SCENARIOS OF THE NORTHWEST TRANSPORT CORRIDOR FOR THE BRAZILIAN CENTRE WEST AGRICULTURAL HARVEST DISTRIBUTION

Elton Fernandes, PhD., PEP/COPPE/UFRJ, elton@pep.ufrj.br

Cesar das Neves, D.Phil., DEI/POLI/UFRJ, cdn@poli.ufrj.br

Marcia Estrada Braga, D.Sc., PEP/COPPE/UFRJ, estrada@pet.coppe.ufrj.br

Eliane Gomes de Brito, M.Sc., PET/COPPE/UFRJ, elianebrito@pet.coppe.ufrj.br

Marcela Rubert, M.Sc., PET/COPPE/UFRJ, mrubert@pet.coppe.ufrj.br

Vinícia Gomes Cardozo, M.Sc. PET/COPPE/UFRJ, vinicia@pet.coppe.ufrj.br

ABSTRACT

This paper discusses the distribution chain of the centre west agricultural harvest. It analyses the possible transport savings in the centre west agricultural harvest distribution throughout fluvial and ocean ports located in the Brazilian North Region. Therefore it considers ongoing transport infrastructure projects of the so called Northwest Transport Corridor. Actually the region exports its production throughout almost all the Brazilian main ports. The methodology consists of the analysis of existing and projected routes for the distribution of the agricultural harvest, as well as the analysis and design of Actual Scenarios (2008) and the, 2015, 2020, 2025 and 2030 Scenarios. The five scenarios were analyzed under two perspectives: the first without interventions and the second with infrastructure interventions in the Corridor. The transport system service level variables investigated were: transport costs, transport flow and emission of CO_2. The discussions show possible transport impacts, identify distribution routes, such as the Teles Pires-Tapajos waterway, and the Vilhena/Uruaçu railway, as well as the most viable options for cost savings, and some minors environment impacts.

Keywords: logistics, transportation and agricultural harvest.

INTRODUCTION

Brazil is among the world greater soybean producers, ranking currently second position. The world-wide production in harvest 2007/2008 was of about 221 million tons, being the Brazilian 27% of this total. Official agencies esteem approximately that for the 2016/2017 world-wide harvest there will be an increase of 23%. This will be concentrated in the three larger producers of grain: Argentina, Brazil and United States, that together will represent 83% (Map, 2009).

More specifically this paper approaches the multimodal distribution of agricultural products from the north of the Mato Grosso State and east of the Rondônia State. This area is considered the new Brazilian agricultural border. The corridor Influence Area is located in the Brazilian centre west region. This region exports its production trough almost all the Brazilian main ports. As the production region is far from the main exporting ports, it is noted high logistic costs. Additionally, the most representative ports also operate other types of loads and are located in transport congested areas. The congestion problems are aggravated by access deficiencies and port infrastructure poor capacity.

Figure 1 presents this study framework. First it is done the Influence Area delimitation and characterization, considering the Northwest Corridor. In this stage it was verified the region agricultural production and its main (flows) destinations. The soybean, as the region main agricultural product, heads the study for the current distribution chain characterization. The main obstacles to the distribution were identified. The second stage concerns in the definition of the existing Transport Corridors used by producers and in the identification of projects that fully or partially influence the region harvest distribution. Following, the scenarios were defined under the two perspectives: without interventions in the infrastructure of transports and considering interventions in the corridors. Finally, the main results of the study and the conclusions were pointed.

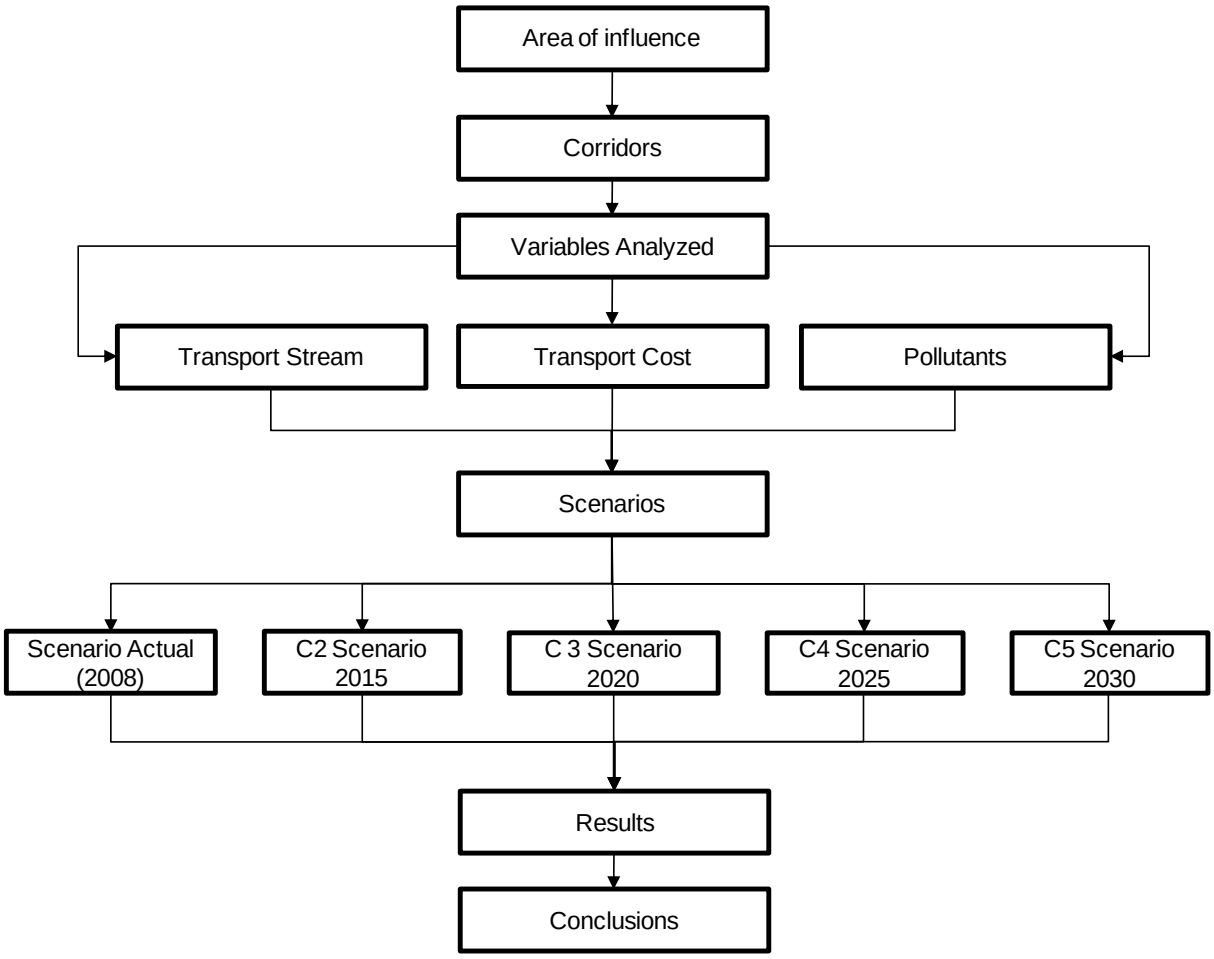

Figure 1 – Framework of the study

CORRIDOR INFLUENCE AREA CHARACTERIZATION

The delimitation of the Influence Area was based on the Northwest Corridor multimodal transport system compounded by highways BR-364, BR-163 and MT-235, and by the Madeira waterway. This area was defined from analyzes of the region harvest production value, being the soybean the dominant product. The transport infrastructure used in the distribution of the agricultural harvest was also considered. The Influence Area includes 119 cities, which were grouped in four centroids: Sorriso - MT (R1), Sapezal - MT (R2), Vilhena - RO (R3) and Porto Velho - RO (R4) (figure 2).

The Northwest Corridor Influence Area has its vocation directed to agricultural and cattle activities, with prominence to the first sector. The region presents low population density, with areas of high Human Development Index - IDH, however it still presents strong income inequalities.

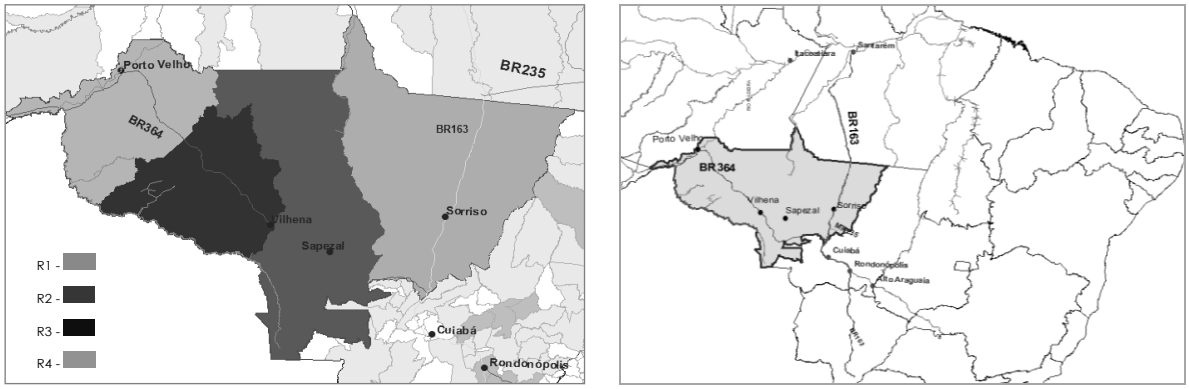

Figure 2 - The Influence Area of the Northwest Corridor

Main agricultural products are: soybean, maize and sugar. Figure 3 shows the force of soybean in the region, it is the main culture in the Influence Area and it has strong prominence in the national economy. Based on that, its distribution headed the Northwest Corridor study and the definition of its Influence Area.

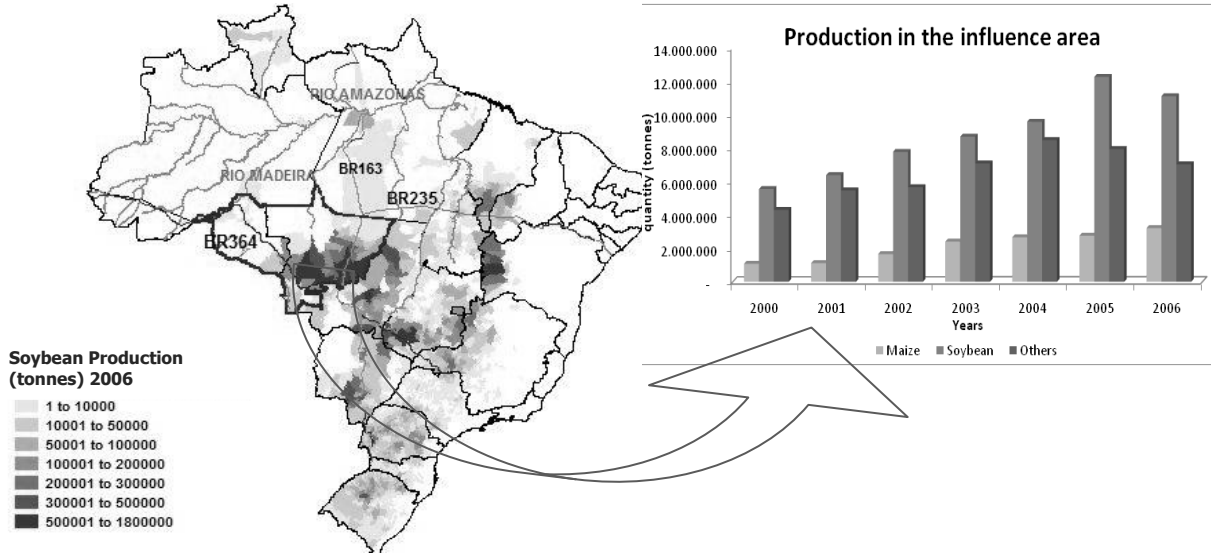

Figure 3 - Amount of grains produced in the Influence Area

Exports are the main soybean destination. The perspectives for its consumption are increasing, despite the world-wide crisis (Portal do Agronegócio, 2009). The general expectations are that exportations of soybean and maize will be increasing, being the maize rate of growth expected to be superior of the soybean one by the incorporation of the Arab market.

Influence Area distribution chain of the agricultural production

The production of the Influence Area is exported through almost all the Brazilian main ports, with predominance of the south and southeastern ports. Figure 4 presents the main leaving points of production in the period of January to July 2009. One observes that 69% of the total exported had left for the southeastern ports, 17% for the North ports and 13% for the South ports.

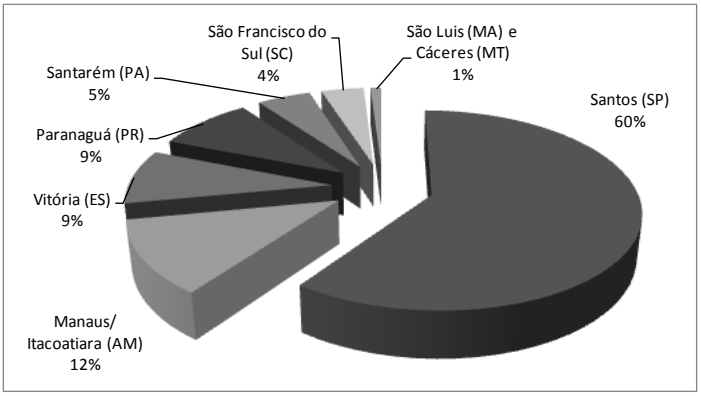

Figure 4 - Main exportation ports of the Mato Grosso (MT) and Rondônia (RO) harvest.

Source: IMEA (2009).

Together, southeastern and south ports have more than 80% of the Mato Grosso and Rondônia agricultural production exports. However, these are distant from the centre west producing sources, what increases the transport cost and, consequently, lower their competitiveness. Additionally, by the time of agricultural harvest distribution great congestions occur. This may be attributed to: high competition from closely harvest production, deficiencies of port accesses, and also short port capacities.

The centre west production distribution throughout the Northwest Corridor presents great advantages in relation to others Corridors, either for using a waterway, more appropriate for low value added products, either for reducing the traffic pressure upon the Brazilian Southeastern Region transport facilities. Beyond these advantages, the main economic chances of the Influence Area are:

1. Increasing agribusiness opportunities, with possibilities of vertical integration in the chain of the soybean (oil for feeding and biofuel, bran, production of rations with soybean bran and maize), of the sugar cane (ethanol), of cotton seed and, in a minor scale, improvement of other products of the Influence Area (manioc, rice, etc.).

2. Optimization of energy sources in the key industry. The energy will become more available, with the two news hydro-electric power stations under construction, and the energy transmission costs will decrease.

3. The environmental impact of mineral extraction will decrease. The better supply of energy sources can clean the polluting processes. And also the gains with the return freight of several other goods.

4. South American integration through a new connection of trade transport to the countries Brazil, Peru and Bolivia, in order to create more one way between Pacific-Atlantic Oceans.

5. The inevitable discovery of the possibilities of the ecotourism, potentiated with the great unknown biodiversity in the unexplored nature.

The Corridor Northwest competes with other corridors for the distribution of the production of the Influence Area. Despite the Corridor offer of an estimated cost economy from 25 to 30% in relation to others corridors, only 17% of the 2009 production was transported through the northwest corridor. This signalizes that many difficulties need to be overcome.

The absence of a clear investment policy in the distribution corridor of the centre west region generates uncertainties for the producers. These uncertainties make it difficult for producer to have a trustworthy expectation of the freight value. So they are very conservative and resistant to put privet capital in new ventures.

The soybean producers don't have clear in mind about the public works that could be done in order to improve the flow off in the middle-west corridor. And it is a government owned bad planning. In the other hand the producers cannot create reliable scenariosry in the projection of freight costs.

Multimodal transport in Brazil still finds many difficulties, which increase operational costs. The excessive regulation to intermodal movement and exportations affect all transport systems. In this context, the Multimodal Northwest Corridor is the beginning of a integrated solution.

CORRIDORS IN THE INFLUENCE AREA

As shown above, the distribution of the agricultural production of the Northwest Corridor influence area is carried through by almost all the exportation corridors. In this stage of the work the exportation corridors were characterized for better comparison of the scenarios. Below one brief description of the Corridors is presented.

The Northwest Corridor

This corridor is composed of two stretches: the first undertaken by highway and the second conducted by waterway that access to ports located in the north of the country. The amount of soybean of Mato Grosso transported through for this Corridor in the 2008 was of 1,297,000 t. This itinerary approximately provides an average economy of US$ 25/t in relation to the traditional routes (South or Southeastern) for the distribution of the soybean of the northwest of Mato Grosso. (ANTAQ, 2009).

Center-Amazonian Corridor

This corridor is composed only by highway that access to the Santarém Port located in the north of the country. On account of the excessive rains in the region, this corridor is only used during four months of the year. The amount of soybean of Mato Grosso exported through the Port of Santarém in 2008 was of 842,000 t (ANTAQ, 2009), where the volume carried for this corridor was 300,000 t, the rest come from the Northwest Corridor. The interdependence of Santarém Port maintained through the northwest corridor and Center-Amazonian leads to consider these two corridors as only one.

Center-North Corridor

This corridor does not attract from the influence area of the Northwest Corridor. It uses as export Ponta Madeira e Itaqui Ports. It is also a multimodal corridor including road, waterway and railway. According to ANTAQ (2009), the amount of soybean from Mato Grosso transported in 2008 through this corridor was of 93,000 t.

Southeastern Corridor

This corridor makes use of two options of routes: highway and road-railway with access to the southeastern port. This has been the main corridor of exportation of soybean of Mato Grosso. The amount of soybean of Mato Grosso transported this Corridor in 2008 was of 4,187,000 t. (ANTAQ, 2009).

South Corridor

The South Corridor makes use of four different options, combining highways and railway. The amount of soybean transported for this corridor in 2008 was of 548,000 t (ANTAQ, 2009). Until recently, this corridor was the main corridor of exportation of the soybean of Mato Grosso, but problems of congestion in the roads and limit of capacity of the Southern ports caused a reduction of that amount.

Center-East Corridor

This corridor is compost of the two logistic options: the first uses exclusively the highway and the second uses the highway and railway. The amount of soybean of Mato Grosso drained for this corridor in 2008 was of 1,030,000 t (ANTAQ, 2009).

The bibliographical research on the corridors of transports shows that the Corridor Northwest is the option of transport with lesser operational cost. This Corridor provides an average economy of US$ 25/t in relation to the traditional routes for the distribution of the soybean of the northwest of Mato Grosso.

CASE STUDY

Premises for analysis of the scenarios

The scenario analysis pointed to the competitiveness of the Northwest Corridor against the others alternatives in the Influence Area. The scenarios represent two views of analysis: the current situation (without interventions) and the interventions in the transport corridors, foreseen in the current program of government planning (Program to Accelerate Growth).

The scenarios can simulate a situation in future, based on probability models, relative to the logistic operations about the ways and available terminal disposal. The formations laws of agribusiness production demand imply logistic procedures that represent the performance of the silos in grains overflow.

The analysis must, before the scenarios definition, study the projection of the agricultural soybean and maize growth. This projection is based in information of Brazilian official agencies such as the Ministério da Agricultura, Pecuária e Abastecimento (MAPA). These studies analyze the perspectives of evolution of the production and competitiveness of the Brazilian soybean in the international market.

For the projections we used regression models. Input variables of the model are: the land use, production and productivity, and its historical development. All applied in the influence area and divided by centroids.

The percentage of cultivable area in relation to the total area of each centroid was calculated in the period observed between 1990 and 2006. The regression model was applied to predict the years 2015, 2020, 2025 and 2030. The adopted maximum limit of this percentage was set at 25%. The Sorriso centroid shows the change from 1990 to 2006 almost six times higher, due to expansion of agriculture in the midwest and north of the country. Sapezal

centroid increased approximately three times. The other centroids did not significant increase.

The prediction model was conservative. The production of soybean will have a higher growth until 2033. Maize and sugar cane tend to grow until 2022, becoming constant from this point. The other products will grow less from 2016. The growth of soybean and maize between 1996 and 2006 was around 14% per year. Between 2010 and 2030, the average growth rate will be 4% per year.

Part of production of influence area is transported to ports. Another part is processed and consumed in the country. In structuring the scenarios we assume that 50% of the production of soybeans and maize uses the corridors.

Table 1 shows the prediction results.

Table 1 - Estimated production (maize and soybean)

Prediction	**2008**	**2015**	**2020**	**2025**	**2030**
Production (soybean + maize) in the IA; 1000 t	20.199	40.767	53.978	65.471	68.508
Flow in Corridors (50%), 1000 t	10.099	20.384	26.989	32.735	34.254

LEGEND: IA - Influence Area

Scenarios Framework

The scenarios consider the production projections and the planned interventions in the corridors, according to the methodology shown in Figure 5. The focus “without intervention” represents the current transport system. The focus “with interventions” considers the government investment programs, with respective term of conclusion. The scenarios consider the years 2008, 2015, 2025 and 2030 with their respective interventions.

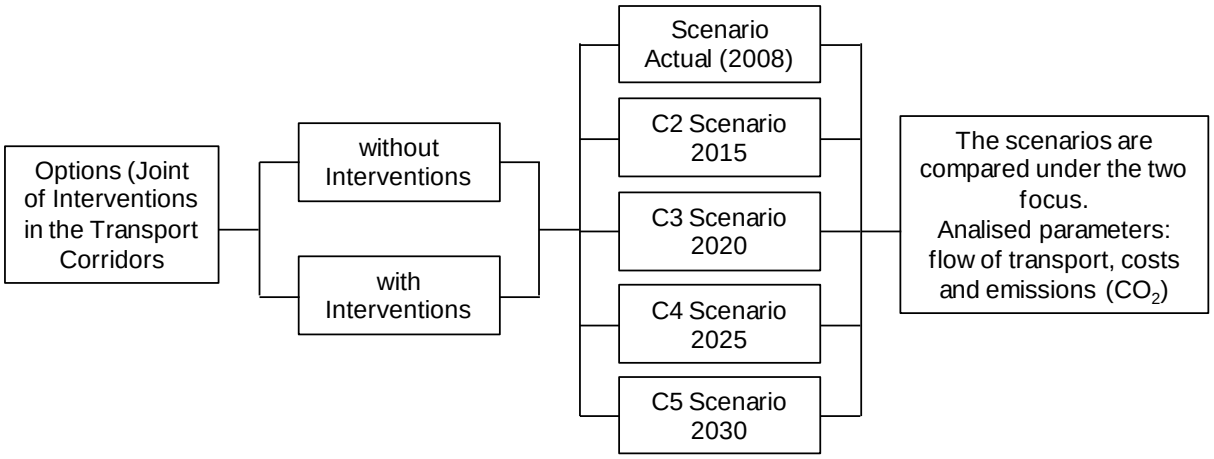

Figure 5 - Evaluation methodology of the scenarios

The parameter investigated is the chain flow of main products in the Influence Area of the Northwest Corridor. The analyzed variables are: flow of transport, transport costs by different modes (transport and storage) and emissions (CO_2).

The considered premises were:

1. The agricultural production increases in Influence Area until 2030. After that the values stabilizes;

2. When the ways and installation capacities of the transport in the South, Southeast and East Ports are being exhausted, part of the shipments is transferred to terminals in Amazônia;

3. The distribution of the Influence Area production is around 50% of the soybean and maize production;

4. The way out points from the Influence Area to the exporting ports are the centroids: Porto Velho, Vilhena, Sapezal and Sorriso.

Table 2 presents the estimated average cost of transport, including all used modalities, transshipment, excluding freight of long distance shipment. The costs were calculated by distances between origin and destinations points and their transport modality. The results were adjusted and validated by some known freight routes.

Table 2 - Estimate of the costs of transports (US$/t) in the corridors

Route	**Modes**	**Cust US$/t)**
Northwest Corridor: IA - Porto Velho - Itacoatiara	Road + Waterways + Port (long course)	80.70
Northwest Corridor: IA - Porto Velho - Santarém	Road + Waterways + Port (long course)	96.50
Central Amazon Corridor: IA - Sorriso - Santarém	Road + Port (long course)	89.00
Southeast Corridor: IA - Rondonópolis - Santos	Road + Port (long course)	110.20
Southeast Corridor: IA - Alto Araguaia - Santos	Road + Rail + Port (long course)	95.30
Southern Corridor: IA – Rondonópolis - Paranaguá	Road + Port (long course)	118.20
Southern Corridor: IA – Maringá - Paranaguá	Road + Rail + Port (long course)	115.10
East Corridor: IA - Uberlândia - Vitória (Tubarão)	Road + Rail + Port (long course)	136.30

LEGEND: IA - Influence Area

The benefits were based on production prospects of the Influence Area for the foreign market. There are benefits that achieve improvements in transport system, such as goods that would benefit by the return freight (fertilizer and fuel).

Actual Scenario - Current events (2008)

The capacity of the Madeira waterway was limited to 3,500,000 t of soybeans and maize, which corresponds an effective utilization of 93% of capacity.

Currently the BR-163 to north seeps about 300,000 t of agricultural commodities. Part of the highway (899 km) is not paved and bridges are made of wood, complicating their use during rainy season.

The remaining outputs of the Influence Area in south and southeast through Paranagua and Santos ports respond for the main exportation route.

C2 Scenario - BR-163 paved (2015)

According to the PAC (2009) the paving of BR-163 (Center-Amazonian Corridor integrated with the Northwest Corridor) is planned for 2010. However, this intervention cannot contribute in the flow of production of the Northwest Corridor due to limited capacity of the Santarem port. Currently the Santarém Port Capacity is the 1,200,000 t, of which 542,000 t come from Porto Velho.

C3 Scenario - Northwest Corridor duplication (2020)

This scenario considers the interventions: paving BR-163; doubling the Porto Velho terminal to 5,800,000 t; increasing capacity of the Itacoatiara terminal to 4,800,000 t; and the Santarém Port of 1,000,000 t. So the BR-163 will carry about 1,400,000 t and the Northwest Corridor (added to the Center-Amazonian Corridor) will reach about 7,200,000 t of grain.

C4 Scenario – Madeira waterway extension (2025)

The extension of Madeira waterway to Vila Bela da Santíssima Trindade city, with the construction of Jirau and Santo Antonio sluice. The navigation of the Madeira waterway will be completely implemented throughout the year. The waterway may attract some 10,600,000 t of grain (ANTAQ, 2009).

C5 Scenario – Tapajós-Teles Pires waterway (2030)

The Tapajós - Teles Pires Waterway stood out among the competitive options for the Northwest Corridor, mainly due the transportation low cost. That potential is estimated around of 5,000,000 t. The estimated freight for this route is US$ 61.3/t and the deadline for operation is until 2023.

The East-West Railway is also a competitive excellent option to Northwest Corridor. With 1,390 km extension it will connect the cities of Vilhena and Uruaçu. The transport capacity is estimated at 5,000,000 t. The estimated freight for this route is US$ 101.7/t.

This scenario still keeps many uncertainties. The Project's comprisement and its necessary investment were not yet completely defined, but their analysis is relevant.

THE SCENARIOS ANALYSIS

The parameters analyses for comparison were: transport flow, transport cost and CO_2 emission. The five scenarios were analyzed under two focuses: without interventions in the transport Corridors and with interventions.

Transport flow by modality

The demand function of transport system is characterized by the variables: level of service (internal to the transport system) and socioeconomic factors (externals). The interaction of these two variables determines the transports flows in the diverse systems. The static storage capacity is defined in terms of departure and arrival cargo flows and shipments.

Figure 6 shows the transport flows by mode for the scenarios. A more balanced transport matrix indicates the best case scenario.

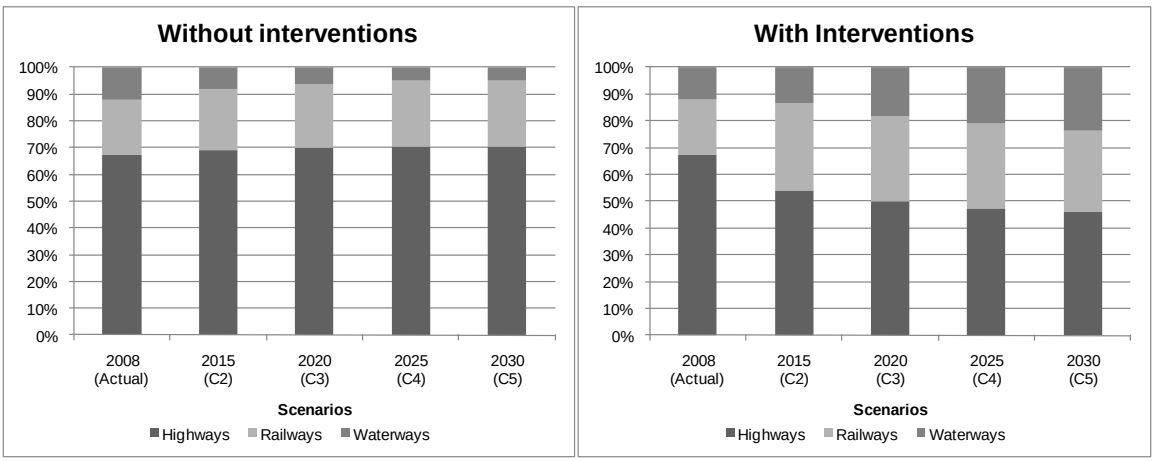

Figure 6 - Transport flows by modality

All the scenarios (without interventions) pointed the deficiencies in the cargo transport matrix. There was an increase of the participation of the road modality, with small expansion of the railway transport and reduction in the waterway modality.

There is a significant improvement on scenarios with interventions. In the C2 Scenario (in the 2015) there is a reduction of participation of the road modality from the 69% to 54%, with increase railroad transport from 23% to 32%. In C3 Scenario (in 2020) will reduce distortions in the transport matrix. The waterway modality wills double its participation until the end of the planning.

In 2030, with all interventions established, there will be a balance in the transport corridors through the use of various routes. The waterway modality will increase to over 20% and road modality will reduce to less than 50%. The rail mode also increases participation. It is a scenario which indicates the balance between modes with outputs for different regions in the Country.

Transport Costs

The reduced cost of travel is a good indicator of the aggregate income generated by the interventions and can be measured in monetary terms (tangible variable). This variable is important for cargo transport of big volumes with low aggregate value. The scenarios were evaluated by the reduction of transport costs by the interventions until exit port.

Figure 7 shows to the comparison of the scenarios for the total and average transport cost since the Influence Area until the exportation ports.

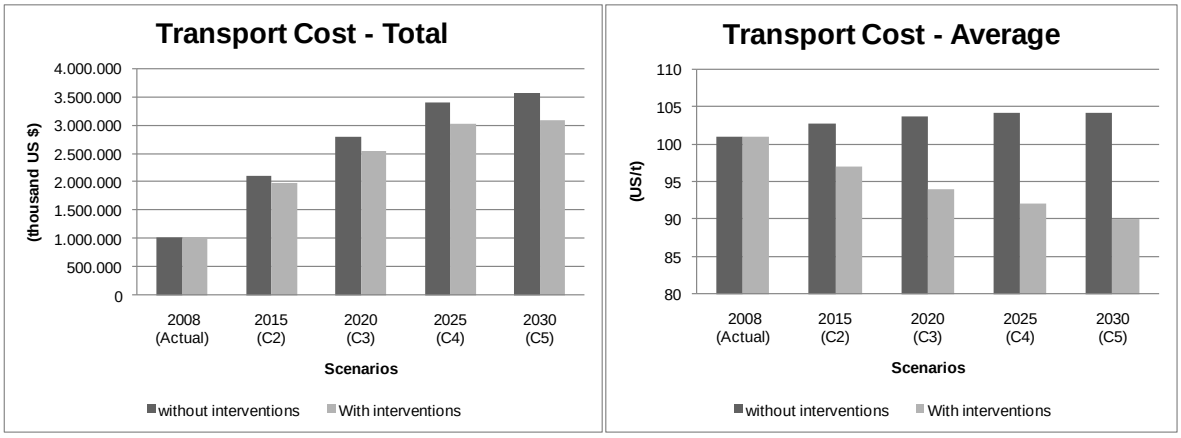

Figure 7 - Transport Cost for the distribution of soybean

The graph above shows a progressive growth in all scenarios without interventions. In your turn the scenarios with interventions shows a significant deceleration.

The impact of the average transport cost is more evident. In the scenario C5 there will be 14% reduction in average cost compared to the Actual Scenario (2008).

The paving of BR-163, under C2 Scenario, may reduce the transportation cost to US$11,400,000 per year in the current scenario. This value is not very significant because of

the limited capacity of the Santarem port and other restrictions. However it is estimated that the highway when ready will reduce approximately 35% of transportation costs.

Scenario C3 will reduce transport costs approximately US$100,000,000 per year. This advantage is due to increased participation of the waterway mode.

The C4 scenario with provided interventions: there will be an economy transport cost of US$100,000,000 per year. In the same scenario with the extension of the Madeira waterway this economy will reach about US$232,000,000 per year.

The Madeira waterway extension should bring benefits to the influence area. In addition to reducing road transport in internals centroids it will allow the expansion of the border with Bolivia. These interventions will add more than 4,000 km of waterways. Estimates indicate approximately more 15,000,000 t to the production of the Influence Area. It becomes necessary to establish that such estimates were not considered in this analysis because the lack of effective integration in Latin America.

Considering all the interventions in 2030 (C5 Scenario), the average transport cost will fall over time. It will be an economy of about US$482,000,000 per year.

The CO_2 Emission

We considered the official sources to estimate the pollutant emission impacts. The Agência Nacional de Transporte Aquaviário - ANTAQ (2009) had used data from the National Waterways Foundation (NWF) and U.S. Maritime Administration (MARAD) as reference parameters for emissions.

Environmental costs of carbon dioxide (CO_2) emissions were calculated from information available in literature. The transportation sector is the main source of emissions of this pollutant (Wang, 2007 apud UFSM, 2007).

The CO_2 emission was calculated from the covered distances, fuel consumption and emission factors. The unit measure used was standardized in t/km carried. The graph of Figure 8 synthecizes these result. The best scenario has lower CO_2 levels.

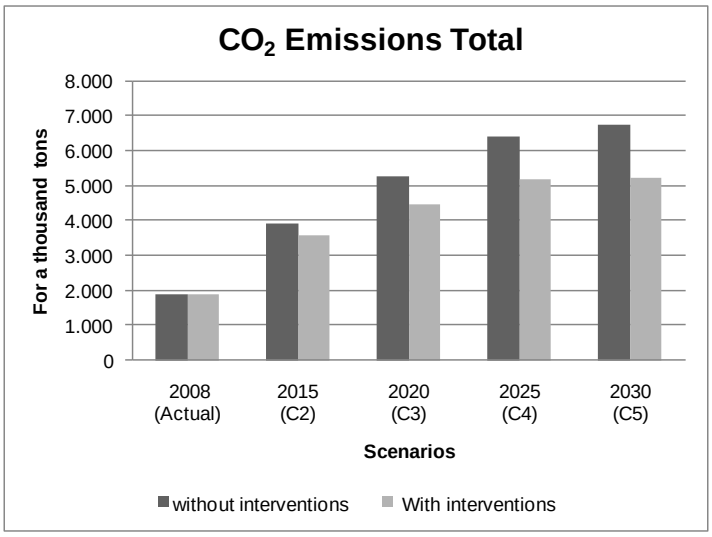

Figure 8 - CO_2 emissions

In the scenarios "without interventions" the CO_2 emission will progressively grow. In the second case it will occur a significant reduction. In that way there will be a more balanced distribution of the use of modals. In the case "without intervention" the modality of the roadway is predominant with increasing curve emission CO_2.

The Scenario C3 (2020) "with interventions" the consumption of diesel oil will bring a economy of 72,000,000 l/year. So we can avoid to emit about 191,000 t/year of CO_2. The CO_2 emissions are cumulative and impact the global climate as a whole. In 30 years it will leave to accumulate approximately 5,700,000 t/year of CO_2 in Earth's atmosphere.

The Scenario C4 (2025) "with interventions" presents a more significant improvement, around 220,000,000 l/year less than diesel oil consumption in relation to the current scenario. This economy is generated by increased use of the waterway mode. The reduction of CO_2 it will be 591,000 t/year, in other words 17,700,000 t in 30 years.

The best result occurs in Scenario C5 (2030) "with interventions." In its fullness will bring a economy of 560,000,000 l/year of diesel. This scenario reduces 1,504,000 t/year of CO_2. Compared with the previous scenario has the lowest degree of negative impacts. The option has a lower waterway operational flexibility that road, but has less potential conflict with indigenous peoples.

The C5 scenario "with interventions" will reduce the pressure on South and Southeast regions and promote a better regional balance. There will be a strengthening links in the Influence Area with the North and Northeast regions. Consequently, promote national integration.

EVALUATION OF THE SCENARIOS

In the scenarios "without interventions" will occurs strangulation in all Brazilian ports. These scenarios are unenforceable due to existing limitations of the ports.

The Scenario C2 "with interventions" has few differences with the current scenario, due to limitations capacity of Santarém port. The disadvantage is the increased use of the roadways modality (t/km). The generated accessibility by intervention on highway BR-163 is permeated by the Amazon forest. This will require increased control of deforestation and a consistent policy in dealing with indigenous peoples.

With the planned interventions for Scenario C3, will have an increased use of waterway mode. With this, there will be fuel economy and pollutants reduction . However, the capacity expansion of the Northwest Corridor will be modest, with flowing by other congested corridors (the Southeast and South ports).

The C4 Scenario "with interventions" will have more alternative outlets. This scenario will contribute significantly to regional economic development. Generates unique opportunities arising from new development. In addition, there will be impact on the transport matrix, promoting energy economy and reduction in CO_2 emissions.

The best result obtained in the study was in the C5 Scenario "with interventions". He will have the greatest ability to meet of the production potential of the influence area. The scenario considers the distribution routes others, with major energy economy and the greater reduction of CO_2 emissions.

Despite the advantages presented by C4 and C5 scenarios, one should be cautious due to deforestation and the intensification of conflicts with indigenous peoples.

CONCLUSIONS

The study indicated an increasing transport demand due to the Northwest Corridor Influence Area agricultural production growth, this make necessary that existing delivery routes are improved and new delivery routes are opened, preventing the production displacement throughout already congested South and Southeastern routes. The analyzes had indicated that the most promising options are the inland waterway Tapajós - Teles Pires, for its low transport cost, and the railroad linking Vilhena (RO), Uruaçu (GO), having as final destination to the Port of Ilhéus (BA), through the link of North-South and West-East (BA) railroads. Such

interventions would contribute to the balance of the national and regional development, strengthening the links of the region in study with the North and Northeast Regions.

It is clear as result of this study that is not just a case of selecting one transport alternative. The diagnosis shows that the biggest obstacle affecting the Northwest Corridor Influence Area is the scarcity of logistic alternatives and their capacity limitations. This serious and poor service situation will only be solved with simultaneous investments in alternative routes and modalities.

Finally, the study verified that the Northwest Corridor can become, in only one decade, a promising project for the Country, with the advantage of creating numerous externalities. Taking the correct care, it will be environmentally and economically sustainable. Being thus, the Northwest Corridor does not have to be faced as only one more logistic alternative for distribution of grains, but also in an ampler perspective, where the transport projects have a role to fulfill in the development planning process. In such a way, projects of this nature must be directed to promote changes in regional and national scopes.

REFERENCES

Agência Nacional de Transporte Aquaviário - ANTAQ (2009). The Hidroviário Transport as Logistic and Ambient Solution. House of representatives - 1º Forum on Hidrovias: The Contribution of the Hidroviário Transport to the Environment. http://www.antaq.gov.br/Portal/ForumHidrovias2009.asp.

Fundação COPPETEC (2009). Logistic of transport of the Corridor northwest, final Report, Financiadora de Estudos e Projetos - FINEP - FINEP, December of 2009, Rio De Janeiro.

Instituto Matogrossense de Economia Agrícola - IMEA (2009). Monthly report of the Soybean of Mato Grosso. Number 5, January of 2009. http://www.imea.com.br/upload/publications/arquivos/0109_RMS.pdf

Ministério da Agricultura, Pecuária e Abastecimento - MAPA (2009). Projections of the Agronegócio - Brazil - 2008/2009 the 2018/2019. Assessorship of Strategical Management - http://www.agricultura.gov.br.

Portal do Agronegócio (2009). World-wide consumption of soybean will keep growth in the next harvest. http://www.portaldoagronegocio.com.br/conteudo.php?id=27819.

Portal do Governo Brasileiro PAC (2007). Growth Acceleration Program 2007 - 2010. - https://www.pac.gov.br.

Universidade Federal de Santa Maria (2009). CO_2 transports and emissions: a boarding based on the methodology of the IPCC. Ingepro magazine - Innovation, Management and Production - Outubro/2009 - Vol. 1, In the 8. www.ingepro com.br.