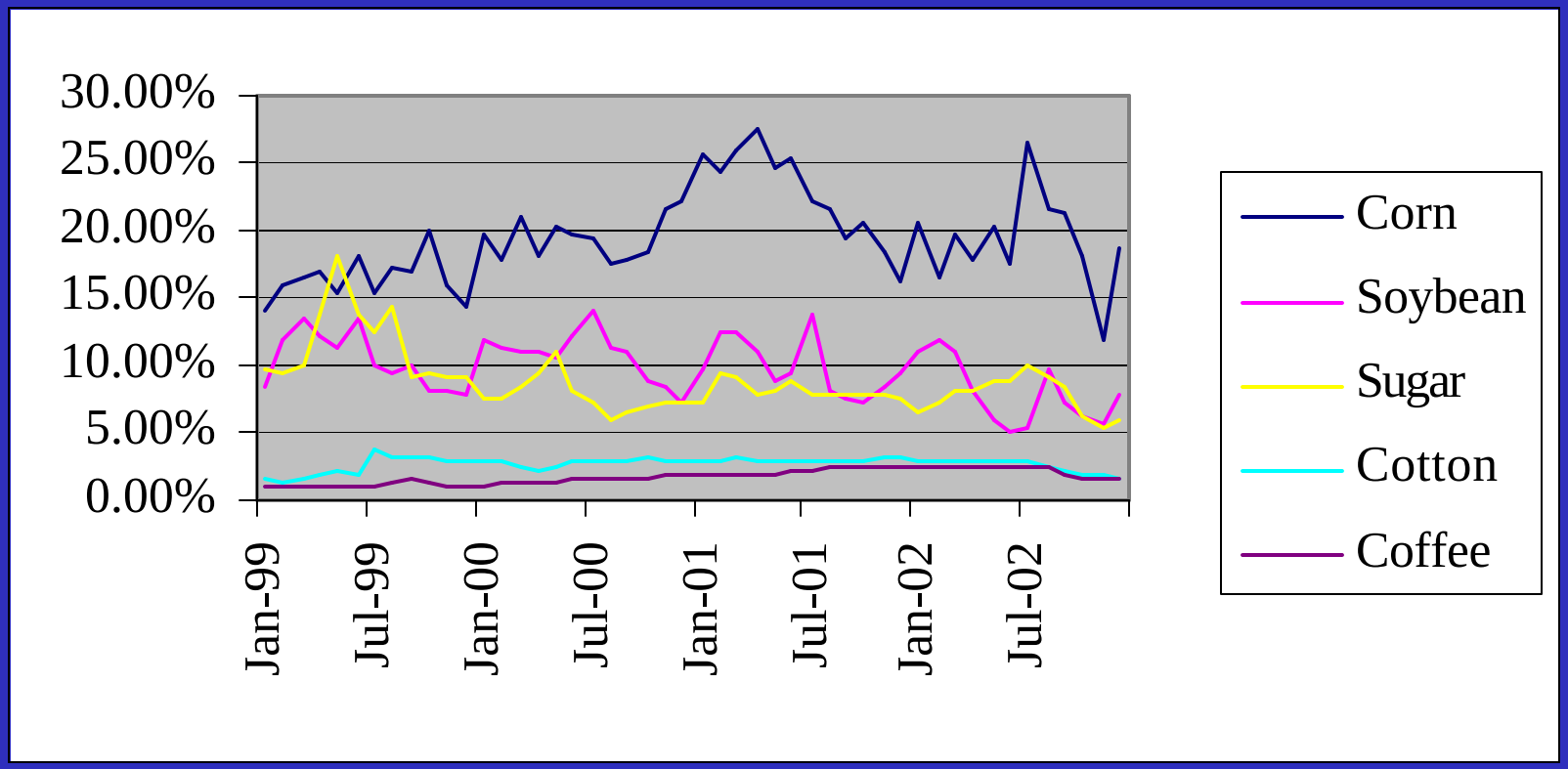
Prof. Dr. José Vicente Caixeta Filho

MEAN VALUES OF UNITARY FREIGHTS (US$/T.KM) PER PRODUCT, 1999-2002



Source: Sifreca

RELATIVE PARTICIPATION OF THE HIGHWAY FREIGHT VALUE (%) ON THE PRODUCT'S VALUE, 1999-2002



Source: Sifreca

THE ADVANCE OF THE AGRICULTURAL FRONTIER IN THE AMAZON REGION

Prof. Dr. José Vicente Caixeta Filho

MAIN HIGHLIGHTS...

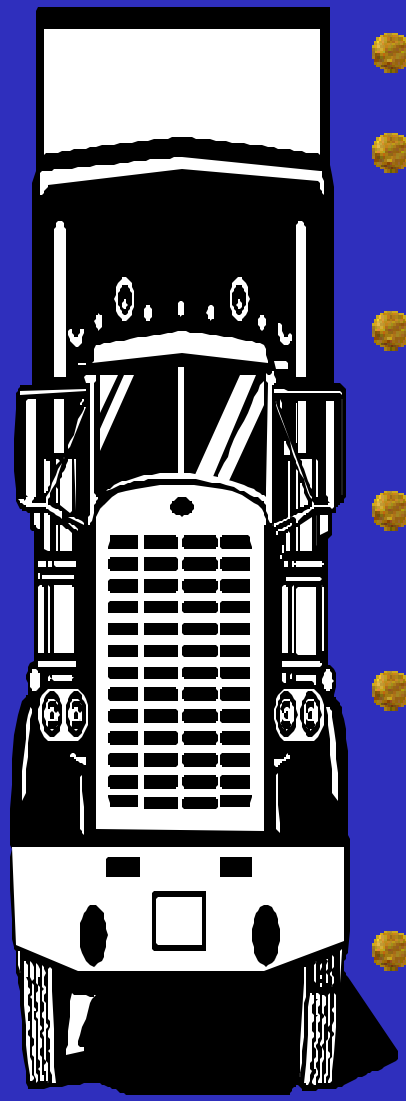
- advance through the *cerrado* (virgin savannah land) border;
- consolidation of Mato Grosso State as the main soybean producer of Brazil;
- very positive expectations for Santarém (PA);
- new axis through the highway BR 163.

Santarém (PA)

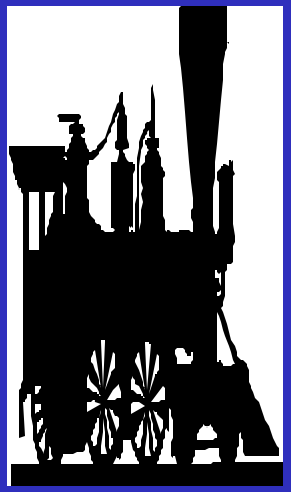
BR 163

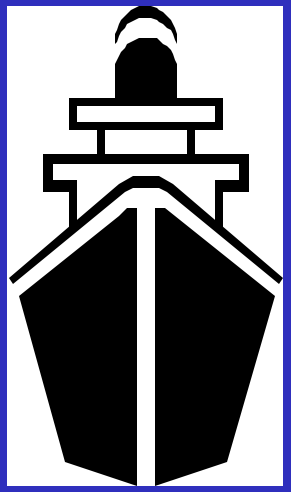
LOGISTICS EXPECTATIONS OF THE MARKET

Prof. Dr. José Vicente Caixeta Filho



- release of specific banking credit lines;
- efficient strategies for a systematic maintenance of the highways;
- higher number of tolls and rigor at the scales;
- increase of the highway freight tariffs (and better level of service);
- greater frequency of back-hauling operations (independent of the size of the shipper);
- still to be used as a door-to-door alternative, even for long distances.



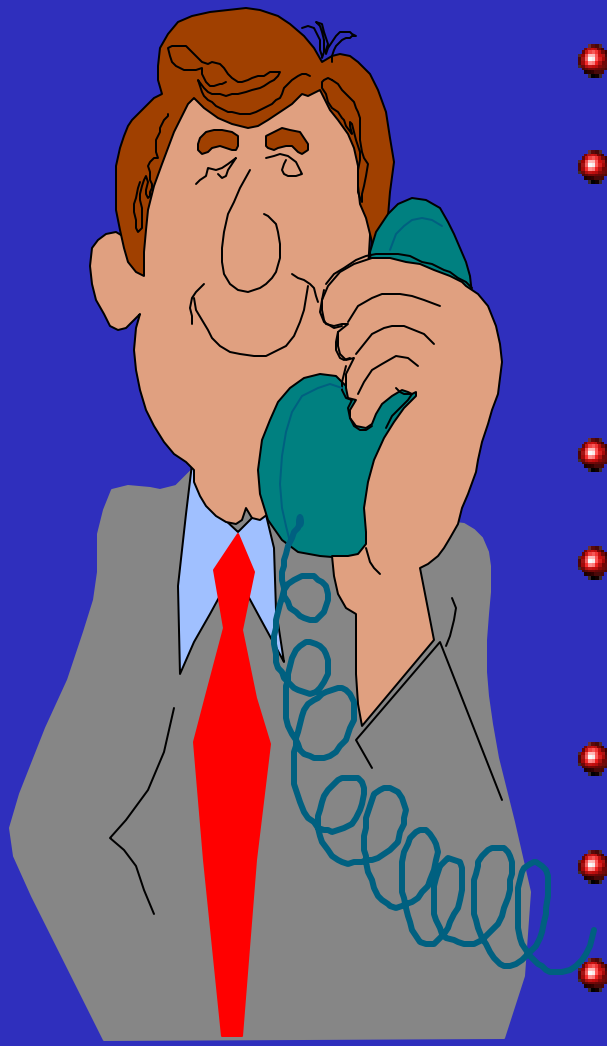


- decrease of the rail and waterway freight tariffs;
- rescue of the credibility of railway networks (lost under the public management period);
- technological up-grade of the waterway system;
- release of specific banking credit lines;
- expansion of coastal traffic (cabotage activities);
- increase of the capacity and efficiency of the seaport terminals.

GENERAL

- location of new industrial plants near to the main transportation corridors;
- expansion of the storing system (especially on the farm);
- active role of the transportation coordinating agent as a regulating policy maker;
- consolidation of the intermodal model in remote areas (North and Center-West).

FURTHER CONTACTS...



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