

SHORT SEA SHIPPING (SSS) INTEGRATED LOGISTICS SERVICES PROVIDING USING FAST TERMINALS MODELING APPROACH - A PORT OF SANTOS CASE

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ABSTRACT

This paper analysed Short Sea Shipping (SSS) in Brazil, focusing Porto of Santos' container operation and applying the intermodal transport concept using "fast" short sea terminals concept. Port of Santos, located in Brazilian Southeast region, is the biggest organized port in Brazil and in 2012, it moved 104,573, 783 ton, a record, as cited by CODESP (2012). As a port terminal isn't an isolated facility, the paper also approached: terminals location in the network, terminal conceptual projects and ships fleet sizing for economical-operational feasibility. Besides that, it was analysed competition strategy domestic cargo's market by aggregating value to clients, in an integrated logistics dimension. This study detailed Brazilian aspects (legal, economical, customs, technological and environmental) of intermodal transport network concept using fast maritime SSS terminals. The methodology used quantitative and qualitative analysis and exploration activities based upon a bibliography review and a multicase study. It has also been developed a research on existing data referred to ports, which were complemented by semi-structured interviews with executives and experts. Brazilian shipping companies are providing logistics alternatives towards door-to-door solutions, including parcel shipment and transportation management, with services provided in partnership with inland terminals and transporters, and, in some cases, using their own lorries. SSS companies compete directly with road transportation, offering clients freight, cargo security (damage prevention) and better environmental adequacy advantages. Nevertheless, road infrastructure and flexible services provided by a large amount of suppliers explain and justify road wide share on Brazilian transportation matrix and a strong competition based on door-to-door services. It was relevant the comparison with European experience of Motorways of the Sea for "fast" terminal conception and system dimensioning. Market required scenarios must include regulatory changes and

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more completed partnerships between shipping companies and port operators. Researchers concluded that, in order to face road transportation strong competition and to fulfil market requirements, shipping companies are acting as Third Party Logistics Providers (3PL), searching partnership with inland transporters and terminals as well as port operators. Fast and dedicated port terminal feasibility must consider intermodality, through a more intense economical, energetic and environmental appropriated modes use. The paper aimed to contribute to the transportation market sector by characterizing a transport net which contemplates a sea route of navigation, land accesses and location of fast terminals in Brazil.

Keywords: Short Sea Shipping, Fast terminal, Integrated logistics, Port of Santos.

INTRODUCTION

This paper focuses on Short Sea Shipping (SSS) companies operating containers at Port of Santos and analysed intermodal transport concept using "fast" short sea shipping terminals. The paper has approached other issues as, terminals location in the network, terminal conceptual project and ships fleet sizing for economical-operational feasibility and SSS strategy to compete in Brazilian domestic cargo market and how strategically the terminals and shipping companies are enlarging their services by aggregating value to clients, in an integrated logistics dimension.

In this sense, it was addressed the concepts of Motorways of the Sea and the requirements for "fast" short sea shipping terminals development in a specific approach to Port of Santos. Port of Santos is the biggest organized port in Brazil and it is located in the Brazilian Southeast region. The movement of cargo accumulated in 2012, in this port, was a record for the period, amounting to 104.5 Mton, according to the Dock Company of São Paulo – CODESP.

The paper, based upon integrated logistics concept, comprises a multicase study composed by a bibliography and specialized sites research, as well as applying semi-structured interviews with shipping companies, port, inland terminals executives and Port of Santos Authority officials. The literature review undertook a comparison between European and Brazilian experiences, in order to support the analysis of current difficulties to implement SSS in Brazil, from this, it was contextualized the concept for "fast" terminals.

This paper is based also upon University of São Paulo research sponsored by a funding agency in Brazil, called National Council for Scientific and Technological Development (CNPq)ⁱ. The shipping companies' strategies towards logistics chain agents (transporters and terminals operators) and with shippers (clients) were identified, i.e., beyond port-to-port services providing to door-to-door integrated logistics dimension. It was identified a developing and growing industry, which, nevertheless, requires legal measures in order to a 'fairer' competition with road transportation.

SSS has an environmental advantage in comparison with road transportation and so, exploited by shipping companies in marketing approach. In Brazil, road transportation is responsible for almost all intercity cargo movement, usually, explained by road transportation

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flexibility, mobility, diversified, extensive and door-to-door services providing. Larger scale modes as railway and sea way require, besides cargo volumes, a planning ahead and integrated regarding logistics chains. In Brazil, this results in a "road culture" by shippers and other mode service providers have to deal and face it. Integrated logistics services providing can be a 'sound way' to operate in the Brazilian market.

SHORT SEA SHIPPING IN BRAZIL

The authors assumed and it was identified in the interviews that SSS in Brazil is a feasible alternative for many industries supply chains, by reducing logistics costs and, at the same time, by contributing to environment by replacing inland cargoes transportation.

Brazilian Law N. 9432 from 1997 defined SSS as 'navigation held between ports or points of Brazilian territory, using sea or inland waterways'. Mercosul Trade Agreement considered navigation between Brazil and Argentina and Uruguay as SSS, as well. Nevertheless, Brazilian legislation reserves SSS for Brazilian companies, operating Brazilian flag ships and manning with a Brazilian crew.

Brazilian large navigable coast, production and urban centres concentration nearby the coast are positive factors to SSS, but, only from 1999, when Brazilian economy was stabilised and inflation put under control, the alternative had acquired competitiveness and shipping companies started to reinvest in the industry (CNT, 2006). In ten years (1998-2008), according to ANTAQ – National Transportation Regulatory Agency (2009) data, container traffic related to SSS increased 5.05 times. In Brazil, the traffic is concentrated on solid and liquid bulk cargoes, and, despite its continued growth, SSS represents no more than 23% of total moved in Brazilian ports, according to the Statistical Yearbook of ANTAQ (2010).

Port of Santos focus can be justified for its importance on container movement (deep and short sea shipping) and for its role Brazilian economy. In 2010, Brazilian total TEUs movement was 6.8 MTEU and Port of Santos moved 2.7 MTEU (39.8%). Brazilian SSS moved 1.2 MTEU, 270 000 TEU (23.2%) in Port of Santos, followed by Suape Port near Recife-PE (Brazilian Northeast region) with 190 000 TEU (16.3%) and Rio Grande Port near Porto Alegre-RS (Brazilian South region) with 109 000 TEU (9.4%). (ANTAQ, 2010).

The feasibility of SSS movement can be demonstrated in terms of costs and environmental impacts, as it is shown by Table 1, which shows a costs comparison between road and sea mode carrying packaged rice from Porto Alegre-RS (475 ton/month) to Recife-PE (Brazilian Northeast region). Schlüter (2008, p. 73).

It is demonstrated that, by sea, one can obtain savings of R\$ 167 000/month, around US\$ 102 000 equivalent by transferring the load from 19 lorry travels by 21 containers freight. The road distance between these cities is about 3 800 km and between the ports called (Rio Grande-RS to Recife-PE) is 1 800 nautical miles.

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Table 1 – Transportation Alternatives for Packaged Rice Logistics from Porto Alegre – RS to Recife – PE.

	Road Mode	Sea Mode
Freight tariff (\$/vehicle or Container)	R\$ ⁱⁱ 8 000.00 – US\$ 4 893.00 (Complete journey)	R\$ 5 200.00 – US\$ 3 180.00 (including mode integration and transshipment in origin and destination)
Delivery Lead Time (from collecting to effective delivery at DC)	8 days	9 days
Availability	Full – vehicle leaving at any moment	Frequency: one ship each 8 days
Capacity	25 000 items (per vehicle)	23 000 items (per container)
Third Party Logistics Provider: It charges a fixed cost R\$ 25.00/ton (US\$ 15.3/ton) for space rented plus R\$ 12.00/ton (US\$ 7.35/ton) for product movement. Packaged rice in 1 kg bags, valuing R\$ 1.20 (US\$ 0.74) per bag free from damages or obsolescence.		

Source: Authors based upon Schlüter (2008, p.73)

In terms of environmental gains, Costa (2009) demonstrated that a 1 000 ton rice cargo with origin in Pelotas-RS (Brazil Southern Region) and destination to Fortaleza-CE (Brazil Northeast Region) by road transportation can generate approximately 680 ton of carbon dioxide (CO₂). By a multimodal way, i.e., from RS to CE, in which lorries transport cargo until Port of Rio Grande-RS, then it is shipped to Port of Pecém-CE and again transported by lorries to Fortaleza-CE, the CO₂ production estimated is 180 ton, representing a 500 ton or 72.3% reduction (Costa, 2009). The sea distance between these ports is 2 400 NM.

Brazil, differently from other continental dimensions nations, has a transport system with small intermodality use, especially with waterway mode. Nevertheless, in Brazil, some enterprises had already adopted logistic solutions using more than one mode, including maritime transportation. An example is the so-called "industrial cabotage" modality in which the system is completely controlled by the firm that owns the load and transportation structure (ports, ships etc.). A remarkable example is wood to a pulp and paper facility in the Southeast Brazilian region.

Brazilian transportation market is considered as a highly competitive one and intercity cargo movement has the road as responsible almost for all of them in spite of country huge size and its remarkable coast line (Brazil has a coastline of about continuous 8,000 km). Economics activities are concentrated on the Southeast Region and the cargo traffic volume between Northern and Southern Regions is less important. Besides that, there is an imbalance in regional cargoes, with more volume from South to North than vice-versa. These characteristics lead shipping companies to strategically provide integrated logistics, assuring

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clients door-to-door movement in a supply chain management vision in order to compete with road transportation service providers.

Integrated supply chains, as defined by Bowersox et al. (2002), implies a relationship management and different firms joint efforts to operationally connect themselves to clients, in order to obtain a competitive gain by 'identifying and achieving lowest total cost by capturing trade-offs that exist between logistics functions' (Bowersox et al. 2002, p.8).

This way, integrated logistics services must achieve the lowest logistics total cost and accomplish service level requirements by integrating logistics components as transportation, warehousing, packaging, material handling, information systems, order cycle management, inventory management, fiscal and environmental issues along supply chains, aggregating value to clients, aiming to obtain and maintain competitive advantages (Robles, 2001)

Transportation is considered the most important logistics function and it is responsible for more than 32% of logistics costs (World Bank as cited in Brazil, 2007). In Brazil, as previously mentioned, cargo transportation is concentrated in highway mode. Transportation and Logistics National Plan (PNLT), Brazilian Transportation Ministry study pointed that more than 60% of domestic cargo is transported by road. (Brazil, 2007) Road transportation, as it is known, has some advantages as speedy, agility, with collect and delivery in far regions, flexibility, and diversity. In Brazil, road transportation services are provided by a large amount of suppliers and the country has a road network mostly in adequate conditions. These issues represent advantages to road carriers enabling door-to-door and multimodal services, reducing time and costs for shippers.

For Lanchmann and Castro Jr. (2009), taxes burden and bureaucracy are the main restrictions to SSS development in Brazil, mainly if it is compared to other countries, as Japan and U.S.A., where there are tax exemptions. The main falling taxes pointed by the authors were:

- a. On freight (PISⁱⁱⁱ, COFINS^{iv} e ICMS^v): 14.5% on freight value to destinations to Northern, North-Eastern, West-Centre Regions and Espírito Santo State (Brazil Eastern Region). For other destination the rate is 19.8%;
- b. On seafarers' payroll: INSS (National Social Security Institute) and FGTS (Employees' Retirement Fund) represent 39.7% of payroll;
- c. On fuels: On MGO – Marine Gasoil fall ICMS and CIDE^{vi}, and on IFO – Intermediate Fuel Oil fall ICMS, representing a total average from 40% to 50%;

Related to bureaucracy, Lanchmann and Castro Jr. (2009) pointed:

- a. Difficulties for recovering contribution related to AFRMM (Freight Surcharge for Merchant Navy Renewal). The bureaucratic paperwork leads to systematic delays and working capital additional costs to shipping companies.
- b. Clearance process for imported spare parts is very bureaucratic and time-consuming, and besides that, there are still taxes, as II (Tax on Imports) and IPI (Tax on Manufactured Products) on ship parts without similarity in Brazil.
- c. Cargo customs clearance on SSS follows the same procedures for deep sea transportation.

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This last issue is very important and it represents an unfair treatment in comparison with domestic cargo moved by lorries, as it will be seen later. It is agreed by shipping companies, port terminal and industry experts that Siscomex Cargo^{vii} used for SSS generates operation inefficiency, jeopardizing competition with road transportation. According to Ballau (2009), Siscomex Cargo doesn't either simplify or speed up operations, which could be critical since competition with road transportation depends upon service level quality provided (generally, reliable and frequent docking in ports and reduced transit-time), an efficient port infrastructure, port terminal productivity, mode integration and area availability for cargo handling.

Some studies, such as Fernandes (2001), Andrade (2003) and Medina et al. (2007), emphasize the regulation aspects that still compromise the development of Brazilian SSS. This specific issue was also pointed on interviews, but it is beyond this study scope, as it is related to Brazilian regulation for sea transportation and/or public incentive for naval industry. But, its importance recommends specific research, approaching legal and institutional issues in order to identify and suggest adequate measures to improve the industry competitiveness and enhance its supply chain service providing. Figure 1 shows a schematic representation of this approach.

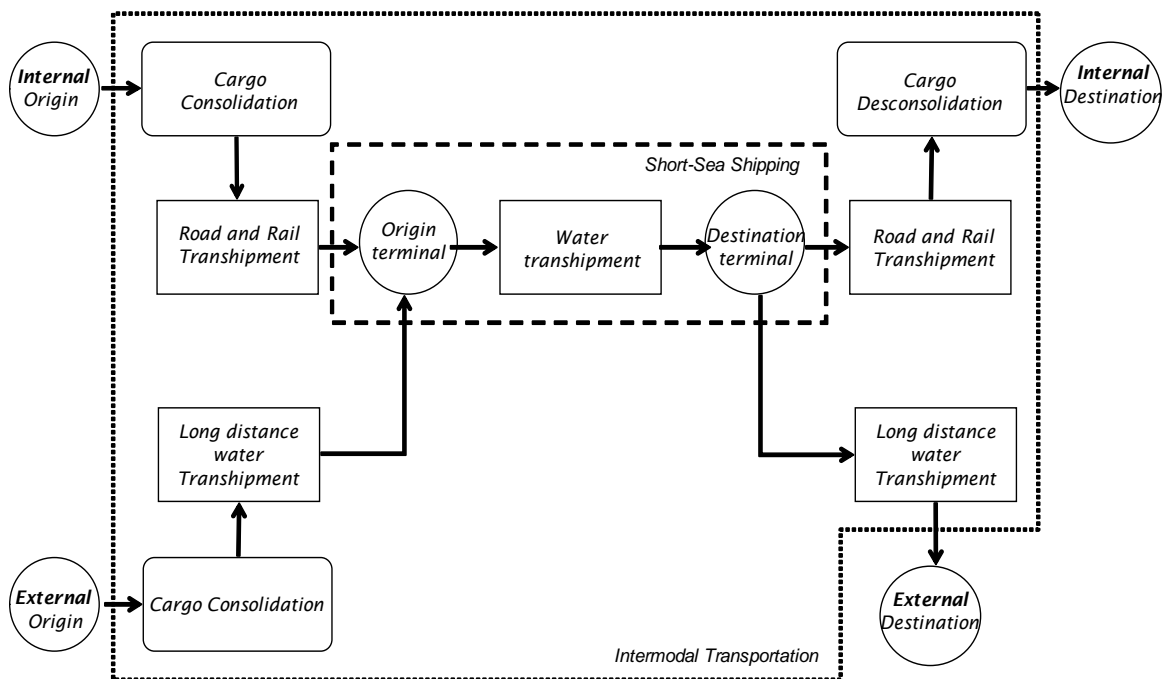


Figure 1 – Schematic representation of the intermodal transport involving the SSS.

Source: (Medina et al., 2007)

The SSS transportation, as characterized in Medina et al. (2007) is necessary for transportation sector development, and somehow necessary to achieve the goals proposed by the Government Plan, named as Logistics and Transportation National Plan - PNLT. In the concept presented by the authors, SSS comprehends logistic net of cargo transportation

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that uses the maritime transport as one of its links between points of the Brazilian coast (Figure 1). For the authors, the SSS must not be detached from his intermodal nature, since it depends on the routes between the sea terminals and the points of origin and destiny.

For navigation, it was pointed two systemic problems: its slow operational speed when compared to other modes and the small number of routes, measured by weekly travel frequency. Adding the excessive port time, resulting from the fiscal and customs difficulties and the limitations to the port accesses, a significant loss of competitiveness is noticed on the Brazilian SSS. Another important issue is related to cargo speed in SSS, i.e., the lead time between its loadings in the origin to the unloading in final destination.

So, this study's basic assumption is that SSS logistics services providing requires a door-to-door approach, integrating other transportation modes, as pointed by CNT (2006). By its nature, ships reaching and leaving ports services have to be complemented by cargo collecting and delivery, so the scope of the services has to incorporate inland movements in order to compete with road transportation.

In this sense, it were identified the main SSS companies operating containers in Brazil, as follows: In 2010, there were 36 companies authorised by ANTAQ. Three of them were operating container vessels: Aliança Navegação e Logística Ltda. – Hamburg Süd Group, Mercosul Lines Navegação e Logística Ltda. – Maersk Group and Log-In Intermodal S/A. – Vale Group.

According to Dias (2009, p.2): 'Short Sea Shipping container market is increasing consistently with offer capacity expansion', and, in domestic cargoes, with origins and destinations until 200 km from ports and 1 500 km or more for actual transportation distance, SSS mode split is around 18%.

A research in shipping companies' sites and confirmed in interviews, made it possible to define door-to-door logistics integration, as services covering one or more of the following services:

- a. Clients plant gathering and delivering cargoes using road transportation;
- b. Container stuffing or unloading (cargo delivery at final destination). This can be done at clients' site or, in case of small cargo packages, at an inland terminal;
- c. Container transshipment to railway in an inland terminal, where stuffing and unloading operations can also be accomplished;
- d. Railway or road transportation to shipment port;
- e. Containers embarked on ship;
- f. At the destination port, the container presents an opposite process to the final client's destination.

In this sense, shipping companies are intending to act as Third Party Logistics Providers - 3PLs and are managing to be responsible for the logistics chain as a whole, establishing relationships with road and railway transporters, as well as port and inland terminals, as it could be verified ahead.

METHODOLOGY

This study can be considered an exploratory one and it is based upon a bibliography research and a multicase study referred to SSS companies operating containerised cargo at Port of Santos, and to ports and inland terminals, which included semi-structured interviews with executives and experts.

As well, it was developed an analysis based upon the Motorway of the Sea concept in order to determine the terminal requirement to SSS operation and to compare European and Brazilian conditions for the industry.

Gil (1996) classified the research by its general objectives, into three groups: exploratory, descriptive and into explanatory, taking into account the theoretical and conceptual approach from an empirical point of view. The author recommends planning the research and the main component data collection procedures, which can be divided into two groups: (a) Paper sources, data gathered from bibliography and documental research; and (b) People sources, data gathered by experimental research, ex post facto, survey or case studies.

In this sense and according to Bryman and Bell's (2007), the study can be defined in relation to a) its purpose, as a multicase study; b) its strategy, as qualitative and quantitative c) its method as semi-structured interviews and internet research methods.

The multicase study is referred, basically, to three shipping companies operating containers at Port of Santos, two port terminals and one inland terminal. Yin (2009) stated that 'the same study may approach more than one case and will be considered as a multicase project'. In this study, main evidence sources were semi-structured interviews with professionals with functional responsibility linked to logistics integrating process in data collection units.

The communication method and an interview form were used with semi-structured and not disguised questions applied to shipping companies and terminal executives. The form, where appropriate, was adapted to the respondents' conditions, in order to allow and even to stimulate further contribution or other remarks considered relevant to approach.

The field research began with shipping companies' executives responsible for marketing areas, previously contacted by phone and e-mail in order to show the study purpose and scopes. All of them agreed to be interviewed and two interviews took place in Santos-SP (Brazilian Southeast region) and one in São Paulo capital (Brazilian Southeast region). Analysis units considered by researchers were:

- Aliança Navegação e Logística Ltda., from the German group Hamburg Süd, with headquarters located in São Paulo and with an office in Santos. In 2008, the Group operated 21 container ships, both for deep and Short Sea Shipping, with total yearly revenue of 914 000 Euros, moving to Short Sea shipping container business 250 000 TEU (Valor Econômico, 2009). Nowadays, Aliança operates eight containers ships (16,398 TEU nominal capacity) in two routes, with weekly and quarterly berth windows at Port of Santos. It provides door-to-door services, road/railway integration, logistics projects and parcel shipment (Aliança, 2009). Aliança's site defines door-to-door service as follows:

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“System that links inland (road and/or railway) to sea transportation to collect and deliver cargo at site defined by clients. The deliveries are coordinated, with scheduling (day/hour) according to the receiver requirement. The service enables too yard organization operation, with lorries arriving at scheduled time, avoiding bottlenecks, and providing suitable container to client cargo”. (ALIANÇA, 2009)

- Mercosul Line Navegação e Logística Ltda. was created in 1999 and, in February 2006 became part of Danish group A. P. Moller – Maersk. Its headquarters are in Santos-SP and since 1999 it has been operating container SSS providing integrated and customised logistics solutions, as door-to-door services, transportation and information flow management. It has three sea routes with weekly berth windows at Port of Santos, operating three containers ships (7,500 TEU nominal capacity). (Mercosul, 2009)
- Log-In Logística Intermodal S/A. is a Brazilian company linked to Vale Group (Vale is the main iron ore producer in Brazil and one of the biggest in the world) and since 1998 it has been operating on container shipment. Its headquarters are located in Rio de Janeiro-RJ (Brazilian Southeast region) and it has offices in Santos and São Paulo. It operates seven container ships (9,250 TEU nominal capacity) in two routes with weekly berth windows at Port of Santos. Log-In is part of Vale logistics business, which has also railway concessions, as Carajás (Northern Brazilian Region), Vitoria-Minas (Eastern Brazilian Region) and Centro-Atlântica (Southeast Brazilian Region). (Log-In, 2009)

Secondary analysis units were identified by researchers in the interviews with shipping companies' executives, who facilitated contacts with their service providers (port and inland terminals) and by e-mail, visits and interviews were scheduled. These terminals are responsible for cargo transshipment operations and container movement, storage and, in some cases, cargo stuffing. They are:

- Intermodal Container Terminal Road-Railway -Transporte e Comércio Fassina Ltda. located in Jundiaí-SP (São Paulo State hinterland) and used by Aliança and Mercosul Line shipping companies. It has a railway link direct to Port of Santos and a support 422,505 m² of total area. Besides cargo road-railway transshipment, it maintains and repairs containers and is responsible for road gathering and delivering cargoes.
- Container Port Terminal (TECON) – Santos Brasil Participações S/A., located at Port of Santos left bank, is considered South American biggest container terminal, with 47% of Port of Santos and 19% Brazilian container traffic. It has a total area of 596,000 m², with four berths comprising 980 m length and 13 m as berth depth. It has two warehouses with 12,000 m² area, 2,000 reefer energy connectors and four railway tracks with 3 km. Its yearly movement capacity is around 1.5 MTEU and in 2009 moved 1 MTEU. TECON is used by Aliança.
- A Port Terminal in Saboó quay at Port of Santos right bank, operated by Rodrimar Group with total area of 70,000 m², two berths with 400 m length and 11.5 m of depth. It has a 3,000 m² warehouse for general cargo, another with 1,000 m² for chemical products and a container yard with capacity of 300,000 TEU/year. It is used by Log-In.

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The semi-structured questionnaires were applied personally by the researchers with the interviews lasting until two hours and it was agreed that the information gathered was only for academic use, as well as to preserve the respondent identification on answer comments.

MULTICASE STUDY AND FAST TERMINALS MODELING APPROACH

To detail the several aspects (legal, economical, customs, technological and environmental) necessary to develop the intermodal transport network concept using “fast” maritime short sea terminals in Brazil, it was used a methodology that consists of quantitative and qualitative analysis and exploration activities. It has also been developed with research and simulation or analytical activities and evaluation of existing data.

Problem approach. Initially, it was identified international experiences, particularly projects related to the concepts of MoS in the European Community, such as PORTMOS (Integration of the Portuguese Port and Maritime System in the Motorways of the Sea), and Agile Port System (APS) in the U. S. A. and other national and international experiences. In parallel, it was done a bibliographical revision related to involved regulatory aspects, both outside and inside Brazil. This stage was ended by the construction of a "map" with all the aspects involved in the opening and operation of terminals. A part of the map is showed in Figure 2.

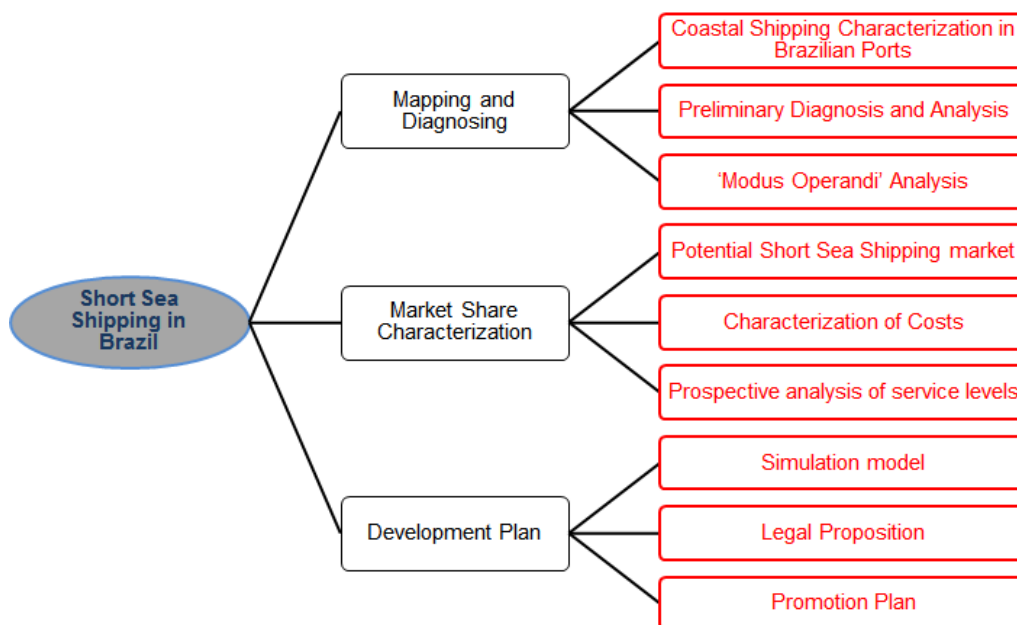


Figure 2 – Preliminary Map of SSS aspects

Source: Authors

European experience. In Europe, a major problem with SSS is that it is perceived to be too slow and therefore unattractive to freight logistics demands. In their analysis of SSS, Paixão and Marlow (2003) identified weaknesses relating to port environment and also to the quality of service that SSS can provide. Perakis and Denisis (2008) found that administrative and

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operational barriers have to be overcome, port charges reduced, and SSS needs to be integrated into intermodal transport networks. They suggested, albeit in reference to U. S. A., that alliances between lorries firms and port authorities would help. In Europe, there is evidence of trucking firms starting to offer SSS services as an alternative to long distance trucking (e.g. the company UN RoRo in Turkey was established by trucking interests), as well as shipping lines setting up new services.

One of the key motivations to expand SSS has been to counteract the rise in road freight transport. If SSS is to penetrate this market, however, the challenge (for maritime transport) will be to offer the same overall service package as road transport. Brooks and Trifts (2008) identified three main aspects to consider when looking at SSS competitiveness:

1. Service characteristics – i.e. transit time, price, reliability and frequency are key characteristics for any SSS service provider;
2. Buyer requirements – i.e. SSS image is often positive, however it does not tend to fit multi-stop en-route trucking operations requirements;
3. Situational variables – i.e. switching modes from road to sea can be induced by price incentives, such as an 'ecotax' imposed on truck fuel or a rebate on SSS rates, by changes in transport total cost, or by access barriers such as worsening road congestion or security delays.

SSS suggested advantages included environmental benefits, lower energy consumption, economies of scale and lower cost for expansion of infrastructure; however, SSS is perceived as slower as, and less reliable, than trucking.

Paixão and Marlow (2009) established that SSS was generally regarded as low quality and suffered from a poor image in potential users' point of view. In terms of competitiveness, Musso and Marchese (2002) concluded that SSS depended directly on the distance of the sea travel distance. Sea transport, it is claimed, is more competitive than trucking over longer distances. They further argued that any focus on costs should include both internal and external costs.

These findings regarding situational variables are similar to the outcome Garcia-Menendez et al. (2004) earlier study, which established that shippers' choice of short sea shipping transport is more sensitive to changes in road transport prices than to changes in its costs. Concluding, the study shows that mode switching to SSS could be induced by imposing an 'ecotax' on road transport.

It is argued that the inclusion of external costs is important to effectively change SSS financial and social position in relation to road transport (Medda and Trujillo, 2010). Road transport could maintain its competitive advantage (over SSS) unless external costs are internalised. This process could be enhanced by introducing subsidies such as the Italian 'Ecobonus' (i.e. a sea freight rebate for truckers) or the EU Marco Polo programme (i.e. start-up subsidy for shipping lines), the latter helping to develop a series of Motorways of the Sea (MoS) in Europe (Baird, 2007). However, it is also suggested that port investment are to be focussed and required to an intermodal change towards SSS.

MULTICASE STUDY ANALYSIS

This item was developed in two stages one referred to the basis of a simulation model for dimensioning a SSS system; focusing Port of Santos conditions to implement a “fast terminal” concept. The second stage approached existing SSS firms’ point of view to develop the industry in Brazil.

Fast terminal modelling. Both stages implied interviews with transport agents to support the discrete event simulation model (Chwif and Medina, 2007) intended for system analysis and dimensioning. In this stage, system relevant aspects must be refined, in such a way that, at the end, there is a computational simulation model that loyally represents the real proposed system. As presented in Figure 3, a model of simulation is composed, basically, by three stages (Chwif and Medina, 2007):

1. Model concept and formulation;
2. Model Implementation and;
3. Analysis of the model results.

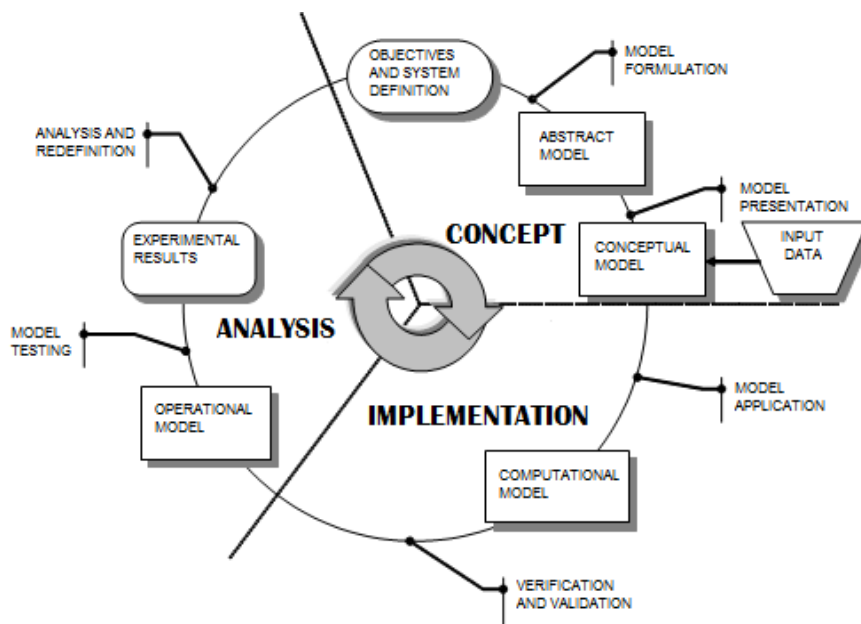


Figure 3 - Simulation Methodology

Source: (Chwif and Medina, 2007)

These stages cannot be understood in a linear sequence and, typically, several iterations and feedback can take place in the simulation model, as the understanding of the problem changes (CHWIF and MEDINA, 2007).

The computational model built in the project of simulation will then be used in order to define the frontier of competitiveness with the competitor systems or mode, and in which conditions it takes place. As performance measures, it will be used the levels of service identified in the

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beginning of the inquiry. It stands out the necessity of methods of optimization applied to the built simulation model, to calculate the size in an optimized way in the whole system: Terminals and Navigation Fleet.

As it was explained before, the terminal concept leads to a different mode of operation in Brazilian terminals. From what it was exposed, the conceptual project of the terminal should contemplate, therefore, assumptions relating to operations, customs, security, economic and regulatory aspects, such that, if all is reached, it will enable SSS efficient in Brazil.

Fast terminal purpose is to speed up the process of load transference between modes, increasing the agility of the operation, making SSS competitive in service quality and making the door-to-door transport feasible.

The fast terminal itself has a concept of process simplification, as its operation should facilitate cargoes handling: reception, verification, storage, customs procedure, shipping, etc. "The fast" terminal, as all marine terminals, should have operational capacity enough to generate economies of scale to the transport chain. In particular, it should ensure that the economies of scale generated by vessels' operations in regular lines would not be undermined by diseconomies of scale in land. Therefore, for the terminal conceptual project, it must also estimate its capacity. In this project, this sizing will be carried through with the aid of a discrete event simulation model.

However, a terminal is not an entity isolated or disconnected from the existent transportation intervenient, so it would also be part of the goal: terminals location in transport net, terminal conceptual project and vessel fleet dimensioning aiming at economic and operational feasibility.

In Europe, this operation has been discussed from some time by transportation Research Centres and it is known as short distance maritime transportation (PORTMOS, 2008). The concept proposed is the Motorway of Sea – MoS (Baird, 2007), that releases integrated services and operational systems, administrative, bureaucratic, information technology and logistics infrastructure, which could enable door-to-door transport of goods as an alternative to road transport, in an efficient, economical and competitive way. The central idea is implementing short distance maritime corridors, in which it is possible to compete with the road transport.

In this sense, a study is being developed, with Brazilian agency support, intending to contribute to intermodality growth in Brazil, through more efficient mode use considering economical, energetic and environmental aspects. The study, when accomplished will comprise:

1. Characterization of a transport net which contemplates a sea route of navigation, land accesses and location of "fast" terminals in Brazilian coast of Brazil, in a built Case Study;
2. Methodology and Case Study available for public use;
3. Legal, economical and institutional aspects for the operation of intermodal "fast" terminals, identifying the normative and regulatory gaps;

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4. Conceptual project of a "fast" terminal with: basic layout, necessary equipment and environmental requisites;
5. Patent of economical-operational project of a SSS "fast" terminal;
6. Publications in national and international scientific journals;
7. Knowledge diffusion through a Workshop with actors and entities involved.

SSS firms' present point of view. The research and interviews allowed identifying that shipping companies are providing to client logistics project alternatives in order to offer more feasible door-to-door solutions, including parcel shipment and cargo flows and transportation management. These solutions can embark services provided in partnership with inland terminals and transporters, and, in some cases, using their own lorries. The services are marketed by their own personnel directly with shippers, using their sites as a communication support to clients. The client portfolio is, typically segmented by geographical regions or industries. The main containerized products transported are Hygiene and Cleaning products; Electronics; Resin; Paper; Building Supplies and Ceramic and Agricultural Products as packaged rice.

The clients' contracts are in short-term (no more than two years), generally one year long, and they are under permanent negotiation, mainly related to pricing. The respondents pointed out a strong and steady competition with road modal service providers.

The partnership with inland transporters and terminals is regulated by long-term contracts. This relationship is transparent to clients, who have door-to-door service tariffs. The integrated service providing is shipping companies' responsibility, as well as management of inland service suppliers. The shipping companies are homologated as Multimodal Transportation Operators (OTM) by ANTT (National Inland Regulatory Agency), but only Log-In's executive affirmed that it operates within a Multimodal Certificateviii.

At Port of Santos, there are 26 ships calls both directions, 18 Aliança's, two Mercosul's and six Log-In's, monthly. These ships can be considered as small or medium size as compared with deep sea ships and, in general, old. The shipping companies don't inform containers quantity moved by port, but point as the main route to/for Port of Santos: Manaus-AM (Amazon River Port in Northern Brazilian Region); Rio Grande-RS; Suape-PE; São Francisco do Sul-PR (Southern Brazilian Region) and Salvador-BA (North-eastern Brazilian Region).

The main challenges to deal with for developing SSS, as pointed by respondents, can be summarized as follows:

- Excess of documentation requirements. Time expenditure to process information required by Merchant Navy and having cargo liberating (after registering Utilization Merchant Tax – TUM), can increase cargo transit time in until four days;
- Cargo control similar to international transportation. The Siscomex Cargo requires shippers and shipping companies planning ahead, as said by one

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respondent: 'if a cargo is supposed to be loaded on a ship programmed to call Port of Santos on Monday morning, on the previous Thursday, the container and all its documentation must be ready. This leads to more difficult competition with road transportation'.

- Short Sea ships and cargoes are also controlled by ANVISA (National Health Control Agency) with the same international traffic procedures. As it was mentioned by one respondent: 'if cargo doesn't leave Brazilian waters, why taking the same procedures'?
- Workforce qualification for handling cargoes and containers. In spite of shipping companies' efforts to develop sub-contracted workforce. A steady control is necessary, as pointed by one respondent: 'there is lack of commitment by outsourced employees, requiring constant monitoring'.

Besides that there were mentions on port infrastructure investment requirement; reduction on fuel costs, which are more expensive for SSS than for road transportation, and lack of qualified seafarers in country, as said: 'There are not officers, chief engineers and specialized crew availability in the Brazilian work force market'. This fact is leading shipping companies to search for ships REB (Brazilian Special Register), a special condition register to ships for SSS. As illustrated by one respondent: 'It is possible to hire specialized workforce abroad by keeping only the captain and the chief engineer Brazilian'.

The respondents agreed that SSS is more advantageous in freight rates and in transit times for long distances in comparison with road transportation and it could generate 30% and more savings, as complemented by one respondent: 'damages and losses are lower, so, insurance premium is lower and higher reliability will assure cargo arriving port on scheduled time'. He illustrated: 'Travel time by sea between Manaus (AM) and Santos (SP) is ten days, by road it reaches 13 days, in regular conditions'. He considered SSS competitive for transportation until 400 km from seashore and in opposition: 'To move a cargo from Goiás (Brazilian Centre Region) to Piauí (Brazilian Northeast Region), the road option is more interesting'.

SSS has a more efficient energy use, as cited by a respondent: 'Short Sea environmental sustainability is used for Marketing promotion, as the mode is friendlier to environment than road, generating six times less CO₂, which represents an advantage for firms concerned and engaged on environmental certification'.

Besides road competition, deep sea shipping competes at port terminal with Short Sea shipping traffic, as told by one respondent: 'Nowadays there are Short Sea port tariffs that can harm the option, by allowing deep sea shipping companies to negotiate lower prices, for example, for the link Santos-SP to Buenos Aires (Argentina)'.

An important issue identified was that shipping companies have effective plans for fleet reconstruction and expansion (ongoing contracts and constructions), implying modern and bigger container ships dedicated to Brazilian conditions, as size, equipment and draft. The schedules preview delivery until 2014.

The inland terminal researched provides different services as: road transportation, container (full or empty) storage yard; container repair and maintenance facility; containerised cargo

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transshipment; reefer container installations. The terminal is served by MRS railway and it has its own lorry fleet (37) and 13 other hired, corresponding to a 50 lorry total fleet under its control. 70% of cargo collecting and delivering is done in a range of 50 km from terminal area. The terminal charges shipping company for container storage, repair and movement besides road transportation, with 10 days or more of free time, depending on negotiations.

Port terminals researched have contracts with shipping companies with one to five years, which can be closed at any moment with previous warning (30 to 60 days). The contract assures minimum productivity, berth windows and free time for containers moved from seven to 30 days, depending on the agreement.

One respondent stated that shipping companies (domestic cargo) and port terminal operator (deep sea cargo oriented) approaches are different because: 'The port terminal lives on container moving, which shouldn't be stored for long time. If a SSS company has some problem and couldn't deliver or remove cargo, the container remains stored here, and this isn't interesting for the terminal'.

In fact, SSS has a small share on port terminal movement, for example: in Santos Brasil, only 5% and in Rodrimar, it doesn't reach more than 20%. The bottlenecks pointed by respondents are almost the same cited by shipping companies' executives, as follows:

- Bureaucracy: a domestic cargo is processed by the same way as an imported or exported one and is submitted to Customs control (ISPS Code, Siscomex Cargo, and others). This fact can represent up to a week wasted in cargo transit time. One respondent emphasized: 'A different treatment for SSS cargoes is urgent'.
- Competition with deep sea traffic. One respondent illustrated: 'Short Sea freight for a cargo from Santos to Argentina is around R\$ 400.00 (US\$ 245.00) and on deep sea freight it can reach R\$ 100.00 (US\$ 61.00), if the shipping company needs an empty container in destination'.
- Information Technology investment in order to enhance speed and precision on present systems.

One respondent stated that terminal positioning regarding Short Sea Shipping should be of partnership, otherwise 'It is impossible to work with', because 'a contract involving a large amount of containers to be moved requires an operational joint strategy from a port terminal and a shipping company'. On one hand, a shipping company requires terminal information to plan its operations, and on the other hand, a port terminal depends upon information in order to accomplish clients' requirements. This represents an interdependency that has to lead to cooperative behaviour, with joint planning and information sharing, in order to turn the port terminal a shipping company extension.

The respondents declared themselves ready to fulfil traffic projections on Brazilian transportation matrix (Brazil, 2007), with huge investment on physical area and on last generation equipment.

Nevertheless, port terminals dedicated to SSS are not considered feasible in the near future, because cargo perspective movements can hardly justify them, especially considering longer

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free time periods, Siscomex Cargo bureaucracy and other problems that could prevent a faster container collecting at terminals by shippers, as it was reported in the interviews.

In short, integrated logistics services providing require continuous management on logistics process, because any problem in one part can result in uncomfortable events to clients and to the shipping company, so partners' intervention should avoid reliability loss by shippers. The research identified in shipping companies, people exclusively dedicated to monitoring logistics chains in order to assure service conditions agreed accomplishment and to act immediately if failures or problems eventually occurred. In other words, shipping companies are, in fact, acting as Third Party Logistics Providers.

CONCLUSIONS AND FINAL REMARKS

This paper discussed SSS potential in Brazil, identifying the main industry difficulties for implementation and pointing a model to evaluate 'fast' short sea shipping terminals feasibility, identifying main intervenient and roles.

Brazilian SSS developing perspectives can be explained by containerisation, port infrastructure improvement and monetary stabilization. Shipping companies are offering value added services to clients, not only moving containers from one port to another, but also being responsible for cargo transportation from true origins to actual destinations. This service portfolio change implies integrated transportation management with other modes in order to fill the 'gaps', from port-to-port to door-to-door.

So, SSS is intending to compete directly with road transportation, offering clients advantages on freight, cargo security (damage prevention) and better environmental adequacy. Nevertheless, in Brazil, road infrastructure and large variety of services provided and large amount of suppliers, enhance the flexibility, extensive accessibility, diversity road transportation advantages that still justify the mode wide share on Brazilian transportation matrix and result in a strong marketing competition.

In spite of container traffic in SSS growth (5.0 times in 10 years); the industry has to face important challenges as:

- Fair and similar legal treatment with road domestic cargoes;
- Bureaucracy and slow cargo releasing, resulting from the same control system used to international traffic;
- Service providing conditions improvement, both operational (eventual lorries shortage, transportation and transit time restrictions on railways) and strategic in port terminals that, typically, give priority to deep sea containers traffic;
- Federal Revenue Secretary procedures and Siscomex Cargo linking;
- Other legislation restrictions, as crew costs and payroll, chartering foreign vessels difficulties, Customs controls, AFRMM compensation difficulties;
- Brazilian Naval industry development, including Government incentives for SSS vessels construction.

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A relevant and favourable issue to SSS is its environmental benefit in comparison with road transportation, which is already attracting clients engaged on sustainable practices or applying for environmental certifications.

The multicase study identified integrated logistics services providing by shipping companies and its importance to Brazilian social and economic development. Researchers considered the theme challenging, with an approach requiring a special care on statistical data treatment, which varies among industry entities. Analysis units' positive reception and cooperation with the research were remarkable.

This study also aimed to contribute to research, technological development, and to knowledge innovation for Operational Research analysis and technique application development for problems solution in intermodal cargo transportation.

The main conclusion is that, in order to face strong competition by road transportation and to fulfil market requirements, shipping companies are acting as Third Party Logistics Providers going on partnership with inland transporters and terminals as well as port operators and simulation techniques, as those proposed, could help to accomplish feasible and sound solutions.

Some issues, identified along the research are beyond the scope proposed and they could be addressed by specific studies as: conditions to implement new port terminals dedicated to Short Sea Shipping traffic; legal measures propositions reducing tax on fuels; Brazilian crew obligation easing; cargoes process and documentation simplification and specific procedures establishment for this kind of cargo.

Certainly, also applying the research to shippers' point-of-view could clarify and improve the study conclusions. It would be approaching changes required on Brazilian firm practices, as well, in order to adapt themselves to scale transportation modes as railway or in waterways, which requires, besides volume, integrated planning on logistics chains.

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ⁱ CNPq is an agency linked to Ministry of Science and Technology (MCT), dedicated to the promotion of scientific and technological research and to the formation of human resources for research in Brazil.

ⁱⁱ Brazil's currency is the Real (symbol R\$).

ⁱⁱⁱ PIS – Social Integration Program, a tax levied on corporations' total sales, created in 1970 to finance unemployment insurance and allowance to workers that earn up two minimum wages.

^{iv} COFINS - Social Security Financing Contribution - federal tax contribution, based on companies general gross revenues to finance social security

^v ICMS – Value Added Tax on value of interstate, intercity and communication movement of goods and services provided.

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- vi CIDE – Intervention in Economy Contribution. Tax on oil and derivatives; natural gas and derivatives and ethanol fuel. (CNT, 2006)
- vii SISCOMEX Cargo is an IRS system for control over the movement of vessels, cargo and empty containers transported via the waterway in Brazilian ports through the Internet (WEB). (RFB 2009)
- viii In Brazil, it is considered as multimodal transportation when only one entity is responsible for all the movement from origin to destination, using more than one transportation mode (intermodal). It is under ANTT regulation and until now it is not a very common market practice. Tax regulation (ICMS) has prevented its generalized use and intermodal transportation is the general case. This discussion, despite being relevant, is beyond the article scope.