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How to Decrease Freight Logistics Costs in Brazil

Safe, Clean, Affordable
TRANSPORT

HOW TO DECREASE FREIGHT LOGISTICS COSTS IN BRAZIL

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ABBREVIATIONS AND ACRONYMS

CURRENCY EQUIVALENT

(Exchange Rate Effective July 2007-Feb. 2010)

Currency Unit =Brazilian Real R$

R$2.2-1.8 = US$1

FISCAL YEAR

January 1 – December 31

ABAG	Brazilian Association of Agribusiness (*Associação Brasileira de Agribusiness*)
ANA	National Water Agency *(Agência Nacional de Águas)*
ANTF	National Association of Rail Transporters (*Associação Nacional dos Transportadores Ferroviários*)
ANTP	National Association for Public Transportation (*Associação Nacional de Transportes Públicos*)
ANUT	National Consumer Association of Cargo Transport (*Associação Nacional dos Usuários de Transporte de Carga*)
ANTAQ	National Agency of Waterborne Transportation (*Agência Nacional de Transportes Aquaviários*)
ANTT	National Agency of Land Transport (*Agência Nacional de Transportes Terrestres*)
ASLOG	Brazilian Logistics Association (*Associação Brasileira de Logística*)
CEL	Center of Logistics Studies (*Centro de Estudos em Logística*)
CIDE	Fuel Tax at the Refinery (*Contribuição de Intervenção no Domínio Econômico*)
CNCO	Transpetro National Center of Operational Control (*Centro Nacional de Controle Operacional da Transpetro*)

CNT	National Transport Confederation (*Confederação Nacional do Transporte*)
CONIT	National Council for Transport Policy Integration *(Conselho Nacional de Integração de Politicas de Transporte)*
COPPEAD	Business School of the Federal University of Rio de Janeiro (*Instituto de Pós-Graduação em Administração da Universidade Federal do Rio de Janeiro*)
CVRD	Companhia Vale do Rio Doce, now known as VALE
DENATRAN	National Department of Motor Vehicles (*Departamento Nacional de Trânsito*)
DNIT	Department of Transportation Infrastructure (*Departamento Nacional de Infra-estrutura de Transportes*)
FIESP	São Paulo State Federation of Industries (*Federação das Indústrias do Estado de São Paulo*)
GDP	Gross Domestic Product
GEIPOT	National Transport Planning Agency (*Empresa Brasileira de Planejamento de Transportes*)
GOB	Government of Brasil
ICMS	Tax on Goods and Services (*Imposto Sobre Circulação de Mercadorias e Prestação de Serviços*)
IPEA	National Institute for Applied Economic Research (*Instituto de Pesquisa Econômica Aplicada*)
LAC	Latin American Countries
LPI	Logistics Performance Index
MDIC	Ministry of Development, Industry, and External Commerce (*Ministério do Desenvolvimento, Indústria e Comércio Exterior*)
NLC	National Logistics Council
NLS	National Logistics Strategy
OECD	Organization for Economic Co-operation and Development
OGMO	Port Workers Labor Managing Organization (*Órgão Gestor de Mão de Obra do Trabalho Portuário*)
MTO	Multimodal Transport Operator
PAC	Growth Acceleration Program (*Programa de Aceleração do Crescimento*)

PNLT	National Plan for Transport Logistics (*Plano Nacional de Logística de Transportes*)
PPP	Private-Public Partnership
PROCOMEX	Institute for the Modernization of Foreign Trade Logistics (*Instituto Aliança Pro Modernização Logística do Comercio Exterior*)
SPMR	Sao Paulo Metropolitan Region
TEU	Twenty Foot Equivalent Unit
TKU	Net Ton-Kilometres (*Tonelada Quilômetro útil*)

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EXECUTIVE SUMMARY

Background and Objectives

The ultimate goal of this work is to provide recommendations to the Brazilian government, private sector and non-governmental organizations for the preparation of a freight logistics policy agenda that prioritizes investment projects and improvements in supply chain procedures with the highest potential to achieve cost-efficiency gains for the country. Specific objectives of this work are: (i) to understand how the country's logistics system functions and identify its main problems; (ii) to understand Brazil's state of preparedness in the context of international best practice in logistics; (iii) to analyze information from users of the logistics system regarding their perception of problems and proposed solutions, and (iv) based on these analyses and on international best practices, offer recommendations on how to improve Brazil's logistics system.[1]

For Brazil, the relevance of the logistics system is high; exports and imports account for 15 percent and 12 percent respectively of its GDP. Brazil's trajectory into higher economic growth has been largely fueled by international trade. Given this dependence on international trade, and continued positive economic growth in the country, freight logistics will play an increasingly important role in supporting international and domestic trade growth.

This study is opportune in that its objective is to propose improvements to the existing freight logistics system through the identification of policy agenda actions which include, among others, packages of investment in infrastructure projects and supply chain measures to achieve cost-efficiency gains in the logistics movements. These actions are justified through investigations of existing and proposed transport infrastructure, logistics costs, Brazilian case studies, user surveys and international best practices.

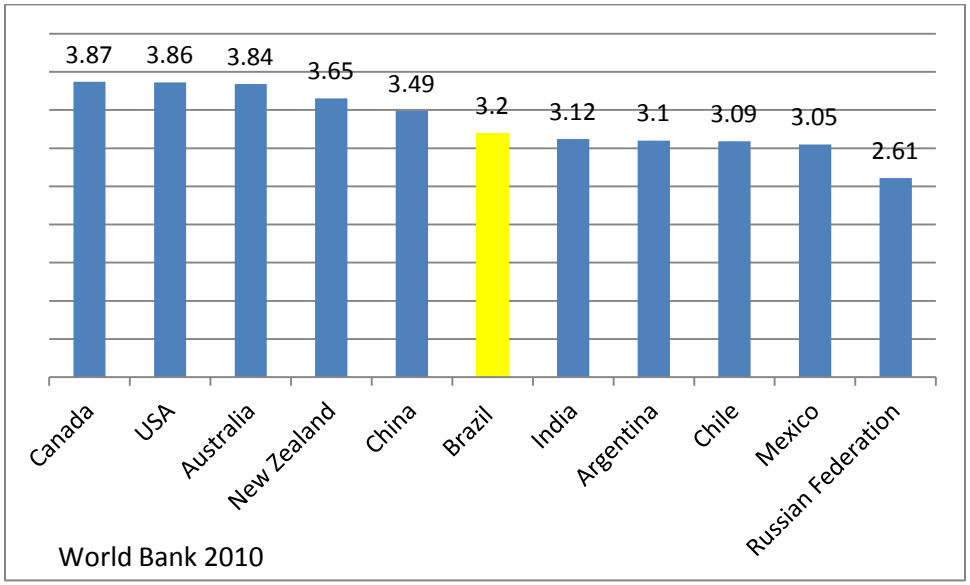
Global Comparative Analysis: Logistics Measures

The study examines Brazil's logistics system against its global competitors. Four measures are used for this comparison. The Logistics Performance Index (LPI) provides an in-depth cross country assessment of the logistics gap among countries by drawing information from professional operators and users involved in the logistics sector world market (see Figure 1). The index evaluates performance in customs procedures, infrastructure quality, ease and affordability of international shipments, domestic logistics industry competency, tracking and tracing, and timeliness in reaching destination. Evaluators comprise domestic logistics professionals and international trading partners. Brazil is identified in the 41st

[1] The report does not deal with airports and air cargo since this will be the subject of a separate review.

position from a total of 155 countries, lagging behind its main competitors China, Australia, United States and Canada and within the upper middle income cohort.

Figure 1: Logistics Performance Index 2010



The Index reveals that on a global scale, for Brazil, customs (including phytosanitary) performance and international shipments are perceived more as a problem than infrastructure, logistics competence, tracking or timeliness. In comparison with Latin America as a whole, Brazil performs on par with the regional Latin America and Caribbean indicators. For the remaining indicators, Brazil may be considered in line with its international comparators such as India and China. If the Russian Federation is to be included in the comparison, as is often done when comparing the key emerging countries (known as BRICs)[2] only the Russian Federation is behind Brazil in terms of performance.

The cost of doing business, in terms of time, cost and documentation to export or import products, ranks Brazil in the 125 position out of 181 countries. The results indicate that cost to export a container (TEU) is $1240 for Brazil and $1069 for the OECD[3] average and it takes more than twice as long for Brazil to export as it does the United States. However; the time to export and import is better in Brazil than in China, though the costs are considerably higher in Brazil. Overall it appears that Brazil's efficiency is adequate, though there is still improvement to be made on the cost structure.

[2] So-called BRIC group of key emerging economies refers to Brazil, Russia, India and China.

[3] Members of the Organization for Economic Cooperation and Development.

The World Economic Forum[4] through its Enabling Trade Index ranks Brazil in the 87th position in a class of 121 countries. Its most pressing challenges appear to be related to burdensome customs procedures, too few and poor quality roads, government inefficiencies and high business costs related to crime and violence. Conversely, Brazil demonstrates tariff simplicity, capable transshipment and liner shipping connectivity, postal service efficiency and absence of terrorism. In comparison with the BRICs, Brazil is positioned 3rd after China and India.

Finally, Brazil logistics costs as a percentage of GNP are compared with logistics costs of other emerging economies and industrialized countries, revealing that, according to World Bank calculations, Brazilian logistics costs are estimated at 15.4 percent of GNP. This value is in line with other Latin American countries. However, they are lagging in relation to the United States and OECD countries where logistics cots are about 8-10 percent of GDP.[5]

Study Analysis: Development Scenarios, Case Study, User Surveys

Based on the analysis of the logistics costs of the main infrastructure bottlenecks and supply chain procedures, the study presents a sketch planning exercise with a set of development scenarios, each with a different package of transport investment, improvements in supply chain procedures and policy measures that if implemented, would potentially reduce logistics costs. The measures range from maintaining the status quo to heavy infrastructure investment (see Table 1). The objective of the exercise is to evaluate how logistics costs alter as a percentage of GDP given the investments, some of which attempt to re-balance the transport matrix in favor of more cost-efficient modes.

TABLE 1 DEVELOPMENT SCENARIOS

Scenario	Infrastructure Investments	Policy Measures	Logistics Cost as % of GNP
1. Do-Nothing	The status quo which consists of continuing with: o very poor quality roads, o difficult road/rail access to ports, inefficient ports, o low participation of rail and waterway, o limited number of pipelines, o few port terminals and intermodal transfer terminals, o complicated and time-consuming customs/revenue procedures.	None	15.4%

[4] World Economic Forum, *The Global Enabling Trade Report 2009*, 2009.

[5] Caution is advised when comparing different countries having different GDP compositions.

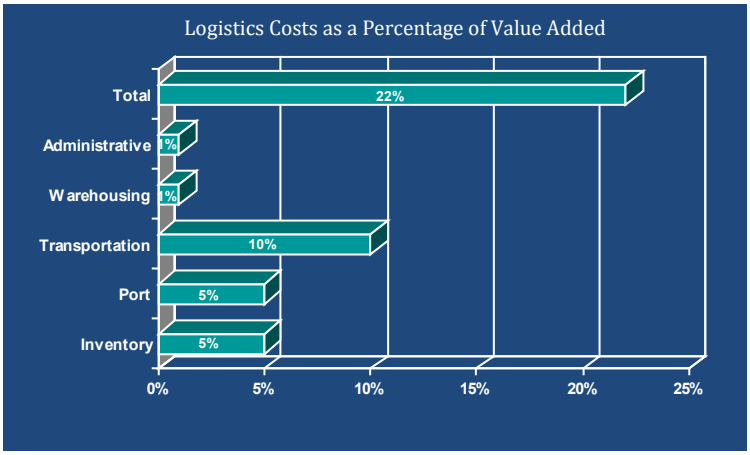
2. Improved Do-Nothing (mainly road)	Scenario 1 and: ○ improved roads through a major road maintenance program with maintenance funds guaranteed every year	○ accelerate road concession and PPPs, ○ guarantee CIDE transfers to States, ○ improve police surveillance to decrease theft, ○ improve tracking procedures.	15%
3. Metropolitan Ring Roads, port dredging, port access roads, improved port interface	This scenario would: ○ build all the road bypasses around the major metropolitan regions, ○ investments in BR163 and 158, ○ catch up with dredging backlog, ○ improve the road accesses to the ports of Santos, Paranaguá, Rio de Janeiro, Itajaí, S. Francisco do Sul, Rio Grande and Ilhéus /Aratu.	○ decentralize ports to local authorities, ○ professionalize management. ○ improve the Labor Management situation, ○ major effort to improve supply chain procedures particularly the port interface with customs, ○ simplify paper work, ○ incentivize the proliferation of MTOs.	14.4%
4. Scenario 3 plus the construction of the metropolitan rail bypasses	Scenario 3 and: ○ construction of the rail bypasses around São Paulo, Rio and other major metropolitan areas, ○ eliminate critical grade crossings.	○ policies to treat encroachment on rail right-of-way, ○ policies to allow mutual traffic rights on other railway tracks, ○ revision of concession models to facilitate interface between concessionaires.	14%
5. Scenario 4 plus the construction of more port terminals, intermodal transfer terminals, additional warehousing and improved port/customs interface	Scenario 4 and: ○ addition of port terminals, ○ incentives for road/rail intermodal terminals in the hinterland of main ports, ○ major improvement of the port/customs/security interface, ○ improve coastal shipping.	○ create fiscal incentives for construction of new multimodal terminals, ○ warehousing for agricultural products.	12%
6. Scenario 5 plus completion of some major railways which are under construction	Scenario 5 and: ○ completion of the North-South and Transnordestina railways, ○ important acquisition of rolling stock by the PS, ○ completion of ethanol pipelines already under consideration by Transpetro and private sector.	○ review leasing policies to facilitate the leasing of railcars and locomotives, ○ provide incentives for construction of short branch lines to connect with major railways.	9.4%
7. Scenario 6 plus several important investments in waterways and pipelines	Scenario 6 and: ○ navigation improvements in the Tapajós-Teles Pires waterway and in Araguaia, São Francisco, Bacia Amazonica and Tocantins rivers	○ de-link waterway transport from national shipbuilders, ○ allow acquisition of barges abroad, ○ provide tax breaks for pipeline investors particularly those working with ethanol.	6.4%

The results prove interesting; the scenario which most closely matches the government's current Growth Acceleration Program (PAC - a federal government initiative for 2007-2010 to stimulate the productive sector and thereby increase social benefits through government investments in infrastructure) results in some gains to the logistics costs attributed mainly to the continued focus on roads (Scenario 4). On the other hand, the ideal scenario, one which relies heavily on additional investments in railway lines, new rolling stock, and additional ethanol pipelines results in a logistics costs at 9.4 percent of the GNP (Scenario 6). The final results for scenarios 6 and 7 for logistics improvements obtained in this study are

very close to those recommended by the PNLT (National Plan for Transport Logistics-planning tool outlining investments, and their associated costs and benefits, required to support future commodity flows by modeling demand and trip distribution to generate a potential modal split) for the future (2023) transport matrix. Interestingly, the similarity in the results is achieved even though the PNLT's and this study's approach to calculating the logistics costs is somewhat different. Currently, the PNLT considers separately scenarios for regional growth and transport transformations. The cost of inventories, administration and warehousing are factors incorporated into the regional growth model while the costs of transport and port interface are factors incorporated into the transport model. Under the study, as exemplified in the Santos case study included in Chapter 3, the approach is to include all the components of logistics costs (inventories, transport, terminals, warehousing and administration) as a single modeling exercise representing products from all sectors independently of the transport mode currently employed. It also includes the possibility of directly measuring the effects of travel time reduction on the cost of inventories.

The study also reviews key elements of Brazil's logistics system in order to identify the main bottlenecks responsible for increasing production and logistics costs, focusing on the various transport modes, and including the regulatory framework and private sector. Brazil's freight transport modal split is evaluated against that of other countries in order to better understand the reasons for and consequences of the dominance of the road mode in Brazilian freight transport. To highlight how Brazil has been successful in addressing some of these challenges, the case study of the port of Santos examines more closely the steps that are being taken to resolve the port challenges. The analysis investigates the elements comprising the total logistics costs (transport, inventory, warehousing, port, and administrative costs-see Figure 2) required to export products in several sectors using a logistics generalized cost model. The share of transport amounts to a very large percentage of the overall export costs – 56 percent for foodstuffs and 54 percent for automobile parts.

Figure 2: Logistics Costs as a Percentage of Value Added



Total logistics costs reach 22 percent of the value added of an export product, indicating the high burden of logistics costs on exports. The investigation probes further the bottlenecks (transport costs, administrative fees, port fees, warehousing, exchange rates and inventory) for exporting, identifying transport costs as accounting for almost 80 percent of the challenges facing the foodstuff sector and almost 60 percent for the automobile sector. When two simulation exercises of logistics costs considered a reduction in supply chain documentation processing time and an increase in railway speed, logistics costs decreased by 16 percent and transport costs decreased by four percent. Results of the case study signify the impact investment opportunities can have on the logistics costs for products moving through the port, but more importantly, the potential increase in demand and competitiveness as a consequence of addressing the challenges in the sector.

To put in perspective the institutional issues of the sector encountered in Brazil, the study also analyzes global trends in logistics and describes the organization of the freight logistics sector in Australia, showing the importance of a national logistics strategy, state logistics strategies, capacity building centers, government networks and standards certifications as best practice example from the global arena.

One of the unique elements of this study is the inclusion of first hand responses from the users of the logistics system gathered from user associations' surveys on the challenges and potential solutions for the sector. Based on this background analysis, as well as the users' input, the study constructs the previously explained potential development scenarios that should they be implemented, have the potential to considerably decrease logistics costs.

Main Findings

The logistics panorama in the country shows that most sectors, despite making some recent progress, still have room for improvement to reach the levels of logistics efficiency of corresponding sectors in OECD countries, BRICs, and other emerging economies. The following paragraphs contain a list of what logistics users classify as important infrastructure and regulatory challenges and these are not very dissimilar to the types of challenges other countries are tackling.

The study summarizes the main infrastructure related challenges found in Brazil across all transport modes. A key conclusion is that the freight transport matrix is heavily biased towards roads, for which trucks become more expensive than other modes for long haul bulk transport, and whose costs are exacerbated by the lack of proper axle load enforcement causing an accelerated deterioration of the road conditions. Lack of maintenance coupled with increased reliance on this mode will eventually require more frequent recurrent investments, making truck operating costs even higher. In addition, the railroad network is insufficient in size, has different gauges which make connectivity difficult, offers low geographic coverage particularly from the main grain belt areas to the ports, and could benefit from improved intermodality with roads and waterways. The ports suffer from important dredging backlogs and need increased container handling capacity and post-panamax facilities, improved interface with trucks and trains and, resolution to the

serious labor and management issues which impact negatively on their cost-efficiency. As for pipelines, the mainly state-owned network needs additional strengthening to respond to the growing ethanol market, an important commodity for Brazil in the years to come. Limited coastal shipping due to lack of adequate terminals and legislation and undeveloped inland waterway navigation also adds to the insufficient transport infrastructure. Finally, the lack of intermodal terminals and warehousing along the supply chain, and the enabling environment for greater private sector participation, coupled with an absence of a unified institutional structure that could promote policies in favor of non-road modes, result in an inefficient logistics system. In general, the lack of price competition between modes, as a result of low coverage, limited players, among other issues, results in the consumer having to pay far higher prices for goods and services than in OECD countries.

On the institutional level, this study recognizes the tremendous gains that could be achieved through improved systematic planning, evaluation, selection and packaging of potential projects and policies by a specialized entity, in order to build upon the great efforts started by the PNLT. The study findings also recommend that the next phases of the PNLT, deal more explicitly with total logistics cost and the benchmarking required to evaluate how far the logistics system progresses with new infrastructure and policies[6]. Improvements to the existing freight database with origin-destination matrices could facilitate the systematic analysis of commodity flows used in the PNLT and GIS-based initiatives to map the data and the logistics poles could contribute positively to a system-wide approach. Finally, the study recognizes the presence of CONIT (National Council for Transport Policy Integration) and recommends that it be activated to hold more frequent meetings in response to a clear agenda and form thematic groups as needed, as a means to improve coordination between the various ministries and government agencies involved in logistics and the private sector.

Other study conclusions derived from user interviews and independent analysis, highlight the negative impact of under-investment by the public sector in infrastructure during the past decade, leading to budget cuts in all transport infrastructure investment and maintenance. By 2005, the macroeconomic indicators of the country had improved, however, at a high cost in the deterioration of transport infrastructure. The recent allocation of substantial public resources into the PAC is seen as a very positive step, and these investments should contribute to preventing further asset deterioration and expanding infrastructure stock.

It is estimated that Brazil should continue, at a minimum, the effort started with PAC by investing in infrastructure on a continuous basis over the next 10-20 years, taking into account the priorities established in the PNLT. Analyses show that major economies spend five to seven percent of their GDP each year on infrastructure[7],

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[6] For instance, this is being done at present by Transport Canada (Transport Canada, 2009) which allows a system-wide evaluation performance of gateways and trade corridors almost on a real-time basis.

[7] Infrastructure refers to transport, energy, urban and water.

while according to the World Bank, investments in infrastructure in Latin America need to reach four to six percent in order to compete effectively with Asian countries such as Korea and China.[8] Brazil, on the other hand, has spent in the range of 0.6 percent to 2.1 percent in the last few years[9]. This type of investment is particularly important since "public spending on infrastructure - roads, ports, airports, and power crowds private investment in. It expands investment opportunities and raises the return to private investment. By paving the way for new industries to emerge, it (public spending on infrastructure) is also a crucial aid to structural transformation and export diversification."[10]

Despite a slow start to Private Public Partnerships, the private sector appears to be participating actively in the infrastructure sector. It continues to participate actively in road concessions and is professionalizing its transport services to increase reliability and cut costs, decreasing inventories and tracking shipments. However, the majority of big private firms have said that they are uncertain how the government will address the problems with port interfaces, multi-modal transport, ports and roads improvements, and railway bypasses around the major metropolitan areas. The private sector also has significant knowledge to contribute to a program to improve infrastructure logistics, and in particular, recognizes what needs to be simplified in the supply chain procedures. The private sector is able to voice its concerns to government, through user associations and frequent seminars, and is also active in mobilizing public attention. It is also recognized that significant gains can be made through training and awareness campaigns to medium size firms of the importance of having an efficient logistics department with properly trained professionals. Such training may result in significant increases in reliability, decreases in stock inventories, loss and theft and better overall door-to-door service quality which, in the end, will translate into savings for the firms.

Overall, there is a consensus in government and private sector that a major training program in logistics should be launched, similar to the efforts made by the National Transport Planning Agency (GEIPOT) in the 1970s. The Ministry of Transport has begun this effort by hiring additional staff fully dedicated to the PNLT and the results are appearing at least at the planning level. Promotion of this type of training should continue in order to prepare logistics technicians to work with the private sector firms.

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[8] World Bank, Infrastructure in Latin America and the Caribbean: Recent Developments and Key Challenges, 2005.

[9] http://www.edc.ca/english/docs/speeches/2007/mediaroom_12565.htm

[10] See Commission on Growth and Development. 2008. "The Growth Report: Strategies for Sustained Growth and Inclusive Development." Quote from page 36.

Options for Action

This study believes that in order to enhance its competitiveness in the global marketplace, Brazil needs to set in motion a series of institutional and policy development actions, as well as major infrastructure investments.

The following options for short term action may help achieve the goal of improved competitiveness, followed by medium and long term actions to support improved intermodality and cost reductions in the logistics system.

Short Term Activities

A National Logistics Council (NLC) – It is suggested that a leadership council composed of representatives of the main stakeholders, Ministries and States, be formed, responsible for planning the National Logistics Strategy (NLS), setting its targets and overseeing its implementation. Such a council could be set up within the context of the existing, but expanded, CONIT with more effective private sector participation. The leadership of this council should be given to a person from government or private sector whose credentials and experience in the sector are highly respected. The NLC would be considered a partnership between the private and public sector, providing leadership in the industry, advising government, and promoting improvements to Brazilian logistics by proposing regulatory reform and appropriate infrastructure investment. Furthermore, given Brazil's size and diversity, it is possible that the states could have their own State Logistics Councils, with analogous functions to the NLC but functioning at the state level.

Logistics Planning Unit – The study recommends that Brazil revitalize the process of planning, evaluation and selection of its main investment projects, both in infrastructure and supply chain procedures, so that they can be properly prioritized. In the short-term, this would require re-creating a strong planning and evaluation unit within the Secretary of Policy at the Ministry of Transport in order to lend credibility to the planning, evaluation and selection of investments in the sector. The role of the planning unit is more operational in nature, and it should propose adequate national logistics policies under, and in line with, the National Logistics Strategy (NLS) such as streamlining supply chain procedures and documentation to speed up movement of freight.

National Logistics Strategy - As a timely follow-up to the PNLT, Brazil would benefit greatly from the preparation of a National Logistics Strategy. This strategy should have as its goals: a) higher customer service through customer responsiveness, geographic coverage, delivery time, reliability of delivery time, frequency of delivery, safety and security of goods, protection of corporate image and value-adding services; and, b) lower service cost in: transport and storage tariffs, inventory holdings, product damage and deterioration, pilferage losses, insurance costs, administration costs, customs and other clearances, bribes and malicious delays and social and environmental costs. The National Logistics Strategy should, as one of its fundamental principles, encourage private enterprise and competition.

Data Collection - Without reliable and extensive data that are regularly updated, it is very difficult to undertake systematic analysis of the different logistics corridors of the country and those that need to be created to serve potential flows. In order to support the proposed logistics framework, a database containing all of the inputs that are required for the proper functioning of the logistics system, such as commodity origin and destination, costs of transport, infrastructure availability, operations indicators, registry of users, among others, is required urgently.

In order to strengthen information on the sector, several studies are recommended:

1) Achieving a decrease in consumer prices as a result of lower logistics costs;
2) Global competitiveness in areas such as transport security and documentation;
3) Trucking industry, its characteristics and agenda for improvements;
4) Methods to increase competition between railways;
5) Increasing participation of railways in the short-haul market;
6) Impact of adding a third rail to the broad gauge to allow for metric gauge interconnection;
7) Cost-benefit of investments required to introduce double stack;
8) Improve transport related management information systems;
9) Customs and phytosanitary performance benchmarking;
10) Defining intermodal corridors to reduce congestion and environmental impacts; and
11) Port competition to lower port costs.

Infrastructure and Supply Chain Investment - This study recommends that the government signal its intention to double its investment on logistics infrastructure and supply chain procedures and include those investments in the PAC or other unrestricted programs[11]. The list of immediate investments that this study strongly recommends to be implemented, and which have reached consensus through the user associations, includes:

a. Major road rehabilitation program with assured funds,
b. Constructing/improving the railway bypasses around the main metropolitan regions, namely São Paulo and Rio de Janeiro;
c. Constructing the road rings (*rodoaneis*) around São Paulo and Rio de Janeiro;
d. Eliminating the dredging backlog in the Santos Port and other ports.

Most of these priority investments have been identified in the PNLT and prioritized in the PAC. The investments presently contemplated in the PAC would allow the implementation of Scenario 4 discussed previously, which would be a good start to improve the current system.

[11] The government is already moving in this direction; as part of the anti-economic crisis program in 2010, the government expanded the PAC program from R$ 504 billion to R$ 646 billion, close to a 30% increase http://www.brasil.gov.br/pac/.arquivos/8balancoparte1_131009.pdf.

The list of "soft" investments to improve the supply chain includes:

a. Harmonizing taxes in the different states to decrease circuitous truck transport routes to avoid taxes;
b. Improving regulatory functions particularly in the road sector;
c. Simplifying required documentation in the supply chain, including customs and phytosanitary issues;
d. Facilitating and encouraging construction of intermodal terminals to reduce the cost of transferring freight from one mode to another, and warehousing to facilitate storage along the supply chain.

Although some interministerial work is already underway to simplify supply chain procedures, this study believes that a special commission under the proposed NLC should be created to overhaul the interfaces between Customs, Phytosanitary inspection and Revenue and the private sector. Yet two important measures are still required: 1) the introduction of the Electronic Bill of Lading (*Conhecimento de Transporte de Cargas Eletrônico,* CT-e); and 2) the introduction of fiscal exemptions to encourage building port terminals and intermodal transfer terminals. By building port terminals and intermodal transfer terminals, short haul intermodal rail services is fostered, promoting a reduction in the number of trucks in urban areas with important environmental gains, a legislative program already underway in the United States, France and Canada.[12]

Medium and Long-Term Activities

The study recommends preparing a medium and long-term plan to provide the enabling environment necessary to increase the participation of rail and waterways in the freight matrix. The payoffs of rebalancing the freight transportation matrix from road to other transport modes are high compared with the necessary investment. Accelerating this shift will require a carefully designed investment plan to extend some railways, build branch lines to production areas, make the main inland waterways navigable, boost coastal shipping and create the incentives for building more intermodal transfer terminals.

The scenarios outlined previously detail the type and cost of investments necessary to realize the modal shift. In brief, a list of potential major investments ranging from addition of ports to completion of railway lines to maximize Brazil's competitive advantage are estimated to reduce the logistics cost from the current 15.4percent of GNP to less than 10percent. One of the main factors to enable this reduction is the focus on the waterway and port sector with the abovementioned investments.

Moreover, such a modal shift towards water and rail will enable Brazil to take advantage of current conditions and projected trends in order to influence future energy use and emissions by freight transport. First, a growing economy will invariably increase the flow of goods, but reducing the gross weight or distance

[12] See Resor 2004, Transport Canada 2004, and Foundation for Intermodal Research & Education 2003.

traveled for the same freight would reduce the amount of energy consumption and emissions. Second, shifting the heaviest and densest freight currently carried by trucks to rail or waterways would have a significantly positive effect on energy consumption and emissions, all else being equal. Third, introducing or scaling-up innovative certification and financing programs such as SmartWay in the United States can accelerate the turnover or improvement of the fleet. Fourth, freight management strategies in an urban context will be increasingly important as cities continue to grow. Finally, alternative fuels and electric/hybrid vehicles, a Brazilian advantage, may further reduce energy consumption depending on the production process and energy source.

This study believes that further strengthening the global competitiveness for Brazilian companies should be a major goal of the proposed NLS in the medium-term so that the Logistics Performance Index for Brazil improves substantially when compared to OECD and other emerging competitors. Building on the improvements that could be achieved in the short term, the above recommendations for large infrastructure investments, coupled with new policies, will enable Brazil to gradually alter the modal shift in favor of water, rail and pipeline transport resulting in an enhanced logistics framework promoting improved performance and reduced costs.

TABLE 2 SUMMARY RECOMMENDATIONS

Recommendation	Responsibility to Create/Enact/Undertake	Observations
		Short Term
Create a National Logistics Council (NLC) with more state and private sector participation	Council of Ministers	An expanded CONIT with strong private sector participation and leadership by a person whose credentials are acceptable to government and private sector
Foster State Logistics Councils	State Government	Similar to NLC at State level
Logistics Planning Unit	Secretary of Policy at the Ministry of Transport	This should be a very strong Planning Unit similar to the old GEIPOT
National Logistics Strategy	CONIT/ Secretary of Policy of the Ministry of Transport/State Logistics Councils	Follow up to PNLT emphasizing: a) higher customer service through customer responsiveness, geographic coverage, delivery time, reliability of delivery time, frequency of delivery, safety and security of goods, protection of corporate image and value-adding services; and b) lower service cost in: transport and storage tariffs, inventory holdings, product damage and deterioration, pilferage losses, insurance costs, administration costs, customs and other clearances, bribes and malicious delays and social and environmental costs.
Data Collection	Secretary of Policy at the Ministry of Transport	Systematic and periodic data collection made available to all interested users

Priority Studies	Secretary of Policy at the Ministry of Transport	• Achieving a decrease in consumer prices as a result of lower logistics costs; • Global competitiveness in areas such as transport security and documentation; • Trucking industry, its characteristics and agenda for improvements; • Methods to increase competition between railways; • Increasing participation of railways in the short-haul market; • Impact of adding a third rail to the broad gauge to allow for metric gauge interconnection; • Cost-benefit of investments required to introduce double stack; • Improve transport related management information systems; • Customs performance benchmarking; • Defining intermodal corridors to reduce congestion and environmental impacts; • Port competition to lower port costs.
Infrastructure Investment		• Major road rehabilitation program with assured funds, • Constructing/improving the railway bypasses around the main metropolitan regions, namely São Paulo and Rio de Janeiro; • Constructing the road rings (*rodoaneis*) around São Paulo and Rio de Janeiro; • Eliminating the dredging backlog in the Santos Port and other ports.
Supply Chain Investment		• Harmonizing taxes in the different states to decrease circuitous truck transport routes to avoid taxes; • Improving regulatory functions particularly in the road sector; • Simplifying required documentation in the supply chain, including customs and phytosanitary issues; • Facilitating and encouraging construction of intermodal terminals to reduce the cost of transferring freight from one mode to another, and warehousing to facilitate storage along the supply chain.
Medium and Long Term		
Rebalancing the Freight Matrix by increasing rail, waterway and pipeline coverage	CONIT/Ministry of Transport/Ministry of Planning/Ministry of Finance	• Extend some railways, build branch lines to production areas, • Make the main inland waterways navigable, • Boost coastal shipping • Encourage more pipelines for ethanol • Create the incentives for more intermodal transfer terminals to be built.

INTRODUCTION

The ultimate goal of this work is to provide recommendations to the Brazilian government, private sector and non-governmental organizations for the preparation of a freight logistics policy agenda that prioritizes transport investment projects and supply chain procedures with the highest potential to achieve cost-efficiency gains for the country. Specific objectives of this work are: (i) to understand how the country's logistics system functions and identify its main problems; (ii) to understand Brazil's state of preparedness in the context of international best practice in logistics; (iii) to analyze information from users of the logistics system regarding their perception of problems and proposed solutions, and (iv) based on these analyses and on international best practices, offer recommendations on how to improve Brazil's logistics system.[13]

Logistics can be understood as the "process of planning, implementing, and controlling the efficient, cost effective flow and storage of raw materials, in-process inventory, finished goods and related information from point of origin to point of consumption for the purpose of meeting customer requirements."[14] Freight logistics involves different physical and economic activities, which are more commonly categorized as[15]: 1) Core Logistics Services: line-haul transport, pick-up and distribution, storage, loading/unloading, stuffing/stripping, load consolidation; 2) Value Adding Services: packaging, quality control, product testing/repair, assembly, installation, information and inventory control; and 3) Support Services: equipment hiring/leasing, equipment maintenance, sanitary services, security services, trade insurance and finance. As such, logistics is one of the most important aspects for accessing markets, affecting both the volume and value of internationally traded goods.

For Brazil, the relevance of the logistics system is high; Brazil's trajectory into higher economic growth has been largely fueled by international trade (See Figure 1 for the growth in the proportion of exports/imports to GDP). Given that Brazil's economic expansion is expected to grow in a range of 3 to 4 percent per year, logistics will play an increasingly important role.[16]

[13] The report does not deal with airports and air cargo since this will be the subject of a separate review.

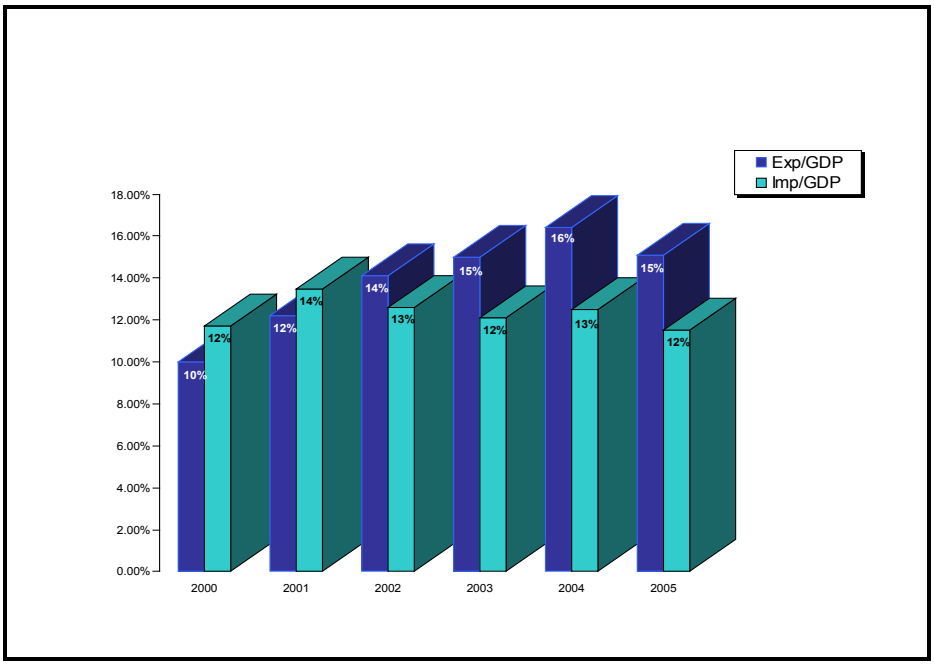
[14] US Council of Supply Chain Management Professionals. Previously, Council of Logistics Management, 1989.

[15] NESDB Conference, Bangkok 2007.

[16] The reader should be aware that this assumption was made in May 2008. Global market events following this date were not incorporated into this assumption.

Table 1 shows the annual percentage increases over the base year 1977 for the volume and value of total exports, primary products (also called basic goods) exports, and manufactured goods exports. Brazil's exports by value and volume have grown significantly during the period examined. More importantly, the data indicates that export value has increased more rapidly than export volume. For example, the index of the value of manufactured goods exports increased almost 23-fold while the volume of these exports increased by about 12-fold over the 30 year period examined (this will be developed later in the case study of the Port of Santos). Overall, the value of total exports grew 50 percent more than their volume. As Brazilian exports are worth more relative to their volume, the opportunity cost of marginal time spent transporting or storing these goods becomes higher. As logistics costs increase, there may be a point where they become prohibitive and turn into a bottleneck. As such, the inputs to logistics: time, reliability, just in time delivery, and security, become critical considerations.[17] A good logistics system will allow faster rates of growth, while a logistics system in poor shape will most likely impact negatively the economy. The ability to trade with other countries and to grow will be increasingly intertwined with the logistics system.

FIGURE 1: EXPORT & IMPORT AS A PROPORTION OF GDP (%) 2000-2005



Source: IBGE

[17] See Hummels (2007).

TABLE 1: GROWTH OF VOLUME AND VALUE OF TOTAL EXPORTS, BASIC GOODS EXPORTS, AND MANUFACTURED GOODS EXPORTS AS PERCENTAGE OF 1977 (BASE YEAR) FIGURES

	Total Exports		Basic Goods Exports		Manufactured Goods Exports	
Year	Volume	Total Value	Volume	Total Value	Volume	Total Value
1977	100.0	100.0	100.0	100.0	100.0	100.0
1980	124.4	149.4	68.5	75.3	211.2	276.3
1985	168.3	177.5	101.6	87.3	267.3	343.1
1990	230.7	257.6	129.6	101.4	355.2	506.3
1995	269.8	336.7	119.1	111.7	439.9	681.4
2000	362.9	390.3	168.4	125.3	566.2	801.1
2005	691.3	842.6	378.7	312.8	1123.0	1720.6
2007	818.7	1241.1	521.1	564.4	1236.1	2292.8

Source: www.ipeadata.gob.br and calculations by authors.

1 COMPARING BRAZIL WITH OTHER COUNTRIES

Selecting which countries Brazil could most accurately be compared with, in terms of logistics performance, may be an exercise in its own right. Geographically, Brazil is often compared with other Latin American countries, yet in terms of overall scale, this comparison may not be entirely justifiable. At present rates of growth, Brazil is also considered part of the group of rapidly developing countries like China and India, which one day could overtake today's industrial states[18]. Economically, developing countries known as the BRIC (Brazil, Russia, India, China) are becoming more assertive in international trade, dominate their regions economically and politically, and have achieved middle income status in the World Bank (India is an exception). Finally, given the availability of recent and readily available data, and the expected development trajectory of the BRIC group, comparison with OECD countries is often conducted.

Four logistics measures are reviewed to rank Brazil in comparison with other countries: a) the World Bank Logistics Performance Index, b) the World Bank Doing Business, c) the World Economic Forum's Enabling Trade index, and d) the World Bank estimate of logistics costs as a proportion of GNP. The remainder of the section elaborates on the results of the four measures. The results indicate that in some logistical aspects, Brazil is ahead of its competitors, while in others, Brazil experiences impediments to its performance.

The Logistics Performance Index (LPI): The 2010 survey was designed and administered by the World Bank in cooperation with the Turku School of Economics in Finland (TSE, Finland). The LPI provides an in-depth cross country assessment of the logistics gap among countries by drawing information from professional operators and users involved in the logistics sector. It uses a 5-point scale (1 for the lowest, 5 for the highest) which enables the illustration of disparities as well as to benchmark against a country's competitors. With more than 5,000 country evaluations, the individuals surveyed rate the following six areas of performance: (1) efficiency of customs procedures, (2) transport related infrastructure quality, (3) ease and affordability for the arrangement of international shipments, (4) competence and quality of the logistics industry, (5) ability to track and trace shipments, and (6) timeliness in reaching destination.[19]

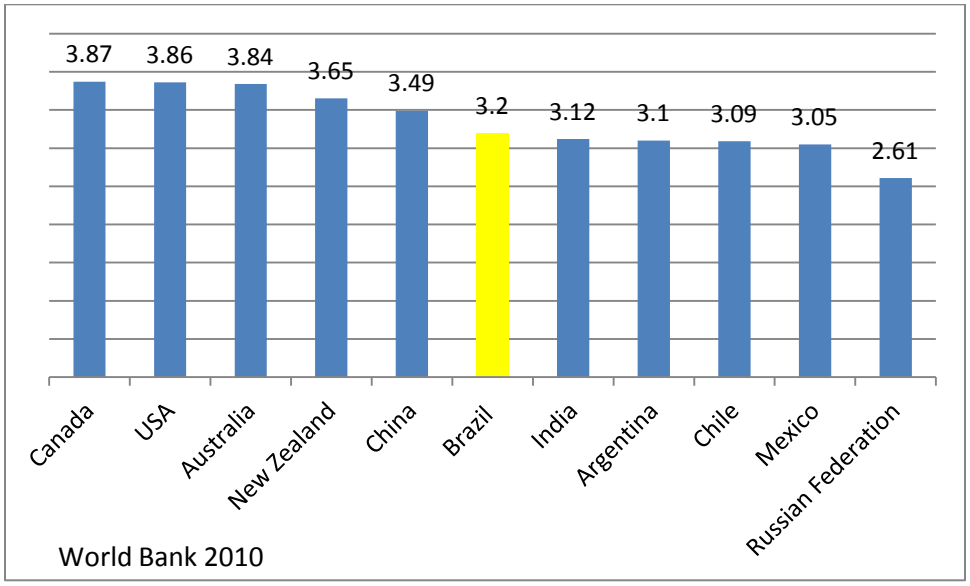
[18] Decker, A New Geography in International Trade, 2005.

[19] www.worldbank.org/lpi (2010)

The LPI consists of two major parts: international (qualitative evaluation of the six indicators by trading partners) and domestic (qualitative and quantitative evaluations by domestic logistics professionals). The precision of the LPI estimate is defined by a robust combination of the various dimensions included in international assessments, built by standard econometric techniques to maximize significance and improve confidence intervals, which are computed at a 10 percent level. The average confidence interval on the 1-5 scale is 0.16, the equivalent of eight places in the LPI ranking.

On the overall logistics performance index (the compilation of the above 6 areas), Brazil ranks number 41 out of 155 countries, lagging behind Mexico, India, China, Australia, United States and Canada (See Figure 2).

Figure 2: Logistics Performance Index 2010: Brazil

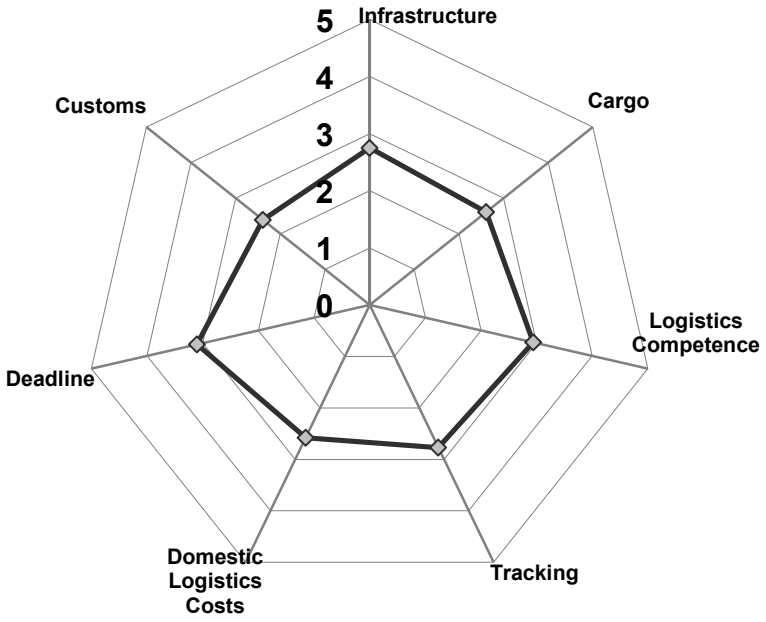


The breakdown by category (Figure 3) reveals that for Brazil, customs (including phytosanitary) performance and international shipments are perceived more as a problem by international traders than infrastructure or the competency of logistic operators. On the domestic perspective, when compared with the upper middle income cohort, Brazil has a mixed performance. Brazil has performed well in terms of efficiency of processes, but on levels of fees and charges and quality of infrastructure, Brazil has room for much improvement. On the last indicator, respondents were asked about changes in their logistics environment which may

have improved, and the largest improvement appears in the reduced level of corruption, IT infrastructure, and private logistics services.

FIGURE 3: BRAZIL'S LPI WITHIN UPPER MIDDLE INCOME COUNTRY GROUP

International Perspective



Domestic Perspective

Level of Fees and Charges		
Based on your experience in international logistics, please select the options that best describe the operational logistics environment in your country of work	Percent of respondents answering high/very high	
	Brazil	**Upper middle income**
Port charges are	78.26%	40.21%
Airport charges are	68.18%	44.96%
Road transport rates are	62.50%	37.73%
Rail transport rates are	40%	25.17%
Warehousing/transloading charges are	50%	28.53%
Agent fees are	34.78%	24.18%

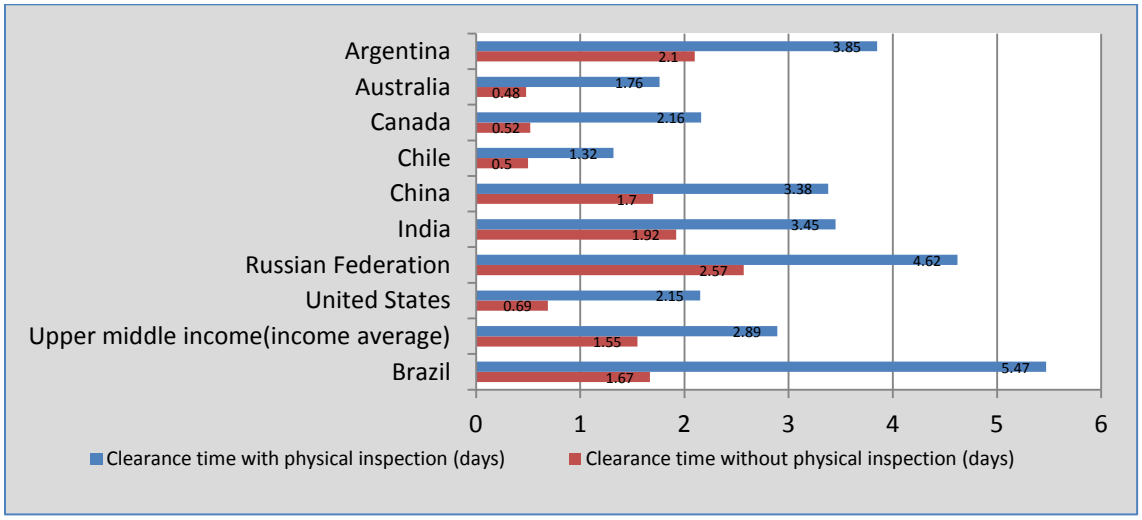
Quality of Infrastructure		
Evaluate the quality of trade and transport related infrastructure (e.g. ports, roads, airports, information technology) in your country of work	Percent of respondents answering low/very low	
	Brazil	**Upper middle income**
Ports	75%	24.81%
Airports	40.91%	22.89%
Roads	52%	17.79%
Rail	90%	11.14%
Warehousing/transloading facilities	24%	29.87%
Telecommunications and IT	17.39%	17.92%
Competence and Quality of Services		
Evaluate the competence and quality of service delivered by the following in your country of work	Percent of respondents answering high/very high	
	Brazil	**Upper middle income**
Road	16.67%	25.44%
Rail	4.76%	10.26%
Air transport	36.36%	41.24%
Maritime transport	25%	46.39%
Warehousing/transloading and distribution	28.00%	37.94%
Freight forwarders	54.17%	53.15%
Customs agencies	21.43%	29.69%
Quality/standards inspection agencies	4.35%	17.80%
Health/SPS agencies	4.35%	13.22%
Customs brokers	21.74%	31.53%
Trade and transport associations	10%	14.82%
Consignees or shippers	16.67%	21.78%
Efficiency of Processes		
Evaluate the efficiency of the following processes in your country of work	Percent of respondents answering often or nearly always	
	Brazil	**Upper middle income**
Clearance and delivery of imports	30.43%	64.07%
Clearance and delivery of exports	82.61%	78.15%

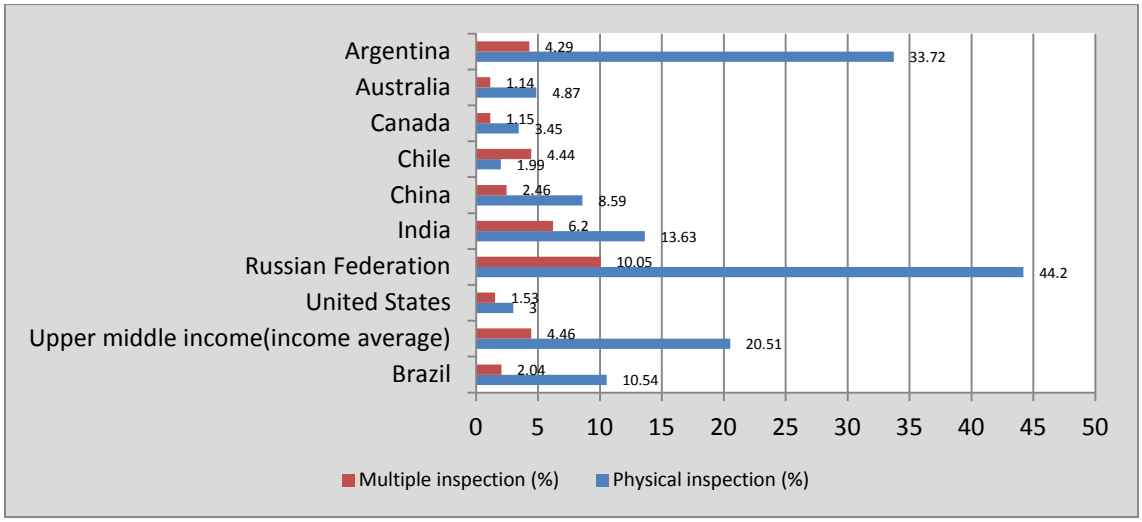
Transparency of customs clearance	42.86%	41.58%
Provision of adequate and timely information on regulatory changes	30.43%	47.04%
Expedited customs clearance for traders with high compliance levels	64.29%	47.66%
Sources of Major Delays		
How often in your country of work, you experience	Percent of respondents answering often or nearly always	
	Brazil	**Upper middle income**
Compulsory warehousing/transloading	19.05%	21.56%
Pre-shipment inspection	22.73%	21.28%
Maritime transshipment	13.64%	25.16%
Criminal activities (e.g., stolen cargo)	7.69%	12.83%
Solicitation of informal payments	16.67%	20.39%
Changes in the Logistics Environment Since 2005		
Since 2005, have the following factors improved or worsened in your country of work	Percent of respondents answering improved or much improved	
	Brazil	**Upper middle income**
Customs clearance procedures	45.45%	56.16%
Other official clearance procedures	28.57%	38.12%
Trade and transport infrastructure	39.13%	49.99%
Telecommunications and IT infrastructure	77.27%	74.64%
Private logistics services	78.26%	74.73%
Regulation related to logistics	18.18%	28.91%
Incidence of corruption	81.82%	34.28%

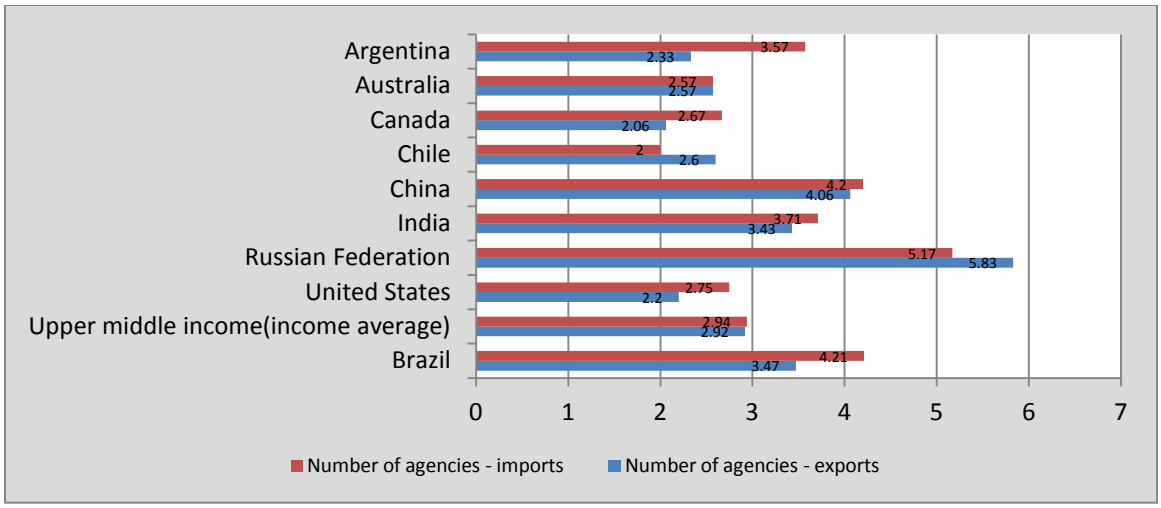
Source: World Bank, 2010

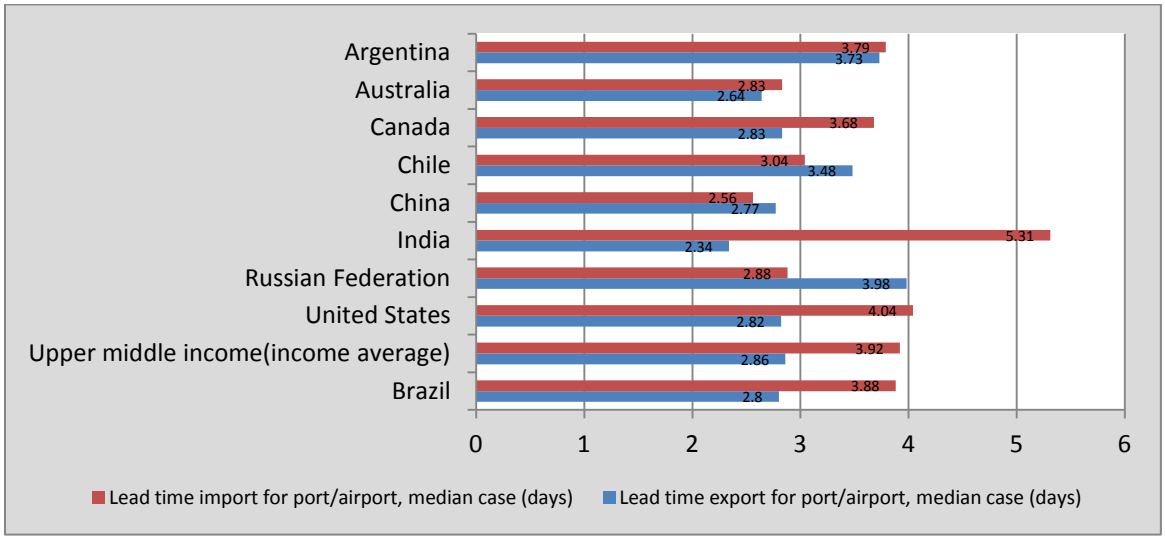
The breakdown by category and cross countries (Figure 4) as evaluated by domestic logistics professionals reveals that Brazil performs worse than the upper middle income countries on all indicators. Interestingly, on lead time for import and export, Brazil has performed quite well in comparison with all the countries analyzed, including the United States and Canada, and the cost of import seems to be in line with the United States, though for both countries the performance could be improved. Compared to the BRIC countries, number of agencies seems to be a positive indicator, however regarding inspections and container costs, Brazil could also improve its performance.

FIGURE 4: LPI CROSS COUNTRY COMPARISON






Argentina
Australia
Canada
Chile
China
India
Russian Federation
United States
Upper middle income(income average)
Brazil
3.57
2.33
2.57
2.57
2.67
2.06
2
2.6
4.2
4.06
3.71
3.43
5.17
5.83
2.75
2.2
2.94
2.92
4.21
3.47
0
1
2
3
4
5
6
7
Number of agencies - imports
Number of agencies - exports


Argentina
Australia
Canada
Chile
China
India
Russian Federation
United States
Upper middle income(income average)
Brazil
3.79
3.73
2.83
2.64
3.68
2.83
3.04
3.48
2.56
2.77
5.31
2.34
2.88
3.98
4.04
2.82
3.92
2.86
3.88
2.8
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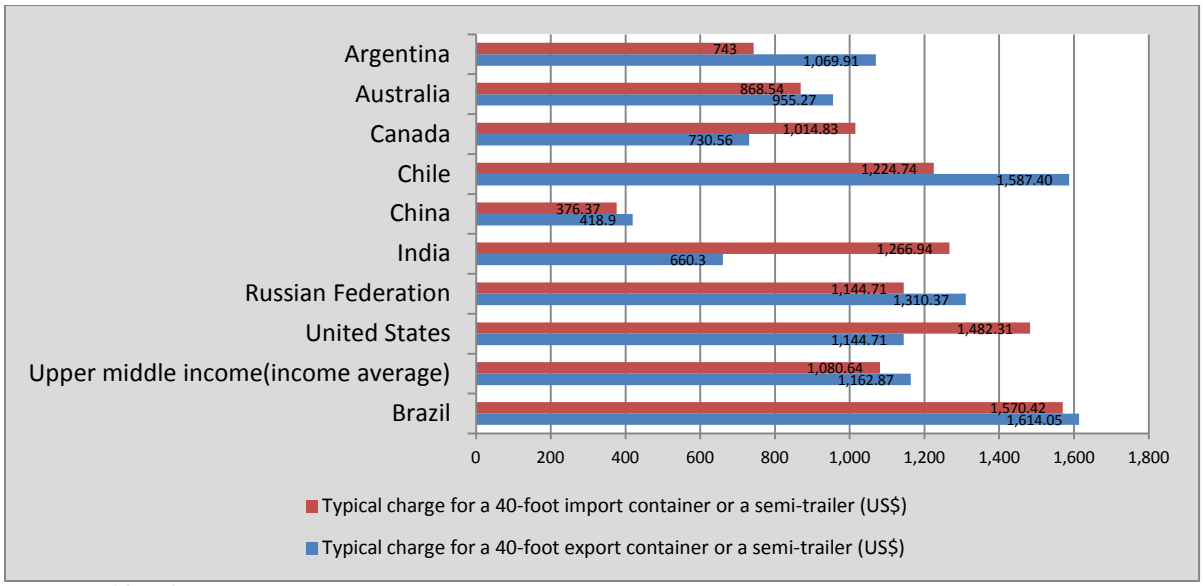
2
3
4
5
6
Lead time import for port/airport, median case (days)
Lead time export for port/airport, median case (days)



Source: World Bank, 2010

The Cost of Doing Business: The World Bank doing business database allows for the comparison of 181 economies, including several logistics indicators. Brazil's overall rank in the cost of doing business can be considered high, though it had moved up from 2008 to 2009 from 126 to 125. In addition, under the measure for Trading across Borders, its position for 2008 (Doing Business 2009) is ahead of Argentina and overall, its ranking moved from 98 to 92. However, Brazil still has a long way to improve efficiency, as compared to the OECD average (See Table 2).

According to the World Bank, it takes more than twice as long for Brazil to export as it does the United States, and almost four times as long as it takes the United States to import goods. However, the time to export and import is better in Brazil than in China, though the costs are considerably higher in Brazil. Overall it appears that Brazil's efficiency is quite good, however; there is still improvement to be made on the cost structure (as compared with OECD, India, and China,). Specifically, demurrage charges at ports are still about US$700 million/year, increasing the cost of shipping in and out of Brazil. This notion is reinforced in Table 3 indicating historically the continuous increase in costs to export and import, contrasted with an increase in efficiency (decrease in time required for export/import).

TABLE 2: COST OF DOING BUSINESS 2009 (TRADING ACROSS BORDERS) (Figures to June 2008)

Country	Documents to export (number)	Export Time	Cost to export (US$ per container)	Documents to import (number)	Import Time	Cost to import (US$ per container)
USA	4	6	990	5	5	1245
OECD High Income (Averages)	4	11	1069	5	11	1133
Argentina	9	13	1480	7	18	1810
India	8	17	945	9	20	960
Brazil	8	14	1240	7	19	1275
Chile	6	21	745	7	21	795
China	7	21	460	6	24	545
Mexico	5	17	1472	5	23	2700
Latin America (Average)	7	21	1246	8	24	1427
Peru	7	24	875	8	25	895
Russian Federation	8	36	2150	13	36	2150

Source: World Bank (2009)

TABLE 3: HISTORICAL DATA OF DOING BUSINESS IN BRAZIL

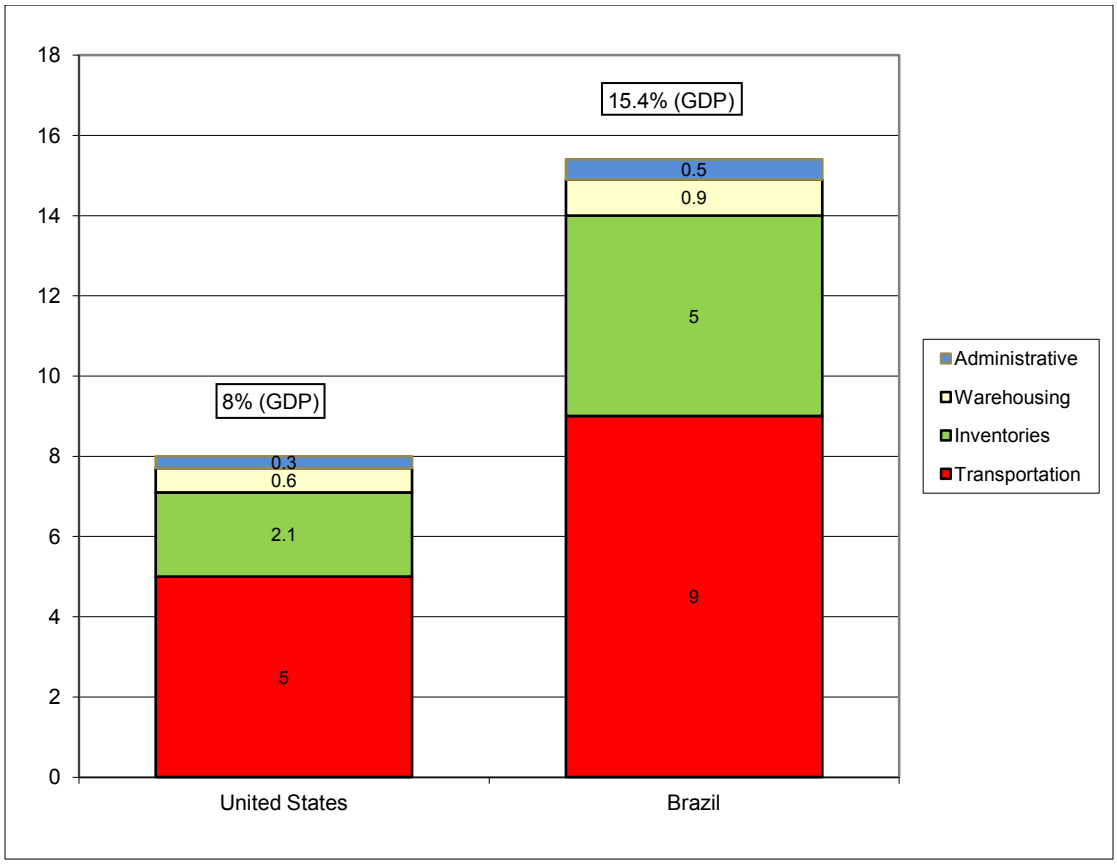
Trading Across Borders Data	Doing Business 2007	Doing Business 2008	Doing Business 2009
Rank (Trading Across Borders)		98	92
Documents to export (number)	8	8	8
Export Time (days)	18	18	14
Cost to export (US$ per container)	895	1090	1240
Documents to import (number)	7	7	7
Import Time (days)	24	22	19
Cost to import (US$ per container)	1145	1240	1275

Source: World Bank (2007, 2008, 2009) (Nominal $ Values)

Enabling Trade Index (ETI): The World Economic Forum's ETI measures the extent to which institutions, policies and services facilitate the free flow of goods over borders and to final destinations. The ETI measures market access, border administration, transport and communications infrastructure, and business environment. Brazil is ranked 87th among 121 countries, a similar position to the Doing Business ranking (approximately 70th percentile) due, in part, to the input of World Bank data in both reports. In comparison with the BRIC countries, Brazil ranks 3rd following China (49th), India (76th), and before the Russian Federation (109th). The best performer is Singapore, the United States ranks 16th, and Argentina ranks 97th. Comparing globally, Brazil is an average or somewhat better performer in availability and quality of transport services (56th), availability and use of technology (54th), and efficiency and transparency in border administration (65th). However, there are impediments and room for improvement in addressing the level of protectionism (95th), quality and availability of transport infrastructure (93th -particularly weak on availability and quality of roads and quality of port infrastructure), and efficiency of customs procedures (98th) (see Annex 2 for more information).

Logistics Costs as a Percentage of GNP: The World Bank (2007) calculates that Brazilian logistics costs are approximately 15.4 percent of GNP, which is twice as large as in the United States (See Figure 5). The logistics costs involved in this index include administration, warehousing, inventories and transportation. There is some controversy with respect to the proper method for calculating this cost due to the process of valuing inventories. Estimates from other sources including COPPEAD (2004) estimate the logistics cost in Brazil to be 13.6 percent, while other authors consider inventory costs to be significantly higher. De Castro estimates logistics costs at around 17 percent, while Guasch (2002) estimates logistics cost at 24 percent of GDP. This study believes however, that the correct estimate ranges between 15-18 percent, based on COPPEAD estimates and the case study of the Port of Santos. In general, these figures place Brazil among the best performers in Latin America. Yet, Brazil is significantly lagging OECD and other emerging countries (see also Figure 2).

FIGURE 5: LOGISTICS COST AS PERCENTAGE OF GDP[20]



Brazil's placement behind many of its logistics comparators raises concerns on the state of preparedness of the country to provide the desirable logistics enabling environment to serve an economy which is forecasted to grow at three to four percent in the near future. Inadequate logistics infrastructure and supply chain procedures may become a serious bottleneck in preventing timely delivery of an increasing amount of agricultural and general cargo products to the main export gateways. In an ever more integrated global marketplace, inadequate logistics will increasingly negatively affect Brazil's competitiveness. However, notable examples of overcoming this logistics challenge are companies such as the VALE (See Box 1) and TRANSPETRO, the state-owned transport company of petroleum products.

[20] Although economies and their composition of GDP are different, the ratio between logistics costs and GDP is commonly used to assess the importance of logistics activity in the economy. Another measure is the transport intensity which is a ratio of GDP over the total TKU (See Banister and Stead, Reducing Transport Intensity, STELLA FG4 Workshop, May 2002).

BOX 1: VALE - OVERCOMING THE LOGISTICS CHALLENGE

While Brazil's general logistics system exhibits significant challenges towards improving overall shipping conditions within the country, under specific circumstances, world-class logistics systems for specific products have been developed and are being used in Brazil. Companhia Vale do Rio Doce (VALE) is the largest mining company in Brazil and the largest producer and exporter of iron ore and pellets in the world. VALE operates in more than 30 countries in five continents and is Brazil's largest net exporter. Placing first in a heavy industry such as iron ore mining and having such a strong market position required VALE to take advantage of its economies of scale and invest in its logistics services. Responding to its supply chain needs and seeking to minimize empty backhauls from Asia, VALE made logistics a standalone successful business within the company. Today, VALE has built an integrated logistics structure that comprises more than 10,000 km of railway and five ports, transporting 27 million tons of cargo for other shippers plus more than 200 million tons and 139 billion TKUs of its own products, mainly iron ore and generating US$2.6 billion gross revenue in 2007. VALE is currently China's top ore supplier, despite being located farther away than its main competitor, Australia. VALE's ore supply accounts for 23.2% of China's total imports.

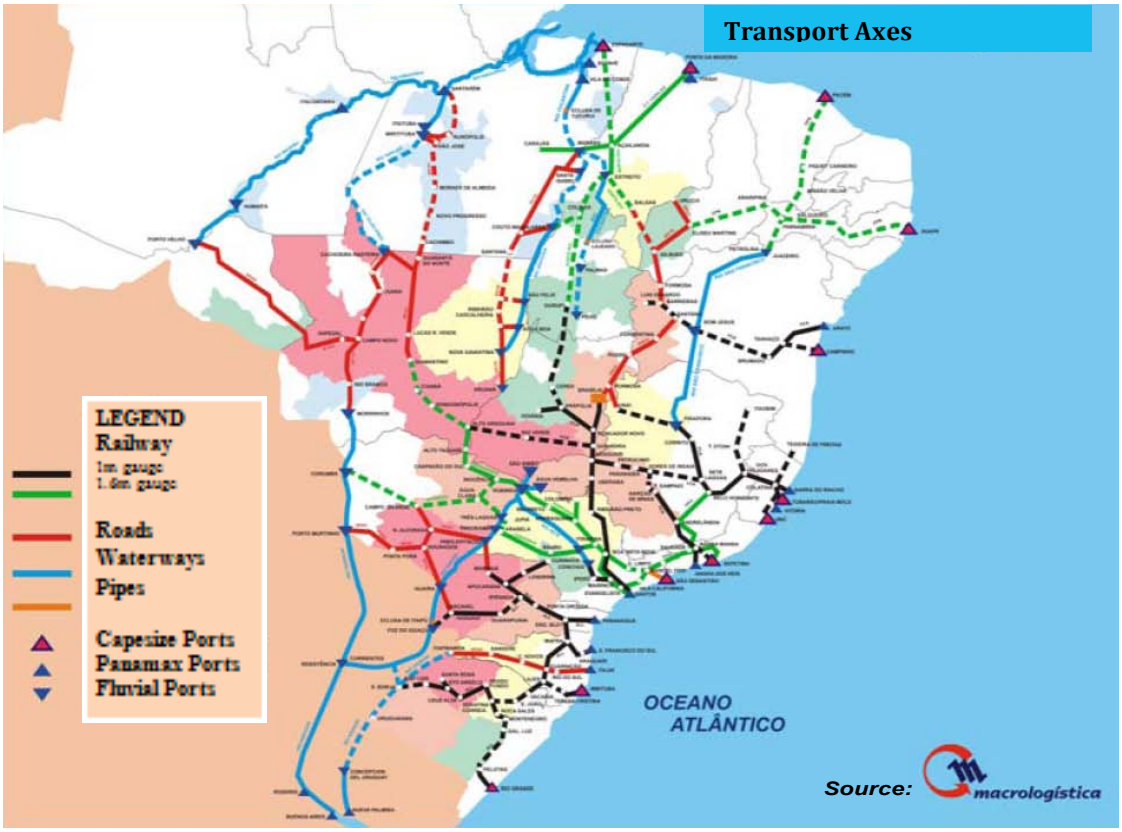
Source: http://www.vale.com/vale_us/cgi/cgilua.exe/sys/start.htm?sid=60, accessed July 2008.

In conclusion, Brazil's logistics system may be considered as a better performer than those of other Latin American countries. However, relative to the country's main competitors, for example China, India and OECD countries, the logistics system is generally underperforming. The presently high levels of logistics costs could affect the competitiveness of the country, and particularly, products with high value added. This is especially concerning given that Brazil's exports, as has been mentioned earlier in the study, have demonstrated that their value has grown more rapidly than their volume.

2 A SNAPSHOT OF BRAZILIAN TRANSPORT SYSTEM FOR FREIGHT LOGISTICS

Brazil transport environment is characterized by an extensive and intensive road network, one which dwarfs the other transport modes. According to the PNLT (2005), Brazil's cargo modal split is classified as 58 percent road, 25 percent rail, 13 percent waterway 3.6 percent pipeline and 0.4 percent airway (modal split is described in full later in the document). The main transport axes for freight are shown in Figure 6 and the key features of the main transport modes and facilities are discussed below.

FIGURE 6: MAIN TRANSPORT AXES OF BRAZIL

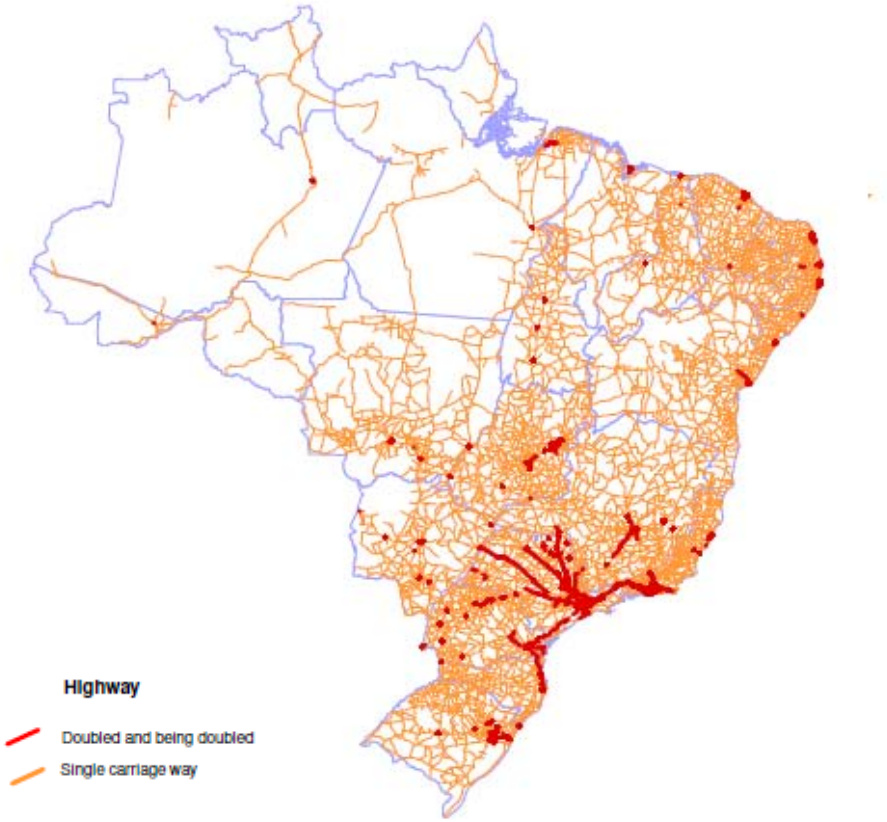


2.1 THE MAIN FREIGHT TRANSPORT MODES: ROAD, RAILROADS, PORTS, WATERWAYS, AND PIPELINES

The Road System: Brazil has the third largest road network in the world, at approximately 1.6 million km, but only 196,000 km (around 12%) of it is paved. The federal road network, which is almost all paved and covers about 58,000 km, facilitates most of the long-distance transport, as well as about 70 percent of all goods transported. Brazil's roads are critically important to the country's transport matrix and logistics system.

This network, however, is highly concentrated in the eastern part of the country, where the major urban settlements and industrial activities are located (See Figure 7). The transport sector in Brazil is highly dependent upon certain major road links, such as those connecting the northeast and southeast regions (BR 116 and 101), the central-western and southern regions (BR 487 and 163), the southern and southeastern regions (BR 116, 101, 153, and 158) and the central-western and southeastern regions (BR 354, 040, 364, and 262). These road links are responsible for supporting approximately 45 percent of the entire freight volume in the transport matrix and, together with the state roads of Minas Gerais, São Paulo, and Rio de Janeiro, facilitate movement of a significant percentage of the country's production. These roads also connect the major production areas to the ports of Santos, Rio de Janeiro, Paranaguá, and Rio Grande, which are the country's main points of entry and exit.

FIGURE 7: HIGHWAYS IN BRAZIL



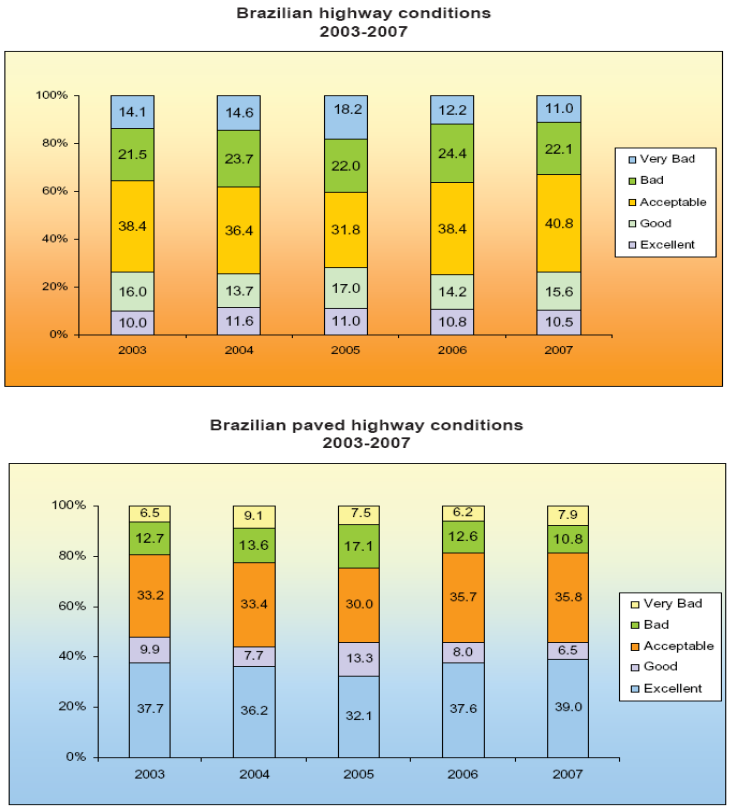
Source: PNLT 2007

The expansion of the road network into the Brazilian hinterland was a major contributor to the enlargement of the agricultural frontier, a process which accelerated in the 1950s. Despite the long distances involved, road development was favored over railroads in the regional integration of the most distant states, mostly because of the increased motorization taking place at the time. According to Castro (2004), the large construction projects and paving of the Brazilian road network, between the 1950s and the 1980s, resulted in sharp reductions of interregional transport costs. These reductions contributed to increases in agricultural production and productivity in the northern and central regions of Brazil, as well as to the development of the industrial south.

The development of the road system slowed down significantly in the 1980s as the fiscal situation in the country worsened. Ultimately, even road maintenance expenditures were scaled back, and as a result, the road system is presently

substantially deteriorated; only 32 percent of the federal network is in good condition according to the Department of Transportation Infrastructure (DNIT) 2007 data. Data for the National Confederation of Transport (CNT) Road surveys (2007) indicate that only 25 percent are in good or very good condition[21] (See Figure 8 and Figure 9). Inadequate road conditions, in addition to increasing costs of transportation, contribute to a high rate of accidents; according to the CNT estimates, the mortality rate per kilometer on Brazilian highways is 70 times higher than that of Canada and 30 times higher than that of the United States.

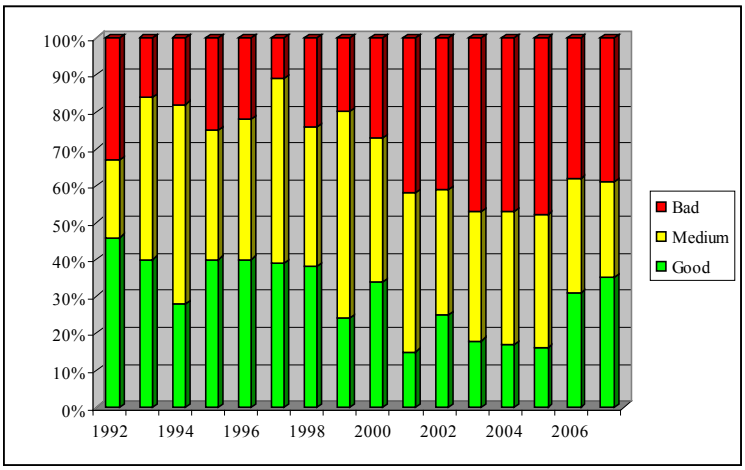
FIGURE 8: EVOLUTION OF HIGHWAY CONDITIONS CNT



Source: CNT Road Survey (2007)

[21] Data from CNT (Figure 8) differs from DNIT (Figure 9), which shows slightly better conditions. DNIT data for years 2003-2006 results from simulations based on 2001 objective surveys. The Ministry of Transport does not accept the classifications used by CNT arguing that their criteria are too narrow. Nevertheless, the industry does bi-annual surveys and it would be worthwhile to unify the classification criteria between CNT and DNIT in order that both groups have a realistic user's perspective of the road conditions.

FIGURE 9: ROAD CONDITIONS OF FEDERAL HIGHWAY NETWORK



Source: DNIT (2007)

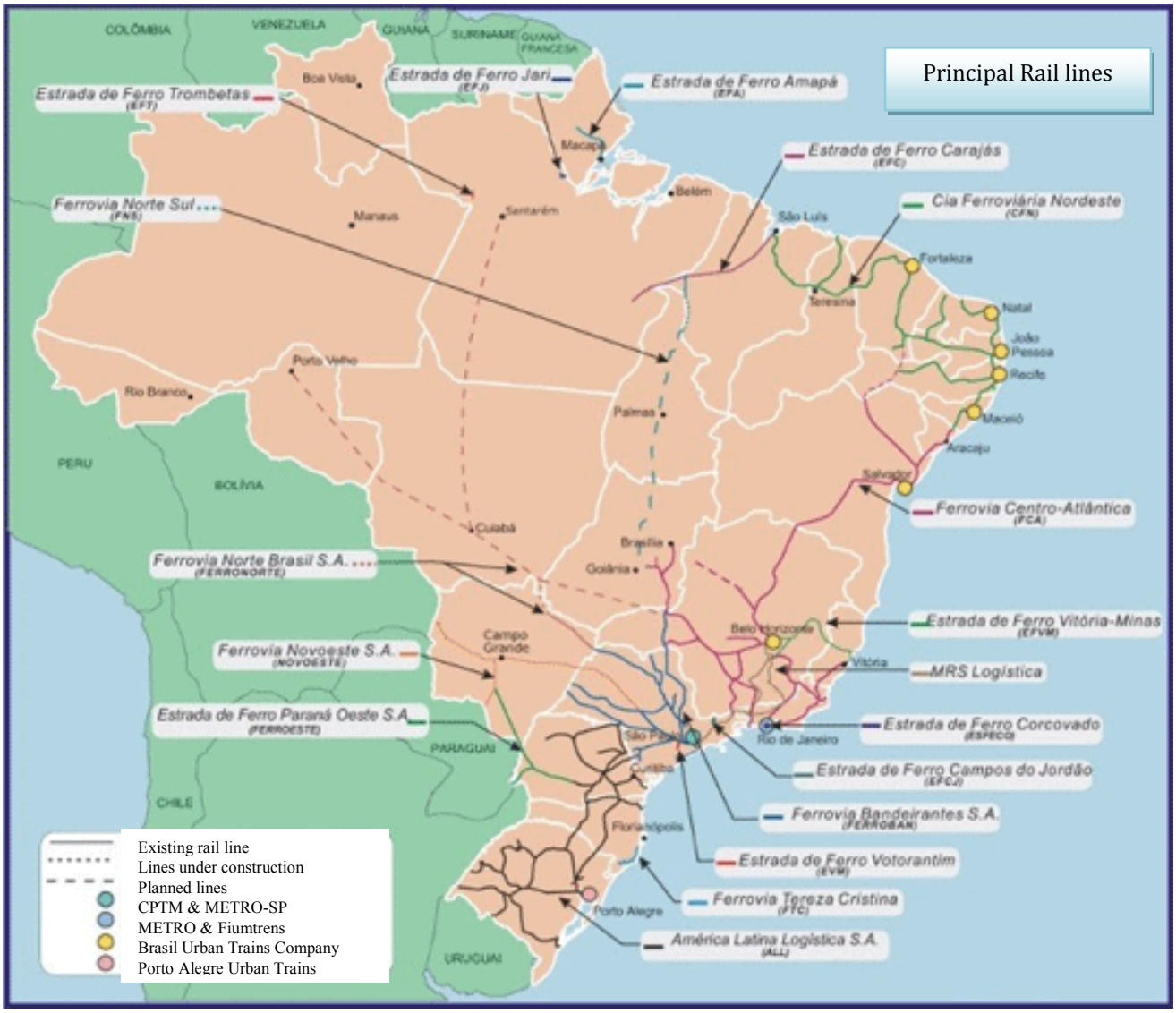
Brazil has several companies devoted to transporting freight by truck. These companies tend to own their own truck fleets. The vast majority of the country's trucking services, more than 800,000, are organized in a way that results in an excessive number of trucks and extreme competition. There is over supply and many return trips are made with empty trucks. While competition is generally desirable, extreme competition leads to fares that do not cover long run variable costs. To continue operating the trucking services despite the low marginal profitability, truck owners in Brazil have been forced to cut down on maintenance, overload their vehicles, demand long hours from drivers, and require them to drive at higher speeds than desirable.

The poor condition of Brazilian roads reduces the efficiency and reliability of trucking services within the country, increasing operating costs by 10-30 percent. Indeed, overloaded trucks damage roads proportionately more than lighter vehicles. Over reliance on trucks to transport freight coupled with the poor condition of roads is leading Brazil along an unsustainable path, more so in light of the inconsistency in fuel costs (see section 2.4 & 2.5).

Railroads: At a total of 29,500 km, the rail network in Brazil represents a significant asset to Brazil's logistics system (See Figure 10). Railroads are responsible for the movement of approximately 22-26 percent of total freight volume in Brazil, representing an increase of almost 20percent since privatization in 1996. Under the management of private concessionaries, the Brazilian railroad system has witnessed increased investment which in turn has fostered higher traffic volumes, productivity gains, and accident reductions. Public and private investment in railroads increased from R$574 million in 1997 to R$4,610 million in 2008, of which the private sector contributed R$412 million in 1997 and R$4,385 million in 2008 (See Figure 11). In the same period, the freight per kilometer (in TKU) transported by railroads increased by 95.1percent (see Figure 12) while total volume increased by 81.5 percent

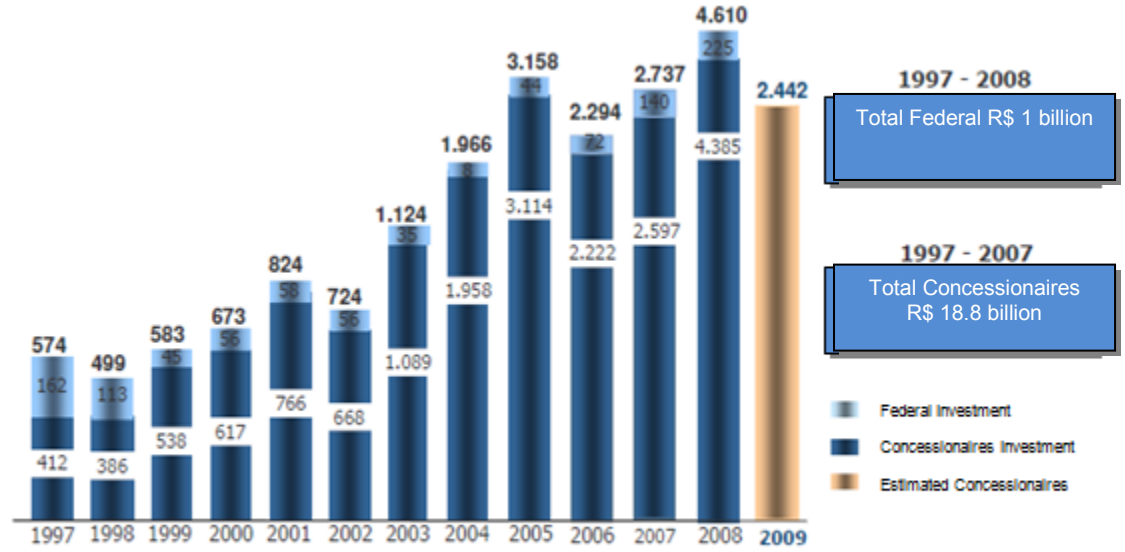
(see Figure 13). Furthermore, in 1997 there were 76 accidents per 1000 km of track compared to 33 in 2005 (ANTT, 2006). Close to 85 percent of the total freight carried by rail is export-related, mainly iron ore, exhibiting the great potential of railroads to improve Brazil's competitiveness.

FIGURE 10: THE RAILROAD NETWORK



Source: ANTT, 2009

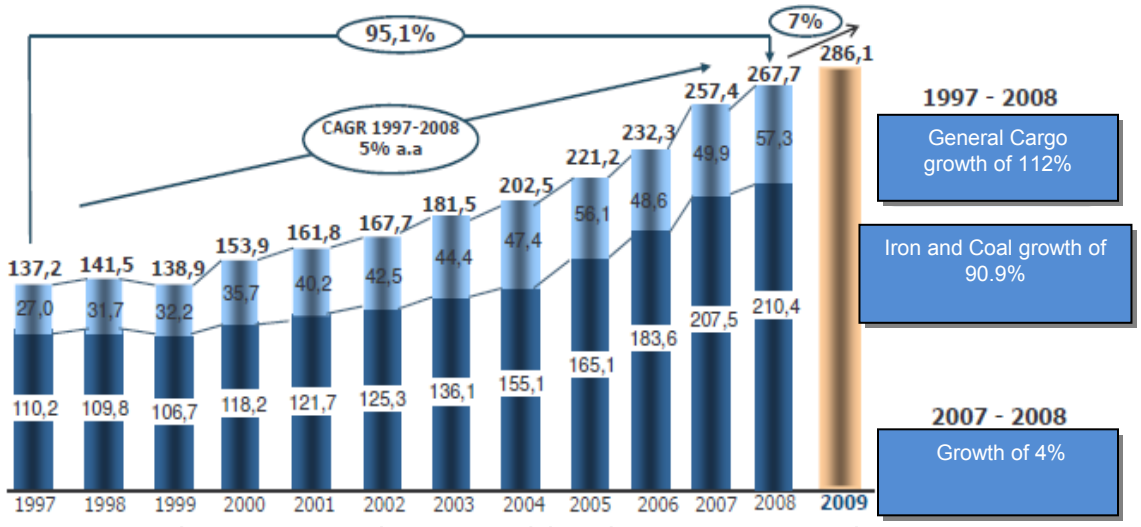
FIGURE 11: RAILWAY INVESTMENT UNDER PRIVATE CONCESSION (MILLIONS R$)



Note: 1) estimated values for 2008; 2) 1997 values contain 1996 investments; 3) 2009 is estimated
Source: Ministry of Transport, DNIT and ANTF Associates

Source: ANTF, 2009

FIGURE 12: CHARACTERISTICS OF RAIL TRANSPORT CONCESSIONS (RAILWAYS PRODUCTION IN BILLIONS TKU)

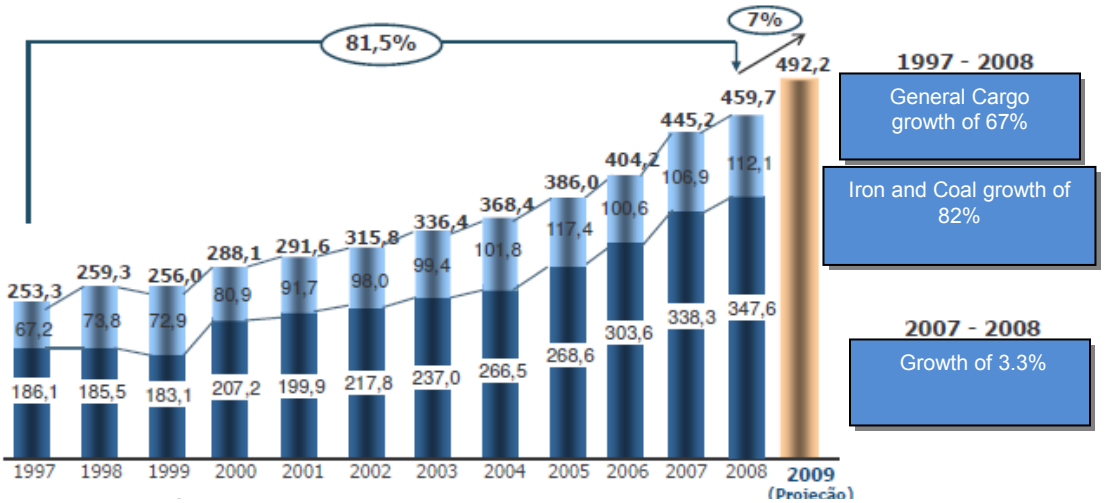


Note:TKU: Ton per Kilometer Unit Transported, CAGR: Compounded Annual Grown Rate, 2009 is projected

Source: ANTT and ANTF Associates, 2009 projections from FGV/ANTF study

Source: ANTF, 2009

FIGURE 13: RAILWAY TRAFFIC – TRANSPORTED VOLUME (MILLIONS TU)



Note:TU: Ton Unit, 2009 is projected

Source: ANTT and ANTF Associates, 2009 projections from FGV/ANTF study

Despite recent improvements, the railroad network is still insufficient in terms of its extension and capacity in some high demand areas. The agricultural frontiers, for example, lack sufficient supply of rail service, which has resulted in increased road development. Trucks, however, represent an inferior alternative for shipping agricultural products – they can only transport goods in relatively small portions. Trucks, therefore, limit producers' ability to move high volume freight which is more appropriate to transport by railroad. Despite the fact that railroad costs for bulk products and distances above 750 Km are approximately 40 percent lower than road costs, the railroad system is not able to fulfill its potential, mainly due to the insufficient size of the network (See Table 4), its limited location mainly along the coast (See Figure 10), and unfavorable operating conditions including lack of adequate transfer terminals. Transport of agricultural products is increasing but there is room for further increases (Table 5 gives the main products by rail corridor). For example, 60 percent of the soybean grain production is still carried by road while rail carries 33 percent and waterways 7 percent. In the United States, for soybeans, the split is 16 percent by road, 61 percent by waterway and 23 percent by rail. Finally, short-haul transport of containers could also be another growth opportunity particularly in some corridors and as an intermodal movement using trucks as the mode of transport.

TABLE 4: KM OF RAILROADS AND KM OF ROADS PER SQUARE KM BY COUNTRY

Country	Km of Railroads per 1000 km²	Km of Roads per 1000 km²
Argentina	12.9	22.8
Brazil	3.4	23.2
Chile	6.5	21.3
China	6.3	35.6
Germany	100.5	613.9
India	19.2	577.9
Japan	53.2	2390.5
Mexico	13.6	55.2
Russia	5.0	21.2
United Kingdom	70.2	1531.8
United States of America	14.7	389.5

Source: Secretária dos Transportes de São Paulo (2005)

TABLE 5: MAIN PRODUCTS TRANSPORTED BY CORRIDOR

Rail corridor (in %)	Mineral	Cement	Coal	Lumber	Soya	Fertilizer	Fuels	Industrial products	Other Products	NS/NR	Total
Sao Luis	15.4	7.7			30.8	7.7	30.8	7.7			100
Intra-regional Nordeste	18.8	12.5					31.3	18.8	12.5	6.3	100
Sao Paulo – nordeste	16.7	16.7					16.7	41.7	8.3		100
Vitoria	9.1		4.5	9.1	22.7	22.7		31.8			100
Belo Horizonte – Rio de Janeiro	50	25						25			100
São Paulo – Rio de Janeiro								66.7	33.3		100
Centro-Oeste – São Paulo	8.3				16.7	12.5	12.5	41.7	8.3		100
Santos Bitola Estreita	15.4	7.7			7.7	15.4	23.1	30.8			100
Santos Bitola Larga	4				32	20	12	28	4		100
Paranagua		2.4			38.1	23.8		33.3	2.4		100
São Francisco do Sul					66.7			16.7	16.7		100
Imbituba			81.3					18.8			100
Rio Grande				6.7	66.7	26.7					100

Source: CNT, PESQUISA FERROVIÁRIA, 2006

In addition, the railroad system remains relatively fragmented, in part as a result of the use of different track gauges in different railway lines. Additionally, poor signaling, over 2500 critical at-grade intersections, shared tracks with commuter trains that stop frequently, and over 200,000 low income families that reside less than 25 meters away from train lines reduce the operational speed of trains. Rail service also suffers from tariff, reliability, and contractual problems, which lower its level of service, according to users (see Table 6 for a list of obstacles compiled from CNT surveys).

TABLE 6: MAIN OBSTACLES AND DIFFICULTIES FOR HIGHER UTILIZATION OF RAIL TRANSPORT FOR VARIOUS RAIL ROUTES

Railway corridor (in %)	Freight Rates	Communication & Information on Shipment	Reliability of Delivery Time	Lacking complementary services	Level of Freight security	Access to loading areas	Availability of product specific railway cars	Take or Pay contracts	Other
Sao Luis	19.2		15.4	3.8	7.7	11.5	7.7	23.1	11.5
Intra-regional Nordeste	17.1	2.9	22.9	5.7	8.6	5.7	8.6	17.1	11.5
Sao Paulo – nordeste	37	7.4	25.9	3.7	3.7			22.2	
Vitoria	24.5	6.1	16.3	2		6.1	8.2	20.4	16.3
Belo Horizonte – Rio de Janeiro	28.6		14.3	14.3	14.3	14.3		14.3	
São Paulo – Rio de Janeiro		16.7	33.3				16.7	33.3	
Centro-Oeste – São Paulo	16.4	10.9	27.3	9.1	1.8	3.6	5.5	12.7	12.7
Santos Bitola Estreita	24.2	12.1	27.3	6.1	6.1	6.1		12.1	6
Santos Bitola Larga	19	3.4	22.4	1.7	3.4	3.4	6.9	19	20.7
Paranagua	20.2	10.6	22.1	1.9	2.9	4.8	5.8	17.3	14.4
São Francisco do Sul	13.3	13.3	26.7	6.7	13.3	6.7		6.7	13.4
Imbituba	40.9			4.5		13.6	4.5	13.6	22.7
Rio Grande	12.9	6.5	19.4	3.2	6.5	6.5	16.1	22.6	6.5

Source: CNT Survey 2006

Although rail cost in general is lower than road costs, railroad tariffs on specific lines are high compared to other modes, including São Paulo – Northeast, Imbituba, and Santos Narrow Gauge. The high variance in the travel times of rail service makes it difficult to ship products with high value added by rail, and limits the

extent to which intermodal transfers can take place reliably. Take or pay contracts introduced unnecessary rigidity which motivates shippers to use other modes. In take or pay contracts the buyer of the rail service pays a minimum amount regardless of whether or not the service is actually provided. These contracts are now less of an obstacle because several shippers agreed to provide the rolling stock, lowering the risks to the concessionaires and thereby allowing lower tariffs. All in all, the problems of rail service in Brazil have hindered the expansion of long-haul transportation activity on the country's railroad network. Although the concession of freight railways in Brazil was a milestone, critics argue that geographic monopolies were favored rather than logistics corridors. They also argue that the contracts included few obligations for the concessionaires, which led to higher tariffs and lower investment than expected. Another challenge is the inability of operators to use other concessionaires' tracks (the right of mutual passage), which is allowed by law and prevents competition. ANTT is rewriting these mutual traffic passage laws with the aim of fostering competition. Nevertheless, since the start of the concessions, overall railway traffic increased substantially (See Figure 13).

There has been extensive discussion on the issue of unification of the gauge across the train systems. The costs of such a conversion are considered high and, since concessions are for 30 years, such investments will only be justified if the returns are equally as high or the government partially funds this unification. Alternatively, National Association of Rail Transporters (ANTF) proposes to provide a third rail in broad gauge systems in order that metric gauge equipment could be used. There has been recently a move by some of the railways providers, like *MRS Logistica S.A,* to look for short-haul traffic, as they did with *Companhia Siderúrgica Nacional* (CSN). This type of traffic is intended to offset the lower mineral ore demand as a result of the 2008 economic crisis, but requires careful planning in order to show clear comparative advantages of rail over trucks. Other railways, such as *America Latina Logistica* (*ALL),* have now slowly transformed into logistics companies and have either partnered with trucking companies or bought trucks in order to produce door-to-door movements which also enabled them to function as licensed MTOs.

Other options, such as double stack container movements, which helped North-American railways in competing with trucks, need to be more carefully examined and were earlier dismissed due to the costs involved in adapting existing infrastructure for this purpose (double stack containers require 22 feet clearance). But it is not clear whether a detailed cost-benefit analysis of such options was undertaken as had occurred in North-America when railways partnered with governments to adapt tunnels, bridges and other structures. Maybe legislation such as the US Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), which leveraged investment in the Alameda Corridor (Los Angeles/Long Beach Port), would increase the interest of concessionaires for this short-haul traffic.

Overall, it is expected that with the support of government investments, rail networks will reach approximately 35,000 km by 2015. Several investments are underway, such as the completion of the North-South railway and the Transnordestina railway but others, which were recently authorized, have yet to begin construction.

The Port Sector: Ports are a key asset of Brazil's logistics system, serving the entire coastline, one of the longest in the world (See Figure 14). Of all the Brazilian ports, the Port of Santos is the most important because of its freight handling capacity, and therefore, its influence on the national economy. Besides Santos, four other ports can be ranked as important maritime facilities: Vitória, Paranaguá, Rio Grande, and Rio de Janeiro. Ten others could be added to this group due to their potential to become significant international ports: Itajaí, São Francisco do Sul, Manaus, Salvador, São Luís, Sepetiba, Aratu, Fortaleza, Suape, and Belém.

FIGURE 14: MAIN PORTS IN BRAZIL

Having one of the longest coastlines in the world and harbors located in almost all the coastal states could become an important advantage in international trade (See Table 7 to Table 9 for data on port activities). However, in spite of this spatial advantage, the port system suffers from several critical problems that impede its development and contribute to high logistics costs throughout the economy. These include equipment obsolescence, inefficiencies in labor development and labor allocation, lack of harbor capacity, and inefficiencies in the port administration model (Table 10 computes these problems). While the Brazilian ports handle on average 34 containers per hour per ship, ports such as Hamburg handle 66 containers and Singapore 100 containers.

Furthermore, and quite critically, the data in Tale 10 also show that ports seem to be reaching their capacity; waiting times for berthing are increasing and yard space is insufficient in several ports. For example, at the Port of Santos during the first 23 weeks of 2008, 35% of ships waited more than 12 hours, and more than half of these waited more than 24 hours. Moreover, ship owners estimate that in 2007, ports lacked 1.1 million square meters and by 2012 they will need an additional 5.4 million (see Balau, 2008 and Table 12) in order to maintain their current operating levels. Improvements in port efficiency would therefore have a major impact on reducing transportation costs in Brazil.

TABLE 7: DATA ON BRAZIL PORT ACTIVITIES

Year	Solid bulk	Liquid bulk	General Cargo	Containers	Total
2003	336,276,308	161,886,081	30,955,990	41,671,676	570,790,055
2004	369,611,250	166,555,087	34,077,930	50,476,278	620,720,545
2005	392,903,932	163,717,494	37,833,211	54,964,144	649,418,781
2006	415,727,739	175,541,324	38,225,648	63,338,757	692,833,468
2007	457,435,373	194,598,576	34,760,346	67,922,360	754,716,655
2008 (1st semester)	201,159,709	92,282,654	16,899,556	31,322,558	341,664,448

TABLE 8: EVOLUTION BY NAVIGATION TYPE

Year	Long haul	Cabotage	Other navigation	Total
2003	401,596,268	145,926,525	23,267,262	570,790,055
2004	447,136,221	148,418,917	25,165,407	620,720,545
2005	473,057,421	150,112,048	26,249,312	649,418,781
2006	502,919,319	163,520,202	26,393,947	692,833,468
2007	559,045,893	168,455,583	27,215,179	754,716,655
2008 (1st semester)	254,607,463	74,894,198	12,162,817	341,664,477

TABLE 9: EVOLUTION OF CARGO MOVEMENT IN LONG DISTANCE, LINKED TO FOREIGN TRADE

Year	Import	Export	Total
2003	87,715,381	313,880,887	401,596,268
2004			
2005	82,974,736	390,082,685	473,057,421
2006	90,010,736	412,908,583	502,919,319
2007	111,208,520	447,837,373	559,045,893
2008 (1st semester)	55,798,341	198,809,121	254,607,463

Antaq, Panorama Aquaviário 2009 (Vol. 3)

TABLE 10: SITUATION OF CONTAINER PORTS ACCORDING TO SHIPPING COMPANIES

Port	Access to the Port *		Maximum Operational Draught (meters)		Average Wait time for berthing (hours)	Containers per hour per ship	Condition of Wharfs and Yards
	By Water	By Land	Current	Necessary			
Pecem	VG	VG	13.6	14	4	31	Adequate
Suape	VG	VG	14.0	14	4	29	Adequate
Salvador	S	S	12.0	12.5	9	34	Critical
Vitoria	U	U	9.3	12.5	9	39	Insufficient
Rio de Janeiro	S	U	12.3	13.5	6	31	Adequate
Sepetiba	U	U	14.3	14.3	9	39	Adequate
Santos	U	C	11.8	13.5	13	39	Critical
Paranagua	C	U	10.3	12.5	11	31	Adequate
S. Francisco do Sul	U	U	9.5	12.5	14	35	Critical
Itajai	U	U	9.5	11.5	20	23	Critical
Rio Grande	U	VG	12.2	12.5	7	41	Insufficient

* VG= Very Good, S=Satisfactory, U= Unsatisfactory, C= Critical ; Source: Balau (2008)

The present model adopted by the government of Brazil maintains the administration of the main ports of the country under national jurisdiction through the Port Companies (*Companhias de Docas*) though the terminals are allowed to be private. These companies are run by directors appointed by the national government; although in most cases the state administration where the port is located appoints one of the directors. This centralized rather than decentralized model, in which the ports would be run by the state or the city where they are located, is defended by the Government of Brazil (GoB) on the grounds that the main ports are of national interest. In some cases, like the Port of São Sebastião, which is considered of local interest, the national government has an agreement that allows the state of São Paulo to run the port. Logistics users critical of the model argue that the lack of public resources and politically appointed managers has not allowed the complete modernization of the Brazilian ports making them uncompetitive at the global level, and that lack of decentralization of the main ports has hurt the ability of these ports to respond quickly to the needs of their closest hinterland. Furthermore, they contend that some state governments are better prepared to manage their ports than the national government. Overall, 38 percent of the ports are decentralized. Those who are against full decentralization argue that while some states/municipalities are good managers, others are not considered up to the task as demonstrated by recent audit reports of decentralized ports. Therefore, they argue decentralization should be evaluated on a case by case basis, and making sure that the local authorities have the necessary resources and capacity to run the port without depending on the federal government. Another model, as is used in some EU countries, would allow for a decentralized setting with funding being provided by city, state and federal governments in response to an agreed performance contract.

But more than the centralization versus decentralization issue, a key challenge in the Brazilian port system is the lack of fully professional port management. The salaries paid by the government are not sufficient to attract the type of talent that a private sector concession could attract, and port directors are often political appointments without the experience required to run these complex nodes of the logistics chain. It is important to note that the Companias Docas (Harbor Authorities) were until very recently included in the Plano Nacional de Desestatização (Privatization Plan), which prevented the government from hiring more staff and implementing salary adjustments. This issue has now been corrected and the newly created Ports Secretariat is working to hire more professional management.

Another area where improvements could be achieved is by government acting more quickly to decrease the requirements imposed on private sector ports and terminals. Of particular importance are labor requirements that have led to the employment of a greater number of workers than in other countries' ports (Table 11). Moreover, the sector would benefit from a sound regulatory framework which promotes competition between ports. Greater competition will lower costs and promote more efficient use of resources.

TABLE 11: A COMPARISON OF THE PORTS OF SANTOS, ROTTERDAM, AND SINGAPORE

Ports	Containers loaded/ unloaded (Number containers/hour)	Time required to load/unload a container (man hours/container)	Average cost to move a container (US$)	Number of containers moved annually (million)
Singapore	100	2	70	17.0
Rotterdam	60	5	100	6.3
Santos	39	22	250	0.99

Source: Background Papers, Anut 2005[22], A importância da Logística no Crescimento Sustentado da Produção Industrial Brasileira.

A main preoccupation in the port sector is the need to increase the provision of container capacity. Four out of the five main Brazilian ports already reached capacity in 2007 (see Table 12). The Secretary of Ports is now undertaking a National Strategic Plan for Ports (PNE/Ports) which should have been ready by mid 2009. While this PNE is being prepared, the Secretary of Ports, recognizing the major bottleneck caused by dredging backlogs in some of the most important ports of the country, launched the National Dredging Plan (*Plano Nacional de Dragagem-PND*) estimated at R$1.4 billion which is aimed at the following ports: Recife-PE, Rio Grande-RS, Santos-SP, Fortaleza-CE, Salvador-BA, Itaguaí-RJ, Rio de Janeiro- RJ, Paranaguá-PR, Suape-PE, Natal-RN, São Francisco do Sul-SC, Itajaí-SC, Cabedelo-PB, Imbituba-SC,Vitória-ES. At the time of writing this report, most of these dredging projects were being prepared for bidding. Of the other port infrastructure works valued at R$1.4 billion, R$901 million will be funded under the Growth Acceleration Program (PAC[23]) to be completed in 2010, and the rest by federal and state funds. The Secretary of Ports also indicated that R$26 billion of investments by the private sector in different types of port terminals will be completed by 2010 mainly in the ports of Santos, Paranaguá, Itaguaí, Açu and Vitória. Therefore, there is considerable investment underway to increase capacity which, if not affected by the 2008 economic crisis, should make up for some of the capacity shortage feared by some experts. In addition, the Secretary of Ports has launched other programs such as the Port Management by Results, Paperless Port Project to facilitate electronic based logistics processing, General Port Concession Plan and a Manpower Training

[22] ANUT (Associação Nacional dos Usarios de Transporte de Carga, Omar Silva Jr.) estimated that in 2004, US$1.2 billion was paid in fines for delays in loading/unloading at ports with 22 days/year and 10 days/year for demurrage at ports, respectively at harvest time or between harvest times.

[23] PAC is a federal government initiative for 2007-2010 to stimulate the productive sector and thereby increase social benefits through government investments in infrastructure.

Plan, among others. The Secretary of Ports is currently also reviewing the sector's regulatory framework and the previously approved laws/decrees on such subjects as: allowing for results-based dredging, excluding companies controlled by the PND and enabling a results-based management, and defining port concession and leasing and authorization for maritime port installation. In the meantime, the study recommends that all efforts should continue to increase capacity required for the short-term while planning for the long-term, since the required infrastructure for terminals takes 3 to 5 years to build.

TABLE 12: BRAZIL CONTAINER TERMINALS CAPACITY UTILIZATION 2007

By quay length				
	meters of quay	teus handled in 2007	teu/m/year	industry standards
Santos	2560	2,532,900	989	700 to 1000
Itajai (**)	740	681,852	921	700 to 1000
Rio/Sep	1618	617,551	382	700 to 1000
Rio Grande	600	607,725	1,013	700 to 1000
Paranagua	680	595,261	875	700 to 1000
Brazil (*)	9092	6,424,500	707	700 to 1000
By storage area				
	hectares	teus handled in 2007	teu/ha/year	industry standards
Santos	90	2,532,900	28,143	15,000 to 25,000
Itajai (**)	15	681,852	45,457	15,000 to 25,000
Rio/Sep	71	617,551	8,698	15,000 to 25,000
Rio Grande	25	607,725	24,309	15,000 to 25,000
Paranagua	29	595,261	20,526	15,000 to 25,000
Brazil (*)	322	6,424,500	19,952	15,000 to 25,000
(*) assumption : 1 move = 1.5 teu, 1 teu = 20 foot container				
(**) excluding Navegantes				

Sources : Containerisation International, J.Balau, B.Kruk et al.

Maritime transport: The Brazilian sea and support navigation fleet comprises some 1,000 vessels, with a total carriage capacity of up to 2.9 million deadweight tons (TPB). Oil tankers, all owned by PETROBRÁS, and bulk carriers, represent only 10% of the vessels but account for 76.2 percent of the full capacity. Liberalization of maritime transport in the 1990s resulted in a reduction in the cost of maritime freight, but also in the contraction in the size of the Brazilian merchant fleet. In 2008, there were 229 Brazilian owned or foreign-owned shipping companies authorized to provide maritime transport services in Brazil.

The National Agency of Waterways Transportation (ANTAQ), a publicly independent agency linked to the Ministry of Transport, is the regulatory agency for maritime services in Brazil. ANTAQ regulates the Port Authority, the federal waterway infrastructure, private use terminals, and shipping companies. ANTAQ establishes the rules for the usage of shipping services, bestows grants for shipping companies, inspects shipping companies operating in Brazil, and authorizes contracts to charter foreign vessels as well as government cargo transportation. Studies have shown that the performance of the firms regulated by ANTAQ improved after this entity was established in terms of efficiency and pricing.

Cabotage activities are restricted to domestic flag vessels operated by a Brazilian individual or a Brazilian shipping company (called *Empresa Brasileira de Navegação* - EBN) in accordance with Law 9.432/97. Foreign vessels are only allowed to engage in cabotage, interior navigation, offshore support navigation and navigation within ports when chartered by an EBN, for which authorization is required. Authorizations may be granted if: (a) a Brazilian flag vessel of the required type is not available; (b) there is declared public interest; or (c) if the foreign vessel is substituted for one that is under construction in Brazil.

In 2004, 148 million tons were transported by cabotage; the ports of São Sebastião (SP), Aratu (BA), and Belém (PA) moved respectively 29 percent, 12 percent and 7 percent of the total cabotage cargo. In Santos, cabotage cargo reached 14 percent (10 million tons of total cargo). The cabotage movement of liquid bulks accounted for 79% of the cabotage cargo in Santos. In 2005 cabotage transported 374,000 TEUs or about 7 percent of total container transport in Brazil. One of the main problems faced by cabotage is the lengthy delays in clearing the cargo at the ports. Compounded by longer travel, loading and unloading times, these delays place cabotage at a disadvantage when compared to road transport, despite the lower tariffs.

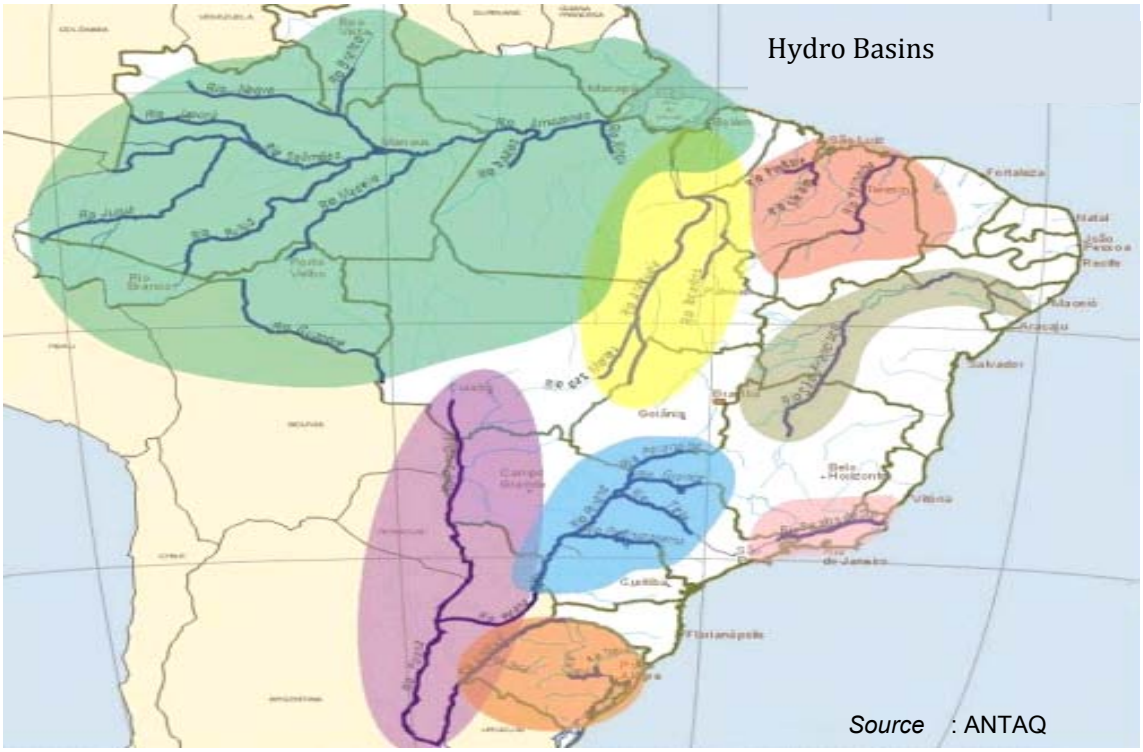
An important challenge is the improvement of cabotage activities in Brazil. This can be achieved by increasing the competition of Brazilian shipping companies against other flags by the reduction of Brazilian vessels' operating costs and increasing capacity of naval construction, among other measures. A future improvement of cabotage activities certainly will contribute to decrease maritime freight costs in Brazil.

Waterways: Brazil has eight river basins with navigable waterways that total 28,000 Km and currently account for only about one percent of the total freight volume (See Figure 15). Most of the inland waterways are, however, in the northern region of the

country where the local economy is still not generating sufficiently high volumes to be transported. Four of these basins are of international importance: Amazônica, Paraguai-Paraná, Tieté-Paraná, and Uruguai. Of the eight basins, six are better suited for shipping of exports –Amazônica, Paraguai-Paraná, Tieté-Paraná, and Uruguai, Araguai-Tocantins and São Francisco. With few exceptions, river transport in Brazil continues to rely on low quality infrastructure and facilities. Some of the main challenges facing waterborne transport are lack of harbor facilities capable of handling large volume cargo as well as freight that demands more sophisticated packaging and container systems.

The Amazon basin concentrates most of the inland waterway transport; in 2002, the Amazon basin transported 82 percent of cargo while Rio Paraguai and the Tieté – Paraná transported respectively 8 and 7 percent. In 2002, the Madeira waterway in the Amazon basin transported 3.2 million tons of which 41 percent was solid bulk, 34 percent liquid bulk, and 25 percent general cargo. In the Paraguai waterway there is mainly transport of solid bulk such as soya, soya pellets, iron ore and manganese. In the Tieté-Paraná the main freight transported is soya, soy bran (farelo de soja), wood, sugarcane and sugar.

FIGURE 15: INLAND WATERWAYS



Other challenges to inland waterways improvement in Brazil include integrating the system with other transport modes so as to facilitate necessary transfers from trucks and rails to barges[24]; providing proper legislation for current and future operations; allocating a portion of transportation taxes for improving dam and bridge passages; and, assigning proper administrative responsibilities to the transport agency, the Agência Nacional de Transportes Aquaviários (ANTAQ) to control the operation of inland waterways.

Significant upgrades in equipment and technology, as well as in administration and financing are necessary if waterways are to play a larger role in the transport matrix. If the development of inland waterways effectively facilitates long navigation distances, transport costs can be significantly reduced. For example, in Brazil transporting 1000 tons one kilometer by waterway is estimated to cost 12 dollars and by road 45 dollars. In the United States, this difference is estimated to be even larger, at 5 dollars for waterways and 56 for road.

One major concern in developing waterway transport is the conflict between hydropower development and navigation in existing and potential waterways, especially in the Amazon. Due to lack of coordination and overall vision of the multiple waterway uses, hydropower projects are often developed without considering river navigation. There is a consensus that National Water Agency (ANA), as the overall water regulatory agency in the country, needs to be closely engaged in river basin planning and multi-sector resource allocation decisions.

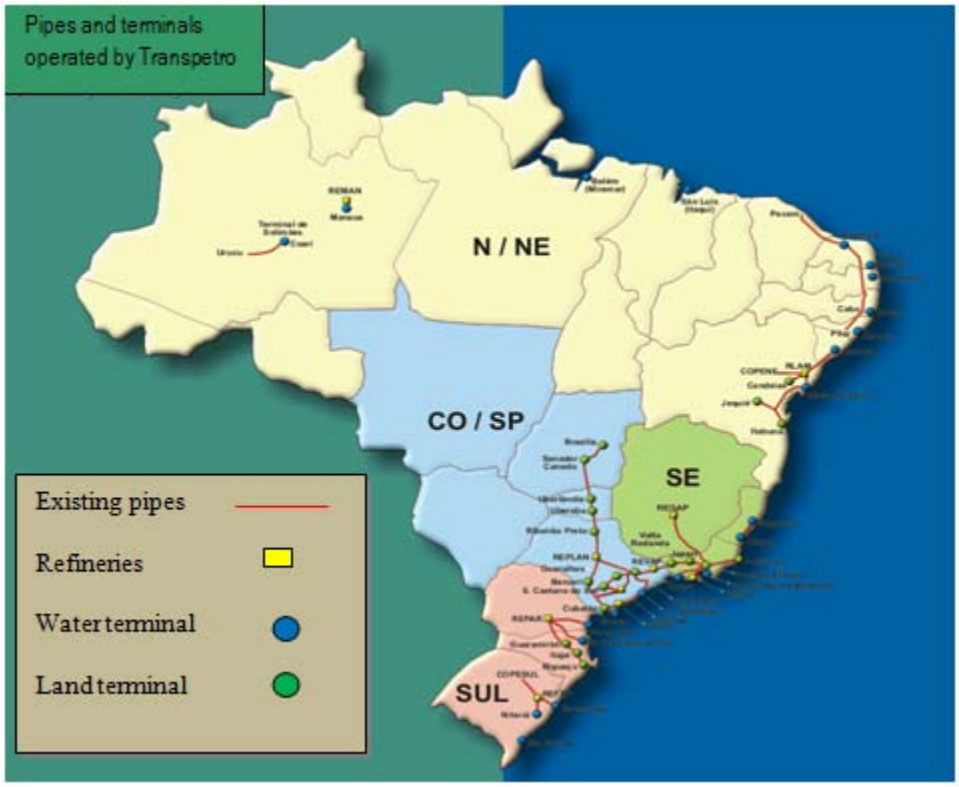
Pipelines: Generally considered the most economical way of transporting great amounts of fuels, pipelines have a lower cost per unit and higher capacity than rail or truck. Transpetro, an integrated subsidiary of Petrobrás, is a multimodal operator with an integrated logistics network that runs most of the pipelines in Brazil (see Figure 16).[25] Transpetro has solid experience in transporting and warehousing petroleum and its derivates, natural gas, renewable fuels, petrochemicals and other types of fuel. The company has developed a logistics network that integrates pipelines, waterways, railways, and roadways, which is complemented by partnerships with other companies. Transpetro owns 53 oil tankers, 7,000 km of pipelines, 3,000 km of gas pipelines, 45 terminals, 75 gas distribution points, 12 pumping stations, and 1 gas processing unit. This logistics network moves 640 million m^3 annually, of which 170 million tons are via waterway. Land and water terminals function as intermodal hubs able to stock 10 million m^3 of petroleum and its derivatives. Transpetro operates 25 maritime terminals along the 8,698km of Atlantic coastline as well as others on 4,500 km of rivers and navigable waterways. Transpetro has the installed capacity to annually move 2 million m^3 of ethanol. By the end of 2007, 10 land and water terminals had been adapted to transport the fuel.

[24] See Quintella (2008) (p. 408): "When we opened the trading (company) to export soybeans, at the beginning of the 1980s, there was a bottleneck in transportation: railroads were insufficient, road transport too expensive. We decided to invest in waterway transport….with an enormous advantage because the cost was 25% lower than road transport...we built the first freight terminal – a waterway one, in São Simão, Goiás…the soybeans were transported in barges on the river up to our other terminal in Pederneiras. From there the soybeans were transported by train."

[25] http://www.transpetro.com.br last accessed July, 2008.

Surveillance and control of gas and oil pipelines is operated remotely from the Rio de Janeiro headquarters. While Transpetro has demonstrated to have well-developed medium and long distance delivery/marketing infrastructure, it has done so within a monopolistic environment. This monopoly has enabled Transpetro to secure a significant advantage over private sector firms operating in the transport of liquid fuels, severely limiting competition. This closed competition culture particularly hurts the ethanol sector, which stands out as the alternative fuel with the largest potential for Brazilian export.

FIGURE 16: TRANSPETRO PIPELINES



Source: www.transpetro.com.br

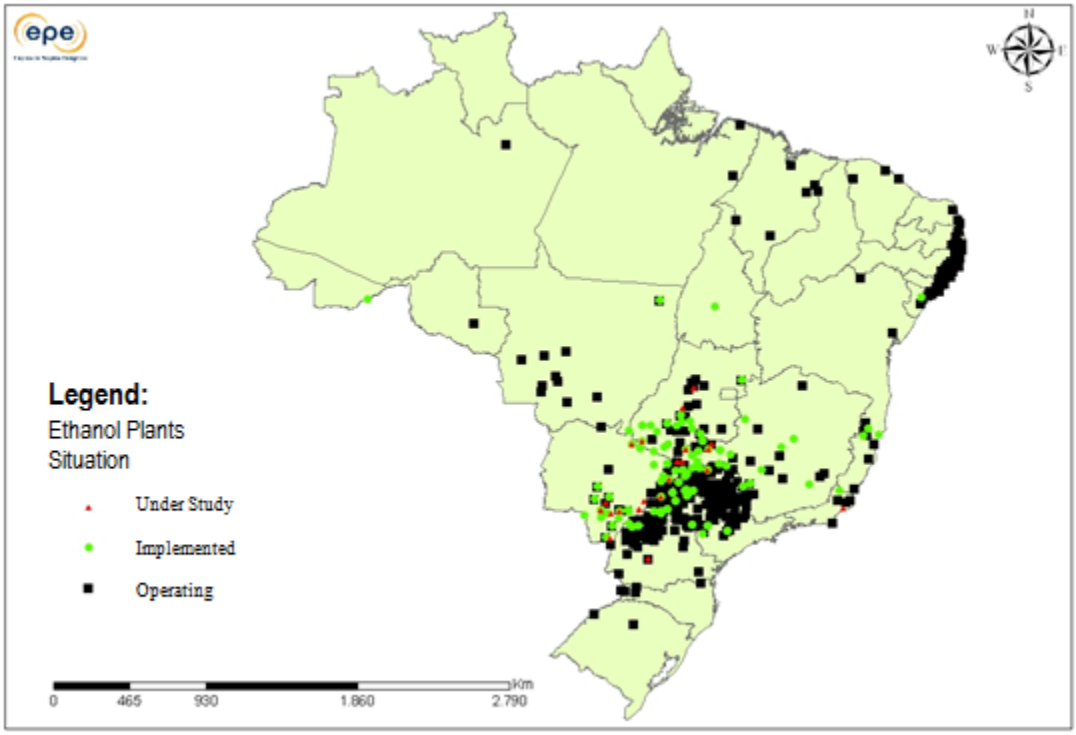
Brazil has a long history as one of the world's foremost sugarcane producers. Introduced in 1975, the National Ethanol Program (Proálcool) aimed at reducing the country's excessive dependence on imported oil while also opening a new market for sugar producers by providing incentives for the automobile industry to develop and manufacture vehicles fuelled exclusively by ethanol. As a result of the second oil crisis in 1979, the Brazilian government decided to increase the use of ethanol as a fuel and proceeded to sign agreements with the automobile sector as well to encourage the construction of a large number of independent distilleries. This led to

the beginning of large-scale hydrated ethanol production in Brazil that due to the introduction of the "flex-fuel" or "bio-fuel" vehicle in 2003, saw an increase in the use of flex-fuel from 3.762 million m^3 in 2003 to 10.366 million m^3 in 2007.

Brazil possesses a number of natural advantages for producing ethanol, such as the availability of a large amount of arable land (approximately 100 million hectares located a long way from natural biomes (Amazonia), as well as excellent climatic conditions for growing sugarcane. At present, Brazil uses only 7 million hectares for growing sugarcane, half of which is used for producing ethanol and the remainder for ordinary sugar. This area represents only one percent of the total amount of land under cultivation. According to recent forecasts for future demand for ethanol, the growing number of flex-fuel light vehicles as a proportion of the Otto Cycle light vehicle fleet in Brazil is the decisive factor governing the future growth of carburant ethanol in the domestic market. With regard to market share for Otto Cycle vehicles, by 2017 ethanol will represent approximately 80 percent of the total volume of liquid fuel consumed in Brazil. By 2017, a forecast 8.3 billion liters will be exported primarily to Japan, the United States and the European Union countries.

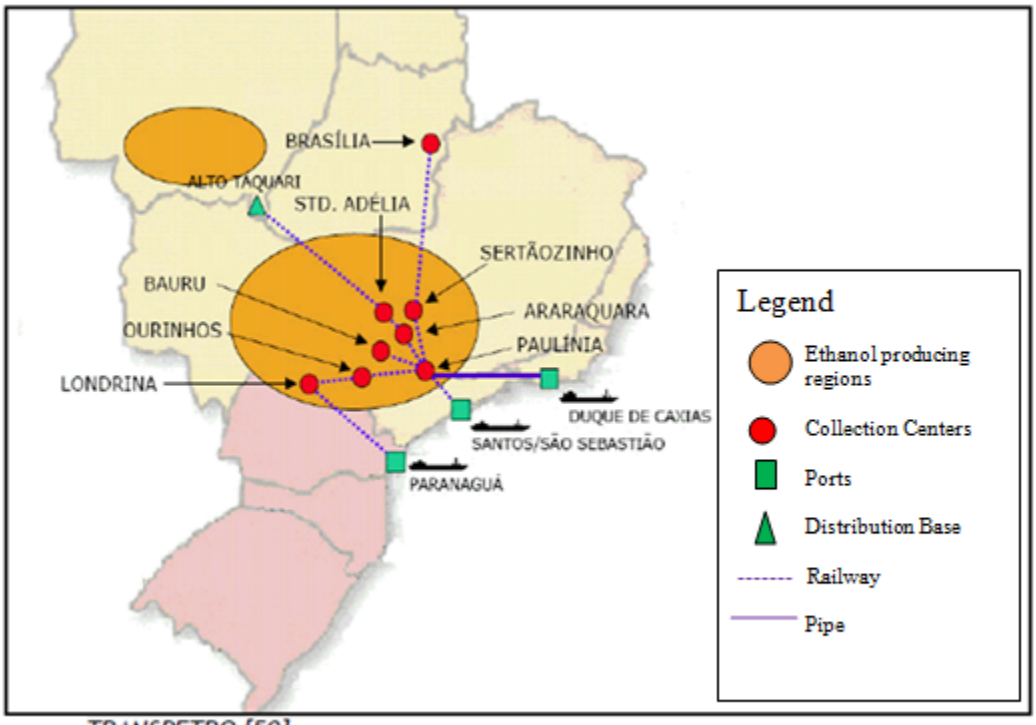
It is expected that the geographic distribution pattern of ethanol production will be reinforced, given the trend highlighted by Figure 17, which shows the current location of ethanol distilleries and sugar mills in Brazil, as well as proposed expansion projects. Noteworthy is the very large concentration of installations to the north and west of São Paulo state, in northern Paraná, in the western part of the state of Minas Gerais and in southwest Mato Grosso, where sugarcane plants tend to be located adjacent to the growing areas primarily to reduce production and logistics costs.

FIGURE 17: ETHANOL PRODUCTION PLANTS



The logistics arrangements for transporting ethanol, which are similar to transporting petroleum derivatives, are the following: (1) delivery of the product from the mills to the primary base (primary flow) is done wholly by truck over an average distance of 200 km; (2) transfers between distribution bases (transfer flows) of fuels in general (petroleum derivatives and ethanol) are carried out using road, rail and barge modes; (3) transport of fuel ethanol from the primary and secondary bases to the end-consumers (delivery flow) is done entirely by road transport involving short distances: 69 percent of deliveries involve a distance of up to 100 km; 15 percent between 100-200 km; 7 percent between 200 - 300 km; 9 percent between 300-600 km; and (4) some pipelines for transporting ethanol between "reception points" (origin) and "delivery points" (final destination). Figure 18 below illustrates the overall pattern of collection, internal distribution and exportation of ethanol.

FIGURE 18: THE EXPORTATION LOGISTICS INFRASTRUCTURE OF THE CENTRE-SOUTH REGION



Source *TRANSPETRO [50].*

Due to a lack of pipelines available to transport ethanol, exporters are forced to transport the majority of it by truck, a rather inefficient alternative to pipelines for shipping this product. Specifically, for distances over 750 km and bulk products in high volumes, the cost per m^3 of transporting ethanol by pipeline is approximately 60 percent of the cost of transporting it by truck (Annex 3) and by railroad and waterway it's 53 percent and 40 percent respectively, though perhaps a more complex medium than by pipe. If Brazil is to maintain its global position as a producer and exporter of ethanol, consideration should be given to the manner in which this commodity is transported.

Four Brazilian ports were responsible for exporting 94.8 percent of the ethanol exported by Brazil during the last five years. Santos is the main ethanol-exporting port, accounting for 56.8 percent in terms of quantity exported and 53.8 percent in value terms, followed by Maceió (14.1% by volume and 13.4% by value), Paranaguá (12.5% by volume and 11.3% by value) and João Pessoa (11.3% by volume and 14.0% by value). The main exporting state is by far São Paulo (64.7% by volume and 60.6% by value), followed by Alagoas (15.4% by volume and 14.7% by value), Paraíba (7.5% by volume and 9.0% by value), Pernambuco (3.7% by volume and 4.8% by value) and, finally, Paraná (3.9% by volume and 4.2% by value).

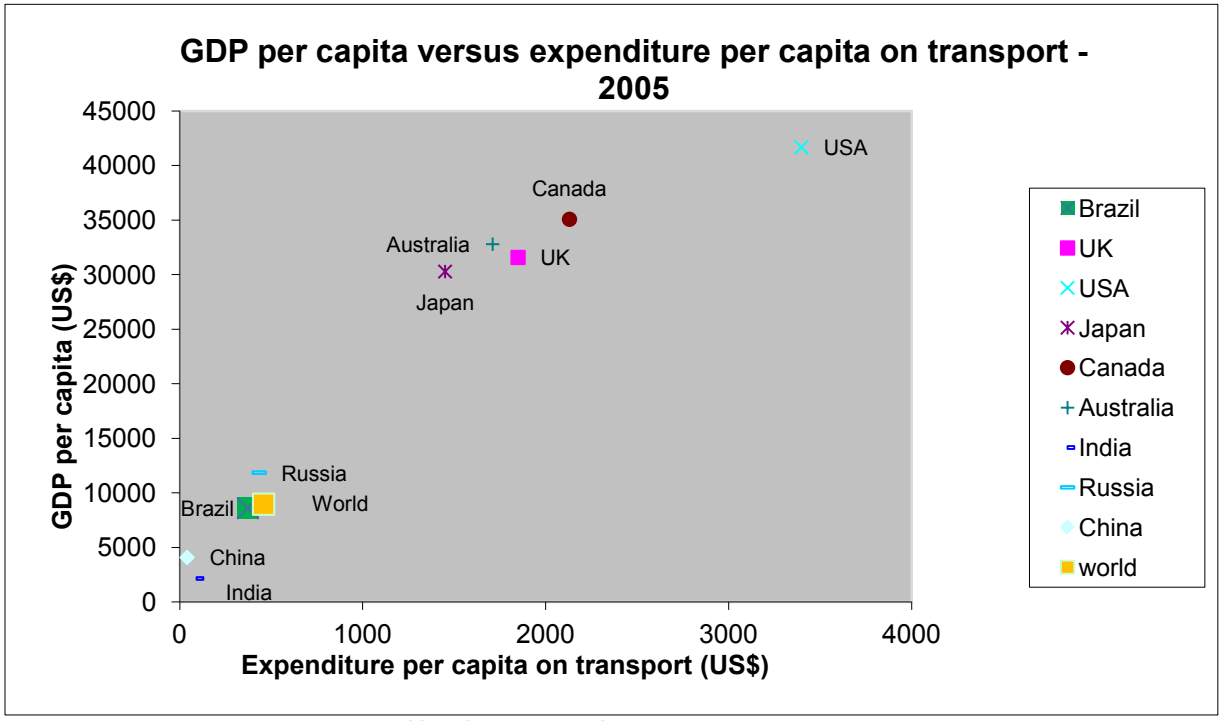
The PAC (Growth Acceleration Program – a federal government initiative begun in 2003 to stimulate the productive sector and thereby increase social benefits through government investments in infrastructure) foresees investments in ethanol pipeline infrastructure of the order of R$890 million up to the end of 2010 to be supplemented later by R$1.53 billion for the stretch between Senador Canedo and São Sebastião. 1171 km of pipelines are also planned for linking the Brazilian Center-West with the Southeast in order to increase the ethanol flow to São Paulo and Rio de Janeiro. Looking forward, Transpetro proposes setting up a logistics infrastructure to support the anticipated increase in ethanol demand, involving building dedicated ethanol pipelines and a series of waterway terminals. Petrobras's "Ethanol Program" concerns three major areas of investments: (1) the Ethanol Export Corridor Program covering the center-west and southeast regions; (2) the South Region Export Project; and (3) the Northeast Region Export Project. As a result of this program, it is forecasted that capacity will increase by 17.75 million cubic meters annually. Also noteworthy is the anticipated private projects for shipping the 'Brenco' (Brazilian Renewable Energy Company) and 'Uniduto' output, involving the construction of a pipeline system expected to increase total delivery capacity by 9 million cubic meters per year.

2.2 GOVERNMENT INVESTMENT AND GOVERNMENT POLICIES IN TRANSPORTATION

The government's role in transportation began to shift in the early 1990s from one focused on investment to that of a regulator – a process driven by fiscal constraints on public investment and the need to increase overall efficiency. Despite mixed results between transport modes and sectors, there has been widespread improvement in the regulatory role of the public sector in most elements of the logistics system. In spite of this trend, the role of the private sector is still very limited in terms of overall transportation infrastructure.

Government Investment in Transportation: Government investment in transport infrastructure, along with national infrastructure investment more generally, slowly decreased in Brazil following the debt crisis of 1982. Furthermore, Brazil's expenditure on transportation has been low when compared to other countries (See Figure 19). The loss of earmarked funds from the National Highway Fund (*Fundo Rodoviário Nacional*) after the 1988 Constitution further sharply reduced investment in transportation. The consolidation of the Real Plan in 1994 and the establishment of a primary surplus target aimed at stabilizing the public debt-to-GDP ratio have constrained government investment, even as current spending has continued to grow. In addition to fiscal space difficulties, transportation investment has suffered from inadequate long term planning, as well as insufficient funds to guarantee continuous transportation improvements. Often, the lack of individual strategic road projects has made the complete integration of economic corridors difficult.

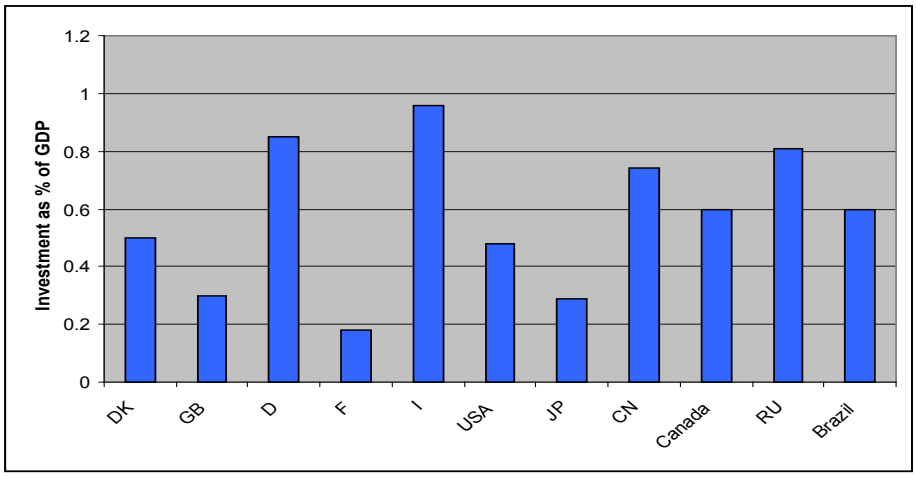
FIGURE 19: TRANSPORT EXPENDITURE VERSUS GDP



Source: World Bank, International Comparison Program 2005

The federal government's recent approval of the PAC represents a momentous attempt to increase infrastructure investment in Brazil. The PAC involves investments in transportation projects totaling approximately R$58.3 billion for the 2007-2010 period. These investments, which are to be financed primarily by the public sector, vary from R$33.4 billion for roads, R$7.9 billion for railroads, R$2.7 billion for ports, and R$0.7 billion for inland waterways. This represents approximately 0.6 percent of GDP per year, or about twice the current government investment in transportation. This would be considered similar in average to the OECD countries transport investments (see Figure 20) if, in fact, this plan would be fully implemented.

FIGURE 20: COMPARISON OF TRANSPORT INFRASTRUCTURE INVESTMENT AS % OF GDP (2004)



Source: EU Energy & Transport in Figures, 2005, OECD, Les Infrastructures à l'Horizon 2030

Sector Planning: The recently prepared National Plan for Transport Logistics (*Plano Nacional de Logística de Transportes*, (PNLT)) is also an important planning tool, as it attempts to map future commodity flows and the investments required to support them efficiently. However, the PNLT stops short of being a complete strategy since it does not continuously evaluate projects in a systematic fashion, which is a fundamental component of any initiative to improve a logistics system. This is also the case with some other potentially innovative and positive initiatives such as the Study of Axes (*Estudos dos Eixos*) and Brazil in Action (*Brazil em Ação*) undertaken under a previous administration but which were interrupted with the change of government. Compounding the lack of continuity between administrations is the lack of a centralized and updated database, and severe shortages of training for logistics specialists. These factors, and the absence of a specific unit that could plan and evaluate projects, such as the now defunct National Transport Planning Agency (*Empresa Brasileira de Planejamento de Transportes,* GEIPOT), have meant that previously good ideas have been interrupted or discontinued, only to start anew with another administration. In fact, this "stop and go" posture has contributed to the lack of a serious and implementable medium and long-term plan.

PNLT: As indicated above, the PNLT (Relatorio Executivo, April 2007) which was prepared under the Secretary of Transport Policy of the Ministry of Transport is a major breakthrough in the planning and evaluation of transport investments necessary for the development of more efficient passenger and freight logistics in Brazil. Starting with existing and new traffic surveys, the PNLT uses an economic demand model developed by FIPE (Economic Forecasting Equilibrium System) and a classic 4-step transportation model developed by LOGIT to estimate the major expected flows in the country from 2007 to 2023. The PNLT looks in detail at several regions of the country, namely the north, northeast, center-west, southeast

and south regions and at the most important groups of products, i.e, mineral ores (iron, bauxite, coal), steel products, soya complex (grain, bran and oil), wheat, sugar cane complex (sugar cane, sugar and ethanol), liquid fuels, fertilizers, wood, paper and cellulose, cement, vehicles, meat, containers, and general cargo. Preparation for the PNLT considered extensive consultation with stakeholders in order to ensure a bottom-up approach. The methodology behind the PNLT study included modeling various forecasts and trip distributions having different capacity constraints, which resulted in the development of a potential future modal split complemented by a traffic assignment exercise. Based on the generated modal split and traffic assignment models, a portfolio of investments was developed for each logistics vector. These forecasted investments were prioritized with cursory benefit-cost analyses, amongst other methods. A summary of the PNLT investments required for 2008-2023 horizon (R$ 2007) is R$72.7 billion from 2008-2011, R$28.6 billion from 2012-2015, and R$71.1 billion from 2015-2023, all of which include airport investments. This would suggest a total investment of R$172.4 billion over 15 years, of which 43 percent is for roads, 29.4 percent for rail, 7.4 percent for waterways, 14.6 percent for ports and 5.6 percent for airports.

In addition to the list of investment priorities and a series of policy measures, the PNLT report forecasts that the modal split would change as in Table 13:

TABLE 13: FREIGHT TRAFFIC FORECASTS

Mode	2005		2025	
	%	TKU (BILLION)	%	TKU (BILLION)
Road	58	514.1	33	482.1
Rail	25	221.6	32	562.4
Waterway	13	115.2	29	466.0
Pipeline	3.6	31.9	5	80.3
Air	**0.4**	**3.5**	**1**	**16.1**
Total	100	886.4	100	1606.8
Growth Forecast	81.3%			

Source: PNLT –Relatorio Executivo, 2007

Although the PNLT cautions that the road mode will continue to dominant for a number of years, it identifies and proposes a number of rail, waterways, ports and pipeline investments in addition to road investments, which, by 2023, could shift the modal share, providing shippers with alternatives which are more cost-effective than the road mode for long-haul bulk products. The PNLT warns that the GoB increases the value of investments in transport infrastructure to about 1.5 percent of the GNP versus the present 0.21percent. Although the ideal outcome for

transport investment would require at least 2percent of the GNP, the PNLT report argues that a combination of government investments, PPPs and concessions can keep the momentum provided by the PAC as long as the budgeted government investments are treated as they were in the PAC, i.e., there will be no disbursement constraints for the required core investments. The PNLT report also recommends strengthening the traffic flow database and increasing staff in the Ministry of Transport to work on the next phases of the PNLT in order to update the proposed investments as part of a continuous exercise. It also recommends an extensive training program for transport specialists similar to the one carried out by GEIPOT in the 1970s, and a more coordinated effort between transport units, environmental authorities and account tribunals in order to minimize project suspension or prevent delays in project commencements.

The PNLT was a major breakthrough as a planning document and required a considerable amount of effort and resources. Yet to be an actual logistics strategy, in the next phases, it should consider the following aspects described in detail in Table 25:

- Public policy objectives, principles of industry access, licensing and the roles of: public and private sectors, markets and regulations, central and local governments.
- Auditing of current performances with detailed benchmarking of service, custom, government functions and perception of customs.
- Inclusion of measurable objectives, timetables and milestones, clear responsibility and accountability, public transparency and reporting.

PNLT proposal to use the CONIT as the main entity in charge of the logistics strategy is noteworthy and this study suggest that the concept should be expanded. CONIT needs to have more private sector input and, in order to make it more practical and client-oriented, it would be desirable that it is led by a well-recognized industry champion instead of the line ministries. Also, the CONIT needs to establish the thematic groups (*camaras tematicas*) and establish an agenda driven by the needs of the various sector associations. Finally, the creation of logistics councils in the states, also driven by the private sector, will be highly desirable because each state would be able to design its own strategy and provide valuable feedback to the next phases of the PNLT. This should be always driven and funded partially by the private sector otherwise there is little incentive for their participation.

The strong effort underway to secure a database that can be quickly updated and made accessible to all stakeholders as well with the geo-referencing of the network are also good initiatives, but additional studies are required to underpin the next phases of the PNLT. Some of these studies are: a) study of the trucking industry, its characteristics and agenda for improvements with detailed analysis of the truckload (TL) and less than truck load (LTL) movements and costs; b) study of the ways to increase competition between railways and the impact of actual application of mutual rite of passage law; c) study of increasing participation of railways in the short-haul market as an environmentally friendly alternative to trucks in the

metropolitan regions; d) study of the impact of adding a third rail to the broad gauge to allow for metric gauge interconnection; e) study of the cost-benefit of investments required to introduce double stack where possible; f) study to improve transport related management information systems; g) study on customs performance benchmarking; h) study to define the main intermodal corridors which the government is willing to support to reduce congestion and environmental impacts; i) study of port competition to lower port costs, and j) study on how transport costs savings can be transferred to the final consumer.

In general terms, the significant effort and thrust of the PNLT and its strategy to propose infrastructure that will shift the modal split to rail, waterways and pipelines by 2023 is commended. In future phases, more emphasis on developing a total logistics cost model, as exemplified with the Santos case study in this report, will be a useful tool to demonstrate the link between the proposed investment and policies and actual impacts of those initiatives. This will require even more data but should be done at least for the hinterland of most of Brazil's main ports.

Regulatory Agencies and Policies: Beginning in the 1990s, Brazil experienced a series of important regulatory and policy reforms which by and large affected positively the transportation sector. Old agencies have been replaced by new ones under different roles and responsibilities. Policies have been enacted to modernize and consolidate port operations and multimodal operators, along with regulatory changes in road and railroad concessions, and transfers of administrative authority from the federal government to the states. The public sector has reduced its participation in transportation, while the participation of the private sector has increased, particularly in roads and port terminals. The implementation of these new policies and regulations has been a positive step towards improving the logistics system, however, the change has not been entirely successful. Results have varied across transport modes and sectors.

In Brazil, the Ministry of Transport is the main player in providing the physical infrastructure of the logistics system with its Secretary of Transport Policy in charge of the PNLT. Other Ministries, such as Development, Industry and External Commerce (MDIC), Agriculture and Finance also make decisions which affect the logistics system. In addition to the Ministry of Transportation, the Department of Transportation Infrastructure (*Departamento Nacional de Infra-estrutura de Transportes,* DNIT) is also in charge of implementing infrastructure policy for roads, railways, ports, and inland waterways, as well as construction, maintenance and operation. The agency responsible for the control and regulation of the road and railway systems is the National Agency of Land Transport (*Agência Nacional de Transportes Terrestres,* ANTT), which is the most important regulatory agency in the transportation sector. There is also a national program of highway concessions (*Programa de Concessões de Rodovias Federais*) that has initiated an ambitious effort to increase private sector participation in the highway system. The ANTT was established to reduce conflicts between operators, clients, investors, and the public sector, and is responsible for the management and operation of all overland transportation in Brazil. It is in charge of the administration of concession contracts, regulation of tariffs, prices and freight, registration and control of multimodal

operators, as well as overall promotion of regulatory policies across land transportation in the country.

The National Agency of Waterborne Transportation (*Agência Nacional de Transportes Aquaviários*, ANTAQ) has similar responsibilities for ports and inland waterways. Created in 2001, ANTAQ is in charge of regulating ports, maritime transportation and waterborne commerce. Since 1993, the Law of Modernization of Ports has contributed to the privatization of major terminals and the creation of local Port Authorities and Port Authority Councils tasked with regulating the operations of ports to foster increased competition. The recently created Special Secretary of Ports[26] is in charge of improving port infrastructure throughout the country, but has no direct control outside port boundaries. Although representing an important step forward, reform of the ports sector has not yet advanced sufficiently due to the absence of clear policies on how to proceed with further decentralization and privatization of port administration and how to promote competition between ports. Nevertheless, the Secretary of Ports has launched a number of initiatives focused on results-based management while it awaits the completion of its Strategic Port Plan. In addition to lack of investment, labor disputes remain a major impediment to improving port productivity and reducing operating costs.

Other important entities are the associations of users, such as National Consumer Association of Cargo Transport (*Associação Nacional dos Usuários de Transport de Cargas*, ANUT), Brazilian Association of Agribusiness (*Associação Brasileira de Agribusiness*, ABAG), Brazilian Logistics Association (*Associação Brasileira de Logística*, ASLOG), and Associação Brasileira de Logística e Transporte de Carga (ABTC), among others. There are also other associations, which represent operators-users or commodity exporters (e.g. FIESP, ANTF) and the National Confederation of Transport (*Confederação Nacional de Transportes,* CNT), an association of transporters and operators which periodically undertakes infrastructure and user surveys.

[26] The Special Secretary of Ports was created in May 2007 and is responsible for advising directly the President of the Republic in the formulation of policies and guidelines for the development and promotion of the maritime port sector and, especially, to promote the implementation and evaluation of measures, programs and projects to support maritime port infrastructure development and the ports under management of the port companies (companhias docas). Before ports and also waterway infrastructure were part of the Ministry of Transport but the complaints about port inefficiency led to the creation of this special Secretariat linked to the President.

2.3 PRIVATE SECTOR PARTICIPATION, PUBLIC PRIVATE PARTNERSHIPS (PPPS) AND PRIVATE SECTOR ROLE

The increasing role of the private sector in the provision of transportation infrastructure and services came as a result of the limits imposed on the government's fiscal policies that led to a substantial drop in government investment in infrastructure (and especially transportation infrastructure). Most importantly, private sector participation has been a positive response to the need to improve efficiency, achieve better service levels, increase the level of investment, and improve technology and labor training. Additionally, the privatization of transportation systems contributed to the reduction in the need for public sector expenditures on the maintenance of transport facilities, thereby leaving greater room for investment in other areas.

Roads*:* The Federal Highway Concession Program (*Concessões de Rodovias Federais*) was originally launched in 1993, but the first concessions actually started in 1996. Currently there are about 4,700km of highways under concession to private operators. In the second phase of the program, which has been delayed due to legal concerns raised by government auditors, about 2,600km will be privatized[27]. Positive changes took place between the first and second phase of concessions. In the first phase, the average toll paid by a car per km traveling on a concession road was 10 cents of real. In the second phase, as Table 14 shows, the average is 2.69 cents of real. The second phase promoted more competition which lowered prices, as shown in this same table. The National Transportation Law, enacted in 2006, is expected to further facilitate concessions. The law establishes that the DNIT may provide financial resources to maintain and build roads to be transferred to private concessionaires. The law also clarifies DNIT's supervisory role. The third phase of highway concessions, involving about 6,700km, is already planned and its implementation will depend on the success of the second phase. As for important state programs, in January 2009, the last lot of the second phase of BRs 116/324 in the State of Bahia involving 680km was concessioned with a toll of R$2.21. The third phase of the program includes about 4,000km of which 2,054 km involves BRs 040, 381, 116 in Minas Gerais state. They are expected to be tendered in the second semester of 2009.

[27] Information updated to June 30, 2008.

TABLE 14: TOLLS CHARGED BY FEDERAL ROAD CONCESSIONS IN THE SECOND PHASE OF CONCESSIONS

Highway	Length	Maximum Toll for a Car Allowed by bidding documents	Lowest Toll for a Car Submitted by Winning Offer	Difference Between Maximum and Winning Offer	Number of Toll Booths in Highway	Total Paid in Tolls by Car Using all the Highway	Equivalent Toll per Km Traveled
BR 381 - Fernão Dias	562.1	R$ 2.844	R$ 0.997	**-65%**	8	R$ 7.976	R$ 0.0142
BR 116 - Regis Bittencourt (São Paulo - Curitiba)	401.6	R$ 2.685	R$ 1.364	**-49%**	6	R$ 8.184	R$ 0.0204
BR 116 / 376 / 101 - Curitiba - Florianópolis	382.3	R$ 2.754	R$ 1.028	**-63%**	5	R$ 5.140	R$ 0.0134
BR 101 - Divisa ES/RJ - Ponte Rio Niterói	320.1	R$ 3.824	R$ 2.258	**-41%**	5	R$ 11.290	R$ 0.0353
BR 153 - Transbrasiliana - Divisa MG/SP - SP/PR	321.6	R$ 4.083	R$ 2.450	**-40%**	4	R$ 9.800	R$ 0.0305
BR 116 - Curitiba - Divisa SC/RS	412.7	R$ 4.188	R$ 2.540	**-39%**	5	R$ 12.700	R$ 0.0308
BR 393 - Divisa MG/RJ - Via Dutra (BR 116)	200.4	R$ 4.037	R$ 2.940	**-27%**	3	R$ 8.820	R$ 0.0440
Average	371.5	R$ 3.488	R$ 1.940	**-46%**	5	R$ 9.130	R$ 0.0269

Source: Government of the State of Sao Paulo.

Rail: The privatization of the Brazilian railroad network in the late 1990s involved the four major government-owned railway companies, together accounting for about 95percent of the total freight transported on railroads. As per the 1988 Constitution, the federal government remains the owner of railroad assets, while private sector companies obtain the right to transport through a concession. Due to several regulatory loopholes, including lack of clear rules for tariff calculations and access prices, lack of penalties for noncompliance with contract targets, and lack of adequate structure of ownership to promote competition, the railway sector failed to develop as expected in the first few years of private sector operation. However, changes in the regulatory environment, as well as the restructuring of the private operators in 2003 have positively resulted in greater capitalization along with a sharp increase in investment and volume transported.

Port: The beginning of private sector participation in port activity began with the Port Modernization Law of 1993, which emphasized privatization, increased private sector participation, decentralization and fostering competition. Beginning in the late 1990s, concessions of the major terminals to private operators and the establishment of new private terminals have contributed to lower operating costs. At the same time, public sector investment in capital improvements and dredging works, though badly needed, has been negligible – a situation that could be improved through further private participation. Policies necessary to continue the process of decentralization and privatization have not been clearly defined. Only 12 ports have been delegated to their corresponding state or municipality, while 20 ports, including those of Rio de Janeiro and Santos, remain under federal control

through the management of eight dock companies. The government has been reluctant to advance in the concessioning to the private sector of these dock companies, in part due to their precarious financial situation and longstanding labor disputes. As a result, only secondary ports are likely to be concessioned in the near future.

Closely related to the privatization programs are the Public-Private Partnership Projects (PPPs). This type of partnership has been successfully implemented in the Unites States, Canada, Australia, Italy, South Africa, Mexico, Portugal, and Chile, among others. In Brazil, the appropriate regulatory framework has recently been developed, together with the acquisition of the fiduciary resources necessary to support the PPPs. PPP activities in Brazil began in the states of Minas Gerais and São Paulo, with the MG-050 and Line 4 of the São Paulo subway, respectively. The first project is a 25-year concession in Minas Gerais for the highway connecting Belo Horizonte to the north of São Paulo state. The second project is a 13 km subway stretch in the capital city of São Paulo state. There are currently a considerable number of similar projects at both the federal and state levels, including railroads and ports as well as roads which are under evaluation. Brazil has two types of PPPs allowed by legislation: a) The Sponsored Concession (*Concessão Patrocinada*) which is the concession of public services or public works legislated by Law#8987 of 2005 and involves a tariff charged to users in addition to a monetary contribution of the public administration to the private partner; and b) Administrative Concession (*Concessão Administrativa*) which is a contract for provision of services in which the Public Administration is a direct or indirect user, although it may involve the provision of works or goods. The PPP institutional framework in Brazil also provides for a Guarantee Fund legislated under Decree 5411/2005. Since all the legislation is in place, there is no reason, other than the current temporary credit crisis, for the number of PPPs not to increase in the country in the future.

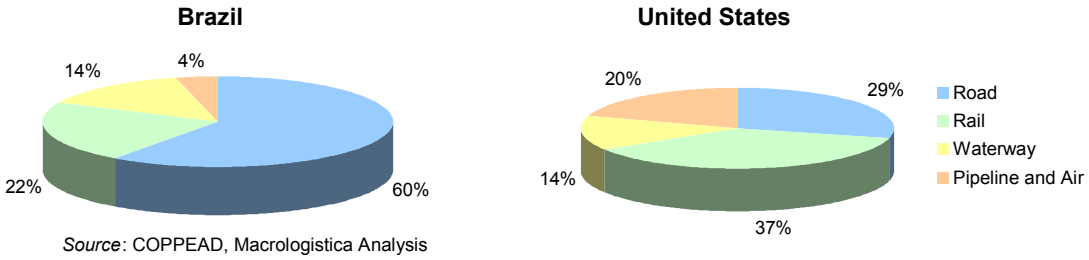
2.4 TRANSPORT MODAL SPLIT IN BRAZIL: CAN IT BE CHANGED?

The present transport modal split in Brazil is quite unbalanced in favor of roads, which accounts for about 60percent of net ton-kilometers. As a means of comparison, Figure 21 shows Brazil's and the United States' freight modal split[28], suggesting that the United States has a more balanced and cost-efficient distribution between the modes, although it is understood that modal split depends on the types of products available for transport and the topography of the country. The study believes that this significant lack of balance in the transport matrix presents a key challenge to any effort to improve the efficiency of the logistics system. First, because road transport is almost always the most expensive mode after air transport (see Figure 25).

[28] A comparison of modal split and other indicators in the BRICs is presented in Annex 2 of this report

Although road transport will continue to be indispensable, it is clearly cost-inefficient to long-haul transport bulk products. Second, because Brazil's territorial extension and the predominance of bulk and heavy commodities such as mineral ores and grain justify the use of railroad and waterway transport over the use of road transport. Overall, the present Brazilian transport modal split is not the most cost-efficient as a standalone nor does it allow Brazil to take advantage of its relative competitive advantage in commodities.

FIGURE 21: FREIGHT TRANSPORT MODAL SPLIT IN BRAZIL AND U.S.A.



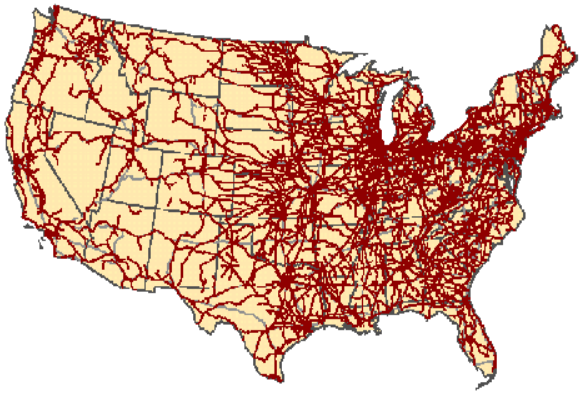
Source: COPPEAD, Macrologistica Analysis

Currently located mainly in the south and southeast, the uneven territorial spread of the rail network is one of the main reasons for the heavy reliance on roads in Brazil. The paved road network is about 5 times longer than the railway network, and the combined paved and non-paved road network is almost 50 times longer than the rail network. Unbalanced development of the two transport modes represents an impediment to rail ever becoming a truly viable alternative to road transport. While the United States has 14.7km of rail per 1000 square km, Brazil has only 3.4 km per 1000 square km, as shown in Table 4 and Figure 22. Although comparing densities across countries is difficult, it is clear that in Brazil railways and waterways (Figure 23) do not serve the grain panhandle and key mining areas, and this leads to an intensive use of road transport for the long haul of these commodities.

FIGURE 22: RAILWAY DENSITIES AND GEOGRAPHICAL LOCATION

Brazil

United States

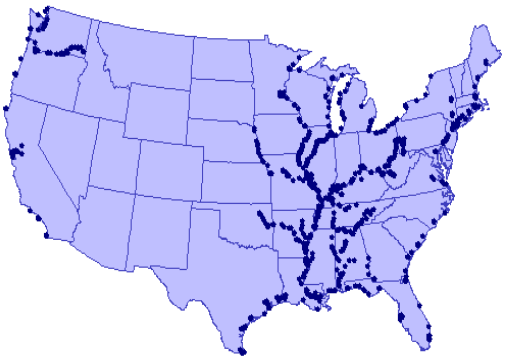


Source: Associação Nacional de Transporte Ferroviário (2006), Association of American Railroads (2006)

FIGURE 23: WATERWAY INTERMODAL TERMINALS

Brazil

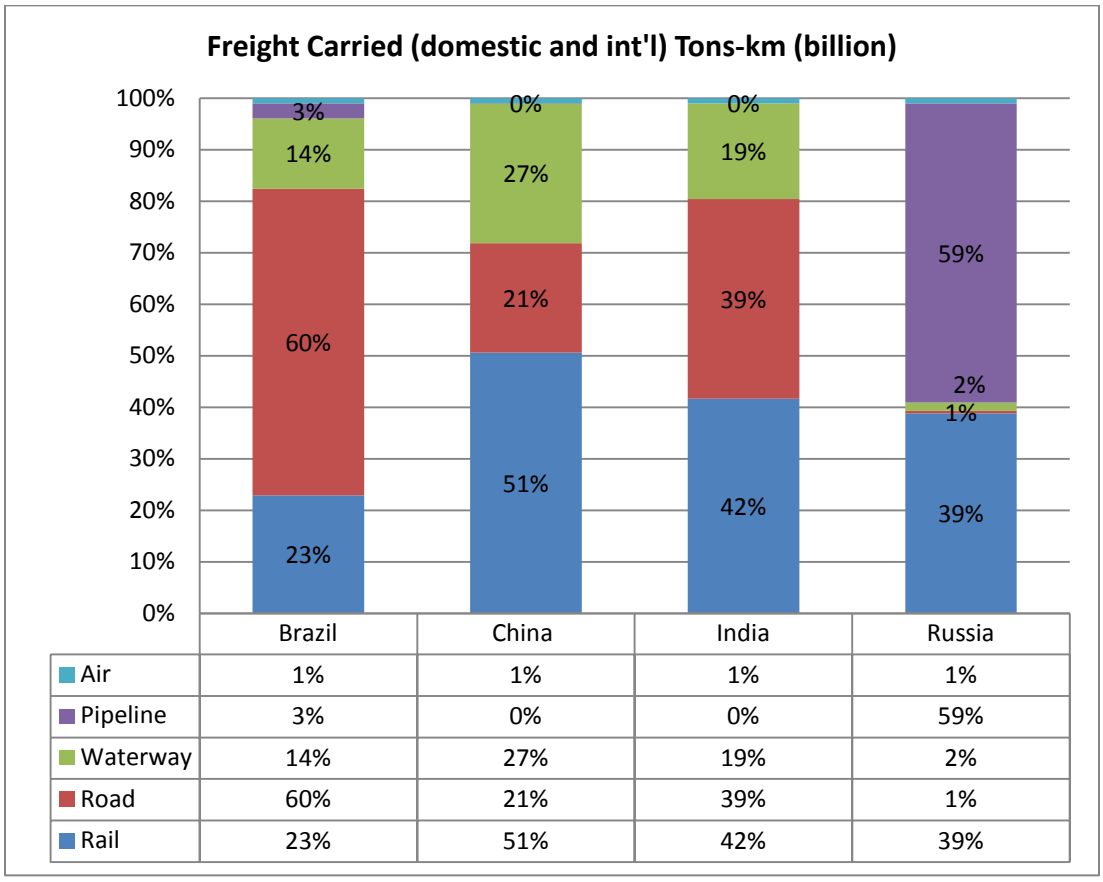
United States



Waterways are used even less because of the lack of appropriate infrastructure to allow the use of longer river convoys, which are fundamental for the transport of grain and mineral ores. In addition, as shown in Figure 23, there are very few intermodal terminals to allow for the quick and efficient transfer from water to road and rail, as compared to the United States, a country of similar size. Figure 24 compares Brazil with a range of other countries with respect to the relative use of waterways versus rail and road transport. Brazil uses fewer waterways than other large countries with similar water geographies, such as China and the United States, and instead uses more of the most expensive mode, trucks on roads. Although, the number of waterway terminals is proportional to the economic activity and

population density in the areas served by the waterways, there is a significant lack of these terminals in Brazil.

Figure 24: Waterway Use in Brazil and in other Countries



	Brazil	China	India	Russia
Air	1%	1%	1%	1%
Pipeline	3%	0%	0%	59%
Waterway	14%	27%	19%	2%
Road	60%	21%	39%	1%
Rail	23%	51%	42%	39%

Source: Annex 2

A 2004 study by COPPEAD compared the freight transport mode costs between Brazil and United States (Figure 25).[29] Three observations can be made of this comparison: 1) in both countries, transport by truck is significantly more expensive than railway transport, waterway, and pipelines; 2) with the exception of truck transport, all modes are more expensive in Brazil than in the United States; and 3) relative prices of rail and waterway to road is considerably cheaper in the United States than in Brazil (rail is 60percent cheaper than road transport in Brazil, but 75percent cheaper in the United States; waterways are 73 percent cheaper than road

[29] Recent (2007) U.S. cost of truckload per 1,000/TKM are between $60.30 and $129.13, and for carload (rail) are between $16.41 and $23.81.

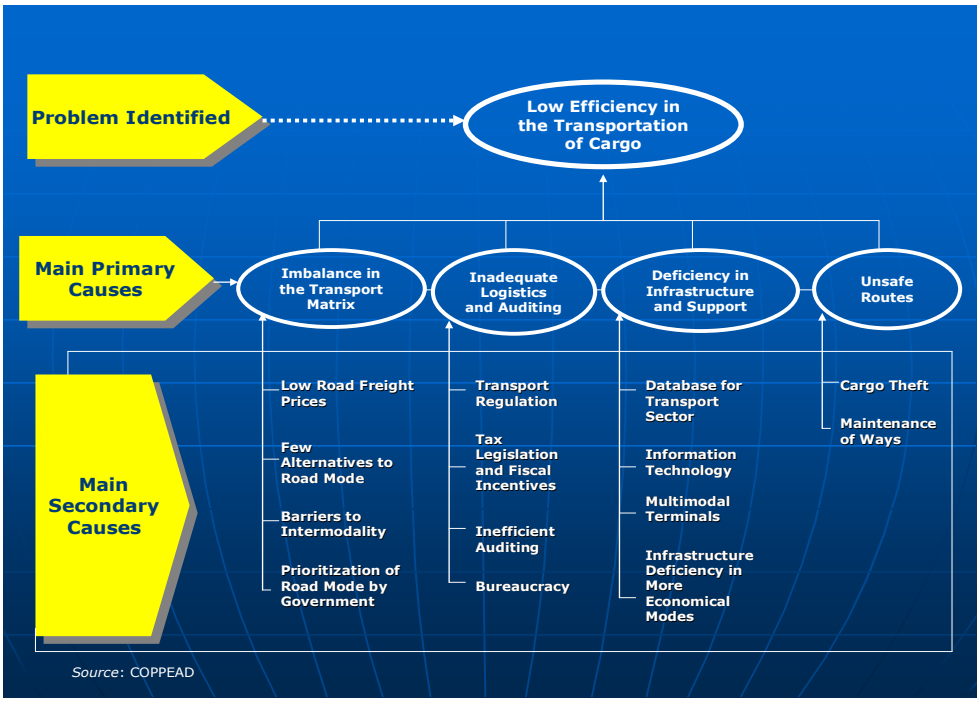
transport in Brazil, but 91percent cheaper in the United States). Some potential explanations to these differences could be: a) greater infrastructure availability in the US and increased congestion on Brazil's transport axes, b) lack of sufficient competition and proper regulation in railway, waterway, and pipeline transport, and c) lower port and terminal efficiency in Brazil. This price differential has affected consumer behavior and biased the freight transport matrix in favor of road transport. It also has contributed to the lack of development of multimodal transport. Figure 26 summarizes the primary and secondary causes for the low efficiency of freight transport in Brazil, some of which were already noted. Specifically, the summary includes such primary causes as: imbalances in the modal matrix, inadequate logistics and auditing, deficiency in infrastructure and support, and unsafe routes.

FIGURE 25: COMPARING FREIGHT LOGISTICS COSTS IN BRAZIL AND THE UNITED STATES

Mode	Quantity of Cargo Transported		Transport Matrix (%)			Medium Freight, International Standard (US$/1,000 TKU)	
			Brazil		USA	Brazil	USA
	TKU (millions)	TU (thousands)	w/ Iron Ore	w/out Iron Ore			
Road	488,000	456,000	60	70	26	45	56
Rail	188,000	356,000	22	9	34	18	14
Waterway	112,000	398,000	14	17	25	12	5
Pipeline	24,000	24,000	3	3	14	10	10
Air	8,000	8,000	1	1	1	360	320
Total	820,000	1,242,000	100	100	100	TKU = 1 Ton transported 1 KM	
Average Cost (US$/1,000 TKU)			36	39	25		
Larger average cost than USA - US$11/MTKU x 820 MTKU = US$9 billion/year or R$20 billion/year							

Source: COPPEAD, Macrologistica Analysis (US$1 = R$3)

FIGURE 26: PRIMARY AND SECONDARY CAUSES FOR LOW EFFICIENCY OF FREIGHT TRANSPORT IN BRAZIL



Despite the high cost of road transport relative to other modes, Brazil has not been able to effectively promote the use of rail and waterway transport – modes that are more cost-efficient and in most cases, environmentally friendlier. The study suggested that a determined effort be made by government to create the incentives necessary to facilitate financing for infrastructure in railways and waterways

2.5 BOTTLENECKS TO MULTIMODAL TRANSPORT IN BRAZIL

Multimodal transport calls for the use of two or more modes and the efficient transfer of freight between these modes. Multimodal transport takes advantage of the savings to be gained by maximizing the distance freight is carried by a trunk service, such as rail or boat that is able to move large volumes and long distances more efficiently. To be effective, multimodal transport must involve low transaction costs for the shipper and must be reliable and available. The service is typically provided by Multimodal Transport Operators (MTOs) which are responsible for all elements of the multimodal shipment. MTOs are professional firms in charge of assuring the movement of freight from origin to destination, by several modes, if

necessary; taking care of all the documentation required for exporting and importing such freight.

Two key parts of the multimodal shipment process can easily become bottlenecks making multimodal transport prohibitively expensive. One is the transfer of freight between modes. A solution to this problem typically involves containerizing the freight so that these containers can be transferred by cranes in a matter of minutes. Another solution is to place loaded trucks and truck trailers on train flatcars. In either case, proper transfer terminals are required. A second potential bottleneck is the paperwork involved in insurance, clearing customs, paying taxes (both national and across borders), as well as the waybill, which must be singular regardless of the number of modes involved.

Development of multimodal transport in Brazil is still incipient. Despite significant progress towards the establishment of the legal framework required to effectively function, as well as the emergence of over 250 legally recognized multimodal transport operators, several bottlenecks impede further development:

1. Underinvestment: Because of historical underinvestment, railroads and waterways are in no position to be the trunk lines for freight transport in a country the size of Brazil. As a result, freight uses trucks for long distance hauls. For example, for soybeans, the average distance traveled by truck is 1.198 km and the longest haul is 2.019 km, according to the United States Department of Agriculture (USDA) (data for third quarter 2007). A multimodal approach is needed for these long shipping distances in which trucks collect the freight and then transfer it to trains or barges which will more efficiently transport the freight over the bulk of the distance it needs to travel.

2. Lack of transfer terminals. Freight transfers need to be seamless. Adequate transfer terminals contribute to reducing the costs of transferring freight between modes. Batista (2005) estimated that just for the agriculture products, there is a deficit of warehousing for 40 million tons.

3. Separate insurance: Insurance companies do not issue policies to cover all modes involved in a multimodal shipment, but instead require purchasing a separate policy for each mode.

4. Excessive paperwork: Government regulations allow the use of a single waybill for multimodal transport but do not prohibit states from requiring separate waybills for each mode of transport. Few states fully recognize the multimodal transport waybill, hence requiring additional paperwork. The existence of more than one waybill for the same trip makes it possible to tax the same trip twice.[30]

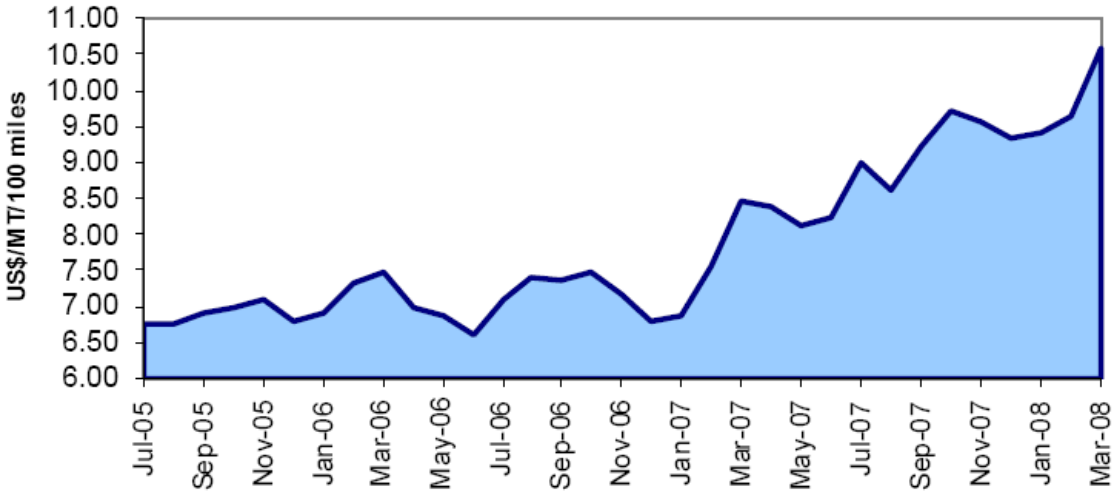
[30] Points 4-6 based on Nunes, 2007

5. Labor: The Banco Central do Brazil does not recognize MTOs, making it impossible for them to carry out transactions in foreign currency, hence impeding multimodal transport across borders.

6. Taxes: The Imposto Sobre Circulação de Mercadorias e Prestação de Serviço (ICMS) varies by state, providing incentives to shippers to avoid states with higher taxes and in so doing not use the most efficient routes and combination of modes.

With particular focus on the soybean sector (a key export for Brazil), the over reliance on truck transport will reduce Brazil's competitiveness in the near future as this mode becomes increasingly more expensive. For example, some recent events that have already negatively affected and may continue to affect negatively the cost of soybean are: 1) rapidly increasing truck sales (31.2% more trucks were sold in 2007 than in 2006) leading to increased road congestion and road deterioration;[31] and 2) Increasing petroleum prices raising the cost of truck transport for all products. Road transport costs are increasing rapidly and significantly for soybeans, as shown in the evolution of soybean transport costs in Figure 27.

FIGURE 27: EVOLUTION OF AVERAGE TRUCK RATES FOR BRAZILIAN SOYBEAN EXPORTS



Source: USDA/AMS. 2008, May. "Brazil Soybean Transportation."

[31] "Supervenda de caminhões pode se repetir em 2008." Jornal dos Transportes. Salvador, Bahia. April 2008. No. 193.

2.6 ENVIRONMENTAL ISSUES

The transport sector in Brazil was responsible for about 31percent of all energy consumed and CO^2 emissions in 2007, with road-based modes contributing more than 90percent of this share (2008 National Energy Balance, Brazilian Ministry of Mines and Energy). Freight represents roughly one-half of transport's total energy use and related emissions based on PNLT estimates of fuel consumption by aircraft, roadway, railway, and waterway vehicles. As mentioned earlier, Brazil is a world leader in the production and use of bio-fuels, particularly for light-duty passenger vehicles and increasingly for other modes in the name of environmental sustainability and energy security.

As detailed in Annex 4, four major trends in freight transport are drivers of energy use and emissions in the sector: (1) the level of freight activity as measured by net ton-kilometers has been increasing with rising GDP and is expected to continue; (2) while mode share by net ton-kilometers has been dominated by road-based transport, evidence from the past decade suggests that other modes are increasing as their networks become more developed; (3) while the efficiency of new vehicles continues to improve on the margin, overall fleet efficiency depends largely on the turnover and maintenance of the fleet; and (4) the principal freight transport fuel is diesel and will likely continue to be for some time, although there have been recent increases in bio-fuels, natural gas, and efforts to manufacture light and medium-duty electric vehicles.

2.7 SECTION CONCLUSIONS

In summary, the transportation sector in Brazil is a positive asset to its logistics system. However, despite the government's investment in the transport sector, as well as its recent efforts towards increasing private participation, institutional coordination and planning, the sector's inefficiency still represents a significant bottleneck towards improving the logistics system and competitiveness of the country. The current state of the transportation sector in Brazil has been in large part the result of the historical development of the Brazilian economy, the lack of adequate and sustained long-term and systematic planning, and lower than necessary investment (as a percentage of GDP) in the transport infrastructure by the national and state governments. Despite the extensive growth of the road network beginning in the 1950s, road deterioration due to maintenance cutbacks in the recent past is still a major concern.

Notwithstanding the existence of a potential for a truly balanced transport sector, road transportation dominates both short and long-distance freight markets. Moreover, traffic volumes are increasing on this network to the point that the capacities of its critical elements have been met, much to the detriment of the performance of the logistics system. Road transportation costs are relatively high,

particularly in the agricultural and mining frontiers which dominate the export market of the Brazilian economy.

This study suggests that one of the key shortcomings of the transportation sector with respect to its contribution to the logistics system is its unbalanced nature. Railways, waterways and pipelines have not received enough attention and sustained investment to present a viable competitive alternative to road transportation, resulting in a vicious cycle. Increases in freight transportation by road have been responsible for higher traffic volumes and accident rates. Meanwhile, the use of other modes is becoming strictly specific to low value added products with spatial concentration of movement. In addition, multimodal transport has not developed to the point where different modes of transportation can be combined within a single freight movement to increase total efficiency.

In principle, the transportation sector in Brazil is governed by relatively modern and appropriate policies, as well as by generally effective regulatory agencies. However, in practice, operations should still be further modernized and developed in order to properly and thoroughly follow through on ambitious improvement efforts. Unclear regulation of ports and railroads has left agencies operating under ambiguous regulatory mandates and operators working within inefficient and uncertain environments.

Finally, operational transfers of transport facilities to the private sector have faltered recently despite the need to relieve the financial and administrative burden on the public sector of road maintenance, port operations, and the like. Comprehensive reviews of concession bidding and contract documents, which take too long, have prevented PPPs from becoming an effective means of improving transportation efficiency in the country. Moreover, the pace of decentralization of road and port administration could be enhanced.

3 A CASE STUDY OF THE PORT OF SANTOS

This case study of the Port of Santos—the main port in Brazil—has three objectives. First, to estimate for a series of export products that uses the Port of Santos the Total Logistics Costs (TLC) and their composition in order to see how different items weigh in the TLC. The constituent items of TLC are transport, inventory, warehousing, port costs, and administrative costs. The second objective is to determine for each product which items constitute a bottleneck. The third objective is to analyze a series of projects currently under implementation or soon to be implemented that seek to mitigate the bottlenecks and reduce the TLC for exporting from the Port of Santos. These projects are sponsored by the federal government of Brazil and/or by the government of the state of Sao Paulo.

3.1 THE PORT OF SANTOS AND ITS HINTERLAND

The Port of Santos is located in the state of Sao Paulo. The state of Sao Paulo is the industrial powerhouse of Brazil – it has the largest economy in Brazil and one of the largest in Latin America. In turn, the Port of Santos is the largest in Brazil, moving 70percent of containerized export cargo by value and 80percent of containerized import cargo by value (Table 15). The area served by the port extends far beyond its immediate hinterland into the surrounding states. Freight from all states in Brazil use this port to some extent. The Port of Santos therefore deeply influences Brazil's national economy and growth. In all, the Port of Santos occupies the 39th position among world ports in the flow of containers with a total of 2.44 million TEU, with a projected increase of 2.46percent in 2008.

TABLE 15: CONTAINERIZED CARGO (ANTAQ, 2007)

	Export				Import			
	Weight		Value		Weight		Value	
	1000t	%	US$ FOB million	%	1000t	%	US$ FOB million	%
Salvador	29.93	0.20%	18.52	0.13%	2.65	0.02%	3.14	0.01%
Vitória	1723.93	11.47%	949.70	6.48%	221.15	1.77%	175.70	0.78%
Rio de Janeiro	3270.00	21.75%	2582.25	17.61%	1612.80	12.94%	2559.65	11.37%
Sepetiba	650.41	4.33%	286.13	1.95%	141.79	1.14%	1505.47	6.69%
Santos	8319.21	55.34%	10303.25	70.25%	10278.52	82.49%	18041.19	80.16%
Paranaguá	667.53	4.44%	242.79	1.66%	100.26	0.80%	93.52	0.42%
Itajaí	293.13	1.95%	238.14	1.62%	74.48	0.60%	99.59	0.44%
São Francisco do Sul	65.89	0.44%	36.97	0.25%	13.88	0.11%	13.17	0.06%
Rio Grande	11.89	0.08%	7.80	0.05%	14.80	0.12%	14.16	0.06%
Totals (SP-MG-RJ)	15031.94	36.71%	14665.55	48.97%	12460.33	54.68%	22505.59	56.95%
Sample Ports total	34599.69	84.49%	27881.30	93.11%	17936.84	78.71%	30300.86	76.67%
Totals Brazil	40950.41	100.00%	29946.05	100.00%	22788.29	100.00%	39519.66	100.00%

The Port of Santos has three distinct geographic areas of influence from which it receives different types of export products. First, the Port of Santos immediate area of influence reflects the São Paulo State industrial pole. It is focused on the following sectors: metallurgic products, heavy machinery, chemical, automotive parts, as well as automobiles. Second, the Port of Santos serves the ethanol sector on the west and northwest of the state of São Paulo. Ethanol accounts for approximately nine percent of total export weight and three percent of value of exports through the Port. Third, the port serves to a large extent 13 states outside of Sao Paulo state (Table 16). The export activities located in these states are comprised largely of food producers, specifically, soy from Mato Grosso, Mato Grosso do Sul, and Goiás, and coffee beans and corn from Minas Gerais. In their totality, food and agriculture sectors represent over 70 percent of the volume and 45 percent of the values exported through the port.

TABLE 16: EXPORT CARGO ACCORDING TO MAIN STATES OF ORIGIN (ANTAQ, 2007)

Port	State of Origin						Totals			
	Minas Gerais		*Rio de Janeiro*		*São Paulo*					
	Weight (1,000T)	Value (millions US$) FOB	Weight (1,000T)	Value (millions US$) FOB	Weight (1,000T)	Value (millions US$) FOB	Weight (1,000T)	Weight %	Value (millions US$) FOB	Value %
Salvador	0	0	0.05	0.08	1.88	2.6	1.93	0.03	2.68	0.04
Vitória	780.18	434.92	18.2	5.02	2.21	1.1	800.59	11.49	441.04	6.48
Rio de Janeiro	497.11	542.21	959.14	602.44	62.33	54.54	1518.58	21.79	1199.19	17.62
Sepetiba	3.59	3.3	295.56	126.52	2.89	3.04	302.05	4.33	132.86	1.95
Santos	183.24	281.26	23.05	31.58	3657.13	4471.96	3863.42	55.44	4784.8	70.32
Paranaguá	41.42	28.13	1.68	0.95	267.07	83.67	310.17	4.45	112.75	1.66
Itajaí	40.04	37.18	0.1	0.33	95.99	73.07	136.13	1.95	110.59	1.63
São Francisco do Sul	11.84	8.62	1.67	0.41	17.09	8.14	30.6	0.44	17.17	0.25
Rio Grande	0	0	0.19	0.16	5.33	3.46	5.52	0.08	3.62	0.05
Totals	**1557.43**	**1335.64**	**1299.65**	**767.49**	**4111.92**	**4701.58**	**6969**	**100%**	**6804.7**	
%	**0.2235**	**0.1963**	**0.1865**	**0.1128**	**0.59**	**0.6909**	**1**		**100,00%**	

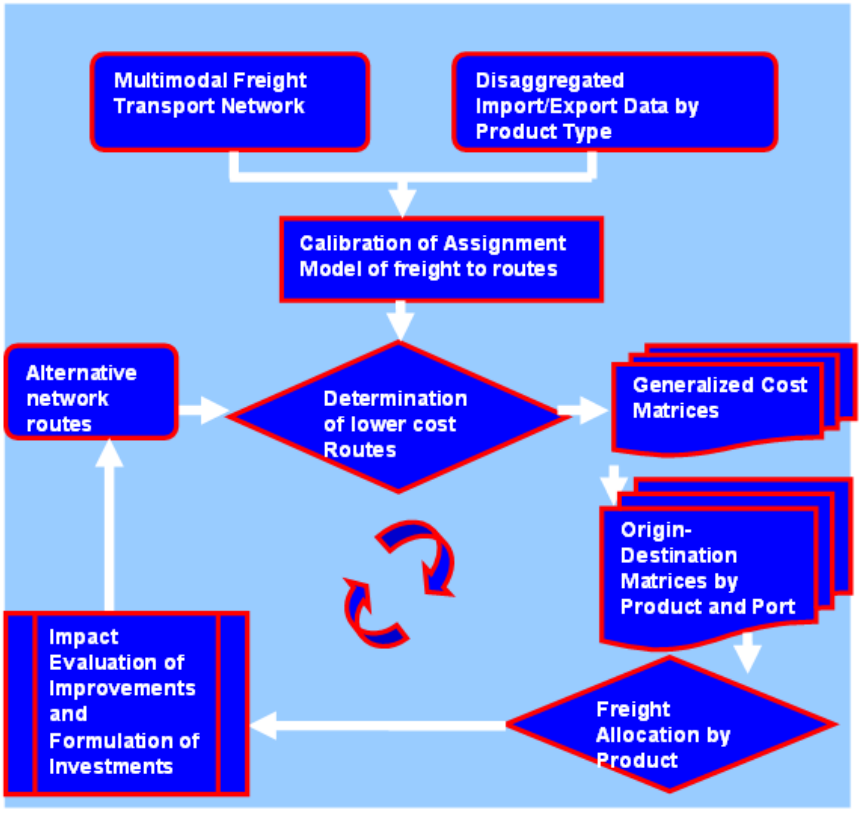
The Port of Santos' efficiency and competitiveness largely depend on the quality of the state of São Paulo's logistics infrastructure. Despite its relatively extensive road and rail networks, São Paulo state lacks basic intermodal integration and suffers from continued bias towards road-based transport.

3.2 METHODOLOGY

This case study employs the concept of total generalized cost to determine the logistics cost associated with a group of export products. The database used information from 2003 from the Secretariat of Industry and External Commerce (Secretaria de Indústria e Comércio Exterior, SECEX). This is the most recent database made available to the public. Other auxiliary data include the information collected in the Origin Destination Survey undertaken by the Sao Paulo's Transport Secretariat in 2005; Investment Climate Survey developed in Brazil by the World Bank in 2002; and the Annual Industrial Survey of the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística*, IBGE) for the years 2002 and 2003.

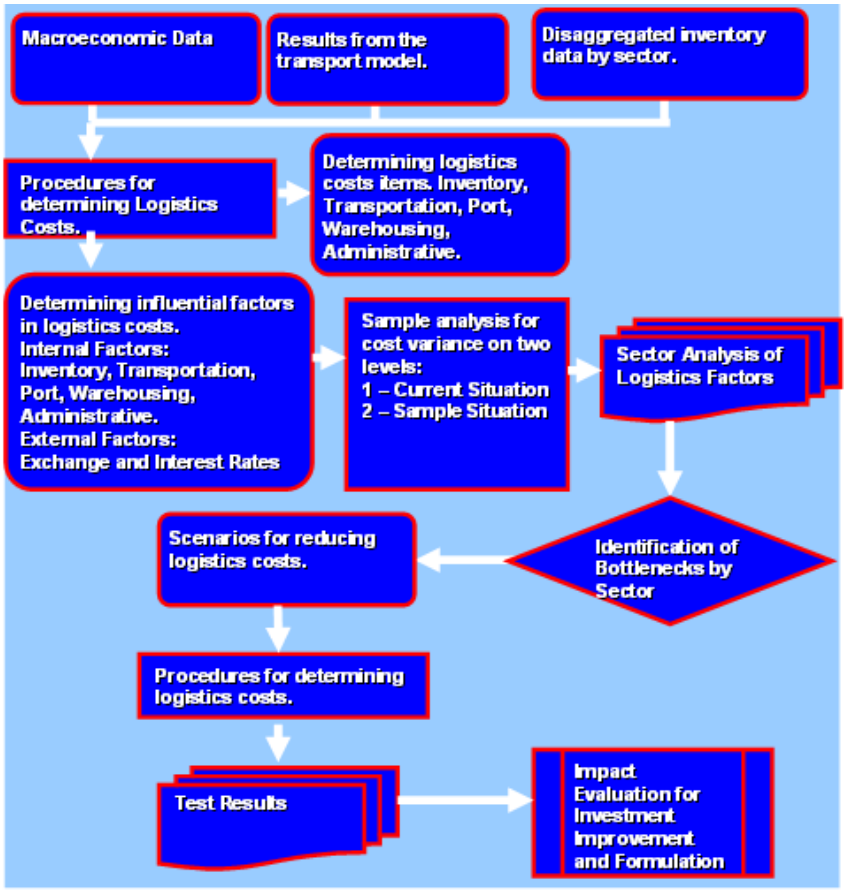
The generalized cost of transport is defined as the obstacle in a transport network flow. The higher it is the more costly and more time consuming is to move the product from origin to a destination. The methodology used in this analysis (Figure 28) was to build a simulation model of the interaction between freight transport demand and supply through the iterative assignment of freight flow matrices onto the freight transport network. The demand matrices were selected from products that account in total for at least 80 percent of the export and import flows, both in terms of weight as well as monetary value of the commercialized products involved. This model was calibrated by matching the loads measured on components of the main road and rail axes as well as the movements in the port terminals. After the model was fine tuned, several alternatives were generated and subsequently evaluated. The evaluation of the results was structured in such a way as to permit testing of infrastructure bottlenecks as well as deficiencies in supply chain procedures.

FIGURE 28: BASIC METHODOLOGY



Bottlenecks in the logistics system were found using analysis of variance techniques and following the methodology shown in Figure 29. Components of logistics costs were quantified from basic macroeconomic data, the transport model results and data on inventories in each economic sector. In addition to the constituent elements of TLC, two external factors were added, rate of interest and exchange rate. These two external elements also determine the TLC because they affect elements such as inventory costs and administrative costs. In order to identify bottlenecks, a variance analysis was carried out on the results of the logistics cost estimates using replication of an experiment with 7 factors at two levels. Those factors that accounted for greater participation in the total logistics cost were considered bottlenecks whose elimination should be a priority towards overcoming existing restrictions for each economic sector.

FIGURE 29: METHODOLOGY USED TO IDENTIFY LOGISTICS BOTTLENECKS



3.3 THE LOGISTICS COSTS FOR EXPORTS USING THE PORT OF SANTOS

The methodology used allows us to estimate the Total Logistics Costs (TLC) for export freight that uses the Port of Santos. Table 17 shows the gross results. These results reflect both product qualities and geographical realities, suggesting the model used is calibrated. For instance, foodstuffs and grains are bulky, and hence they account for a large share of the TLC. Likewise, equipment and machinery and automotives have a high TLC because of their high value. Reflected in the TLC is an opportunity cost for time spent traveling, and high inventory and warehousing costs. Finally, fuels have a relatively low TLC, which reflects their relative proximity to the Port of Santos.

TABLE 17: TLC FOR SELECTED INDUSTRIAL EXPORTS OF BRAZIL USING THE PORT OF SANTOS

Total Logistics Cost		
Export Product	Millions of Reais (2003)	Reais per ton
Foodstuff and grains	1,560	102.0
Equipment and Machinery	260	570.3
Automotives	203	492.2
Basic Metallurgic	194	102.1
Chemicals	172	185.6
Paper and Forestry	147	45.9
Fuels	132	60.5
Automotive parts	85	351.2
Total	2,753	113.0

The models allow detail analysis of the composition of the TLC for each broad category of export products.

Table 18 shows each product's share of transport, inventory, warehousing, port and administrative costs. The bold figures represent the items with the largest share of the TLC. For basic metallurgic products, two figures are in bold because of the small difference between the share of inventory and port costs.

The pattern that emerges is that transport costs account for the largest share of TLC for five of eight sectors: foodstuff (56.3%), automotives (45.1%), chemicals (48.7%), paper and cellulose (54.4%) and automotive parts (51.3%). Inventory costs are the largest share of TLC for equipment and machinery (51.8%) and basic metallurgy (31.0%). Finally, port costs are the largest share of TLC for fuels (59.4%) and basic metallurgy (32.1%). Furthermore, in the aggregate, transport is the main contributor to the TLC.

TABLE 18: DISAGGREGATED TLC BY ITEM FOR EXPORT PRODUCTS FROM THE PORT OF SANTOS

Export Product	Transport costs (%)	Inventory (%)	Warehousing (%)	Port fees (%)	Administrative fees (%)	Total (%)
Foodstuff and grains	**56.3**	13.2	3.1	23.6	3.8	100
Equipment and Machinery	26.6	**51.8**	12.1	5.8	3.8	100
Automotives	**45.1**	36.0	8.4	6.7	3.8	100
Basic Metallurgic	25.8	**31.0**	7.2	**32.1**	3.8	100
Chemicals	**48.7**	32.7	7.6	7.2	3.8	100
Paper and forestry	**54.4**	16.0	3.7	22.0	3.8	100
Fuels	18.1	15.1	3.5	**59.4**	3.8	100
Automotive parts	**51.3**	28.8	6.7	9.3	3.8	100
Total	**47.9**	21.8	5.1	21.4	3.8	100

The fact that transport costs are the largest share for automotives, chemicals, and automotive parts is interesting because most of this production takes place in the Sao Paulo Metropolitan Region (SPMR). The Port of Santos is, on average, only 83 Km (52 mi.) by road from the SPMR (Table 19).

This short distance suggests that transport accounts for a larger share than expected of the TLC for these high value added sectors. These flows use, to a large extent, trucks to get to the port. Transport is also a high share for foodstuff, which is produced mostly outside the state of Sao Paulo. Only the long distance flows use rail, leaving the medium and short distance flows to be moved by truck. These products with high transport costs illustrate Brazil's and Sao Paulo's heavy reliance on trucks instead of more efficient modes such as rail. The large number of trucks, 1 for every 2.7 cars, also aggravates the already high levels of congestion.

TABLE 19: ORIGIN OF EXPORT FREIGHT AND TONNAGE AND VALUE EXPORTED BY PRODUCT

Export Product	Transport Cost/TLC	TLC $/Ton	Produced mostly in
Foodstuff and grains	56.3%	102.00	Outside SP State
Equipment and Machinery	26.6%	570.28	SPMR
Automotives	45.1%	492.2	SPMR
Basic Metallurgic	25.8%	102.07	SPMR
Chemicals	48.7%	185.55	SPMR
Paper and forestry	54.4%	45.89	SP State
Fuels	18.1%	60.42	SP State
Automotive parts	51.3%	351.19	SPMR
Total	47.9%	112.95	

Finally, the model and the data gathered allow comparison of the TLC and the value added per product. TLC in itself is part of the value added (VA-additional value of a commodity over the cost of commodities used) to a product. A high TLC to value added ratio indicates that the product is overburdened by its logistics chain. Such a product is vulnerable to becoming non-exportable if the TLC increases even more. Table 20 shows the results of this comparison. For most products, the TLC is between 10% and 20% of the value added. For foodstuffs, moreover, the ratio is quite high—54.17%—reflecting the relatively low value added and therefore the high impact of logistics costs. Given that Brazil has become highly competitive exporting foodstuffs, this large share poses a risk on the country's competitiveness if TLC were to increase. Conversely, if TLC were to decrease, the country's competitiveness could increase further, particularly in products where the TLC accounts for a high share of value added.

TABLE 20: TLC AS A PERCENTAGE OF VALUE ADDED BY EXPORT PRODUCT

Export Product	TLC/VA
Foodstuff and grains	54.2%
Equipment and Machinery	6.8%
Automotives	14.9%
Basic Metallurgic	18.7%
Chemicals	13.7%
Paper and forestry	11.1%
Fuels	24.4%
Automotive parts	17.5%
Total	21.8%

In summary, this first look at the TLC for several export products suggests that transport accounts for a larger-than-necessary share of the TLC. Key examples of this phenomenon are automotives, chemicals, and automotive parts. They are manufactured mostly in the SPMR, which is quite close to the Port of Santos. This proximity could be a key competitive advantage, but the logistics system seems to burden rather than facilitate the export process particularly in these cases. Furthermore, the logistics system also seems to hurt even products with high value added levels.

3.4 THE BOTTLENECKS OF THE PORT OF SANTOS LOGISTICS SYSTEM

This section investigates the bottlenecks in the Port of Santos logistics system. It builds on the results of the previous section that showed that transport was a significant share of the TLC. This analysis attempts to investigate if transport is really a bottleneck or if this finding is more the result of product characteristics—i.e. a bulky product will have inherently higher transport costs. The key methodological tool used to identify bottlenecks will be Analysis of Variance (ANOVA). ANOVA is a technique that shows what percentage of the variance in the TLC is explained by each component item—transport, inventory, warehousing, port costs, and administrative costs. If an item explains a large share of the variance in TLC, it constitutes a "bottleneck" because the impact of TLC goes beyond the natural relationship between product and transport. This item is therefore, in principle, a potential target for cost-efficient intervention to reduce the TLC.

Table 21 shows the ANOVA results. The figures in bold indicate the item that explains the largest share of the variance for that export product. For equipment and machinery, and basic metallurgic products, this variable is external—interest rate and exchange rate—to the actors in the logistics chain. For policy purposes, therefore, the key variables of interest are not interest rate or exchange rate.

For five products—foodstuffs and grains, automotives, chemicals, paper and cellulose, and automotive parts—transport costs emerge as the variable that explains the largest share of the variations in TLC. Transport is therefore a "bottleneck" for these products. For foodstuffs and grains, this result reflects both the bulky nature of this freight and also the conditions of the transport infrastructure. For instance, 57 percent of this freight is transported by trucks instead of trains, which are better suited for heavy and voluminous freight. This is a direct effect of the bias towards road-based transport over railroads. Automotives, chemicals, and automotive parts are high value added products produced overwhelmingly in the SPMR, which is close to the Port of Santos. Transport costs explain at least 41.1 percent and up to 57.7 percent of the total variations in TLC. The fact that transport is the main bottleneck for these products despite the close distance to the port underscores the scale of the negative influence that this particular shortcoming of the transport infrastructure has on the performance of the entire logistics system.

TABLE 21: PERCENTAGE OF VARIANCE IN TLC EXPLAINED BY EACH LOGISTICS ITEM, INTEREST RATE, EXCHANGE RATE

Export Product	Transport costs	Inventory	Warehousing	Port cost	Administrative costs	External: interest rate and exchange rate	Residual variation	Total Variance explained
Foodstuff and grains	**76.7%**	3.4%	0.1%	13.8%	0.2%	5.6%	0.3%	86.0%
Equipment and Machinery	10.6%	**32.0%**	1.2%	0.7%	0.1%	**53.0%**	2.5%	98.0%
Automotives	**41.1%**	20.8%	0.8%	0.7%	0.2%	34.4%	2.1%	98.0%
Basic Metallurgic	17.2%	19.7%	0.7%	**27.8%**	0.2%	32.7%	1.5%	98.0%
Chemicals	**46.7%**	16.7%	0.6%	6.7%	0.2%	33.5%	1.3%	99.0%
Paper and forestry	**59.6%**	1.3%	0.6%	28.0%	0.4%	1.8%	8.4%	65.0%
Fuels	15.8%	8.7%	0.3%	**60.0%**	0.3%	14.4%	0.7%	40.0%
Automotive parts	**57.7%**	14.4%	0.5%	2.2%	0.2%	23.9%	1.1%	98.0%

Port costs are the bottleneck for basic metallurgic products and fuels. Port costs explain 60% of the variations in TLC for metallurgic products and 27.8% for fuels. Therefore, port-related issues affect the logistics chain for these products. Finally, for equipment and machinery, the bottleneck lies in inventory. For this product inventory values are high because of two interrelated reasons, high opportunity cost given the high value of the product, and large stocking of manufactured products. The data, however, does not distinguish between these two contributing factors. Nonetheless, the large share of inventory that accounts for variations in TLC is most likely caused by large changes in the amount of product stocked. Unreliable transport infrastructure, for example roads and ports, could be forcing manufactures to stock in preparation for sudden failures in these facilities. Unless these stocks exist, manufacturers could be liable for not meeting contractual deadlines. Therefore, it is probable that inland transport and port facilities are the underlying cause of this lack of reliability.

Until now the analysis has focused on the largest individual contributors in the logistics chain to the variations in TLC. It is possible, however, to look at the logistics chain as a whole by grouping all the logistic-related items into one category and comparing it against the variance explained by the external factors, interest and exchange rates. Because the analysis looks at variations, it can be argued that in a well-operated—i.e. reliable—logistics chain, the variations in TLC would be explained mostly by the external factors. The internal or system-related variables would have little explanatory power, thus showing good performance or reliability of the logistics chain. Likewise, in a moderately well-operated logistics chain, the internal variables would explain some but not most of the variations. In a logistics chain with ample room for improvement, system-related variables would account for most of the variations. Table 22 shows the results of the causes for variation between the internal and external factors. Only in the cases of machinery and equipment do the external factors explain a majority of the variations—53 percent. For all other products under study, the logistic chain as a whole accounts for the majority of the variations in TLC. For Foodstuffs and grains, paper and cellulose and fuels, the variations explained by the logistics chain as a whole are 94.5 percent, 98.2 percent and 85.6 percent, respectively.[32] For these products, the logistic chain is highly unreliable and with ample room for improvement. For automotives, basic metallurgic, chemicals, paper and cellulose, fuels, and automotive parts, the logistics chain explains more than two thirds of the variations. Again, the logistics chain as a whole for these products is unreliable and exhibits room for improvement. An unreliable logistic chain imposes costs because actors in the chain have to spend resources to hedge against this unreliability.

[32] The conclusion for fuels; however, is not so clear because the model only explains 40% of the variance.

TABLE 22: PERCENTAGE OF VARIANCE IN TLC EXPLAINED BY THE LOGISTICS CHAIN AS A WHOLE AND INTEREST RATE AND EXCHANGE RATE

Export Product	Logistic chain	External: interest rate and exchange rate	Total Variance explained
Foodstuff and grains	94.5%	5.6%	86%
Equipment and Machinery	47.0%	53%	98%
Automotives	65.6%	34.4%	98%
Basic Metallurgic	67.3%	32.7%	98%
Chemicals	66.5%	33.5%	99%
Paper and **forestry**	98.2%	1.8%	65%
Fuels	85.6%	14.4%	40%
Automotive parts	76.1%	23.9%	98%

In summary, the analysis of variations pointed out bottlenecks in the logistics chain, particularly in the transport item and also in the port-related item. Furthermore, the analysis went on to suggest that the overall logistics chain as a whole could be improved. Of particular relevance is that many of the products for export analyzed are manufactured on average 83 km from the Port of Santos, a relatively short distance. Consequently, not only transport and ports, but also the entire logistics chain emerge as a bottleneck. Actions need to be taken to eliminate these bottlenecks and make the logistics chain more reliable. The inland transport infrastructure—railroads, roads, and waterways—and the Port of Santos emerge as clear areas for policy intervention. The following sections analyze such potential interventions and their possible impacts.

3.5 PROJECTS TO MITIGATE THE BOTTLENECKS AND REDUCE THE TOTAL LOGISTICS COST OF THE PORT OF SANTOS

Over the last 10 years, federal and state governments have planned a series of actions to improve the logistics system in order to facilitate exporting from the Port of Santos. The private sector is also planning and financing projects on its own.

Lowering the TLC is the overall main objective. Both public and privately generated plans call for increasing rail use and intermodalityity.

Table 23 shows a list of the main projects, with a total cost close to 11 billion reais (over 6.5 billion dollars). The federal and the state governments will contribute close to 50 percent of the total investment, and the private sector, either directly or through concessions, will finance the other half.

TABLE 23: PROJECTS TO ALLEVIATE THE BOTTLENECKS IN THE CENTRAL EXPORT CORRIDOR[33]

	Project	Mode	Type	Value R$ million	Funding Source
São Paulo Metropolitan Region					
	Rail/Road Bridge	Road	Works	31.7	PDDT
	Waterway	Waterway	Works	70.0	PDDT
	Araraquara Bypass	Road	Works	146.5	PAC
	BR-153	Road	Concession	27.0	PAC
	BR-381	Road	Concession	51.0	PAC
	BR-116	Road	Concession	630.0	PAC
	East Rondon	Road	Concession	229.0	PDDT
	West Rondon	Road	Concession	105.0	PDDT
	East Raposo	Road	Concession	7.0	PDDT
	West Raposo	Road	Concession	341.0	PDDT
	Euclides da Cunha	Road	Concession	618.0	PDDT
	Ribeiro de Barros	Road	Concession	435.0	PDDT
	Road Ring South	Road	Works	3800.0	PAC, PDDT
	Rail Ring South	Rail	Works	371.0	PDDT
	Rail Ring North	Rail	Works	528.0	PAC
			TOTAL	**R$ 7,390.2**	
Baixada Santista Region					
	Dredging	Port	Works	35.4	PAC
	Perimetral Avenue - Right Margin	Road	Works	58.0	PAC
	Perimetral Avenue - Left Margin	Road	Works	30.0	PAC
	Tunnel on Left and Right Margins	Road	Works	300.0	PDDT
			TOTAL	**R$ 423.4**	
Private Projects in the Baixada Santista					
	Barnabé Barges	Port	Works	2000.0	Private
	Terminal Amplification	Port	Works	695.0	Private
	Rail Access	Rail	Works	27.0	Private
	Transport Belt		Works	240.0	Private
				R$ 2,962.0	
			TOTAL	**R$ 10,775.6**	

These projects can be classified in three categories. First are those projects that target in-land transport modes—mostly roads and railroads, but also one waterway—to reduce travel time. Examples are finishing a road ring around part of

[33] PAC and PDDT in the table refer to the following: In 2007 the federal government approved the Growth Acceleration Program (*Programa de Aceleração do Crescimento*, PAC) to invigorate the transport sector by augmenting spending to approximately R$58.3 billion until 2010—a doubling of public spending in the sector over three years. Similarly, the São Paulo State Transport Secretariat created the Master Transport Development Plan (*Plano Diretor de Desenvolvimento de Transportes*, PDDT), a 20-year plan consisting of investments in infrastructure projects, institutional reforms, and administrative initiatives aimed at improving the system's integration and sustainability so that it will accommodate the rising transport and logistics demands.

the city of Sao Paulo, and building the south and north links of the railroad ring around Sao Paulo city. These three projects cost a total of 4.6 billion reais and the total cost in this category is 7.39 billion. In a second category are projects that seek to expand port capacity and efficiency. Examples are dredging the port access, expanding berth freight handling capacity, and increasing freight liner frequency. These projects in total have a cost of 423 million reais. The final category of projects seeks to promote multi-modality, reduce transfer costs, reduce warehousing costs, reduce customs-processing time, and improve security to minimize stolen freight. Examples include expanding warehousing capacity, improving rail access, and building a transport belt to carry ferrous mineral freeing up rail capacity for trains with containers. These projects in total have a cost of 2.9 billion reais.

These projects, overall, open up the opportunity of increasing intermodalityity by improving the efficiency and carrying capacity of railroads. The projects that seek to create a rail ring around Sao Paulo, for example, would improve rail access to the Port of Santos. Furthermore, the project to transport ferrous mineral on a transport belt and not by train would free up capacity in the train lines (Table 24). This could be the beginning of an “express train" between the north of the state and the port via Sao Paulo City. Train speeds could increase to 38 km/h, a 33 percent savings in travel time, and, as shown below, this improvement would divert significant amounts of freight from the truck to the train. These projects also aim to strategically improve the road network, seeking to improve its overall efficiency by eliminating specific capacity bottlenecks through the expansion of congested facilities financed by mainly private investment.

In summary, government and private sector plans seek the implementation of a series of projects that will reduce the TLC, improve access to the Port of Santos, and open up the possibility of having an express freight train to the port. The plans would begin to improve the extent to which the logistics system is able to take advantage of more efficient modes of transportation, such as rail. Key to achieving a larger multimodal diversification is creating a network of logistics platforms that facilitate transfer from trucks to trains and vice versa.

TABLE 24: PRIORITY PROJECTS FOR INITIAL STAGE OF THE PORT OF SANTOS EXPRESS CARGO TRAIN

Project	Mode	Type	Value $R million	Funding Source
Rail Ring South	Rail	Works	371	PDDT
Rail Ring North	Rail	Works	528	PAC
Rail Access	Rail	Works	27	PRIVATE
Conveyor Belt	Conveyor belt	Works	240	PRIVATE
		TOTAL	R$1,166 billions	

3.6 ESTIMATING THE IMPACTS OF IMPROVING THE LOGISTICS SYSTEM

This section shows the potential cost-savings of improving the different elements of the Port of Santos logistics system. It also summarizes the model for predicting port choice for container-prone cargo highlighting the importance of increasing the use of containers (Box 2).To model the benefits of improving the logistics system the focus was on two key impacts of the projects: reductions in the generalized travel cost (GTC) and reductions in the customs-processing time.

Box 2 Predicting Port Choice

This pilot case study applies a discrete choice model to predict the decision to use Santos or another port. Data from the Foreign Commerce Secretariat (Secretaria de Comércio Exterior, SECEX).

The stages of the study can be summarized as: first, determining the set of container ports involved in the decision making process under simulation; second, establishing the relevant attributes of port supply that influence the decision to use a port; thirdly, determining the decision structure for the model; fourth, calibrating the model; and, fifth, performing a sensibility analysis for port choice.

The study summarizes the port choice into three types of decisions:

1. *First, the total port cost, including, port costs as well as fees associated with ship towing for docking and undocking;*
2. *Second, the weekly stops at Port by connections in diverse routes;*
3. *Third, distance to and from the port.*

The main results of the sensibility analysis are summarized in Table 1. An increase of 10% in the average weekly stops translates into a 10% demand increase. A 10% reduction in port costs translates into a 7.4% demand increase. Combining both the 10% increase in connections as well as the 10% decrease in port costs would increase port demand by 14.7%.

Table 1. Results of Sensibility Analysis Model

Scenario	Port Costs	Connections	Increased Demand (I)	%
Applicable	285.1	48	-	-
10% Increase in Connections	285.1	52.8	677,865	10
10% Port Cost Reductions	256.6	48	503,924	7.4
10% Port Cost Reductions and a 10% Increase in Connections	256.6	52.8	994,202	14.7

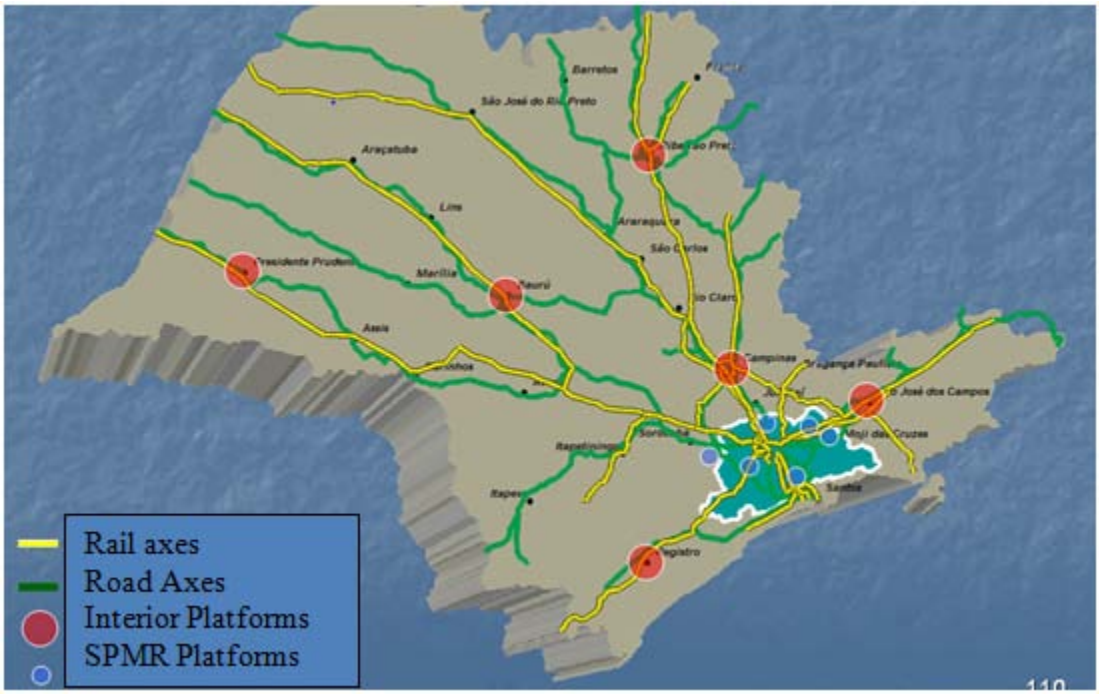
First, the reduction in GTC would happen mainly as a result of improving the railroad network, particularly through the establishment of the "express train." The models predict three products would most benefit; foodstuffs, equipment and machinery, and chemicals. For these products, even small reductions in GTC would increase rail use significantly. Specifically, a four percent reduction would increase by 45 percent the cargo using the railroad to access the Port of Santos. Products such as equipment and machinery and chemicals, which currently do not use rail, would begin to use it. This high elasticity validates the need for investing in these projects.

Second, improved processes would reduce the customs-processing time. These reductions would benefit particularly freight that can use containers. A 4-day reduction in total customs processing time would constitute a 16 percent reduction of TLC. Furthermore, this reduction in customs processing time would also reduce on average from 42 percent to 35 percent the share of TLC devoted to inventory cost for equipment and machinery, chemicals, and automotive parts. The biggest beneficiary of such measures would be automotive parts, because the TLC itself would be lower by 17.7percent.

Third, a more detailed economic evaluation was carried out for the Rail Ring project around the city of Sao Paulo. The results estimate that this project will have a Net Present Value of R$134.4 million, at a 10 percent discount rate.

In summary, the proposed improvements to the transport infrastructure would reduce the TLC, improve the reliability of the logistics chain, enhance the competitiveness of Sao Paulo and Brazil, and fundamentally change the logistics system to be more reliant on railroads and less on trucks. The impacts are shown to be significant even with small reductions in TLC thanks to improved rail facilities. However, these results still do not consider the possibility of implementing a network of multimodal logistic platforms that would cover the state and the Sao Paulo Metropolitan region (Figure 30). If these were built, the impacts of this investment in rail infrastructure would be much larger.

FIGURE 30: POSSIBLE NETWORKS OF LOGISTICS PLATFORMS



3.7 CONCLUSIONS

The data and analysis in this case study suggest that the logistics system that serves the Port of Santos is presently less efficient than is desired, imposing a larger-than necessary cost on export freight. Second, the port in itself has problems, such as large transaction costs—i.e. large customs-processing times—and other inefficiencies. Third, in-land transport, a key element of any logistics system, is probably the most important bottleneck. For example, many of the industrial products studied are manufactured relatively close to the Port of Santos, and yet the transport infrastructure is such that the total logistics cost is higher than it need be. Further, the transport infrastructure does not seem as reliable as desired, hence leading to increased logistics costs because actors have to hedge against this unreliability.

Part of the problem is that Brazil over the last 50 years has spent more in road infrastructure than in railroads, thus biasing the overall transport matrix in favor of truck-based transport.

In addition to promotion of rail transport, it is critical that the road transport network be properly maintained in order to get the most value out of the huge past investment it represents. It should also be strategically improved, seeking to improve its overall efficiency by eliminating specific capacity bottlenecks. Indeed, the marginal economic benefit of investment in the expansion of key congested facilities would be quite substantial relative to the cost. In addition, the inherently large levels of usage of the highway links involved would make private financing schemes quite feasible.

In light of this reality, decision makers in the state of Sao Paulo, at the federal-level and in the private sector have proposed a package of projects that seeks to remedy this situation. The main goal of the proposed package is to reduce the TLC and hence reduce the “Custo Brazil.” Of particular importance to this effort are the results of this case study that show the relevance of improving the railroad system. Demand for freight services appears highly elastic to improvements in rail service. Small reductions in the cost of using railroad, resulting from the establishment of a freight rail "express service" that will run at higher speeds than present, leading to a four percent drop in TLC, can lead to a 45 percent increase in demand for this service.

Another important aspect of this proposed package is its collection of measures to make the port more efficient. One example is reducing the customs processing time. A four-day reduction in the customs processing time would reduce by 16 percent the TLC. Furthermore, reducing the cost of using the port by 10 percent and increasing the frequency of freight lines by 10 percent would increase demand for port services by 14.7 percent.

4 GLOBAL TRENDS IN LOGISTICS AND BRAZIL'S STATE OF PREPAREDNESS

This section analyzes the contrasts between the present state of Brazil's logistics system against global trends in logistics and international best practices. The objective is to assess the country's state of preparedness to respond to a world in which logistics can determine the competitiveness of entire industries and even countries. The section describes the global trends in logistics, presenting Australia as an example of best practice and in the next chapter, assesses Brazil's situation within the global trends context.

The world's logistics industry is experiencing great change. According to Amos (2007), this change may be attributed to globalization, increased competition and additional security requirements, amongst others:

i. Markets: The rapid expansion of international trade in most regions, and particularly in Asia, means that many supply chains are now truly global.

ii. Expectations: The global competition in product and service markets is demanding higher standards and lower costs in logistics supplier markets.

iii. Competition: Despite some industry concentration (i.e., ports), the opening of transport markets is creating greater competition in logistics services and sub-markets.

iv. Technology: All transport modes are investing heavily in technology development to obtain more efficient, and usually larger, vessels and vehicles, as well as improved methods for traffic dispatching, monitoring and control capability.

v. Intermodality: The industry is also focusing more on intermodality, which means that standard and specialized containerization continues to grow to better facilitate intermodal transit and multimodal allocation of traffic.

vi. Energy: Energy prices are having an impact on the sector due to more expensive and declining fossil fuel stocks and expectations of higher energy taxes in response to global warming.

vii. Security: International shipping and aviation, in particular, are requiring higher standards of security in freight.

viii. Bottlenecks: The industry is requiring better amounts and quality of public infrastructure to reduce bottlenecks in roads, railways, ports, airports, shipping channels, etc.

Poor logistics in a country usually result in delays from a range of sources, such as the need for warehousing, long pre-shipment inspections, criminal activities in terminals, thefts during transport and increased opportunities for bribes to be requested. Countries with poor logistics usually have low infrastructure quality – not only in the transport sector but also inefficient telecommunications and other services required for good logistics. As part of recent progress in East Asia, for example, action is being taken to improve customs clearance, the regulatory regime and governance as a means for these countries to catch up to their OECD competitors.

The implications and needs in order to respond to the above global trends are (Batista and Pavan, 2005):

- Design and adopt plans for logistics systems to serve both the internal and external consumer market.
- Create efficient integration and coordination supply chains spread geographically.
- Improve knowledge management and build skilled manpower
- Enhance government efficiency and efficacy, namely: strategic planning, governance, cost reduction, speedy decision-making, economic, social and environmental criteria to decide on investments, and clear rules for environmental licensing.
- Cut red tape and paperwork and create the proper fiscal incentives for private sector participation.

A freight logistics system is much more than merely transport infrastructure; it involves sub-sectoral transport operators and multimodal transport operators (see previous description). A freight logistics system also involves the warehousing facilities required, the inland terminals, and the intermodal transfer terminals that facilitate the transfer of freight from one mode to another. In addition, it involves government agencies such as customs and revenue, phytosanitation services and other services which are in charge of verifying if all the documentation required for exporting and importing complies with the law.

4.1 BEST PRACTICE EXAMPLE: AUSTRALIA FREIGHT LOGISTICS SECTOR

Australia is regarded as an example of international best practice in logistics because of the collection of institutions it has established to facilitate identification of problems and proposed solutions accomplished through consensus. First, in 2000, the government initiated the Freight Transport Logistics Industry Action Agenda to increase the performance of the logistics industry, and in turn, raise the competitiveness of other Australian businesses. The Australian Logistics Council (ALC) was established to drive the implementation of the strategy. The ALC is jointly supported by the Australian government and industry, with membership

comprising industry leaders and government representatives. Second, there are currently ten Australian Freight Logistics Councils operating within each state in Australia. These councils are jointly funded by Australian and state governments with support from the Australian logistics industry. These councils provide a unique, industry-driven forum bringing together all players within Australia's freight logistics chains playing a significant role in improving Australia's regional and urban logistics-chain performance and in implementing the Australian logistics industry strategy. The councils were funded by ministry resources ($1.2m per year for three years) provided that matching funding is committed from each state and territorial government. Third, the Transport and Logistics Centre (TALC)[34] works with the transport and logistics industry to enhance the sector's capacity to attract and develop staff and share information. In its capacity, the Centre manages projects to develop careers, training and education, coaching and mentoring, certification programs, and knowledge sharing. Fourth, the Integrated Logistics Network (ILN)[35] is composed of transport logistics government officials from the federal, state and territorial governments who work to build partnerships and joint projects between the different government levels in order to promote a coordinated national strategy for transport logistics. A major project undertaken by the ILN is the Australian Logistics Assured (ALA), a system of integrated performance standards and monitoring program to verify compliance, covering all members of the perishable goods export chain.

Underscoring the Australian case study is the creation of an encompassing logistics strategy to guide the sector. A World Bank study on freight logistics proposes an outline of the fundamentals of a national logistics strategy (Table 25).

[34] www.talc.com.au

[35] www.coldchaincentre.com.au

TABLE 25: OUTLINE FOR NATIONAL LOGISTICS STRATEGY

Logistics Policy Principles	Audit of Current performance	Legal and Regulatory changes	Stakeholder participation process	Public infrastructure framework	Monitoring and review mechanism
Public policy objectives	Benchmarking of service performance	New Legislation/ regulations if necessary	Customers of transport & logistics	Finance and management	Measurable objectives
Roles of public and private sectors	Benchmarking of cost performance	Amendments to existing legislation or regulations	Private suppliers of logistics services	Access rights to public infrastructure	Timetable and milestones
Roles of markets and of regulations	Benchmarking of government functions (for example custom performance)	Changes to administrative structures to implement logistics strategy	Public infrastructure suppliers	Pricing and cost recovery policies	Clear responsibility and accountability
Roles of central and local governments	Research into customer perception		Government services suppliers (eg. Customs)	Public infrastructure investment priorities	Public transparency and reporting
Principles of industry access/licensing	Problems and bottlenecks		Local government authorities	Land use planning (eg. for transport corridors or logistics centers)	Periodic updating
			Key policy departments (trade, transport, tourism, etc.)		

Source: Amos, World Bank, 2007

5 OBSTACLES AND PROPOSED SOLUTIONS ACCORDING TO USERS

Logistics is an important concern in Brazil and raises much public debate. User surveys are done regularly and large logistics seminars are held several times a year. User associations and academic institutions such as the business school of the Federal University of Rio de Janeiro (COPPEAD) also undertake quality surveys which identify the main bottlenecks and proposed solutions in the logistics sector. A review of these surveys shows a general consensus about the main obstacles faced and the solutions required to eliminate them. Below is a compilation from a study of users' opinions with respect to the most important bottlenecks plaguing the logistics system and outlines their proposed solutions. The study then presents a sketch planning exercise with a set of development scenarios, with proposed solutions for different levels of logistics improvements. A particular scenario is then analyzed, for illustrative purposes, in order to estimate the required investment and the benefits obtained. The objective of the exercise is to evaluate how logistics costs alter as a percentage of GDP given the investments, some of which attempt to re-balance the transport matrix in favor of more cost-efficient modes.

5.1 USER ASSOCIATIONS' VIEWS ON BOTTLENECKS AND SOLUTIONS

The following section outlines the various bottlenecks and solutions revealed through the user associations surveys, and are categorized by transport mode:

Road Transport

Obstacles	*Solutions*
•sub-standard road network mainly due to deferred maintenance; *•high number of road accidents due to poor condition of the roads (the cost of accidents is the highest health cost for the country after malnutrition estimated at R$7.3 billion/year);* *•lack of enforcement of axle loading which accelerates road deterioration;* *•excessive driving time which cause accidents;* *•lack of truck maintenance and low fleet renewal due to the tariffs which are lower than the long run variable costs;* *•transit laws and road transport oversight do not guarantee road safety;* *•lack of police patrolling roads and railways to prevent theft which is estimated to cost R$700 million in 2004.*	*•build or improve rail and waterway infrastructure to meet the demand for agricultural commodities, particularly soybeans.* *•government needs to complete the decentralization process in the road sector and give higher priority to maintenance.* *•The federal government should determine the roads which are of national interest, complete and maintain them, and transfer the others to the States with the Fuel Tax (CIDE) resources required to maintain them.* *•government should guarantee the maintenance resources on an annual basis to avoid the situation created in the last two administrations in which emergency campaigns to fill in pot-holes had to be launched. Short-term measures such as this do not bring lasting improvements to the condition of the network and take away from careful maintenance management with timely resources in a medium-term strategic planning.* *•Promote PPPs or concessions when the government lacks resources.* *•Update road transport regulations and update the National Vehicle and Driver Registry: be stricter with licensing/ registration; Indicate the technician who is responsible; determine minimum fleet for registration and minimum area for terminals; reformulate the annual inspection; Limit the maximum age for the fleet; and improve police supervision of highways to decrease theft and accidents.* *•Restart traffic counts in the non-concessioned network* *•Reactivate weigh stations in the non-concessioned network*

Rail Transport

Obstacles	*Solutions*
•level of government investment in rail and road access is too low and level of government investment for road concessions to reach the rails is too low *•access road width is too narrow* *•Lack of railway lines from major grain areas to ports* *•Lack of Road signaling is a problem for accessing rail terminals* *•Favela settlements located by the rail tracks* *•Critically high passenger levels* *•Incompatible tracks* *•Limited intermodal integration* *•Regulating concessonaires* *•Track sharing*	*•build the railway bypasses around the major metropolitan regions;* *•prevent the encroachment of squatter settlements (favelas) in the rail right-of-way;* *•create special fiscal incentives for the rail concessionaires to build intermodal transfer terminals;* *•more railway lines that serve major production areas through PPP financing* *•encourage and enforce regulations for free mutual traffic and rite of passage, especially with respect to access to the port terminals;* *•allow the use of the concession fee for railway investment in selected cases.* *•long-term investment to harmonize rail gauges and introduce double stack container.*

Maritime Ports

Obstacles	Solutions
•deferred dredging in almost all major ports, *•less than desirable land access to ports* *•low number of intermodal terminals in navigable waterways to facilitate mode transfer,* *•lack of professional management,* *•looming capacity shortage determined by lack of yard and berthing space at the ports, aggravated by the low draught and lack of dredging.* *•waiting times for ships are high, productivity for loading and unloading is low, cost of shipping increases as a result.* *•lack of access channels due to the draught for post-panamax ships* *•Only a few Brazilian ports can accommodate post-panamax ships which have higher speeds, 16 to18 meter draught and lower transport costs than panamax ships.*	*•a balanced decentralization of ports from the federal to the local authorities after careful evaluation of managerial capacity of the local authorities,* *•more private ports where strategic planning deemed necessary.* *•quick plan to build container capacity in the main ports is urgent.* *•Modernize ports to be competitive internationally and to meet international benchmarks: adapt ports according to proven models, and transfer their management and operational responsibilities to the private sector as was done with the railway sector* *•Ports can be transferred to the state or municipalities by law 9277 of May 10, 1996. This decentralization to local authorities may, in some cases, improve the situation and cut a lot of red tape.*

Coastal Shipping (*cabotage*)[36] and Inland Waterways Transport

Obstacles	*Solutions*
•lack of adequate resources from government for maintenance of the waterways. *•Lack of management of water resources from a systemic standpoint and water allocation across competing uses such as for irrigation, electric energy generation, and river transport.* *•strict environmental legislation* *•Low levels of intermodality* *•low service quality at ports* *•conflicts between hydropower and navigation for waterway use* *•delays or discontinuity in execution of projects* *•necessity to include locks in hydroelectric plants* *•lack of standardization of bridge heights* *•low competitiveness in sector* *•restricted use in critical segments*	*•Introduce legislation amendments to rationalize the relation between the Port Workers Labor Managing Organization with the unions in the definition of remuneration, composition of shifts and other working conditions.* *•De-bureaucratize the release of funds from the Merchant Marine Fund as well as regulate the return of some of the collected funds to the coastal shipping companies.* *•Make available to national coastal shipping companies the same costs and taxes which benefit the foreign flag shipping companies and facilitate the "transshipment" of international cargo.* *•De-link the national coastal shipping policy formulation from the domestic preference intended for national shipbuilders allowing the sector to buy used ships, in excellent condition,* ***in other countries and use the Brazilian flag.*** *•Improve port infrastructure for the needs of coastal shipping.* *•For some waterways of economic relevance it is possible to concession them to the private sector for example, the Tapajós-Teles Píres waterway.*

Non-Infrastructure barriers identified by users are as important and include:

- *Tax laws and fiscal incentives*: The wide range of taxes on goods and services (*Imposto Sobre Circulação de Mercadorias e Prestação de Serviço,* ICMS) between 7 and 18 percent and the different fiscal incentives offered by each state are an obstacle to the efficient use of the shortest interstate routes because operators try to avoid states with higher taxes.
- *Customs, phytosanitation and federal revenue* procedures are still very time consuming and bureaucratic. It is necessary to cut the red tape, speed customs and other interfaces with federal organizations. Organizations such as the Institute for the Modernization of Foreign Trade Logistics (*Instituto Aliança Pro Modernização Logística do Comercio Exterior*, PROCOMEX) should be encouraged because they seek solutions to simplify customs procedures. Despite the existence of several interministerial working study groups and the alliances with PROCOMEX, the unified bill of laden (*conhecimento*) is still not used. Furthermore, electronic interchange

[36] A thorough review of issues and options for Brazilian coastal shipping was undertaken by an Interministerial Work Group created by Decree of September 9, 2005 which included Ana Canellas (ANTAQ), Biramar Lima (MAPA), Cláudio Decourt (SYNDARMA), Denise Amaral (CAN), Luiz Fayet (CAPB) and Luiz Maia (MT).

documentation systems are still far behind what would be expected for an emerging power such as Brazil.

- At the stage of preparation of this study, there was a working group preparing the Electronic Freight Bill of Lading (*Conhecimento de Transporte de Cargas Eletrônico*, CT-e). This working group included the Federal Revenue Service (*Receita Federal*), State Secretaries of Treasury, Superintendent of the Manaus Free Zone, transport operators and regulatory transport agencies. This project is part of the Public System for Digital Registration (*Sistema Público de Escrituração Digital*-SPED) and is linked to the electronic fiscal receipt (*Nota Fiscal*- document issued when goods are sold-) project, which has been operating since the first semester of 2008, and is compulsory for sectors such as fuel, cigarettes, alcoholic beverages and cold drinks, cement, steel products, automobiles and pharmaceutical products for human consumption. The intention behind the CT-e is that there will be a single model for all transport modes which will be extended to all the other productive sectors not currently using this documentation, with the eventual introduction of a multimodal CT-e at the end of 2009. Initially, the CT-e will only include origins and destinations within the country. The main benefits expected from the CT-e are :
    - For the firms: reduction in the border waiting time at customs/revenue posts; incentives and standardization of the B2B relationships; improvement in the operational, administrative and fiscal processes; reduction in the costs and volume of forms preparation; and reduction in the costs of archiving documents in terms of space and document management.
    - For the Treasury: reduction in the border posts waiting time; more operational control; integration of information with government entities and with the *Nota Fiscal* electronic project; and improvement in the operational auditing processes.
- *Lack of strict supervision:* the high proliferation of origins and destinations, the multiple uses of the highways and the lack of financial resources make enforcement of maximum speed, axle loads, tax fraud and others aspects very difficult. Part of the resources linked to the CIDE should be used for that purpose; and the new transport regulations should facilitate the enforcement aspects.

Environmental licensing is often cited by users as the main reason for delays in infrastructure implementation. The solutions proposed were:

- Apply law 9.433/97 which takes into account the multiple uses of waterways;
- Rationalize the environmental licensing; cut down on environmental licensing bureaucracy; and
- Establish a specific methodology in the environmental legislation for the evaluation of infrastructure works.

Accounts Tribunals (*Tribunal de Contas*): A good number of projects are stopped or delayed because the account tribunals' reviews indicate irregularities. Although it is understood that the account tribunals play a very important role, a special effort should be made between the industry, responsible government agencies and account tribunals to provide project managers with a clear understanding of the most common reasons for these suspensions or delays and the way to avoid them.

5.2 IMPROVEMENTS PROPOSED BY USER ASSOCIATIONS

Based on the surveys' list of obstacles and solutions, Table 26 outlines the users proposed investment and policy improvement packages necessary *to lower logistics costs in Brazil* for all the different transport modes, including supply chains. According to government and university studies, all the investment projects have internal rates of return of 15 percent or higher. Moreover, most of the proposed investments are already included in the PAC, which reinforces the users' contributions and highlights the positive outcome of this initiative. Unfortunately, the PAC did not correctly identify or include the improvements in supply chain procedures which would have required urgent attention and funding from the authorities. Additionally, there was no clear schedule for implementation of the proposed works in the PAC or the PNLT.

TABLE 26: USERS' INVESTMENTS AND SUPPLY CHAIN IMPROVEMENT PACKAGES

Railways

Proposal and Ranking		Level of Government	Model of investment
São Paulo Ferroanel (Bypass)	*	Federal	PPP
Conclusion of North-South Railway	*	Federal	PPP
Improvement of Access to the Port of Santos	*	Federal	Private
Policies to deal with the rite of passage in another railway track		Federal	Public
Policies to treat encroachment on rail right-of-way	*	Federal	Public
Policies to eliminate grade crossings		Federal	Public
Elimination of rail bottlenecks in the metropolitan area of São Paulo and Minas Gerais	*	Federal	PPP
Transnordestina Railway		Federal	PPP
Revision of the concession model to facilitate interface between concessionaires		Federal	Public

Ports, Inland Waterways and Coastal Shipping

Proposal		Level of Government	Model of investment
Professionalization of Port Management		Federal	Public
Decentralization of Ports from Federal to Local Authorities		Federal	Public

Investments in Port Terminals		Federal	Private
Increasing of draught in Santos, Itajaí, São Francisco do Sul & Rio Grande ports so that they can receive post –panamax ships	*	Federal/ State	Public
Reduction of Port bureaucracy (incentives to more organizations like Procomex)		Federal	Public/Private
Restart feasibility and detailed engineering studies for the navigation of rivers Araguaia, São Francisco, Amazon Basin and Tocantis	*	Federal	Public
Hidrovia (waterway) Tapajós-Teles Pires (Center-North)	*	Federal	Public
De-link inland waterway transport from national shipbuilders and allow acquisition of barges abroad		Federal	Public

Supply Chain Improvement Actions

Proposals		Level of Government	Investment Model
Create Incentives for the construction of new multimodal terminals		Federal/State	Private
Create incentives through fiscal exemption for the construction of warehousing areas for agriculture products		Federal/State	Private
Simplify customs procedures and interface with the Federal Revenue department.		Federal	Private
Improve tracking procedures			Private
Increase police surveillance to decrease theft		Federal/State	Public/Private
Create incentives for the proliferation of MTOs to professionalize logistics		Federal	Private

Road Infrastructure Actions

Proposal		Level of Government	Investment Model
Immediate solution for the transfer of the CIDE to the States		Federal/State	Public
Budget guarantee of US$4 billion in the next 4 years for rehabilitation of the federal road network		Federal	Public
Conclusion of Rodoanel de São Paulo (Roadring)	*	State	Private
Road Ring of Rio de Janeiro	*	Federal/State	Private
Perimetral roads of Santos Port	*	State	PPP
Eixo Norte: Investments in BRs 163 & 158	*	Federal	PPP
Acceleration in concession processes as well as federal and state PPP		Federal/State	Private

* included in the PAC

5.3 POTENTIAL SCENARIOS FOR LOGISTICS IMPROVEMENTS

In this section, the study organizes the collection of proposed initiatives into six development scenarios, which are envisaged as lowering the logistics costs as a percentage of GNP (as described in Table 27). The six scenarios consider possible infrastructure and policy measures that range from the lowest level (status quo) to the highest (heavy infrastructure construction) and estimates what would be each scenario's resultant share of logistics of GNP. Of the scenarios presented in Table 27, Scenario 4 would most closely match the full implementation of the present PAC. Implementation of this scenario would result in logistics costs of 14.4% of GNP while maintaining a predominantly road-based transportation matrix. Given that logistics costs currently amount to 15.4 percent of GNP, implementation of Scenario 4 will not reduce significantly logistics costs. This study believes that Scenario 5, with logistics costs reduced to 12 percent of GNP, should be the minimum target to be achieved within ten years. Scenario 6, with logistics costs reduced to 9.4 percent of GNP, would be a more desirable goal. Although Scenario 5 is still a predominantly road-based scenario, it would involve improvement to other transport modes such as the railway bypasses around the main cities and accessing port terminals, as well as increases in the number of port and intermodal terminals. Scenario 6, the more desirable option, enhances the improvements of Scenario 5 with additions of major railway construction. Further information on the development scenarios is found in Annex 1.

TABLE 27: POTENTIAL DEVELOPMENT SCENARIOS FOR LOGISTICS IMPROVEMENT

Scenario	Infrastructure Investments	Policy Measures	Effect on Modal Split (tkms)	Logistics Cost as % of GNP
1. Do-Nothing	The status quo which consists of continuing with: ○ very poor quality roads, ○ difficult road/rail access to ports, inefficient ports, ○ low participation of rail and waterway, ○ limited number of pipelines, ○ few port terminals and intermodal transfer terminals, ○ complicated and time-consuming customs/revenue procedures	None	Road=60% Rail=22% Wway=14% Pipeline=3% Others=1%	15.4%

2. Improved Do-Nothing (mainly road)	Scenario 1 and: ○ improved roads through a major road maintenance program with maintenance funds guaranteed every year	○ accelerate road concession and PPPs, ○ guarantee CIDE transfers to States, ○ improve police surveillance to decrease theft, ○ improve tracking procedures	Road=60% Rail=22% Wway=14% Pipeline=3% Others=1%	15% (↓ 0.5% in inventories and in theft) NPV net benefits =US$B 0.26/year
3. Metropolitan Ring Roads, port dredging, port access roads and improved port interface	This scenario would: ○ build all the road bypasses around the major metropolitan regions, ○ investments in BR163 and 158, ○ catch up with dredging backlog, ○ improve the road accesses to the ports of Santos, Paranaguá, Rio de Janeiro, Itajaí, S. Francisco do Sul, Rio Grande and Ilhéus /Aratu	○ decentralize ports to local authorities, ○ professionalize management. ○ improve the Labor Management situation. ○ major effort to improve supply chain procedures particularly the port interface with Customs, ○ simplify paper work etc.; ○ incentivize the proliferation of MTOs	Road=60% Rail=22% Wway=14% Pipeline=3% Others=1%	14.4% (↓ 0.5% in inventories and ↓0.5% in transport costs) NPV net benefits =US$B 0.63/year
4. Scenario 3 and the construction of the metropolitan rail bypasses	Scenario 3 and: ○ construction of the rail bypasses around São Paulo, Rio and other major metropolitan areas, ○ eliminate critical grade crossings	○ policies to treat encroachment on rail right-of-way, ○ policies to allow mutual traffic rights on other railway tracks, ○ revision of concession models to facilitate interface between concessionaires	Road=57% Rail=25% Wway=14% Pipeline=3% Others=1%	14% (↓1% in transport costs, ↓0.5% in inventory costs and ↓0.5% in warehousing) NPV net benefits =US$B 1.02/year
5. Scenario 4 and the construction of more port terminals, intermodal transfer terminals, additional warehousing and improved port/customs interface	Scenario 4 and: ○ addition of port terminals, ○ incentives for road/rail intermodal terminals in the hinterland of main ports ○ major improvement of the port/customs/security interface; ○ improve coastal shipping	○ create fiscal incentives for construction of new multimodal terminals ○ warehousing for agricultural products	Road=55% Rail=25% Wway=16% Pipeline=3% Others=1%	12% (↓2.4% in transport costs, ↓0.5% in inventory costs and ↓0.5% in warehousing) Savings=US$ 3.63B/ year

6. Scenario 5 and completion of some major railways which are under construction	Scenario 5 and: ○ completion of the North-South and Transnordestina railways ○ important acquisition of rolling stock by the private sector ○ completion of ethanol pipelines already under consideration by Transpetro and private sector	○ review leasing policies to facilitate the leasing of railcars and locomotives. ○ provide incentives for construction of short branch lines to connect with major railways	Road=38% Rail=35% Wway=16% Pipeline=10% Others=1%	9.4% (↓4% in transport costs, ↓1% in inventory costs and ↓1% in warehousing) Savings=US$9.43B/ year
7. Scenario 6 and several important investments in waterways and pipelines	Scenario 6 and: ○ navigation improvements in the Tapajós-Teles Pires waterway and in Araguaia, São Francisco, Bacia Amazonica and Tocantins rivers	○ de-link waterway transport from national shipbuilders ○ allow acquisition of barges abroad. ○ provide tax breaks for pipeline investors particularly those working with ethanol	Road=29% Rail=35% Wway=25% Pipeline=10% Others=1%	6.4% (↓7% in transport costs, ↓1% in inventory costs and ↓1% in warehousing) Savings=US$14.3B/ year

As indicated in the table below, the final results for scenarios 6 and 7 for logistics improvements obtained in this study are very close to those recommended by the PNLT for the future (2023) transport matrix (Table 28).

TABLE 28: COMPARISON OF RESULTS BETWEEN STUDY AND PNLT

Scenario	Mode				
	Road	Rail	Waterway	Pipeline	Other
Scenario 6	38	35	16	10	1
Scenario7	29	35	25	10	1
PNLT *	33	32	29	5	1 (Air)

Source: PNLT – Relatório Executivo Rev.00 p. 11, CENTRAN – 2007.

In general, the PNLT appears to concentrate its 2008-2011 investments on the road mode for projects having EIRR > 24 percent while railway, waterway and multimodal projects with EIRR between 12 and 18 percent are scheduled for the

2012-2015 period. Projects having EIRR of 12 percent are only planned to begin after 2016. These estimated time horizons for investments are very similar to the timelines proposed in this scenarios study.

The present study considers the main conclusions of the PNLT as very relevant and offers alternative visions to complement and provide new insights to the extensive work undertaken in the PNLT. This alternative approach incorporates the World Bank's experience in previous logistics studies (between 1995 and 2008) and its recent initiatives in international logistics benchmarking such as the Logistics Performance Index. The study focuses on pursuing feasible logistics scenarios which incorporate the policies formulated by the PNLT together with input from stakeholders participating actively in the Brazilian logistics sector, acquired through interviews with the study's authors. The PNLT employs an extensive and thorough approach from a regional development standpoint with detailed scenarios of territorial and sectorial growth trends. Its transport model is based on a recognized supply chain of the relevant products and a simulation of the general freight movements. Thus, the PNLT considers separately scenarios for regional growth and transport transformations: the costs of inventories, administration and warehousing are factors incorporated into the regional growth model while the costs of transport and port interface are factors incorporated into the transport model.

Brazil is in an advantageous position since it can predetermine the movement of products based on their inherent characteristics: mineral ores, bulk agricultural products and fuel represent products with modal-captive flows. On the other hand, the objective of this study, as exemplified in the Santos case study, is to approach all the components of logistics costs (inventories, transport, terminals, warehousing and administration) as a single modeling exercise representing products from all sectors independently of the transport mode currently employed. It also includes the possibility of directly measuring the effects of travel time reduction on the cost of inventories. In fact, this logistics model attempts to identify supply chain bottlenecks by pinpointing and analyzing the total logistics costs components. The advantage of this methodology is the ability to simulate a wider network of express freight trains and to identify the potential contribution of sectors/products by exploring alternative transport scenarios.

A second objective of the present study is to enable a logistics diagnostic by sector, more specifically, a diagnosis of the growing flows of exports and imports whose efficient performance is essential for Brazil's competitive global position compared with other emerging economies. For this study, it was important to establish parallels and international benchmarking of TLC components so that best practices are emulated. In this context, the proposals presented endeavor to respect the national guidelines in the PNLT and the parameters and best practices encountered worldwide.

6 MAIN FINDINGS AND OPTIONS FOR ACTION

6.1 MAIN FINDINGS

The logistics panorama in the country shows that most sectors, despite making some recent progress, still have room for improvement to reach the levels of logistics efficiency of corresponding sectors in OECD countries, BRICs, and other emerging economies. The following paragraphs contain a list of what logistics' users classify as important infrastructure and regulatory challenges and these are not very dissimilar to the types of challenges other countries are tackling.

The study summarizes the main infrastructure related challenges found in Brazil across all transport modes. A key conclusion is that the freight transport matrix is heavily biased towards roads, for which trucks become more expensive than other modes for long haul bulk transport, and whose costs are exacerbated by the lack of proper axle load enforcement causing an accelerated deterioration of the road conditions. Lack of maintenance coupled with increased reliance on this mode will eventually require more frequent recurrent investments, making truck operating costs even higher. In addition, the railroad network is insufficient in size, has different gauges which make connectivity difficult, offers low geographic coverage particularly from the main grain belt areas to the ports, and could benefit from improved intermodality with roads and waterways. The ports suffer from important dredging backlogs, and need increased container handling capacity and post-panamax facilities, and improved interface with trucks and trains and resolution to the serious labor and management issues which impact negatively on their cost-efficiency. As for pipelines, the mainly state-owned network needs additional strengthening to respond to the growing ethanol market, an important commodity for Brazil in the years to come. Limited coastal shipping due to lack of adequate terminals and legislation and undeveloped inland waterway navigation also adds to the insufficient transport infrastructure. Finally, the lack of intermodal terminals and warehousing along the supply chain, and the enabling environment for greater private sector participation, coupled with an absence of a unified institutional structure that could promote policies in favor of non-road modes, result in an inefficient logistics system that ultimately costs Brazil between 15 and 18 percent of its GNP. In general, the lack of price competition between modes, as a result of low coverage, limited players, among other issues, results in the consumer having to pay far higher prices for goods and services than in OECD countries.

At the institutional level, this study recognizes the tremendous gains that could be achieved through improved systematic planning, evaluation, selection and packaging of potential projects and policies by a specialized entity, in order to build upon the great efforts started by the PNLT. The study findings also recommend that the next phases of the PNLT deal more explicitly with total logistics cost and the

benchmarking required to evaluate how far the logistics system progresses with new infrastructure and policies, as is being done by Transport Canada (Transport Canada, 2009) for instance[37]. Improvements to the existing freight database with origin-destination matrices could facilitate the systematic analysis of commodity flows used in the PNLT, and GIS-based initiatives to map the data and the logistics poles could contribute positively to a system-wide approach. Finally, the study recognizes the presence of CONIT and recommends that it be activated to hold more frequent meetings in response to a clear agenda and form thematic groups as needed, as a means to improve coordination between the various ministries and government agencies involved in logistics and the private sector.

Other study conclusions, derived from user interviews and independent analysis, highlight the negative impact of under-investment by the public sector in infrastructure during the past decade, with the focus on achieving a positive primary surplus, leading to budget cuts in all transport infrastructure investment and maintenance. By 2005, the macroeconomic indicators of the country had improved, however, at a high cost in the deterioration of transport infrastructure. The recent allocation of substantial public resources into the PAC is seen as a very positive step, and these investments should contribute to preventing further asset deterioration and expanding infrastructure stock.

It is estimated that Brazil should continue, at a minimum, the effort started with PAC by investing in infrastructure on a continuous basis over the next 10-20 years, taking into account the priorities established in the PNLT. Analyses show that major economies spend 5 to 7 percent of their GDP each year on infrastructure[38], while according to the World Bank, investments in infrastructure in Latin America need to reach 4 to 6 percent in order to compete effectively with Asian countries such as Korea and China.[39] Brazil, on the other hand, has spent in the range of 0.6 percent to 2.1 percent in the last few years[40]. This type of investment is particularly important since "public spending on infrastructure - roads, ports, airports, and power -crowds private investment in. It expands investment opportunities and raises the return to private investment. By paving the way for new industries to emerge, it [public spending on infrastructure] is also a crucial aid to structural transformation and export diversification."[41]

Despite a slow start to Private Public Partnerships, the private sector appears to be participating actively in the infrastructure sector. It is showing an interest in road concessions and professionalizing its transport services to increase reliability and

[37] Transport Canada is currently undertaking an evaluation of its total logistics costs which allows a system-wide evaluation performance of gateways and trade corridors almost on a real-time basis.

[38] Infrastructure refers to transport, energy, urban and water.

[39] World Bank, Infrastructure in Latin America and the Caribbean: Recent Developments and Key Challenges, 2005.

[40] http://www.edc.ca/english/docs/speeches/2007/mediaroom_12565.htm

[41] See Commission on Growth and Development. 2008. "The Growth Report: Strategies for Sustained Growth and Inclusive Development." Quote from page. 36.

cut costs, decreasing inventories and tracking shipments. However, the majority of big private firms have said that they are uncertain how the government will address the problems with port interfaces, multi-modal transport, ports and roads improvements, and railway bypasses around the major metropolitan areas. The private sector also has significant knowledge to contribute to a program to improve infrastructure logistics, and in particular, recognizes what needs to be simplified in the supply chain procedures. The private sector is able to voice its concerns to government, through user associations and frequent seminars, and is also active in mobilizing public attention. It is also recognized that significant gains can be made through training and awareness campaigns to medium size firms of the importance of having an efficient logistics department with properly trained professionals. Such training may result in significant increases in reliability, decreases in stock inventories, loss and theft and better overall door-to-door service quality which, in the end, will translate into savings for the firms.

Overall, there is a consensus in government and private sector that a major training program in logistics should be launched, similar to the efforts made by GEIPOT in the 1970s. The Ministry of Transport has begun this effort by hiring additional staff fully dedicated to the PNLT and the results are appearing at least at the planning level. Promotion of this type of training should continue in order to prepare logistics technicians to work with the private sector firms, as achieved in Australia by institutions funded by the public and private sector.

6.2 MAIN CONCLUSIONS

As part of an increase in the levels of investment, an efficient logistics system requires adequate physical infrastructure with maintenance programs and expansions funded by the government and/or private sector on a recurrent rather than on a sporadic basis. The recently prepared *National Plan for Transport Logistics* (PNLT) is an important start in the right direction, as it attempts to map future commodity flows and the investments required to support them efficiently. However, follow-on versions of the PNLT should transform it into an overarching National Logistics Strategy. This study advocates for a National Logistics Strategy (NLS) where investments should be guided by a vision of the government's direction in the short, medium and long term. This strategy should be amended as needed according to changes in the dominant export/import and domestic market requirements of the country. But it should also provide for benchmarking and auditing and focus in detail on the non-transport aspects of logistics such as warehousing and documentation as explained in Table 25.

In line with the successful structure in Australia, this study also advocates for the creation of a National Logistics Council (or expanding the function of CONIT) to overcome fragmentation among many government agencies with decision making power over elements of the logistics system. The council's aim is to "define an agenda to reduce logistics costs, establish measurement and control procedures, develop a control panel of logistics actions, and make regular follow up of its

progress."[42] This council, which should be led by a champion with recognized stature both by the private sector and by the government, would need to be able to coordinate across sectors and interest groups, and receive a clear mandate, targets and resources from the President. Areas requiring improvements include infrastructure, simplification of procedures and improving the overall enabling environment for private sector investment.

Moreover, to be fully effective, the National Logistics Council requires several specific inputs. First, it requires credible and strong leadership to ensure that the vision is being implemented and that the interests of all the stakeholders involved are taken into account and coordinated. The Ministries of Development, Industry and External Commerce (MDIC) and Agriculture should directly deal with the main clients of the logistics system. Within the framework of a National Logistics Council these ministries could provide critical input for defining the main logistics corridors which will be needed in the medium and long term based on firsthand knowledge of major agriculture, commerce and mining developments. Therefore, there is a need for very close coordination between the ministries to ensure that initiatives towards improving logistics infrastructure are comprehensively designed and executed. At present no framework exists to facilitate such close coordination. Second, the council requires a planning unit such as the GEIPOT that could provide the planning, evaluation and packaging of logistics-related investment projects funded by the government and the private sector. Third, the council and the unit require access to information and personnel necessary to provide the technical input for efficient decision-making in the proposed National Logistics Council.

Overall, Brazil also needs to overcome its historically low level of investment in infrastructure. Concerted action is required, as well as large scale mobilization of major users of logistics (for example, producers associations) to work in partnership with the government in the context of a National Logistics Council. The existing CONIT could be the basis for the proposed council but this study recommends its redesign to provide for more leadership by the private sector, more involvement of the private sector associations active in logistics and more frequent meetings with a clear agenda for action. This agenda should be the result of a "bottom up" effort, produced by thematic groups which will review alternatives for issues confronted by the producers associations following "top down" guidelines defined by the government.

[42] See Gonzalez, Guasch and Serebrisky (2008, p. 40).

6.3 OPTIONS FOR ACTION

Short Term

A National Logistics Council (NLC) – It is suggested that a leadership council composed of representatives of the main stakeholders, ministries and states be formed, responsible for planning the National Logistics Strategy (NLS), setting its targets and overseeing its implementation. Such a council could be set up within the context of the existing but expanded CONIT with more effective private sector participation. The leadership of this council should be given to a person from government or private sector whose credentials and experience in the sector are highly respected. The role of the NLC would be strategic in nature, proposing the overall logistics strategy based on users' and governments' input collected from across the country, as well as developing short-term action plans to respond to specific, unexpected challenges. The NLC could report to the Transport Commissions of the Senate and Congress and would not fall under the authority of any specific ministry. The NLC would be considered a partnership between the private and public sector, providing leadership in the industry, advising government, and promoting improvements to Brazilian logistics by proposing regulatory reform and appropriate infrastructure investment. Furthermore, given Brazil's size and diversity, it is possible that the states could have their own State Logistics Councils, with analogous functions to the NLC but functioning at the state level. To ensure sustainability and financial viability, these could be funded by the respective states and private sector logistics-related associations.

Logistics Planning Unit – The study recommends that Brazil revitalize the process of planning, evaluation and selection of its main investment projects, both in infrastructure and supply chain procedures, so that they can be properly prioritized. In the short-term, this would require re-creating a strong planning and evaluation unit within the Secretary of Policy at the Ministry of Transport in order to lend credibility to the planning, evaluation and selection of investments in the sector. The role of the planning unit is more operational in nature, and it should propose adequate national logistics policies under, and in line with, the National Logistics Strategy (NLS) such as streamlining supply chain procedures and documentation to speed up movement of freight. Furthermore, the unit may act as coordinator, thus assembling demand and supply information from all stakeholders under a single planning unit. Consultation and coordination with other stakeholders to design the policies should be a clear priority - logistics is a multidisciplinary area involving several ministries and agencies which should be synchronized to produce real results. This planning unit could also have the function to undertake a very pragmatic economic evaluation of proposed investments and/or package of investments in order to provide adequate information to decision-makers. Although this work is presently being done by the Secretary of Policy at the Ministry of Transport as one of its tasks, a separate unit within the Secretary fully dedicated to this job is justified given the importance of the planning function due to Brazil's size and role of infrastructure in the development agenda. Careful evaluation of projects will help in their prioritization and speed up their implementation.

National Logistics Strategy - As a timely follow-up to the PNLT, Brazil would benefit greatly from the preparation of a National Logistics Strategy. This strategy should have as its goals: a) *higher customer service* through customer responsiveness, geographic coverage, delivery time, reliability of delivery time, frequency of delivery, safety and security of goods, protection of corporate image and value-adding services; and, b) *lower service cost* in: transport and storage tariffs, inventory holdings, product damage and deterioration, pilferage losses, insurance costs, administration costs, customs and other clearances, bribes and malicious delays and social and environmental costs. The National Logistics Strategy should, as one of its fundamental principles, encourage private enterprise and competition. States should be encouraged to do their own NLSs and discuss them with their federal counterparts. This bottom up approach would help in balancing national and local needs and finding appropriate financing partnerships. A few states (Bahia, São Paulo) have started to prepare their logistics plans but this should be performed in a systematic fashion.

Data Collection - Without reliable and extensive data that are regularly updated, it is very difficult to undertake systematic analysis of the different logistics corridors of the country and those that need to be created to serve potential flows. In order to support the proposed logistics framework, a database containing all of the inputs that are required for the proper functioning of the logistics system, such as commodity origin and destination, costs of transport, infrastructure availability, operations indicators, registry of users, among others, is required urgently. Having a state-of-the-art data system should include input from all stakeholders, including cross-support from the private sector, with the ability of making this information publicly available, for example through the National Logistics Council. Providing an open platform and immediate access to recent information can encourage research and development to promote innovation within the transport and logistics sector. It should be ensured that the efforts started by the PNLT will be strengthened, both in terms of systematic data collection and geo-referencing, made available to all stakeholders.

In order to strengthen information on the sector, several studies are recommended:

1) Achieving a decrease in consumer prices as a result of lower logistics costs emanating from increased inter and intra-modal competition;
2) Global competitiveness in areas such as transport security and electronic interchange of documentation;
3) Trucking industry, its characteristics and agenda for improvements with detailed analysis of the truckload (TL) and less than truck load (LTL) movements and costs;
4) Methods to increase competition between railways and the impact of actual application of mutual rite of passage law;
5) Increasing participation of railways in the short-haul market as an environmentally friendly alternative to trucks in the metropolitan regions;
6) Impact of adding a third rail to the broad gauge to allow for metric gauge interconnection;
7) Cost-benefit of investments required to introduce double stack where possible;

8) Improve transport related management information systems;
9) Customs performance benchmarking;
10) Defining main intermodal corridors which the government is willing to support to reduce congestion and environmental impacts; and
11) Port competition to lower port costs.

Infrastructure and Supply Chain Investment - This study recommends that the government signal now its intention to double its investment on logistics infrastructure and supply chain procedures and include those investments in the PAC or other unrestricted programs.[43] A clear signal that the government is committed to higher investment in infrastructure over time would be an important step towards improving the logistics system. The list of immediate investments that this study strongly recommends to be implemented, and which have reached consensus through the user association, includes:

- Major road rehabilitation program with assured funds,
- Constructing/improving the railway bypasses around the main metropolitan regions, namely São Paulo and Rio de Janeiro;
- Constructing the road rings (*rodoaneis*) around São Paulo and Rio de Janeiro; and
- Eliminating the dredging backlog in the Santos Port and other ports.

Most of these priority investments have been identified in the PNLT and prioritized in the PAC. The investments presently contemplated in the PAC would allow the implementation of Scenario 4 discussed previously, which would be a good start to improve the current system. However, it is important that the proposed Planning unit and National Logistics Council continue to promote infrastructure investments, in conjunction with the PAC, through the development of additional plans and policies, and by supporting the legislative and institutional amendments required for the private sector to participate and finance these initiatives.

The list of "soft" investments to improve the supply chain includes:

- Harmonizing taxes in the different states to decrease circuitous truck transport routes to avoid taxes;
- Improving regulatory functions particularly in the road sector;
- Simplifying required documentation in the supply chain, including customs and phytosanitary issues; and

[43] The government is already moving in this direction; as part of the anti-economic crisis program in 2010, the government expanded the PAC program from R$ 504 billion to R$ 646 billion, close to a 30% increase http://www.brasil.gov.br/pac/.arquivos/8balancoparte1_131009.pdf.

- Facilitating and encouraging construction of intermodal terminals to reduce the cost of transferring freight from one mode to another, and warehousing to facilitate storage along the supply chain.

Although some interministerial work is already underway to simplify supply chain procedures, this study believes that a special commission under the proposed NLC should be created to overhaul the interfaces between customs, phytosanitary inspections and revenue and the private sector. Facilitating the important work of institutions such as PROCOMEX in the customs area may lead to immediate gains. The PROCOMEX-Receita Federal "*convénio*" is a good first step for unification of procedures and standardization of evaluation of present processes. Yet two important measures are still required: 1) the introduction of the Electronic Bill of Lading (*Conhecimento de Transporte de Cargas Eletrônico,* CT-e); and 2) the introduction of fiscal exemptions to encourage building port terminals and intermodal transfer terminals. For the former, preparation of the Bill should be accelerated, and for the latter, the government should form a commission to study the benefits stemming from the impact of these (temporary) fiscal exemptions. By building port terminals and intermodal transfer terminals, short haul intermodal rail services is fostered, promoting a reduction in the number of trucks in urban areas with important environmental gains. The United States, Canada and France have legislation to facilitate access to financing for rail and other modal operators for short-haul corridors (see Resor 2004, Transport Canada 2004, and Foundation for Intermodal Research & Education 2003).

Medium and Long-Term

The study recommends that preparing a medium and long-term plan to provide the enabling environment is necessary for increasing the participation of rail and waterways in the freight matrix. The payoffs of rebalancing the freight transportation matrix from road to other transport modes are high compared with the necessary investment. Accelerating this shift will require a carefully designed investment plan to extend some railways, build branch lines to production areas, make the main inland waterways navigable, boost coastal shipping and create the incentives for more intermodal transfer terminals to be built. There is a need for a much more concerted push in improving supply chain procedures and documentation by electronic data interchange. Careful planning will also be necessary at the project level so that the best options can be properly screened and evaluated. Finally, accelerating this beneficial modal shift will require the creation of an enabling environment under which the private sector will invest in intermodal facilities.

The scenarios outlined previously detail the type and cost of investments necessary to realize the modal shift. In brief, a list of potential major investments ranging from addition of ports to completion of railway lines to maximize Brazil's competitive advantage are estimated to reduce the logistics cost from the current 15-18 percent of GNP to less than 10 percent. One of the main factors to enable this reduction is

the focus on the waterway and port sector. The study believes that Brazil needs some post-panamax facilities equipped for trans-shipment of cargo for relay to smaller sub-regional ports in order to save in transoceanic shipping rates. Undertaking this shift to post-panamax facilities will require participation of the private sector through PPPs or concessions, since the volume of financial resources required will be five to ten times greater than what is presently being allocated by the government for transport infrastructure.

Moreover, such a modal shift towards water and rail will enable Brazil to take advantage of current conditions and projected trends in order to influence future energy use and emissions by freight transport. First, a growing economy will invariably increase the flow of goods, but reducing the gross weight or distance traveled for the same freight would reduce the energy consumption and emissions. Second, shifting the heaviest and densest freight currently carried by trucks to rail or waterways would have a significantly positive effect on energy consumption and emissions, all else being equal. Third, introducing or scaling up innovative certification and financing programs such as SmartWay in the United States can accelerate the turnover or improvement of the fleet. Fourth, freight management strategies in an urban context will be increasingly important as cities continue to grow. Finally, alternative fuels and electric/hybrid vehicles, a Brazilian advantage, may further reduce energy consumption depending on the production process and energy source.

This study believes that further strengthening the global competitiveness for Brazilian companies should be a major goal of the proposed NLS in the medium-term so that the Logistics Performance Index for Brazil improves substantially when compared to OECD and other emerging competitors. Building on the improvements that could be achieved in the short term, the above recommendations for large infrastructure investments, coupled with new policies, will enable Brazil to gradually alter the modal shift in favor of water, rail and pipeline transport resulting in an enhanced logistics framework promoting improved performance and reduced costs.

ANNEX 1 – DEVELOPMENT SCENARIOS

The study organized the collection of proposed initiatives from Users' Investments and Supply Chain Improvement Packages (Table 29) into six development scenarios, as described in Table 2. The six scenarios consider possible infrastructure and policy measures that range from the lowest level (status quo) to the highest (heavy infrastructure construction) and estimates what would be each scenario's required public and private funding, generated savings, Internal Rate of Return (IRR), effect on transport share, and the resultant share of logistics of the GNP.

Figure 31 compares each scenario's logistics costs as a percentage of GNP and the IRR. Of the scenarios presented in Table 2, Scenario 4 would most closely match the full implementation of the present PAC. Implementation of this scenario would result in logistics costs of 14.4 percent of GNP while maintaining a predominantly road-based transportation matrix. Given that logistics costs currently amount to 15.4 percent of GNP, implementation of Scenario 4 will not reduce significantly logistics costs. This study believes that Scenario 5, with logistics costs reduced to 12 percent of GNP and IRR of 23 percent, should be the minimum target to be achieved within 10 years. Scenario 6, with logistics costs reduced to 9.4 percent of GNP and IRR of 35 percent would be a more desirable goal. Although Scenario 5 is still a predominantly road-based scenario, it would involve improvement to other transport modes such as the railway bypasses around the main cities and accessing port terminals, as well as increases in the number of port and intermodal terminals. Scenario 6, the more desirable option, enhances the improvements of Scenario 5 with additions of major railway construction. A deeper evaluation of Scenario 6, including some of the impacts, is found in the next section.

TABLE 29: POTENTIAL DEVELOPMENT SCENARIOS FOR LOGISTICS IMPROVEMENT

Railways

Proposal and Ranking		Level of Government	Model of investment
São Paulo Ferroanel (Bypass)	*	Federal	PPP
Conclusion of North-South Railway	*	Federal	PPP
Improvement of Access to the Port of Santos	*	Federal	Private
Policies to deal with the rite of passage in another railway track		Federal	Public
Policies to treat encroachment on rail right-of-way	*	Federal	Public
Policies to eliminate grade crossings		Federal	Public
Elimination of rail bottlenecks in the metropolitan area of São Paulo and Minas Gerais	*	Federal	PPP
Transnordestina Railway		Federal	PPP

Revision of the concession model to facilitate interface between concessionaires		Federal	Public

Ports, Inland Waterways and Coastal Shipping

Proposal		Level of Government	Model of investment
Professionalization of Port Management		Federal	Public
Decentralization of Ports from Federal to Local Authorities		Federal	Public
Investments in Port Terminals		Federal	Private
Increasing of draught in Santos, Itajaí, São Francisco do Sul & Rio Grande ports so that they can receive post –panamax ships	*	Federal/ State	Public
Reduction of Port bureaucracy (incentives to more organizations like Procomex)		Federal	Public/Private
Restart feasibility and detailed engineering studies for the navigation of rivers Araguaia, São Francisco, Amazon Basin and Tocantis	*	Federal	Public
Hidrovia (waterway) Tapajós-Teles Pires (Center-North)	*	Federal	Public
De-link inland waterway transport from national shipbuilders and allow acquisition of barges abroad		Federal	Public

Supply Chain Improvement Actions

Proposals		Level of Government	Investment Model
Create Incentives for the construction of new multimodal terminals		Federal/State	Private
Create incentives through fiscal exemption for the construction of warehousing areas for agriculture products		Federal/State	Private
Simplify customs procedures and interface with the Federal Revenue department.		Federal	Private
Improve tracking procedures			Private
Increase police surveillance to decrease theft		Federal/State	Public/Private
Create incentives for the proliferation of MTOs to professionalize logistics		Federal	Private

Road Infrastructure Actions

Proposal		Level of Government	Investment Model
Immediate solution for the transfer of the CIDE to the States		Federal/State	Public
Budget guarantee of US$4 billion in the next 4 years for rehabilitation of the federal road network		Federal	Public
Conclusion of Rodoanel de São Paulo (Roadring)	*	State	Private

	Road Ring of Rio de Janeiro	*	Federal/State	Private
	Perimetral roads of Santos Port	*	State	PPP
	Eixo Norte: Investments in BRs 163 & 158	*	Federal	PPP
	Acceleration in concession processes as well as federal and state PPP		Federal/State	Private

* included in the PAC

FIGURE 31: LOGISTICS COSTS AS A PERCENTAGE OF GNP AND INTERNAL RATE OF RETURN FOR SIX SCENARIOS

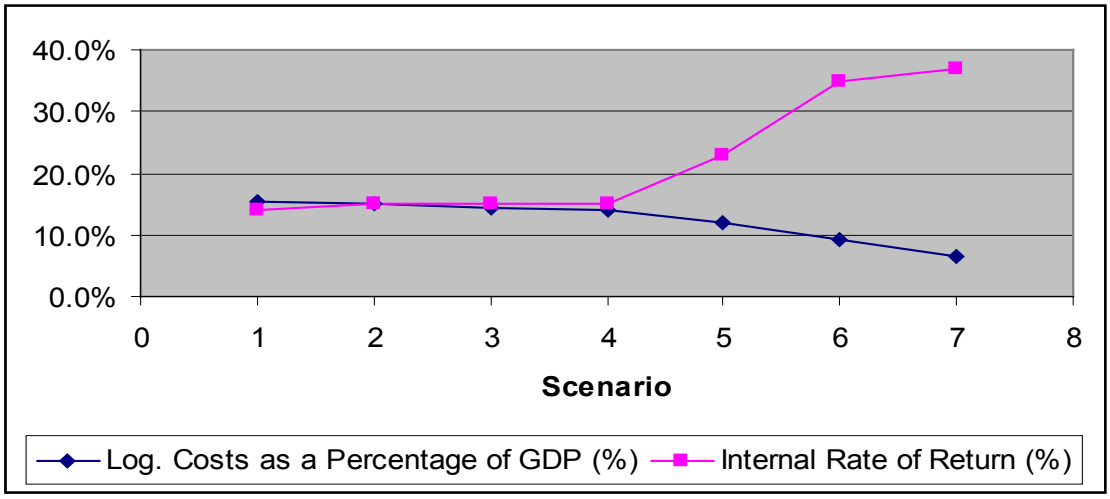


TABLE 30: POTENTIAL DEVELOPMENT SCENARIOS FOR LOGISTICS IMPROVEMENT

Scenario	Infrastructure Investments	Policy Measures	Effect on Modal Split (tkms)	Logistics Cost as % of GNP	Est. NPV of inv in US$b/y over 30 years	IRR
1. Do-Nothing	The status quo which consists of continuing with: ○ very poor quality roads, ○ difficult road/rail access to ports, inefficient ports, ○ low participation of rail and waterway, ○ limited number of	None	Road=60% Rail=22% Wway=14% Pipeline=3% Others=1%	15.4%	2	

Scenario	Infrastructure Investments	Policy Measures	Effect on Modal Split (tkms)	Logistics Cost as % of GNP	Est. NPV of inv in US$b/y over 30 years	IRR
	pipelines, ○ few port terminals and intermodal transfer terminals, ○ complicated and time-consuming customs/revenue procedures					
2. Improved Do-Nothing (mainly road)	Scenario 1 and: ○ improved roads through a major road maintenance program with maintenance funds guaranteed every year	○ Accelerate road concession and PPPs, ○ guarantee CIDE transfers to states, ○ improve police surveillance to decrease theft, ○ improve tracking procedures	Road=60% Rail=22% Wway=14% Pipeline=3% Others=1%	15% (↓ 0.5% in inventories and in theft) NPV net benefits =US$b 0.26/year	0.75	14 %
3. Metropolitan Ring Roads plus, port dredging, port access roads plus improved port interface	This scenario would: ○ build all the road bypasses around the major metropolitan regions, ○ investments in BR163 and 158, ○ catch up with dredging backlog, ○ improve the road accesses to the ports of Santos, Paranaguá, Rio de Janeiro, Itajaí, S. Francisco do Sul, Rio Grande and Ilhéus /Aratu	○ Decentralize ports to local authorities, ○ professionalize management. ○ Improve the Labor Management situation. ○ Major effort to improve supply chain procedures particularly the port interface with customs, ○ simplify paper work etc.; ○ Incentivize the proliferation of MTOs	Road=60% Rail=22% Wway=14% Pipeline=3% Others=1%	14.4% (↓ 0.5% in inventories and ↓0.5% in transport costs) NPV net benefits =US$b 0.63/year	1.60	15 %
4. Scenario 3 plus the construction of the metropolitan rail bypasses	Scenario 3 and: ○ construction of the rail bypasses around São Paulo, Rio and other major metropolitan areas, ○ eliminate critical grade crossings	○ Policies to treat encroachment on rail right-of-way, ○ policies to allow mutual traffic rights on other railway tracks, ○ revision of concession models to facilitate interface between concessionaires	Road=57% Rail=25% Wway=14% Pipeline=3% Others=1%	14% (↓1% in transport costs, ↓0.5% in inventory costs and ↓0.5% in warehousing) NPV net benefits =US$b	2.09	15 %

Scenario	Infrastructure Investments	Policy Measures	Effect on Modal Split (tkms)	Logistics Cost as % of GNP	Est. NPV of inv in US$b/y over 30 years	IRR
				1.02/year		
5. Scenario 4 plus the construction of more port terminals, intermodal transfer terminals, additional warehousing and improved port/customs interface	Scenario 4 and: ○ addition of port terminals, ○ incentives for road/rail intermodal terminals in the hinterland of main ports ○ major improvement of the port/customs/security interface; ○ improve coastal shipping	○ Create fiscal incentives for construction of new multimodal terminals ○ warehousing for agricultural products	Road=55% Rail=25% Wway=16% Pipeline=3% Others=1%	12% (↓2.4% in transport costs, ↓0.5% in inventory costs and ↓0.5% in warehousing) Savings=US$ 3.63b/year	2.53	23 %
6. Scenario 5 plus completion of some major railways which are under construction	Scenario 5 and: ○ completion of the North-South and Transnordestina railways ○ important acquisition of rolling stock by the private sector	○ Review leasing policies to facilitate the leasing of railcars and locomotives. ○ Provide incentives for construction of short branch lines to connect with major railways	Road=38% Rail=35% Wway=16% Pipeline=10% Others=1%	9.4% (↓4% in transport costs, ↓1% in inventory costs and ↓1% in warehousing) Savings=US$ 9.43b/year	2.82	35 %
7. Scenario 6 plus several important investments in waterways and pipelines	Scenario 6 and: ○ navigation improvements in the Tapajós-Teles Pires waterway and in Araguaia, São Francisco, Bacia Amazonica and Tocantins rivers	○ De-link waterway transport from national shipbuilders ○ Allow acquisition of barges abroad. ○ Provide tax breaks for pipeline investors particularly those working with ethanol	Road=29% Rail=35% Wway=25% Pipeline=10% Others=1%	6.4% (↓7% in transport costs, ↓1% in inventory costs and ↓1% in warehousing) Savings=US$ 14.3b/year	4.04	37 %

Estimating the Impacts of Logistics Improvement - Scenario 6

Scenario 6 proposes major infrastructure works such as road and rail bypass construction, dredging work, port road accesses improvement, new port terminals, completion of railway lines and acquisition of rolling stock. The major institutional policies relate to encroachment, traffic rights, concessions, fiscal incentives for terminals, railcar leasing, and rail line construction incentives. Assuming that there is willingness to change the present modal split to have more rail, waterway, pipeline and coastal shipping transport, it is possible to estimate the costs of the investment and policy actions required to achieve the reduction in logistics costs and the estimated benefit (US$ 9.43 billion/year). This exercise is performed only for illustrative purposes to show the significant benefits that can accrue to the industry if all the measures under this scenario are executed, and the shift in modal split is realized. Below are the details for both the infrastructure and policy measures:

Rail Transport: The total freight transport in Brazil amounts to about 800 billion TKUs (net ton-kms) per year, of which rail has now a share of 21 percent. A target share of about 35 percent represents an additional 112 billion TKUs for rail. Assuming that the difference between road and rail tariff is roughly US$16/1000 TKUs, transport cost will be reduced by US$1.8 billion/year. To achieve this reduction, the investment required in rolling stock (45,000 rail cars) and locomotives (1000) would amount to US$8 billion, which would be made mainly by the private sector. The investment in rail infrastructure would be US$8.2 billion, of which US$5 billion would be from public sources, or in some cases PPPs, and the remainder from private investment.

Pipeline Transport: Of the total freight transport in Brazil, pipelines have now a share of 3 percent. A target share of about 10 percent represents an additional 56 billion TKUs for pipelines. Assuming that the difference between road and pipeline tariff is roughly US$23/1000 TKUs transport cost will be reduced by US$1.28 billion/year. To achieve this reduction, the investment required in pipelines would be US$3 billion mainly by Transpetro and ethanol producers. Since Transpetro is a monopoly it will be very important to safeguard the final consumer from eventual price abuses due to its extensive coverage.

Waterway Transport and Coastal Shipping: Of the total freight transport in Brazil, waterways have now a share of 14 percent. A target share of about 25 percent represents an additional 88 billion TKUs for waterways. Assuming that the difference between road and waterway tariff is roughly US$24/1000 TKUs, transport cost will be reduced by US$2.1 billion/year. To achieve this reduction, the investment required in port and waterway infrastructure would be US$3 billion and the investment in oceanic barges would be roughly US$6 billion by the private sector.

Road Transport: The road transport share in the overall freight matrix is very high in terms of TKUs due to the very long distances traveled by road with low value bulk commodities. These products should be transported by rail or waterway, and road transport should be used for shorter distances and higher value commodities mainly in containers. The reduction of the road transport share will be more in

terms of TKUs than in TUs. It is also possible that the road tariffs will increase because the value of the freight will also increase. The road operating costs could also decrease with an adequate road maintenance program. This reduction in operating costs might be reflected in the tariffs if there is competition and good enforcement of maximum axle loads and registration. The investment estimated in roads will be around US$5 billion.

Transoceanic tariffs: Brazil spends roughly US$6 billion/year in transoceanic shipping tariffs. The new post-panamax ships (ships larger than the dimension of the Panama Canal, such as supertankers and the largest modern container ships) could reduce these tariffs by up to 20 percent in relation to the current scenario. The cost reduction is estimated at about US$1.2 billion and the investments required are those related to the port terminals which are discussed below.

Higher number and more efficient port terminals: Although there were major improvements in port terminals particularly in Santos after the introduction of private terminals, there is still a serious lack of port terminals which are suitable for the new post-panamax ships. Demurrage charges, or surcharges for the delayed delivery of a product, are still around US$700 million/year due to shortage of terminals. The terminals in 2004 handled 600 million tones, which generated about 5 million TEUs. An improvement and expansion of port terminals could reduce costs by as much as US$1billion/year with an investment of about US$2billion.

Higher number and efficiency of intermodal transfer terminals: Brazil has only 250 multimodal terminals versus about 2500 in the United States. Each multimodal terminal can cost up to US$10 million. If Brazil doubles the number of terminals the investment will be about US$2.5 billion. The cost reduction could be as high as US$1billion/year in terms of reduction of inventories and warehousing costs.

Better Warehousing of Agriculture Products: According to consultants Macrologística, the warehousing shortage is about 40 million tons/year. Better warehousing reduces physical losses and improves the quality of the products, facilitating marketing and the attainment of better prices. An investment of about US$2 billion in warehousing would help in decreasing those losses by at least 50 percent.

Supply Chain Cost Reductions: The level of inventories in Brazil is about 2-4 times that of OECD countries and the United States, where they account for two percent of GNP. A reduction of 10 percent of the level of inventories reduces the cost by 10 percent or about US$6.4 billion. This requires investments in inventory management, warehousing, administration, and tracking of about US$1 billion assuming also that the infrastructure is improved. If infrastructure is not improved, the cost reduction could still be about US$200 million.

Overall, scenario 6 has a 35 percent IRR and will significantly reduce logistics costs as a percentage of GNP from 15.4 percent to 9.4 percent. This reduction will make Brazil more competitive, particularly vis-à-vis countries such as Australia, India, Russia, and China as well as some OECD countries.

ANNEX 2 – BRICS' FREIGHT TRANSPORT LOGISTICS SYSTEMS

Brazil is in a unique position today. It is considered a middle income country by the standards of the World Bank, a title that is shared with a handful of other countries, such as China and Russia, grouped under the title of BRIC (which also includes India). This categorization, and its status at the World Bank, signifies a developmentally advanced position for a country, establishing its emerging economic status between those countries that are still struggling to increase the quality of life of their citizens, and those highly developed countries. As a result of their ambiguous status, on certain accounts meeting developed countries' measures while on the other hand performing at a developing level, Brazil, and the other middle income countries, are compared against three very distinct classification: developing countries and regions, advanced economies (Europe, United States, Canada, and Australia), and BRIC.

This annex provides a summary of indicators on geography, economy, and trade to position Brazil against its BRIC comparators. These indicators were selected for a) their association with the logistics network, giving the reader an overview of the size, geographic elements, important industries, and scale and type of imports and exports, and b) the similarities shared with the BRIC group. The economic and geographic summary is followed by a more detailed comparison of transport indicators - freight modal split, performance measures and transport intensity index.

The objective of this comparison is to present objective data on Brazil's position against its comparators on the global logistics stage. The reader should be cognizant that each country has its own unique strengths and challenges that have enabled it to achieve its current logistics position, such as government policies and private investments, that are not included in this data, and which do affect the logistics framework.

Geographic Data

Brazil falls in the mid-range in terms of size and available water resources within the BRIC group. However in terms of population density, it is quite low, reaching only 22.6 people per square km, a fact that impacts the availability of transport networks demonstrated in one of the later tables.

	Brazil	China	India	Russia
Population (millions)				
	192	1,330	1,148	141
Area (millions sq km)				
Ttl	8.5	9.6	3.3	17.0
Land	8.5	9.3	3.0	17.0
Water	0.1	0.3	0.3	0.1
Coastline (1000 km)	7.0	10.0	7.0	38.0
Population Density (people/km^2)	22.6	138.5	347.9	8.3

Source: CIA World Fact book: https://www.cia.gov/library/publications/the-world-factbook/geos/rs.html

Economic Data

In terms of economic indicators, Brazil, as of 2007, had the lowest GDP at US$ 1.8 trillion (versus China's US$7 trillion, India's US$3 trillion and Russia's US$2.1 trillion) and the slowest real growth rate at 4.5 percent (versus China's 11.4 percent, India's 8.5 percent and Russia's 8.1 percent) of its BRIC comparators. Yet, performance of the transport sector has surpassed the performance of the overall GDP: transport has achieved a 57 percent growth since 1995 while total GDP has increased by 38 percent since that time, a fact shared with India. Overall, the transport sector's share of GDP is 5.3 percent, equivalent to an annual contribution of approximately US$95 billion.

	Brazil	China	India	Russia
GDP				
GDP PPP (trillion US$)	1.8	7.0	3.0	2.1
Real Growth Rate (%)	4.5	11.4	8.5	8.1
GDP by Sector				
Agriculture	5.1	11.7	16.6	4.6
Industry	30.8	49.2	28.4	39.1
Services	64.0	39.1	55.0	56.3
GDP index 1995=100)	138.0	295.8	217.2	167.1
Annual transport and communications sector growth, %	5.1	13.4	10.1	7.6
Transport sector GDP index (1995=100)	157.0	249.9	248.1	159.9
Transport and communications sector, % of GDP	n/a	5.9	7.6	10.7
Transport, % share of total GDP	5.3	n/a	n/a	n/a
Transport and communications sector value (US$bn nominal)	n/a	n/a	n/a	133.4
Transport industry GDP (US$bn nominal)	66.0	190.0	62.8	n/a

Source: CIA World Fact book: https://www.cia.gov/library/publications/the-world-factbook/geos/rs.html

Trade Data

In terms of overall trade, Brazil does not export as much as its comparators, nor has it achieved the same annual growth as they have experienced in the last 12 years. Although exports have grown in the last year by an impressive 14 percent for Brazil, China has experienced 27 percent growth, India 20 percent growth and Russia 10 percent. Total exports measure almost US$ 160 billion, compared with China at US$1.2 trillion, India at US$140 billion and Russia at US$365 billion. By value, the largest export for Brazil in 2007 was machines and transport equipment, followed by basic manufactures and lives animals. China's largest export by value was also

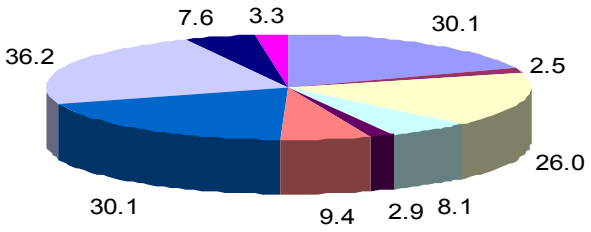
machines and transport equipment, though at 16 times the value. India's most valuable export is basic manufactures while for Russia it is mineral fuel and related materials. Imports have also grown considerably, reaching 26 percent in the last year, compared with China's 19 percent, India's 22 percent and Russia's 28 percent. Total imports measures US$116 billion, indicating a trade deficit for Brazil. Brazil's largest import category by value is also machines and transport equipment, which may signify the involvement of re-processing in Brazil.

	Brazil	China	India	Russia
Oil				
Exports (bbl/day)	278400	79060	350000	5080000
Imports (bbl/day)	674500	3190000	2098000	100000
Natural Gas (mil cu m)				
Exports	0	2874	0	182000
Imports	8478	976	5793	37.5
Total Trade (US$bn)	275	2138	365	625.4
Exports annual growth (%)	13.0	27.2	20.7	10.0
Exports index (1995=100)	336.0	962.5	473.2	405.7
Exports				
Total (bn US$)	159.2	1221.0	140.8	365.0
Value of exports by category (US$bn), 2007				
Food and live animals	30.1	39.0	17.2	4.3
Beverages and tobacco	2.5	2.3	0.9	0.6
Crude materials, excl. fuels	26.0	12.3	3.2	15.3
Mineral fuels, lubricants and related materials	8.1	29.5	0.3	166.8
Animal and vegetable oils, fats and wax	2.9	0.4	0.8	0.2
Chemicals and related products	9.4	56.2	11.4	14.3
Basic Manufactures	30.1	207.4	78.8	52.0
Machines, transport equipment	36.2	560.0	11.4	15.9
Miscellaneous products	7.6	323.5	0.9	3.3
Unclassified goods	3.3	2.5	2.3	61.7
Imports annual growth (%)	25.8	18.6	22.4	27.5
Imports index (1995=100)	230.0	853.4	534.8	335.5
Imports				
Total (US$ bn)	115.6	917.4	224.1	260.4
Value of imports by category (US$bn), 2007				
Food and live animals	6.5	14.3	12.5	27.7
Beverages and tobacco	0.4	1.0	0.1	5.3
Crude materials, excl. fuels	3.6	94.2	6.7	8.3
Mineral fuels, lubricants and related materials	17.0	83.5	53.8	4.1
Animal and vegetable oils, fats and wax	0.4	6.0	4.8	1.8
Chemicals and related products	24.0	110.2	20.2	25.6
Basic Manufactures	11.1	122.5	59.5	27.6

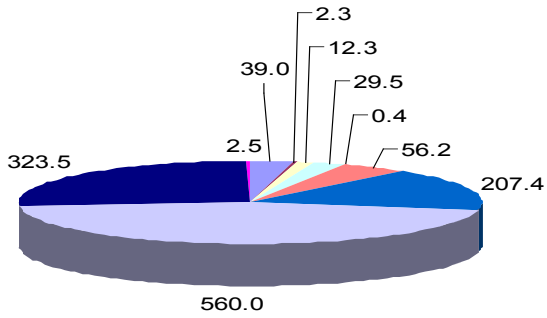
Source: CIA World Fact book: https://www.cia.gov/library/publications/the-world-factbook/geos/rs.html

Value of Exports by Category (US$bn), 2007

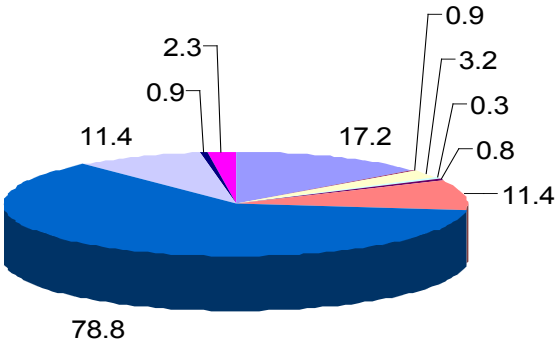
Brazil



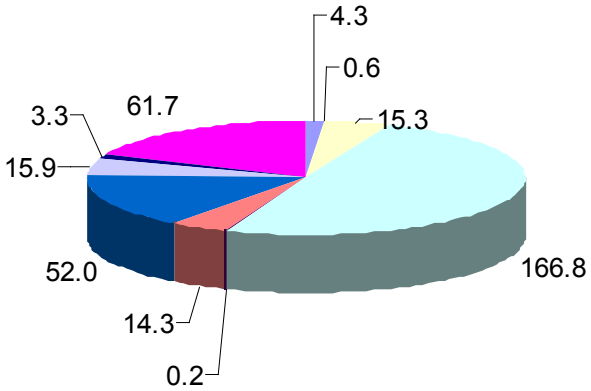
China



India

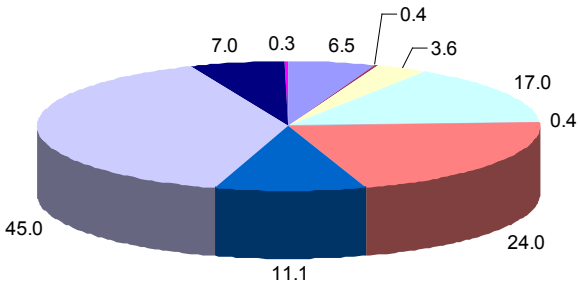


Russia

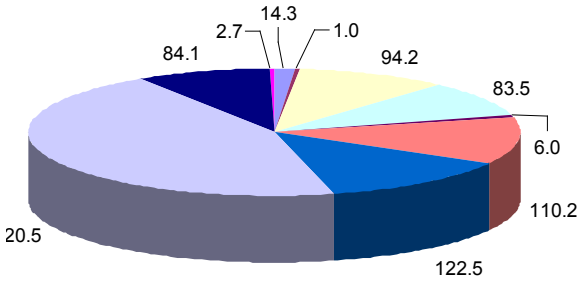


Value of Imports by Category (US$bn), 2007

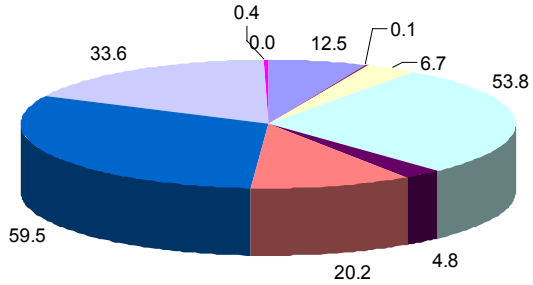
Brazil



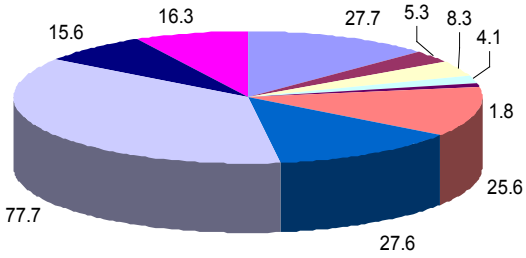
China



India



Russia



Transport Data

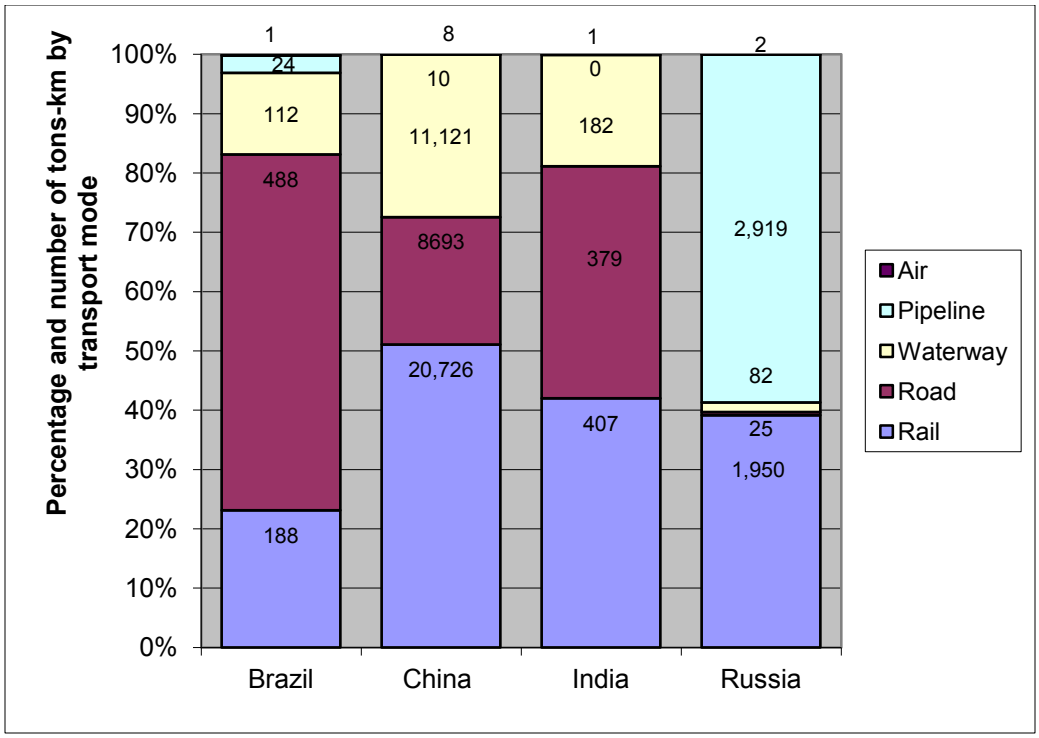
Most of Brazil's freight is transported using rail (48%) followed closely by road (43%). Of all four countries, Brazil has the highest reliance on the road modality and comparing transport intensity, uses this modality to its extreme. It is unknown if the waterway figures signify total or viable waterways. Yet even without this information and simply in terms of scale, Brazil's waterway use is considered almost insignificant when compared to India, having a fraction of the waterway network of Brazil. As for air use, noteworthy is the large number of unpaved runways in Brazil.

		Brazil	China	India[44]	Russia[45]
Freight Carried (domestic and int'l) Tons-km (billion)					
	Rail	188	20,726	407	1,950
	Road	488	8,693	379.0	25
	Waterway	112	11,121	182.0	82.0
	Pipeline	24	10.0	n/a	2,919
	Air	1.4	7.7	1	1.9
Extension of Modes (CIA)					
	Roads - ttl (km)	1,751,868	1,870,661	3,383,344	871,000
	Paved	96,353	1,515,797	1,603,705	738,000
	Unpaved	1,655,515	354,864	1,779,639	133,000
	Rail - ttl (km)	29,295	75,438	63,221	87,157
	broad gauge	4,932	n/a	46,807	86,200
	standard gauge	194	75,438	n/a	n/a
	narrow gauge	23,773	n/a	13,290	957
	dual gauge	396	n/a	n/a	n/a
	Pipelines (km)				
	condensates/gas	244	n/a	9	122
	gas	12,070	26,344	7,488	158,699
	liquid petroleum gas	351		1,861	
	oil	5,214	17,240	7,883	72,347
	refined products	4,410	6,106	6,422	13,658
	Waterways (km)	50,000	124,000	14,500	102,000
	Ports*	7	8	9	8
	Air - Total	4263	467	346	1260
	Air - Paved runways	718	403	250	601

* This entry lists major ports and terminals primarily on the basis of the amount of cargo tonnage shipped through the facilities on an annual basis. In some instances, the number of containers handled or ship visits were also considered (CIA, 2007)

[44] http://sima.worldbank.org/datasite/WDI08/Table5_9.htm

[45] http://sima.worldbank.org/datasite/WDI08/Table5_9.htm

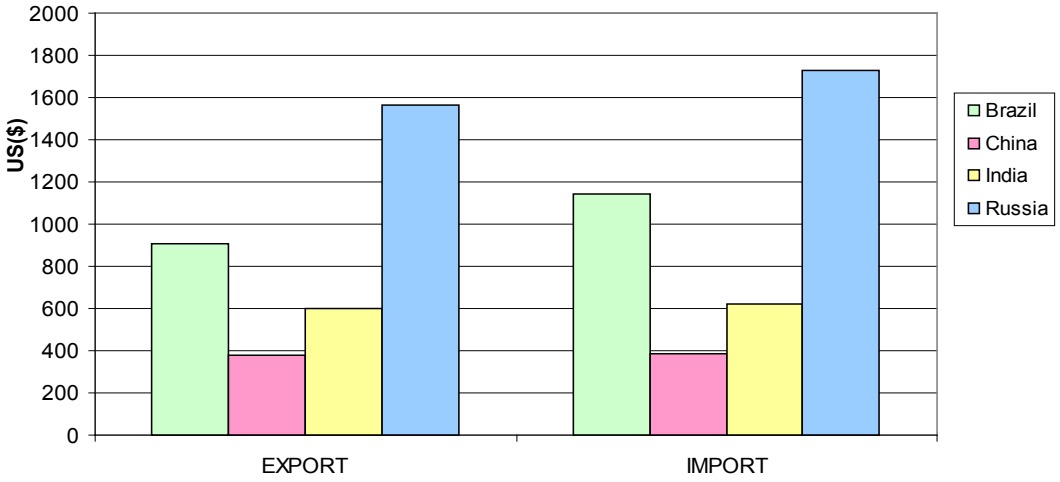


Source: CIA World Fact book: https://www.cia.gov/library/publications/the-world-factbook/geos/rs.html, Business Monitor International, Brazil/India/Russia/China Freight Transport Report Q2 2008, World Bank: An overview of China's Transport Sector 2007 EASTE Working Paper No. 15, World Bank World Development Indicators 2008 (SIMA), COPPEAD for Brazil stats .

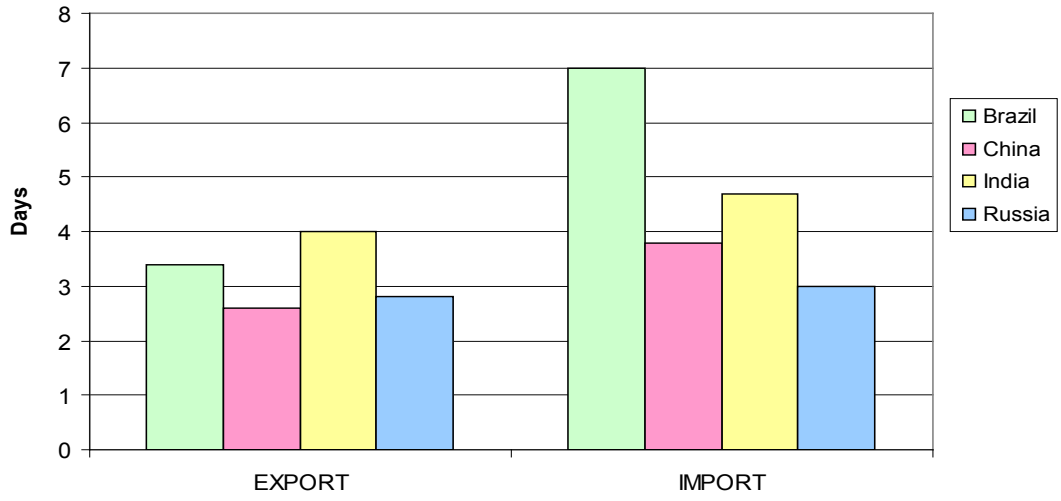
Performance Data

Two specific indicators for comparing transport performance are available below. The first indicates the total transport and port services cost of exporting or importing a 40 foot container in each of the BRIC countries. The data demonstrates how poorly Brazil performs; Brazil's export costs (US$900) are more than double those of China (US$400), and almost 1.5 times those of India (US$600) while import costs (US1100) are almost triple those of China (US$400) and almost double those of India (US$600). It is interesting to note that import and export costs are equivalent for China and India, while import costs are greater than export costs for Brazil and Russia. The second indicator compares lead time from port of discharge to consignee, where Brazil also performs poorly; it requires just over 3 days to export from Brazil, while less than three are required for China and Russia. Importing requires even longer, reaching 7 days in Brazil compared with 4 days for China, 4.5 days for India, and 3 days for Russia. Thus, not only does it take longer, but it is more expensive to trade with Brazil.

Typical charge for a 40-foot container or a semi-trailer
(Total cost to transport and port services)



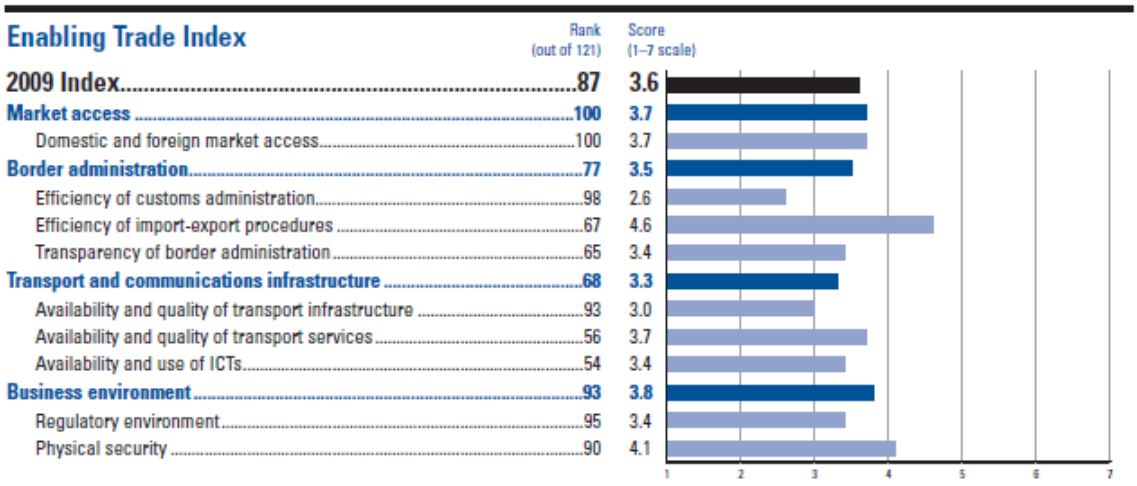
Lead Time, Median Case
(From Port of Discharge to Consignee)



Source: World Bank, 2007. Connecting to compete- Trade Logistics in the Global Economy (2007)

Logistics Index

Enabling Trade Index (ETI): The World Economic Forum's ETI measures the extent to which institutions, policies and services facilitate the free flow of goods over borders and to final destinations. The ETI measures market access, border administration, transport and communications infrastructure, and business environment. In 2009, Brazil is ranked 87th among 121 countries, a similar position to the Doing Business ranking (approximately 70th percentile) due, in part, to the input of World Bank data in both reports. In comparison with the BRIC countries, Brazil ranks 3rd following China (49th), India (76th), and before the Russian Federation (109th). The best performer is Singapore, the United States ranks 16th, and Argentina ranks 97th. Comparing globally, Brazil is an average or somewhat better performer in availability and quality of transport services (56th), availability and use of technology (54th), and efficiency and transparency in border administration (65th). However, there are impediments and room for improvement in addressing the level of protectionism (95th), quality and availability of transport infrastructure (93th -particularly weak on availability and quality of roads and quality of port infrastructure), and efficiency of customs procedures (98th).



Source: The Global Enabling Trade Report 2009, World Economic Forum

The Enabling Trade Index in detail

■ Competitive **Advantage** ■ Competitive **Disadvantage**

	INDICATOR	RANK/121		SCORE	BEST PERFORMER	SCORE
	1st pillar: Domestic and foreign market access					
1.01	Tariff barriers	84	■	8.6	Hong Kong SAR	0.0
	Tariff barriers for non-agricultural products	87	■	8.5	Multiple economies	0.0
	Tariff barriers for agricultural products	49	■	10.1	Hong Kong SAR	0.0
1.02	Non-tariff barriers	82	■	54.9	Chad	0.0
1.03	Complexity of tariffs	18	■	6.8	Hong Kong SAR	7.0
	Variance of tariffs	37	■	8.0	Hong Kong SAR	0.0
	Domestic tariff peaks	1	■	0.0	Multiple economies	0.0
	Specific tariffs	1	■	0.0	Multiple economies	0.0
	Number of distinct tariffs	39	■	16	Hong Kong SAR	1
1.04	Share of duty-free imports	82	■	34	Hong Kong SAR	100
1.05	Tariffs faced	49	■	5.5	Chile	3.8
1.06	Margin of preference in target markets	68	■	23.9	Nepal	94.6
	2nd pillar: Efficiency of customs administration					
2.01	Burden of customs procedures	116	■	2.5	Singapore	6.5
2.02	Customs services index	74	■	4.8	United Kingdom	12.0
	3rd pillar: Efficiency of import-export procedures					
3.01	Effectiveness and efficiency of clearance	67	■	2.4	Netherlands	4.0
3.02	Time for import	53	■	19	Singapore	3
3.03	Documents for import	44	■	7	France	2
3.04	Cost to import	65	■	1,275	Singapore	439
3.05	Time for export	33	■	14	Multiple economies	5
3.06	Documents for export	83	■	8	France	2
3.07	Cost to export	74	■	1,240	Malaysia	450
	4th pillar: Transparency of border administration					
4.01	Irregular payments in exports and imports	70	■	3.8	Sweden	6.6
4.02	Corruption Perceptions Index	62	■	3.5	Multiple economies	9.3
	5th pillar: Availability and quality of transport infrastructure					
5.01	Airport density	67	■	0.6	Norway	10.6
5.02	Transshipment connectivity index	24	■	76.4	United Kingdom	100.0
5.03	Paved roads	116	■	5.5	Multiple economies	100.0
5.04	Road congestion	34	■	18	Bangladesh	1
5.05	Quality of air transport infrastructure	91	■	3.7	Singapore	6.9
5.06	Quality of railroad infrastructure	82	■	1.8	Switzerland	6.8
5.07	Quality of roads	100	■	2.5	France	6.7
5.08	Quality of port infrastructure	111	■	2.5	Singapore	6.8
	6th pillar: Availability and quality of transport services					
6.01	Liner Shipping Connectivity Index	27	■	30.9	China	137.4
6.02	Ease and affordability of shipment	73	■	2.6	Netherlands	4.1
6.03	Competence of the logistics industry	47	■	2.9	Netherlands	4.3
6.04	Ability and ease of tracking	62	■	2.8	Singapore	4.3
6.05	Timeliness of shipments in reaching destination	68	■	3.1	Singapore	4.5
6.06	Postal service efficiency	25	■	6.1	Switzerland	6.9
6.07	GATS commitments in the transport sector	66	■	3.5	Moldova	60.6
	7th pillar: Availability and use of ICTs					
7.01	Firm-level technology absorption	40	■	5.3	Japan	6.3
7.02	Mobile telephone subscribers	70	■	63.1	United Arab Emirates	176.5
7.03	Broadband Internet subscribers	53	■	3.5	Denmark	36.0
7.04	Internet users	40	■	35.2	Norway	85.0
7.05	Telephone lines	56	■	20.5	Switzerland	65.9
	8th pillar: Regulatory environment					
8.01	Property rights	63	■	4.1	Switzerland	6.5
8.02	Ethics and corruption	108	■	2.0	Singapore	6.5
8.03	Undue influence	55	■	3.5	Denmark	6.3
8.04	Government inefficiency	111	■	2.7	Singapore	6.1
8.05	Domestic competition	105	■	3.8	Singapore	5.7
8.06	Openness to foreign participation	90	■	4.5	Singapore	6.3
	Ease of hiring foreign labor	58	■	4.7	United Arab Emirates	6.1
	Prevalence of foreign ownership	73	■	4.9	Hong Kong SAR	6.7
	Business impact of rules on FDI	74	■	5.0	Ireland	6.7
	Capital controls	108	■	3.3	Hong Kong SAR	6.6
	9th pillar: Physical security					
9.01	Reliability of police services	105	■	2.8	Finland	6.7
9.02	Business costs of crime and violence	111	■	3.1	Syria	6.7
9.03	Business costs of terrorism	10	■	6.5	Finland	6.8

ANNEX 3: SECTOR SPECIFIC SURVEY SYHTHESIS

This Annex provides information on four specific sectors in which logistics play a vital role. The largest Brazilian exporters in the ethanol, sugar, soy, and electronics sectors were surveyed, and the results of the survey, including some general information on the sectors, are summarized below.

I. CONCLUSIONS FROM LOGISTICS SURVEY

The main conclusions from the survey regarding logistics in Brazil include:

- Estimated logistics costs are 25 percent of FOB price for agricultural and agro-industrial products, which represents a significant share of the cost for these sectors in the São Paulo State.
- The majority of logistics costs (80%) occur during land transport which is an important point given that all surveys unanimously stated that road infrastructure conditions in Brazil are far worse than in developed countries.
- The shortage of adequate transport occurs because of the low supply of infrastructure and due to the lack of quality and integration of existing infrastructure.
- Rail is not a transport mode that shippers can widely rely on in Brazil or in São Paulo; low supply of services and uncompetitive rail fees constitute the main reasons for the lack of non-road modes. In addition, due to the operators' monopolistic powers in their areas of influence, their pricing for services is not related to their own costs, but is a function of the road tariffs.
- The shallow draught in the Port of Santos of the access channel and the berths constitute an important logistics bottleneck for the State of São Paulo. As a result, increasing ship sizes hinder using the Port of Santos's total capacity.
- With regards to the pipeline transport mode, surveys from the ethanol sector (the main user of the pipelines) indicated that insufficient supply of pipeline infrastructure compromises the competitiveness of the sector since it continues transporting ethanol via truck, as opposed to competitor countries that use more efficient modes. In addition to the lack of pipeline infrastructure, the cost is uncompetitive since the pipeline infrastructure is managed as a monopoly, operated by Petrobrás. Within this point of view, transport infrastructure will have a determining role for the sector's positioning in the international market.
- Exporting sectors especially in high value added product segments mention the time lost in paper work, mainly in customs, as a significant logistics costs element.

II. ETHANOL SECTOR

1. Context of the Ethanol Sector

- Brazil is the largest sugarcane producer in the world and the domestic and world demand for Brazilian ethanol is growing.
- In the 1970s the sugar/ethanol sector went through important transformations, veering from food (sugar) production to producing fuel, which initially was nearly exclusively sold for domestic market consumption.
- In 2004, the U.S. surpassed Brazil as the world's largest ethanol producer. Yet, Brazil holds the position of world's largest sugar exporter followed by the European Union.
- Current ethanol export volumes equal 10 percent of total production, a share that continues to increase with the opening of new world markets.
- Environmental concerns regarding the effects of pollution from cars, reflected in the necessity of adhering to the Kyoto protocol, have been favorable to international demand for ethanol as a fuel or gasoline additive.

2. Current Production

- Current sector production (2006/2007 Harvest):

PRODUCTION	Sugarcane (million t)	Ethanol (million m³)	Sugar (million t)
Center-South	373	16	26
Northeast	53	2	4
TOTAL	426	18	30

- The sugar/ethanol sector has the flexibility of being able to produce either sugar or ethanol outputs.

3. Forecasting Demand

- The production of ethanol in the center-south region will reach 16 billion liters for the 2006/2007 harvest, representing approximately 90 percent of the national production, estimated at 18 billion liters.
- Forecasts indicate that prices will continue to rise and the gross income of the sector will grow more than 30 percent, to approximately R$16.7 billion.
- Sector estimates indicate a potential of ethanol exports of between 5 to 10 billion liters.
- Product demand is influenced by the conditions of world petroleum reserves and prices.

4. Transport Infrastructure

- Brazil will not be able to maintain its competitiveness in ethanol using road transport to access ports. Without a more comprehensive pipeline network in its land logistics, Brazil might lose to competitors which use more efficient transport modes.
- Existing road and port infrastructure does not offer conditions to significantly expand ethanol exports.
- As has already been mentioned, the rail mode is not competitive to keep up with existing sector demand.
- On the other hand, the competitiveness of Brazilian ethanol in world markets will depend on an infrastructure that guarantees the following:
    - Logistics cost efficiency and competitiveness, and
    - Operational reliability.
- The implementation of a pipeline network can also permit the integration with the rail mode and mainly inland water transport, thus aggregating value to the logistics functions.
- Under this view, transport infrastructure for ethanol will be vital for the sector's positioning in the international market.

5. Product Characteristics for Transport

- Although all modes are adequate for ethanol transport, currently only the road mode is used.
- The road mode is not the most adequate for transporting bulk liquids especially because of costs and environmental impacts.
- Other modes (railway, pipeline, waterway) offer more security and present lower costs per m^3.km.
- The lack of adequate infrastructure of non-road modes does not leave users other options other than the truck.
- Unresolved infrastructure issues will create problems for the sector to get the product to international markets.

6. Transport Characteristics

- The average transport distance of ethanol to the port of Santos is about 450 km.
- The largest production centers are found in the north and west of the state
- A new pole is consolidating outside of São Paulo State in the south of Goiás
- Transport and port costs represent about 85 percent of the logistics cost, which represents approximately 20 percent of the FOB value.
- Any savings obtained in logistics is relevant because ethanol is a low value added product with a high volume.

7. Transport Alternatives

- The ethanol sector seeks a solution to the problem of transporting the fuel within the private sector.
- Producers want to commercialize ethanol directly in international markets;
- Petrobrás is trying to consolidate itself as a large exporter, as it is also the sole operator of the pipeline infrastructure;
- As already mentioned, export via Petrobrás infrastructure would place ethanol producers as suppliers to Petrobrás, a position that does not please large producers in the sector;
- The construction of a private ethanol pipeline will allow transporting projected flows allowing the sector to potentially consolidate its position in the international market

8. Transport Costs

- Domestic ethanol transport costs are approximately R$ 0.15 m^3.Km
- Exclusive road use can largely explain this high cost
  - The distance and cost per m^3 transported to Santos is:
  - Piracicaba – 230 km – R$ 34.50/m^3
  - Ribeirão Preto – 400 km – R$ 60.00/m^3
  - São José do Rio Preto – 510 km – R$ 76.50/m^3
  - Ourinhos – 460 km – R$ 69.00/m^3
  - Araçatuba – 600 km – R$ 90.00/m^3
- This cost is incompatible with transporting bulk goods of low value added

9. Cost by other Modes or Intermodal

- An estimate of competitive costs for non-road modes are indicated in the table below
- This reduction can reach more than 50 percent in the case of inland waterways

MODE	Cost (R$/m³.km)
Pipeline	**0.085**
Railway	**0.080**
Waterway	**0.060**

10. Port Choice

- Currently, the port of Santos is the preferred port for the flow of ethanol;
- However, the implementation of a new pipeline infrastructure suggests that other port alternatives could be competitive;
- The Port of Santos contains areas within and outside the port to construct terminals, which gives alternative choices to the private sector; and
- The Port of São Sebastião, although farther away, is attractive because of its draught, available land for terminal construction, and ample right of way of state roadways that allows the implementation of pipelines.

11. Logistical Aspects in the Transport of Ethanol – General Aspects

- Customs time varies between 48 and 72 hours, while the ideal would be 18 hours;
- The sector does not face serious problems regarding shipping delays (up to 1 day), because sales are not lost due to this reason; and
- Total transport time is approximately 1 day.

12. Contracting Transport

- Current ethanol transport from mill to port is outsourced to truck fleets
- Interviewed executives agreed that for rail to be competitive it would have to reduce fees by 30 percent, at current speeds;
- Rail faces another difficulty: supplying rolling stock for ethanol transport;
- They also believe that pipelines would also need a 30 percent reduction in price to become competitive;
- The Petrobrás monopoly on pipeline infrastructure creates unrealistic fees; and
- The private sector is developing and planning to implement its own pipeline infrastructure.

13. The Private Sector View of Logistics in Brazil

- Private companies consider road infrastructure to be much worse than in developed countries to the point of discouraging investment
- Logistics cost factors considered much worse in Brazil than in developed countries are:
    - Port operations (time and fees)
    - Security conditions
- Other issues considered worse than in developed countries were the functioning of maritime transport, customs, document processing and other regulations

III. SUGAR SECTOR

1. The Context of the Sugar Sector

- Brazil is the largest sugar exporter. In 2004, approximately 59 percent of sugar production was exported.
- The per capita consumption of sugar in Brazil is high in comparison to the rest of the world: 52 kilos per year per person on average vis-à-vis a world average of 22 kilos. Yet, the international sugar market is very closed, being one of the most protected products in the world.
- The expectation in Brazil is that the end of European subsidies to sugar production could represent an increase of 5 million annual tons in the volumes sold to this market, representing a market potential of US$ 1.5 billion.
- The cost of producing European sugar is estimated at US$ 800/t, while in Brazil the cost is US$ 300/t.
- Beyond growth through acquisitions and investment in new units of production, investments by foreign companies increased since 2000. In 2003, four multinationals operated in the sugar/ethanol sector in Brazil.

2. Current Production

- Current sector production (2006/2007 Harvest)

PRODUCTION	Sugarcane (million t)	Ethanol (million m³)	Sugar (million t)
Center-South	373	16	26
Northeast	53	2	4
TOTAL	426	18	30

3. Forecasting Demand

- 2006/2007 sugar production in Brazil should reach 30 million tons, and the production in the center-south will contribute 90 percent of this total.
- The center-south region is responsible for nearly all of the national production of white sugar. São Paulo State is the largest national sugarcane producer, corresponding to approximately 68 percent of the center-south production and 58 percent of national production.
- Sugar exports in 2006 reached 19 million tons.
- World sugar consumption is relatively stable with an average two percent annual growth.

4. Transport Infrastructure

- The competitiveness of the sugar sector is hindered by deficiencies in transport infrastructure.
- The difficulty faced by rail to fulfill contractual agreements creates a situation where the sugar sector uses trucks to complement the transport supply, which could potentially be satisfied by improvements to the non-road modes, mainly, rail.
- Traffic congestion in the port area and the lack of warehousing capacity contribute to the elevated logistics costs.

5. The Market and Transport Logistics

- The absolute majority of the volume of exported sugar is transported in bulk. However, there is a tendency to significantly increase the use of containers for exports, which usually transport refined sugar.
- In 2006 the region exported about 16.5 million tons of which 500 thousand were in containers. It is estimated that in 2007 exports will reach 18.5 million tons of which 1.5 million will be in containers.
- There are limitations to container export growth because clients in North Africa and Asia usually prefer to import in bulk for refining at final destination.

6. Transport Characteristics

- The average transport distance of sugar to the port of Santos is 450 km.
- The majority of production centers are in the north and west of the State of São Paulo.
- As related to the use in ethanol, a new sugar pole is forming in the south of Goiás.
- Land transport and port costs represent about 85 percent of the logistic cost, which represents approximately 20 percent of the FOB value.
- As with other agro industrial products, any saving is meaningful due to the large volumes transported.

7. Alternatives to Transport

- The sugar sector longs for a higher quality railway service with competitive fees.
- A way of reducing logistics costs is by increasing the share of more efficient modes such as waterways and railroad.
- Increasing such participation however has problems such as the lack of transport infrastructure, specifically rail infrastructure.
- This lack of infrastructure also includes warehouses and terminals.

8. Transport Costs

- Domestic transport cost is R$ 0.13 / T-Km
- The distance and cost of transporting m^3 from the production poles to Santos is:
    - Piracicaba – 230 km – R$ 29.90/t
    - Ribeirão Preto – 400 km – R$ 52.00/t
    - São José do Rio Preto – 510 km – R$ 66.30/t
    - Ourinhos – 460 km – R$ 59.80/t
    - Araçatuba – 600 km – R$ 78.00/t

9. Port Choice

- Santos is the main port for sugar export.
- Despite other available ports, companies have consolidated logistics infrastructure in this port.
- Port costs in Santos vary between R$16 and R$34 per ton.
- Users pointed out that in order for other ports to become competitive, they must first reduce fees by 25 percent.
- Customs time varies between 2 and 4 days. The sector would like to see this time reduced to less than 24 hours.
- The draught of the port of Santos is considered the second most critical infrastructure bottleneck in São Paulo.
- The increase in the size of ships that operate in the Port of Santos and the limited berth draught impedes ships from leaving fully loaded.
- Currently ships with greater capacity are loaded with approximately 62,000 tons. New ships have an 80,000 ton capacity; however the use of total ship capacity is impossible in Santos due to the limited draught.

10. Logistical Aspects – Modal Choice

- The railway is not currently a viable alternative to road transport either in Brazil or in São Paulo. The only choice is using road transport in order not to pay uncompetitive rail fees.
- Railroad pricing is based on the road mode fee, and not on its own costs, which reduces its competitiveness compared to the road mode.
- Acting as a monopolistic company in its regional markets, rail fees do not constitute an attractive alternative for the development of new businesses, which may need reliable logistics schemes.
- This constitutes the biggest problem faced by the farming-for-export sector, because transport costs represent a large part of total logistics costs (TLC).
- What is worse: the price distortions will continue in the medium and long term because the railroad concessions favor the prevalence of regional monopolies by rail operators.
- Allowing the sale of “Brasil ferrovias,” which encompassed the operation of the largest share of the state railroad lines, to “a.l.l.” also contributed to the

concentration of service railway supply and pointed to the continuation of the above mentioned situation.

11. Logistical Aspects – Contracting of MTO

- The transport of sugar for export does not occur through contracting an intermodal transport operator (MTO), basically due to the low credibility of this type of operator in the commodities market.
- The advantages of utilizing an MTO are related to the improvement and simplification of control systems. Currently, an operator is contracted at the point of origin, another for the railway, and a third at the transfer point.
- The largest use of accredited MTO is in the high value added sectors.
- The existence of scale (volume), regularity, and route coverage are aspects that increase the competitiveness of the railroad.

12. Logistical Aspects in the Transport of Sugar

- Certain relevant logistical aspects relating to the transport of sugar production:
    - Consolidation of products is carried out at the terminal.
    - The loading process takes between 4 and 15 days.
    - The phytosanitary inspections last approximately 4 hours.
    - Freight remains in the terminal about 1 week after completing the customs process.
    - Security measures have increased yet they have not caused considerable increases in time and costs.

13. The Logistics Sector Evaluated by Private Companies

- Companies consider road infrastructure far worse in Brazil than in developed countries to the point of discouraging investment.
- Other logistics cost factors considered far worse than in developed countries:
    - Port operations (time and fees)
    - Transport security conditions
    - Functioning of maritime transport, customs, document procedures and other regulations
- Rail infrastructure is considered deficient and the service provided by operators is considered low in quality.
- Rail has not achieved the planned volumes agreed with the sector.

IV. ELECTRONICS SECTOR

1. Context of the Electronics Sector

- Sector growth follows global tendencies. The boundaries dividing video/audio equipment, personal computers, and telecommunication terminals are bound to disappear. The expectation is that within a few years

these markets will fuse into a larger market consisting of entertainment, education, and communication.

- The devaluation of the dollar in relation to the real constituted the factor that favored sales performance, permitting the drop in costs of inputs used for production and a drop of final consumer price.
- Increased overall consumer purchasing power occurred because of an increase in personal credit, an improved labor market, as well as an increase of real average worker output.
- The continuous fall of interest rates, a stable inflation, the improvement in financing terms, and the replacement of old electronics equipment stimulated the growth of sales of video equipment.

2. Global Markets

Main Destination of Video/Audio Equipment Exports (2005)	
USA	12.1%
ALADI (including Argentina)	73.7%
Argentina	37.7%
Southeast Asia	1.5%
Rest of World	11.9%

Main Origin of Video/Audio Equipment Imports (2005)	
USA	5.5%
ALADI (including Argentina)	6.8%
Argentina	3.3%
European Union	6.2%
Southeast Asia (including China)	80.4%
China	53.5%
Rest of World	3.6%

3. Demand Forecast

- The gross revenue of the electronics sector grew by six percent in the 1st quarter of 2007 in relation to the same period in 2006.
- Exports in dollar terms grew by 12 percent in 2006 with respect to 2005, reflecting the efforts of companies to stay in the international markets, despite the significant valuation of the real to the dollar.
- Exports growth in monetary terms was around three percent.
- The gross revenue of the information technology sector grew by 20 percent in 2006, resulting from the increase of sales of desktops, notebooks and printers.

4. Transport Infrastructure

- Contrary to agricultural and agro industrial products, electronic products are manufactured in a region well served by transport infrastructure.

- The main factories of the sector are located in the Macro-metropolis, comprising the cities of Campinas, São José dos Campos, Santos and Sorocaba, a region that possesses a sound transport infrastructure.
- Santos stands out as the main port alternative, due to its proximity to the industrial pole.
    - The cost of container movement in Santos is around R$680 per FEU;
    - The proximity between Santos and the industrial pole makes the fees charged by other ports not competitive for no fee would compensate the additional land transport costs.
- The time to clear customs for the sector is approximately 4 days. The sector would like to see it drop to 8 hours.

5. Transport Characteristics

- Electronic products are transported in containers.
- Transport distance between factory and the port is approximately 200 km at a cost of R$ 815/FEU.
- Transport between factory and port is by road and takes approximately 6 hours.
- As in other sectors, truck fleets belong to third parties.
- Transport by road guarantees complying with programmed times.
- Losses due to damage and theft during transport are less than one percent.
- Although rail is adequate for transporting containers, its share is insignificant: only one train per day in the State of São Paulo.
- According to the evaluation by executives, rail would be more competitive if fees were reduced by 50 percent or if speeds were increased to be 20 percent faster than trucks.

6. Logistical Aspects of Electronics

- Average stock of inputs and products is 15 days.
    - Deficient infrastructure results in additional costs in stocking, which could be reduced from 15 to 7 days.
- Freight consolidation happens at the factory.
- Loading takes between 3 to 5 days.
- Freight remains at the terminal on average 7 days after clearing customs
- Although the sector considers the customs information system and the tariff system to be efficient, problems remain with document processing.
    - Other document processing problems stem from strikes and worker slowdowns.
- The increase in security of port operations have directly impacted transit times, resulting in larger inventories and costs such as escorting and risk management.

7. The Logistics Sector As Seen by Private Companies

- The companies consider that road infrastructure is worse than in developed countries.
- The sector considers the following as much worse than in developed countries to the point of discouraging investment:
    - Port operations (time, fees)
    - Transport security
    - Customs, international trade procedures and other regulations
    - Airport transportation infrastructure
    - Functioning of land and maritime transport
- Contrary to low value-added sectors, the electronics sector is less impacted by road infrastructure than by other logistics costs.
    - This is also due to the location of the production poles in a region well served by road infrastructure and close to the port.

V. SOYBEAN SECTOR

1. Context of the Soybean Sector

- The US, followed by Brazil, Argentina, and China are the largest producers of soybean and its derivatives.
- The US, China, and Brazil are the world's largest consumers.
- The US, Brazil, and Argentina are the largest exporters and the EU along with China are the largest importers.
- In 2005, soybean cultivation took 23 million hectares, corresponding to 37 precent of the total cultivated area. The production, harvested primarily between the months of March and May, is around 55 million tons (2005), produced primarily in the center-west (56%) and south (25%) regions.

2. Current Production

- According to CONAB, the 2006/07 soybean harvest in Brazil will reach 58 million tons.
- According to EMBRAPA, the soybean agro-industrial complex represents approximately US$ 215 billion per year globally and US$ 30 billion in Brazil.
- Brazil's competitive advantage is linked to its efficient production processes. However; during product distribution transport fees and port costs are high, mainly due to the poor conditions of roads and warehousing infrastructure.
- The sector foresees export growth to Asia and South Asia (India, Pakistan, Sri Lanka, and Bangladesh), the Pacific countries, as well as Europe.

3. Forecasting Demand

- For the following years, high taxes and high logistics costs will decrease the country's competitiveness. Within this scenario, it is likely that exports of

whole grain soybean will increase, thereby harming the national productive chain that could accrue benefits by exporting derivative products with higher value added.

- Population and income growth in developing countries increases demand for vegetable oils for human consumption as well as vegetable protein for animal feed.
- According to estimates, the commerce of whole grain soybean should increase annually at a rate of 2.8 percent, until the 2012/13 harvest.
- The world soybean oil trade should grow at 4 percent and bran at 1.9 percent.
- China will represent 63 percent of the growth of the world whole grain soybean trade until 2012.

4. Transport Infrastructure

- Soybean, as other commodities, is a low-value added product in which transport cost is significant in the product's final cost.
- The sector uses the most efficient modal mix to get its products to the international market.
- Currently the largest bottlenecks are port capacity and deficient road and rail infrastructure.
- The sector demands transport infrastructure improvements and increased supply of rail services.

5. Product Characteristics for Transport

- Soybean sells at approximately US$ 250/t FOB.
- Currently soybean is used mainly for:
    - Export
    - Vegetal oil industry
- Because soybean is transported in bulk, it adapts well to road, waterway, and rail transport.
- The need for a low-cost transport for soybean stems from the long distance between the port and the agricultural frontier, located in the states of Mato Grosso and Goiás.

6. Transport Characteristics

- Although soybean is considered to have the ideal characteristics for rail transport (i.e., bulky and lengthy trips), road transport dominates with a 50 percent modal share, followed by rail and waterway with 40 percent and 10 percent, respectively.
- Transport is outsourced to truck fleets that usually deliver on time
- Average transport cost is R$ 0.10 /t/km, and the least-cost modal mix is always used.
- 3 day is the average time between leaving the factory and reaching the port.

    - There is no clear relationship between travel time and the competitiveness of a mode
- Total logistics cost is 25 percent of FOB cost, and 80 percent of this cost is land transport.
- Losses in transit are less than one percent (0.25% due to transfers).

7. Port Choice

- Santos is the most utilized port for soybean exports (48%):
    - Average port cost is R$25/t
    - Port competitiveness depends more on land logistics than on port costs
    - Other main export ports are also important:
        - Santarém and Ponta da Madeira in the north/northeast region
        - Paranaguá and Rio Grande in the southern region
- The advance of the agricultural frontier towards the north is increasing soybean exports through Santarém (PA) and Ponta da Madeira (MA).

8. Logistical Aspects of Soybean Flows

- Soybean sector logistics are hurt by low transport infrastructure coverage and quality
- The main logistics problems pointed out by the sector:
    - Low port capacity
    - Insufficient land infrastructure
    - Deficient waterway infrastructure
    - Lack of adequate regulatory frameworks
    - Customs is not a problem given that dispatch is carried out beforehand

9. The Logistics Sector Evaluated by Private Companies

- Private companies consider the road infrastructure and transport safety far worse than in developed countries to the point of discouraging investment
- Other logistics factors considered far worse than in the developed countries:
    - Port operation (time and fee)
    - Functioning of maritime transport

ANNEX 4: ENERGY AND EMISSIONS

Freight transport can have a significant impact on the environment, principally by consuming energy and emitting local and global pollutants[46] during operation.[47] The transport sector in Brazil was responsible for about 31 percent of all energy consumed and CO^2 emissions in 2007, with road-based modes contributing more than 90 percent of this share (2008 National Energy Balance, Brazilian Ministry of Mines and Energy). Freight represents roughly one-half of transport's total energy use and related emissions based on PNLT estimates of fuel consumption by aircraft, roadway, railway, and waterway vehicles. Brazil is a world leader in the production and use of bio-fuels, particularly for light-duty passenger vehicles and increasingly for other modes in the name of environmental sustainability and energy security.

The following major trends in freight transport are drivers of energy use and emissions in the sector:

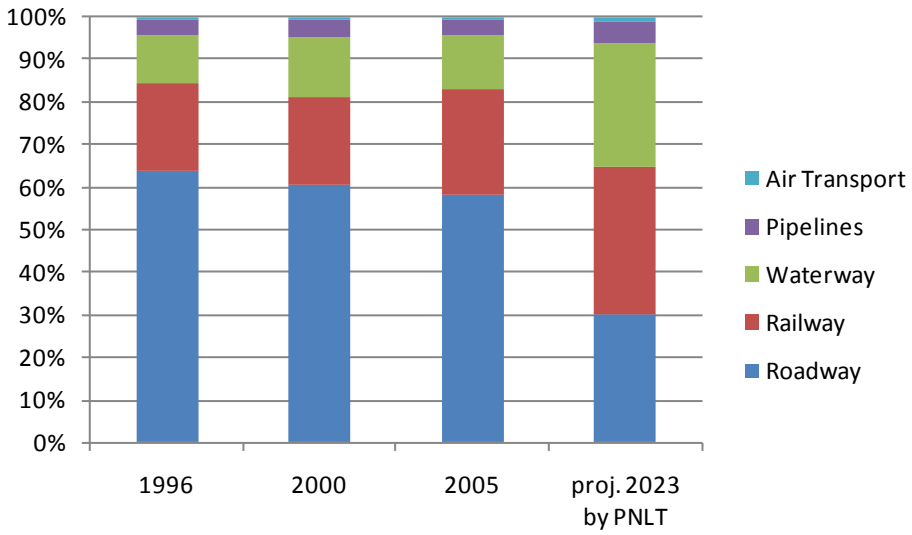
- The **level of freight activity** has been increasing with rising GDP and is expected to continue. A PNLT (2007) projection of net ton-kilometers (tku) shows an increase from about 886 billion in 2005 to 1,607 billion in 2023— an annual growth rate of over 3.3 percent.
- The **mode share** by tku has been dominated by road-based transport but evidence from the past decade suggests that other modes are increasing as their networks become more developed. Figure 1 shows that railways gained over four percent in mode share since 1996, mostly at the expense of road-based transport. This trend is likely to continue but the rate of change will depend on the policies and investment strategies discussed further in Section 6 of the report. The PNLT projects a significant shift towards railway and waterway modes by 2023.
- The efficiency of new aircraft, roadway, railway, waterway vehicles continues to improve on the margin, but overall **fleet efficiency** depends largely on the turnover and maintenance of the fleet. The average age of Brazil's 1.26 million large trucks is more than 18 years (CNT estimate), which is a significant factor in energy consumption, emissions, and even traffic safety.
- The principal transport fuel is diesel, as shown in Figure 2, and will likely continue to be for some time although there have been recent increases in ethanol-alcohol and natural gas. The majority of the diesel fuel used in Brazil is for freight transport and public transport vehicles. The **mix and content of fuels** for freight

[46] The most relevant local air pollutants from internal combustion engines include NOx, SOx, CO, hydrocarbons, and particulate matter. Global air pollution or greenhouse gases from transport are principally made up of carbon dioxide (CO2) as a direct by-product of the fuel combustion that releases energy. In other words, the amount of energy consumed is directly related to the emissions of CO2.

[47] Transport also has significant but relatively smaller environmental impacts during construction and decommissioning, as well as on water, noise, and aesthetics, which are beyond the scope of this study.

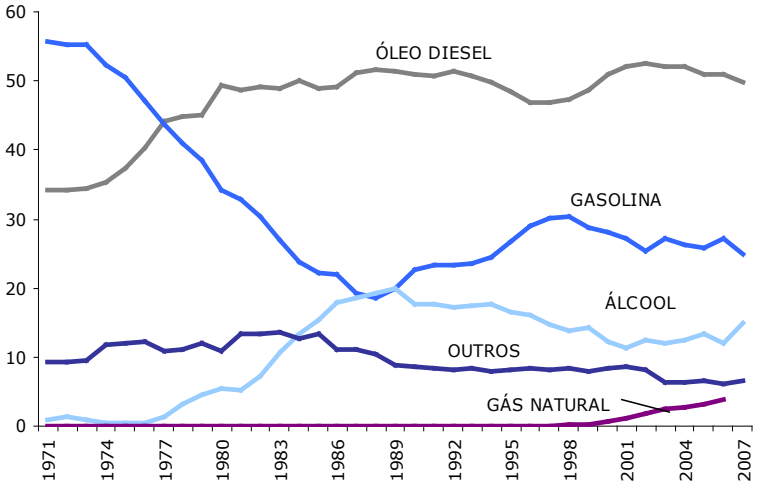
transport has not changed significantly despite the introduction of bio-diesel, low-sulfur diesel, and the electrification of some rail lines.

Figure 1: Actual and Projected Mode Shares by TKU



Sources: GEIPOT and PNLT 2007

Figure 2: Transport Sector Consumption by Fuel Type (% Share)



Source: National Energy Balance, Brazilian Ministry of Mines and Energy

Current conditions and projected trends present a number of opportunities to influence energy use and emissions in the future:

A growing economy will invariably increase the flow of goods, but reducing the gross weight or distance traveled for the same freight would reduce the growth in energy consumption. For example, increasing the infrastructure and service network density in appropriate areas should reduce average travel distances. Also, the tonnage can be reduced with reductions in unnecessary packaging, spoilage, and other waste during the transport of goods.

In general, shifting the heaviest and densest freight currently carried by trucks to rail or waterways would have a significantly positive effect on energy consumption and emissions, all else being equal. For example, the PNLT scenario for 2023 estimates that the consumption of energy in terms of liters of fuel may be roughly the same as in 2005 if the mode shares presented in Figure 1 are realized.[48] Along the same lines, the PNLT estimates significant reductions in CO^2 and NO_x emission assuming the theoretical mode shares in 2023 (as much as 39% less than would have been under the mode split of 2005). Nevertheless, modal energy consumption is a complex function with numerous variables that include: (1) physical characteristics of the mode including vehicle mass, shape, volume, and medium which influence the friction force or resistance[49]; (2) route parameters such as total travel distance, grade, and circuity; (3) operational efficiency including the weight-density of the freight or commodity and the load factor including backhaul and deadheading; and (4) network conditions such as congestion that lead to idling and lost time. For certain low-density, perishable, and high-value goods, transportation by truck will continue to be the most effective by virtue of its vast network and more flexible operations.

Introducing or scaling-up innovative certification and financing programs can accelerate the turnover or modernization of the fleet. Existing initiatives such as the "EconomizAr" Project under the national program to reduce the use of petroleum and natural gas products (known as Conpet within the Ministry of Mines and Energy) have demonstrated the potential for fleet modernization programs and there is industry support for expanding such initiatives with financial incentives or mechanisms. One good example of a voluntary fleet efficiency program is the U.S. EPA SmartWay Transport Partnership,[50] which certifies vehicles (including tractors and trailers and other modes), shipper, carriers, truck facilities, and logistics companies that meet certain energy efficiency standards. It also provides technical assistance and low-cost financing to smaller truck operators with limited access to credit for cost-effective vehicle improvements such as those listed in Figure 3. The fuel savings are used to pay back the amortized investment loan.

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[48] The projected energy savings from modal rebalancing is generally consistent with finding from other studies. For example, the National Waterways Foundation estimates that, all else being equal, 1000 tons can be transported a distance of 1 kilometer using 15 liters of fuel by trucks, 6 liters of fuel by rail, or 4 liters of fuel by water vessel.

[49] For example, the rolling resistance of a steel wheel on a steel rail is typically much less than that of a rubber-tire vehicle on a road surface. The aerodynamic drag on a train of attached cars is also much less than the same freight on separate trucks.

[50] For more information, see http://www.epa.gov/smartway/

Urban freight management strategies will be increasingly important as the cities continue to grow and people desire more goods and services. Many large cities restrict freight movements by area, time of day, or type of vehicle to minimize the traffic congestion. In São Paulo, only special goods vehicle that have been inspected, VUC (*veículo urbano de carga*), are allowed to enter the city center for deliveries during certain hours of the day. Ongoing studies are also analyzing the possibility of improving the distribution network by constructing intermodal facilities and logistics platforms in the periphery of the city.

Alternative fuels and electrification of vehicles, where appropriate, may further reduce energy consumption depending on the production process and energy source. The increased use of bio-fuels in Brazil is generally advantageous considering the scale, production process, and raw materials involved but should be carefully analyzed for cost-effectiveness and sustainability. The electrification of certain light and medium-duty truck and rail vehicles may be beneficial if the new energy required is largely produced from clean or renewable sources.

Figure 3: Sample SmartWay Fuel-Saving and Emission-Reducing Truck Technologies

Technology and Description	***Benefits***	***Approximate Cost (USD)***
Idle Reduction Device **- Auxiliary Power Unit or Generator Set** Small diesel-powered generator mounted outside the cab that provides heat, air-conditioning, and electrical power to run appliances.	Approx. 8 percent fuel savings assuming 2,400 hours of idling per year. Additional reduction in engine wear-and-tear.	$6,000-$8,500
Aluminum Wheels for Single Wide Tires Traditional dual tires are replaced with one single wide tire and aluminum wheel. Can be applied to all tractor and trailer tire positions except for the steer tires.	Approx. 4 percent fuel savings	$5,600
Trailer Aerodynamics Fairings added to the front and underside of the trailer to reduce drag.	Approx. 5 percent fuel savings	$2,400
Emission Control Device A device added to the tractor's exhaust system to reduce the emission of particulate matter and other pollution.	Approx. 20-50 percent reduction in particulate matter	$ 6,000

BIBLIOGRAPHY

Agência Nacional de Transportes Terrestres (ANTT). 2006. "Evolução Recente do Transporte Ferroviário." Brasilia

Agência Porto. 2006. "Porto de Santos: Supera Desafios em Curto Prazo." Accessed on 1 May 2008 from http://www.agenciaportoonline.com.br.

Amos, Paul. 2007. "Responding to Global Logistics Trends with a National Logistics Strategy." Presented at the NESDB Conference, Bangkok. World Bank.

ANTAQ, 2007. Agência Nacional de Transportes Aquaviários. Official Statistics. July 10 2008. http://www.antaq.gov.br

ANTF. "Railway Integration Technical Assistance Plan." Prepared by Transportation Technology Center, Inc., and Railinc. Report. Pueblo, CO.

"Produção das ferrovias dobra desde o início das concessões". Press Release. Brasilia, March 2008

ANTP, IPEA, and DETATRAN. 2006. "Projeto Impactos Sociais e Econômicos dos Acidentes de Trânsito nas Rodovias Brasileiras: Sumário Final." Presented by Iêda Lima on 3 October 2006 at a PAHO Conference.

Arnold, John. 2006. "Best Practices in Management of International Trade Corridors." Transport Papers (TP-13/December), World Bank, Washington, D.C.

Associação Nacional de Transporte Ferroviário. 2006. Background report

Association of American Railroads. 2006. Background report

Australian Government. 2006. "Demand Projections for AusLink Non-Urban Corridors: Methodology and Projections." Working Paper 66, Bureau of Transport and Regional Economics, Canberra.

2003. "Australian Logistics Industry Strategy: Implementation Report." Prepared by the Australian Logistics Council, Canberra.

2001. "Logistics in Australia: A Preliminary Analysis." Prepared by the Bureau of Transport Economics, Canberra.

Australian Industry Steering Committee of the Freight Transport Logistics Industry Action Agenda. 2002. "Freight Logistics in Australia: An Agenda for Action."

Balau, Jose A. 2008. "Portos: em busca de solucoes para o setor. A expansao e a modernizacao do Setor Portuario. A vissao do Armador.

Banister, David and Dominic Stead. "Reducing Transport Intensity." Presented at the STELLA FG4 Workshop on May 3&4, 2002.

Barbero, José A. 2006. "El Banco Mundial y los Puertos en America Latina." Presented at the *Reunión Extraordinaria de la Comisión Interamericana de Puertos* in Algeciras, Spain.

Batista, Eliezer and Renato Casali Pavan. 2007. "Projeto Brasil Competitivo: Adequação da Logística e da Infra-estrutura do Transporte de Cargas à Competividade Internacional." Macrologistica. Rio de Janeiro.

Batista, Eliezer and Renato Paván. 2005. *A Logística do Agronegócio de Hoje e seu Futuro – Uma Visão Global do Brasil.* Macrologistica. Rio de Janeiro.

Booz | Allen | Hamilton. 2002. "Contract Logistics in Brazil." Prepared by Leticia Costa, et al. São Paulo.

Branco, Adriano Murgel *et ali.* 2006. *Alcooduto Conchas-Paulinea-Porto. Analise de Diretrizes de Tracado e de Pre-viabilidade.* Secretaria dos Transportes do Estado de São Paulo and União da Agroindustria Canavieira de São Paulo.

CNT. 2007. "Pesquisa Rodoviária 2007." Accessed on 1 April 2008 from http://www.cnt.org.br.

2006. "Pesquisa Ferroviária CNT 2006: Relatório Analítico." Accessed on 1 April 2008 from http://www.cnt.org.br.

Commission on Growth and Development. 2008. "The Growth Report: Strategies for Sustained Growth and Inclusive Development." Quote from page. 36

COPPEAD/Centro de Estudos Logisticos. 2006. *Custos Logisticos no Brasil – 2006: Relatorio de Pesquisa Panorama Logistico*. Rio de Janeiro.

Da Costa, Francisco Luiz Baptista. 2007. *O Plano Nacional de Logistica e Transporte – PNLT e os Impactos no PAC e no Comercio Exterior Brasileiro*. Presented at the 4th Fiesp de Logística Seminar. São Paulo.

Davis, Herbert W. 2004. *Logistics Costs and Service.* Accessed on 1 November 2007 from www.establishinc.com.

De Castro, Newton and Ana Beatriz Monteiro. 2007. *Brasil – Analise da Situacao do Setor Portuario.* World Bank, Mimeo. Washington, D.C.

Decker, Claudia and Mildner Stormy, 2005. "A New Geography in International Trade." International Politik: Global Edition.

Demaria, Marjory. 2004. "O Operador de Transporte Multimodal como Fator de Otimização da Logística." MA thesis for the Production and Systems Engineering Program at the Universidade Federal de Santa Catarina, Florianópolis.

De Morais, Marcus Vinícius Pratini. 2007. "Enfim, o Celeiro do Mundo!" In *Custo Brazil Magazine* 8, April/May.

Departamento Nacional de Infra-estrutura de Transportes, background paper

ECLAC. 2007. "Port Statistics: Provisional Report 2001-2006." División de Recursos Naturales e Infraestructura, Unidad de Transporte. Accessed on 2 September 2007 from http://www.eclac.org/transporte/.

2007a. La Actividad y la Gestión de Capacidad Portuaria en América Latina y el Caribe 2006. In *FAL Boletín* 252.

2007b. "Empleo y Infraestructura Portuaria: Un Modelo de Abordaje." In *FAL Boletín* 251.

2007c. "La Actividad y la Gestión de Capacidad Portuaria en América Latina y el Caribe 2006." In *FAL Boletín* 250.

2007d. "Freight Rates, the Maritime Cycle and Transport Capacity in Late 2006." In *FAL Bulletin* 247.

Federal Highway Administration. 2005. "Logistics Costs and U.S. Gross Domestic Product." Prepared by MacroSys Research and Technology, Washington, D.C.

FIESP. 2006. "A Logística dos Corredores de Comércio Internacional." Presented at the Third FIESP Logistics Seminar

2006b. "Pontos Fundamentais para a Indústria na Área da Logística de Transporte de Carga." São Paulo. Presented at the Third FIESP Logistics Seminar.

Fink, Carsten. "Transport Services: Reducing the Barriers to Trade." Washington, D.C: Development Research Group.

Foundation for Intermodal Research & Education (FIRE), 2003. "Rail Short Haul Intermodal Corridor Case Studies: Industry Context and Issues."

Gargett, David. 2005. *Freight Rates and Competitiveness.* Presented at the Grains West Expo 2005. Scarborough Beach, WA.

Goldsmith, Peter and Rodolfo Hirsch. 2006. "The Brazilian Soybean Complex." In *Choices Magazine* Q2. Accessed on 1 September 2007 from http://www.choicesmagazine.org/.

Gonzalez, Julio A., Jose Luis Guasch, and Tomas Serebrisky. 2008. "Improving Logistics Costs for Transportation and Trade Facilitation." Policy Research Working Paper No. 4558. The World Bank. Washington D.C.

Gonzalez, Julio A., Jose Luis Guasch, and Tomas Serebrisky. 2007. "Latin America: High Logistics Costs and Poor Infrastructure for Merchandise Transportation." Paper for Consulta de San Jose, Inter-American Development Bank, Washington, D.C.

Government of Canada. 2005. "Annual Report 2003-2004 Crop Year: Monitoring the Canadian Grain Handling and Transportation System." Report by Quorum Corporation, Edmonton.

Governo da Bahia. 2003. "Bahia 2020: O Futuro a Gente Faz, Plano Estratégico da Bahia." Salvador: Secretaría do Planejamento.

Guasch, Jose Luis. 2002. "Logistics Costs and Their Impact and Determinants in Latin America and

The Caribbean." World Bank, Washington D.C.

Guasch, Jose Luis and Joseph Kogan. 2005. "Inventories and Logistic Costs in Developing Countries: Levels and Determinants, a Red Flag on Competitiveness and Growth in Revista de la Competencia y la Propriedad Intelectual." *Revista de la Competencia y la Propiedad Intelectual* 1 (1).

Hummels, David. 2007. "Transportation Costs and International Trade in the Second Era of Globalization." Journal of Economic Perspectives. Vol. 21. No. 3, pp. 131-154.

Industry Canada. 2006. "Logistics and Supply Chain Management (SCM): Key Performance Indicators (KPI) Analysis, A Canada/United States Perspective." Report by Supply Chain and Logistics Canada, Markham.

2006a. "Logistics and Supply Chain Management (SCM): Key Performance Indicators (KPI) Analysis, A Canada/United States Manufacturing Perspective." Report by Supply Chain and Logistics Canada, Markham.

Instituto Mexicano para la Competitividad A.C. 2006. *Logistica y Transporte.* Presented at the Situacion de La Competitividad de Mexico: Punto de Inflexion.

Inter-American Development Bank. 2006. "Railway Integration Technical Assistance Plan (RITAP)." Report by ANTF and TTCI. Washington, D.C.

International Road Transport Union. 2007.
http://www.iru.org/index/en_policy_slides_transport_infrastructure?highlight=Comparison%20of%20Transport%20Infrastructure%20Investment%20as%20%%20of%20GDP

IPEA and ANTP. 2003. "Impactos Sociais e Econômicos dos Acidentes de Trânsito nas Aglomerações Urbanas Brasileiras: Relatório Executivo." Brasília.

Jan De Nul Group. 2007. "World Bank: Performance Based Contracting in the Dredging Industry." Report by Carl Heiremans. Luxembourg.

Jornal dos Transportes. Salvador, Bahia. April 2008. No. 193

Lima, Ieda. 2006. *Projeto Impacto Sociais e Economicos dos Acidentes de Transito nas Rodovias Brasileiras.* Prepared by Ipea, ANTP e DENATRAN and presented at the OPAS. Brasilia, D.F.

Mahoney, John H. 1985. *Intermodal Freight Transportation.* Westport: ENO Foundation for Transportation.

Market Solutions, LLC. 2006. "A Rail Transportation Action Agenda for Soybean Producers." Presented at the Iowa Soybean Association by Mark D. Newman.

Marques, Mauro. 2006. "Balanço Positivo na CODESP." In *Trade and Transport* 106.

Ministério dos Transportes. 2007. "Plano Nacional de Logística e Transportes." Brasília.

Ministério de Transportes. "Projetos e Desenvolvimento Portuário Brasileiro." Report prepared by Paulo de Tarso Carneiro.

Monteiro, Solange.2006. "Busca-se Um Líder." In *América Economia Magazine.* Accessed on 1 May 2008 from http://www.americaeconomia.com.br.

Nascimbeni, Ricardo. 2006. "A Logística dos Corredores de Comércio Internacional." Presented at the Third FIESP Logistics Seminar.

Nunes, Andres de Oliveira. 2007. "Analise da Oferta de Transporte Multimodal de Cargas no Brasil: Uma Aplicação da teoria dos Custos de Transação." Masters Thesis. Universidade de Brasília

Olowolayemo, Deen and Ethel Mitchell. 2007. *Grain Transportation Report.* United States Department of Agriculture / Agricultural Marketing Service.

Porto de Santos. "Porto de Santos: Na Rota dos Melhores Negócios." Prepared by CODESP, Santos.

PROCOMEX. 2006. "Racionalização do Despacho e Movimentação de Cargas e Navios. Presented on April 27. São Paulo.

Protasio, Paulo Manoel Lenz Cesar. "Infra-estrutura: Logística Diante do Desafio do Agronegócio Brasileiro." Presented at the 5th ABAG Congress in São Paulo.

Quintella, Wilson. 2008. "Memorias do Brasil Grande". Editora Saraiva.

Railway Association of Canada. 2006. "Policy Directions 2005-2006." Ottawa.

Rebelo, Jorge and Bernardo Alvim. 2007. "Logistics Costs in Brazil – How to Reduce the 'Custo Brazil'"? Vol I-III. World Bank, Washington, D.C.

Resende, Paulo Tarso. 2005. *Macrologistica no Transporte Modal*. Fundação Dom Cabral. Mimeo.

Resor, Randolph, 2004. "Short Haul Intermodal Service: Can Rail Compete with Truck?" Presented at the Transportation Research Board Alternative Freight Capacity Workshop on January 11, 2004, Zeta-Tech Associates Inc.

Ribeiro, Eng. Elcio S. 2006. “A Logística de Exportação do Agronegócio.” Presented at the Third FIESP Logistics Seminar.

Salin, Delmy L., Jessica E. Faust and Deen Olowolayemo. 2007. *Brazil Soybean Transportation.* United States Department of Agriculture / Agricultural Marketing Service.

Salin, Delmy L. and Jessica E. Faust. 2006. *Brazil Soybean Transportation Guide*. United States Department of Agriculture / Agricultural Marketing Service.

Sánchez, Ricardo J. 2007. “Empleo e Infraestuctura Portuaria: Un Modelo de Abordaje.” In *Boletín FAL* 251.

_____, and Maricel Ulloa. 2007. “The Seaborne Container Trade in Latin America and the Caribbean 2006.” In *Bulletin FAL* 250.

_____. 2004. “Puertos y Transporte Marítimo en América Latina y Caribe: Un Análisis de Su Desempeño Reciente.” CEPAL, Santiago.

Secretaria dos Transportes de São Paulo. 2005. “Boletim Estadístico da Secretaria dos Transportes do Estado de São Paulo.”

Secretaria dos Transportes de São Paulo. “Plano Diretor de Desenvolvimento dos Transportes (PDDT) Vivo 2000/2020: O Clic Sul e Questões Correlatas,” Milton Xavier, ed. São Paulo.

_____. “Baixada Santista: Carteira de Projetos, Agenda Estratégica.” Prepared by SEADE.

Siena Consultoria e Planejamento LTDA. 2007. “Logistics in the State of Bahia.” Prepared by Ivan Barbosa.

SINDOPERJ. 2006. “O Porto do Rio no Século XXI: Revitalização do Porto do Rio de Janeiro.” Rio de Janeiro.

Torres, Carmen Lígia. 2006. “O Intermodal a Passos Largos.” In *Valor Setorial: Ferrovias Magazine.*

Transport Canada. 2009. “Gateways and Trade Corridors: Evaluating Performance – System-Wide.” Presented at the World Bank by Louis Paul Tardif, Chief Economist in March 2009.

_____. 2004. “Literature Review on Intermodal Freight Transportation.” Policy Research Branch, Strategic Policy Directorate Policy Group, Ottawa.

US Council of Supply Chain Management Professionals, US Council Journal, Pub 1-02

USDA. 2008. “Brazil Soybean Transportation Guide.” http://www.ams.usda.gov/AMSv1.0/

_____. 2007. “Record 2006/07 Soybean Crop in Brazil.” In *Commodity Intelligence Report*.

_____. 2004. Agricultural Transportation: An Overview." Accessed on 15 April 2008 from http://www.ams.usda.gov.

Wilson, Rosalyn. 2005. *Security Report Card – Not Making the Grade.* Presented in the 16th Annual State of Logisitcs. Washington, DC.

Wisner, Robert. 2002. *Brazil's Soybean Production Potential and Competitive Position vs. U.S.* Accessed on 1 November 2007 from http://www.econ.iastate.edu/faculty/wisner.

World Bank. 2008. Cost of Doing Business 2009

_____. 2008. *Brazil: Evaluating the Macroeconomic and Distributional Impacts of Lowering Transportation Costs* (forthcoming). Washington, D.C.

_____. 2007. *Brazil How to Revitalize Infrastructure Investments in Brazil.* Report 36624-BR, Vol. I and II. Washington, D.C.

_____. 2007a. "Summary of Exporting Sector Surveys." Prepared by Bernardo Alvim and Milton Xavier. Washington, D.C.

_____. 2007b. *Connecting to Compete: Trade Logistics in the Global Economy.* Washington, D.C.: World Bank.

_____. 2006. "Argentina: The Challenge of Reducing Logistics Costs." Report 36606-AR. Washington, D.C.

_____. 2006a. "Infraestructura Logística y de Calidad para la Competitividad de Colombia." Report 35061-CO. Washington, D.C.

_____. 2005. International Comparison Program.

_____. 2005. Infrastructure in Latin America and the Caribbean; Recent Developments and Key Challenges. Report 32640-LCR. Washington D.C.

_____. 2004. "Brazil: Equitable, Competitive, Sustainable. Contributions for Debate.

_____. 2001. "Trade and Transport Facilitation: A Toolkit for Audit, Analysis, and Remedial Action." Report by John Raven for the Global Facilitation Partnership for Transportation and Trade.

_____. 2001a. "Privatization and Regulatory Reform in Brazil: The Case of Freight Railways."

Prepared by Antonio Estache, Andrea Goldstein, Russell Pittman. Washington, D.C.

_____. 2001b. "A Reforma Portuária Brasileira." Report prepared by GEIPOT. Washington, D.C

www.ipeadata.gob.br

www.worldbank.org/lpi

www.vale.com/vale_us/cgi/cgilua.exe/sys/start.htm?sid=60

www.transpetro.com.br

www.talc.com.au

www.coldchaincentre.com.au

www.edc.ca/english/docs/speeches/2007/mediaroom_12565.htm