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Logistics Costs: an essay of the modal shift operation on containerized cargo

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Abstract

The present paper analyzes the competitive advantages in the logistics costs through the utilization of modal shift and the decision taking by transport companies in this modality, which may influence the logistics and environmental costs, representing an alternative to decrease the port chaos, as well as it allows the responsible management of the environment. The port transactions require holistic elements that contribute to the management of decision. Particularly in the studied case, the rail modal was emphasized as a sustainable option in the modal shift since it reduces the emission of CO₂, which represents gains for the company and for the society; however, not many theoretical references are found on this logistics tool in Brazil, what makes necessary the holding of deep studies on the theme for its utilization by the companies. It has been proved that modal shift is a complex alternative, which requires attention to the several factors involved in the containerized cargo transportation, from the distance between ports and hinterland, adding competitive advantages through operational logistics costs and inventory-theoretic in the supply chain and the kind of modal adequate to the identified conditions in the geographical and political space being studied.

Key words: logistics costs, modal shift, intermodal transport, container, rail modal

Introduction

The present paper identifies modal shift as an option to decrease logistics costs and minimize congestions, urban conflicts and to create awareness for the users of containerized cargo of the consequent reduction of social costs, for the better distribution of rail modal in the matrix of national transports.

The objective is to show the competitive advantages in the logistics costs by using the modal shift, as well as the decision taking by the companies of cargo transports through this modality, with emphasis in the rail modal.

The system of transports in Brazil does not count on significant investments up to the event of the privatization of the railways (decade of 1980, with the deregulation of the Rail Federal), and ports (Law of ports modernization, nr. 8630/93), what has generated to the transport sector a delay in the execution of works of infrastructure and a major participation of the private enterprise, mainly by the logistics services providers - what has resulted in a transition with regards to the opportunities of utilization of more than a modal on the cargo transport, specifically supporting containerization.

As per Nazário (2008), the transported goods through more than a modal are commodities, as iron ore, grains and cement, all characterized as low added value goods. In these segments, the diffusion of the utilization of container in Brazil is seen as too insipient. For this reason, the practice of transports through more than a modal in Brazil requires technical studies to render viable the practice of the modal displacement of the cargo in a sustainable way.

Modal shift in the study of the containerized cargo intermodal transport can be a solution to the bottlenecks which generate cargo urban conflicts. A logistics paradox is observed on the perspective of costs analysis of the port users in this segment. If the solutions of new projects

propose a displacement of the cargo from the conflict zones to areas which are distant from the point of vessels berthing, this generates a new cost of transport and transfer towards hinterland of the (organized = delimited) port of Santos.

In the practice of modal shift, the excesses of cargo displacement render more expensive of the intermodal transport logistics even when containerized, which logistics is competitive when the transshipment option is adopted against analysis of the costs involved.

To Bortolim et al. (2008), the transport through means of containerized cargo is the common denominator of rail, road and water transports, and its main importance – besides the characteristics of facilitating and rendering speedier the transport with unitization - is to standardize and provide more safety to cargo avoiding damages and thefts – and it also renders possible the reduction of operational costs as well as the integration of transports, establishing – therefore – the intermodality. In a globalized environment, costs reduction and intermodality are fundamental for international competitiveness, besides the contribution for the society and the environment considering the reduction of emission of CO₂ through the adoption of modals which are not regularly used or are very seldom used.

A study of case has been carried out in a road and rail transport company, that works with modal shift for containerized cargo and in this case it has been detected that the adoption of the rail modal for the effective flow of the supply chain in the production of services and manufactures is a sustainable alternative and adds competitive advantages counting from the reduction of logistics costs.

Theoretical references

The transport operations become dependant on a logistics of support in order to be more competitive before the production and consumption, which contribute to increase the port demand continuously. For this purpose, an integrated network of suppliers, industries, distributors and transportation companies was created in order to improve the quality of services in an attempt to maintain the global flow of goods having as an origin the hinterland.

The competitiveness in the cargo transport is obtained from the relation cost/service/logistics/handling of cargo and for this reason the analysis of logistics costs is relevant in the modal shift planning.

According to Rios; Maçada; Becker (2003), the strategic function of the containerized cargo transport operations are obtaining more relevance due to the level of detail of the activities involved vis à vis the needs of expansion of operations and planning once the competitive advantages in costs and quality of services are directly linked to efficiency in operations. In the conception of Martins; Caixeta Filho (2001, p.15):

[...] the availability of an adequate structure increases the gains of efficiency to the productive system and not only to companies individually. This happens because there is a growth of the final product, increasing the productivity – at the same time reducing the costs per unit of component. Higher productivity, in its turn, is translated by the increase of remuneration of factors, what stimulates the investment and employment.

The inherent characteristics of the operations reduce the global logistics costs, at the same time elevate the levels of service through standardization of functionalities and operational requirements for handling, going for the concept of multimodality, i.e., the optimization of logistics elements, viz: transports, storage, packaging, handling, IT systems, inventories and fiscal matters (BOWERSOX; CLOSS, 1996).

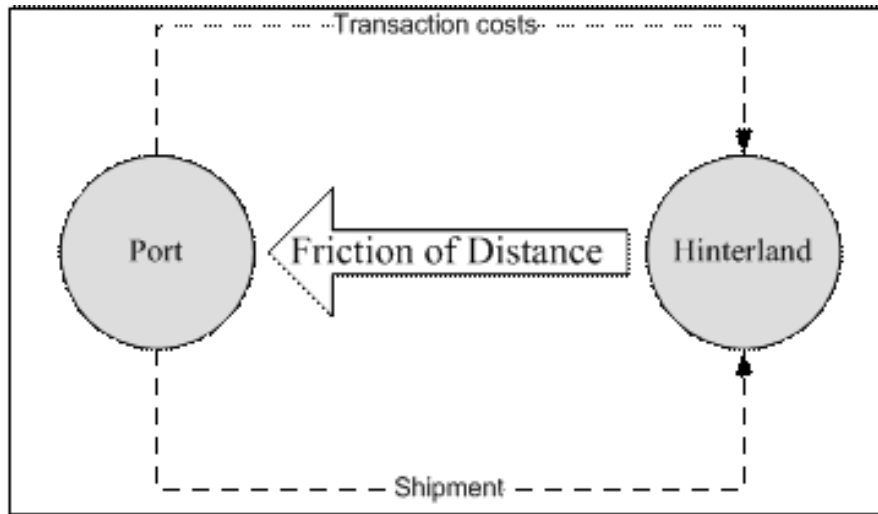
Aspects of modal shift

In this paper are considered the main regional development and geography of transportation, proposed by Rodrigue; Comtois; Slack (1999), Blauwens et al. (2006) examines the influence of total logistics costs and Ogawa (2004) emphasis on the environmental benefit, considering that the exchange of modal will reduce the emission of carbon dioxide, Geerts (2002) deals on the market for modal shift in intermodal transport. Bravo (2000) refers to the multimodality, focusing on theory of cost transshipment port.

Geerts (2002) proposes the adoption of IPI (Intermodality potential index) which measures the intermodality potential from the equation of division between potential and current market of the intermodal transport, which influential factors are:

- Transfer costs
- Door to door delivery time
- Frequency
- Information tracking (delays)
- Reliability
- Distance

Rodrigue; Comtois; Slack (1999) take it that the analysis factors include the distance but include also the logistics costs and available modal options, as laid out below. Consequently, they defend a holistic analysis for the decision making progress, meaning analyzing the distance, operational logistics costs and finally choose the modal options.



Picture 1: The principles of modal shift

Source: Adapted from Rodrigue; Comtois; Slack (1999)

In opinion by Rodrigue; Comtois; Slack (1999) the elements which more affects the transport costs are:

- Geography: the distance and accessibility involve the impacts, specially the friction of distance that involve lenght, time, economic costs and energy used;
- Type of product: packaging, handling and others factors;
- Economies of scale: the larger quantities transport results in lower unit cost;
- Energy: lower energy and CO2 emission with intensive transport modes;

- Trade imbalances: between imports and exports;
- Infrastructures: infrastructures has a direct impact in transport costs with the efficiency and capacity prejudiced;
- Mode: the modal shift often results in lower transport costs;
- Competition and regulation: competitive and regulatory environment.

As per Jolic; Strk; Lesic (2007) the distance is the main factor for the decision of adoption of intermodality considering that the strategic planning can only be defined from the geographical position of the port up to the hinterland. According to the authors, what is decisive for the port situation are the high additional transport costs (caused by the difference between the minimum and maximum distances of transport) which are complementary or contrary to the cargo transfer costs in the ports, i.e., the strategic positioning can be adopted as a tool for analysis of the port competitiveness, which also depends on the infra-structure for the definition of modals and the modal transfer as a whole.

The strategic planning can be adopted as a analysis instrument of port competitiveness combined with the infrastructure to define mode and modal shift.

To Rodrigue; Comtois; Slack (1999) the modal transfer occurs when a modal (a) has a comparative advantage on another (b) in a similar market. The competitive advantages are available in various way as in costs, in capacity, in time, flexibility and safety – each point analyzed in a considerate way taking into account what is being transported. We can infer this rationale if it is considered that for some the transit time is essential and the modal transfer will occur only if the new modal offers improvement in the transit time, while for others the most important item will be costs, which are in this case critical for the modal transfer.

So, the modal transfer represents the delimitation of the decisive process which considers the competitive advantages of a modal in regards to another. Its result comes from a series of decisions taken by the companies (for the cargo) or individual (for passengers) in the transfer to a more convenient modal only if the competitive advantages are the most significant.

In the vision of Blauwens et al. (2006), the analyses is based on the structure of the inventory-theoretic which studies the choice of modal from the business logistics point of view. The critical point of consideration of the inventory-theoretic is the fact that the focus is all costs involved in the supply chain – which is affected by the choice of transport modal. Therefore, the market analysis is used in the container transport from the port to the hinterland. It shows that the combination of certain political measures may lead to significant displacements of unimodal to intermodal transport. However, obtaining the the modal displacement is not an easy task. The alternative of studying the modals in the cargo transport may only show viable competitive advantages in comparison to road transport if they can meet logistics exigencies which suit the supply chain clients.

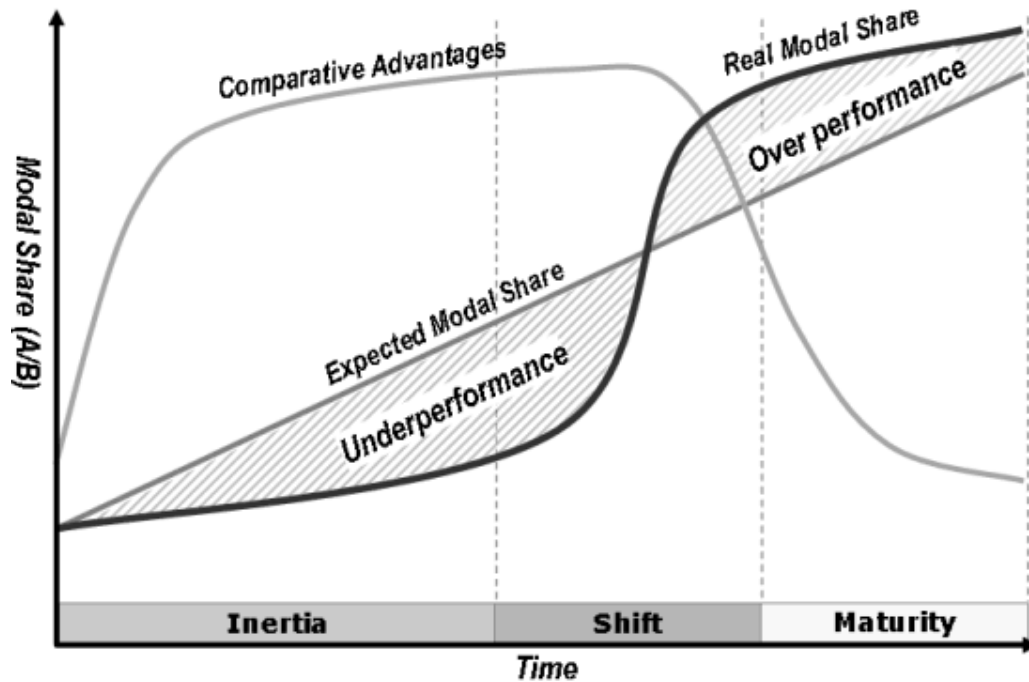
As per Rodrigue; Comtois; Slack (1999), the process of decision to modal shift, normally goes through three defined steps: initiation, change and maturity. Based on the Brazilian scenario, this survey proposes that these steps be divided in four steps as follows:

Initiation: (initiative the inertia proposed by Rodrigue; Comtois; Slack) stage where the perception of a possible change in the modal be of difficult perception as well as slow. In this stage, the result of modal shift is prone to show fewer advantages than the expected leading to a situation of low performance. The reasons behind this inertia are linked to the accumulation of investments employed in the current modal. At this point, it will be possible to check possible

reluctance by the transporters and owners of the cargo, bearing in mind the perception and actual knowledge on the advantages and the *modus operandi* in operations vis à vis the adaptations of the new modal. The negotiation of new procedures and contracts are certainly tasks which corporations do not wish to carry out if the benefits are not visible. While the current modal shows to be reliable – even when too expensive – there will be resistance in the politics of modal alteration. So, the pioneers in the modal change may be seen as adventurers, wishing to test the risks and lay aground the current system with a view to obtain the rewards destined to the explorers.

Change-determination/expansion: The change phase can be split in to determination and expansion phases. The determination determines a quick transition of a modal to another since the perception of the competitive advantages gets clear. The new transport modal develops from an unsatisfactory performance situation envisaging a better performance. At this stage in general the modal change occurs based on a better-than-expected-result and the transition phase runs very quickly going to a phase of expansion, in which the competitive advantage becomes inherent to the supply chain strongly attracting the demand – and this may generate among users and stakeholders an ambiance of surprise due to the agility of the transition.

Maturity: Here are the new balance of the acting powers - such as the capacity, costs, time, flexibility and safety - in the matrix of participation by the achieved modal change.



Picture 2: Phases of the modal displacement

Source: Adapted from Rodrigue; Comtois; Slack (1999)

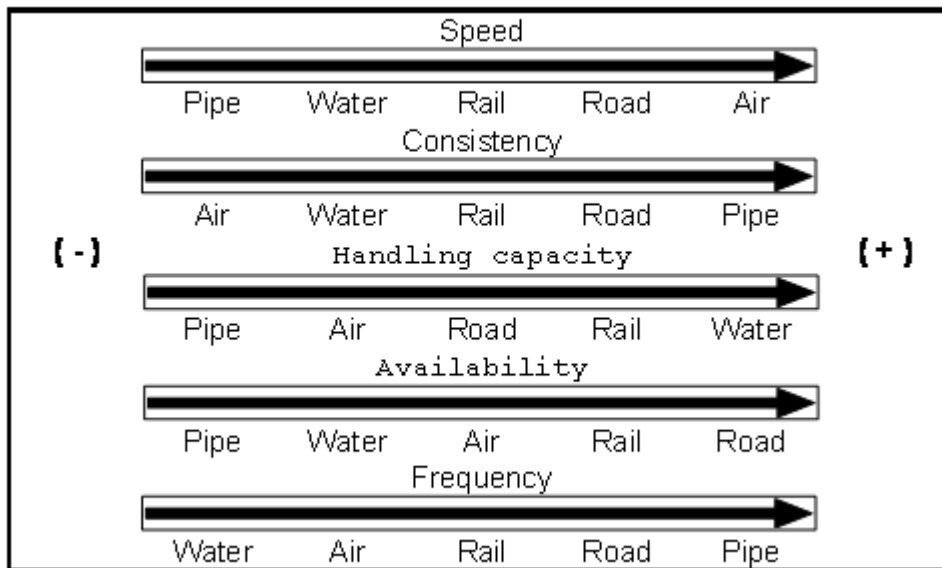
As per Bravo (2000), the kinds of transport which were solely competitors, today are – beyond being competitors – complementary and vice-versa. Consequently, it is possible to obtain costs balance, productivity and agility.

To Soares (2008), modal shift is one of the sustainable logistics solutions with emphasis on the integral approach in connection with modals mobility.

The involved cargo agents must use this possibility for the analysis of the cargo transport systems in general so that, for instance, the urban cargo conflict be eliminated, adding therefore the advantages of each modal in a multi-modal system.

As it can be seen from picture 3, there are variations among the types of services in connection with each kind of modal. To Nazário (2008), some modals show a higher or lower

cost for longer distances and access to another modal; nevertheless, if combined, they may represent lower logistics costs as a whole, what suggests a better balance in the relation cost-service for the modal shift.



Picture 3: Comparison of service characteristics among transport modalities

Source: Nazário (2008)

New operational concepts are divulged about the modals to overcome the obstacles of the need of urgent investments by the corporations in the intermodal terminal business. In recent times, modal shift is used in three types of transport. The two first ones, as per European Conference of Ministers of Transport (ECMT), cited by Bravo (2000) and Nazário (2008) are:

- Combined transport: transport which main stretch is the air-, rail or water means – with road transport being used for the support stretches.

- Intermodal transport: system that utilizes at least 2 different means of transportation through transfer of responsibilities of one modal to another of a shipment

And the 3rd model, as per law nr. 9611/98,¹ has the following definition:

- Multimodal transport: is the one that – supported by a single contract – utilizes two or more means of transport from its origin to its destination – and is executed under the only responsibility of one multimodal transport operator.

Consequently, in the multimodality the transfer of responsibilities differs in the understanding applied in the interpretation of the intermodal practice of the cargo transport. As per Demaria (2004), the adoption of multimodality offers more safety to the cargo owner, who has now a sole responsible party for the transport of the goods - besides allowing important reductions in costs in regards to intermodal since in the latter more than a contract for the cargo transport exists – the same concept is defended by Santana Neto (2005).

As Miles (1994), the structure of transport costs differs from one modal to another, and vary widely and evolve according to the proportion of fixed and variable costs involved. The fixed costs are related to equipment and transport facilities in ports, railway, road and airport terminals or even at points of intermodality between ships, wagons, trucks and others. Do not have a direct relationship with the distances and the cargo flow, where fixed costs vary depending on the volumes of traffic, that is, when the volumes are higher, the fixed costs are lower. If fixed

¹ Available on the Multimodal Transportation of Freight and other provisions.

costs are distributed according to the distances covered by their respective means of transport or by the volume of transport, the incidence of them on the long-distance flow or the more important cargo is lower than that is recorded on short distances or lower volumes of traffic.

In contrast, variable costs such as fuel, maintenance, labor, wear of equipment, grow depending on the level of activity during a certain period of time. Variable costs vary considerably from transport mode to another, mainly due to differences in the intensity factor of the work, the fuel consumption and the economies of scale.

Variable costs per unit carried are higher in the road transport when compared to rail or water modal, because the trucks have a lower transport capacity, so that require more intensive use of labor force and consume more fuel per unit transported . However, in operational terms, it is more expensive to maintain a port or a rail terminal to operate a road ramp, since the fixed costs of road transport are lower. The combination of the fixed and variable costs is fundamental which would take the adequate decision regarding the most appropriate modal for any situation in the logistics chain.

As Bravo (2000), the reason of intermodality follows the analyse of the costs development of the various transport modes, which the advantages are comparative, as mentioned above are characterized in terms of distance and the volume of cargo that each can carry, taking as a reference the requirements framework of market demand. Thus, in general, the road transport is revealed as the most suitable for shipments weighing not high, short journeys or sporadic volumes, while from a determined distance and in the case of important cargo, rail and water transport is outlined as the most appropriate. According to Bravo (2000), the water transport is even more appropriate when the volumes of cargo are higher and the distances are longer, but companies already use ferries and trains to transport over short distances.

The concept of intermodal transport results, therefore, the market needs to be used in the transport chain, the combination of modals most appropriate to the volume of cargo and distance in order to consider the benefits of each and their onus. Given the characteristics and interactions to the current market, and doing the scenario of high competition in which this type of service is inserted. Intermodality is the creation of conditions so that, given the profile of demand, each modal of transport can concretely enhance their comparative advantages, and can integrate different modes, a continuous flow.

Logistics costs

Ballou (2001) states that the global logistics costs is the sum of the transportation costs, stock, processing of orders and total customer service. Decisions taken based on the global logistics costs cannot see or analyze the costs existing internally to the company, costs which compose the global logistics costs. For this reason, the costs management in an efficient way leads us to a broader approach, which also visualizes the activities which are external to the company environment.

One of the main challenges of logistics is to manage adequately the relation between costs and service level. The function of logistics is the continual improvement of profit and offer of service level to the client with lower costs in order to become in competitive performance. Here we search to analyze the traditional methods of disbursements and its relation with logistics costs. Besides this, we want to demonstrate the usage of some available tools for the disbursements of a supply chain focusing logistics costs.

Multimodality is an adequate solution and the one that better meets the equation level of service x quality x minimum global costs. The process technically analyzed under the point of

view of multimodality optimizes its action of lower global costs added to the reduction of the environmental cost fully meeting the high level of service required. This new focus of logistics management and of its costs related to the supply chain leads to a new approach to evaluate the global logistics costs. The analysis of the costs under the logistics point of view consists of the evaluation of global logistics costs and in the concept of added value.

The ordinary logistics costs and those which have more impact for a company are: transportation, storage and customer services. An important factor is that the information from a company's accounting department is used for management purposes. Nonetheless, since they are aimed for a fiscal objective, the managers do not utilize it as management action in the decision making. There is a lack of commitment of the accounting data x logistics costs, since normally the costs of transportation of the acquired material are prone to compose the cost of the sold product as if they were costs of the material and the costs of distribution, in general they appear as Sales expenses.

Regarding the logistics activities, nearly no evidence or detail is presented to account for logistics costs. This lack of information on the costs which can be useful to the decisive process and to the control of the logistics activities leads us to compose a development of management tools aiming the control of logistics costs. However, this reality started to change once the companies administered their logistics activities but not always had a clear picture of how much this cost them – at least until the mid 1950s (BALLOU, 2001).

One of the main difficulties that many companies face in the process of adoption of an approach of logistics costs is the lack of information on the components of these costs. The conventional systems group the costs in ample, added categories and do not allow a more detailed

analysis. Without this resource to analyze added costs, it becomes hard to identify the potential of negotiation that may exist within the logistics system.

For a better understanding of the object of this study some concepts of costs to the management of logistics are stated below – and these occur in the logistics activity. As the logistics activity is imminently a service provision of other company activities, the consumption of the resources associated to this activity have been considered as costs, and so they were treated by all authors and professionals linked to logistics activities. As for the relationship with the object, the costs may be classified in:

- Direct costs: those which can be linked directly to the product or service (LIMA, 2006). Within the logistics focus, they are: labor, fuel, maintenance, packaging and others which impact directly in the service rendering.
- Indirect costs: those which cannot be linked directly to each kind of activity at the moment it happens, such as: support costs, administrative costs and with IT.
- Fixed costs: those necessary to the normal functioning of the company and that can be repetitive or not (LIMA, 2006). Examples: rental for stocking of products, support personnel, etc.
- Variable costs: Are directly proportional to volume of production or service rendering. In the case of logistics activity, they vary according to the volume transported, stored and of services rendered.

The logistics costs in general follow the accounting patterns of other activities, observing however that we must know the business deeply before we decide on the allocations,

classifications and splitting of any kind of cost, avoiding concept errors which may jeopardize the reliability of the numbers presented by the costs accounting.

As per Keedi (2006), the impact of infrastructure in export operations is largely recognized all over. From all logistics costs, the expenses with transportation are clearly affected by the level of infra-structure. Besides the freight charges, the expenses with transportation in exports also involve other items such as vessel demurrage, container detention, truck and train stays, all associated to penalties incurring from demurrage and idleness of these assets.

The main characteristics that differ an organized chain from other forms of non-organized relationship among economic agents are presented by the authors all based on the SCM (Supply Chain Management) (MARTINS; CAIXETA FILHO, 2001):

- Stocks management: one of the SCM objectives is to eliminate redundant stocks along the chain. In the traditional system, stocks management occurs independently among the companies.
- Costs: SCM envisages to procure a better efficiency in the administration of costs along the chain as a whole.
- Horizon of time: On the contrary of the traditional organizational patterns, the long-term vision must prevail in the SCM perspective.
- Planning: the joint planning is one the critical requirements within the SCM concept, together with the process of evaluation of improvement of products and processes.
- Coordination: is a central concept in the SCM perspective. It identifies coordination of 3 levels: among the members of the chain, among the management layers and among the operational functions.

- Information system: the monitoring and sharing of information is a basic aspect for an adequate SCM.
- Philosophy of the organizations: is an important element mainly for the joint planning to be possible and efficient. There must be a similar sense of long-term objectives, i.e, there must be a consensus in regards to “ways” to be followed by the agents that compose the supply chain.
- Suppliers: contrary to the traditional organization forms, the SCM has as objective the reduction of basis of suppliers as far as it aims a better integration and a longer relationship among the agents.
- Leadership: An organized chain within the SCM concept requires a leader or focal organization promoting the coordination of actions, creating conditions for conflicts shooting.
- Risks and profits: the members of a supply chain must be willing to share as many risks as profit in the long term. This procedures guarantees more stability in the relationships ad allows a better integration among the agents.
- Speed of operations: comparatively to other organization forms, the SCM must allow a better speed in the commercial and logistics productive procedures bearing in mind the available technologies and all the aspects previously pointed out.

Anyway, the expected result from the organization is a more competitive supply chain mainly regarding the reduction of intermediary stocks and total costs, besides a quicker move in the operations and in the process of information sharing.

The optimization of the results of a chain organized through SCM principles also occurs bearing in mind the reduction of risks and minimization of losses. This process occurs through the coordinated efforts along the chain.

Like this, for the management of supply chain it is necessary to implement projects for the increase of productivity in the port, enabling the optimization of spaces through rearrangements by multimodality when modal shift is adopted.

Reducing the social cost by modal shift and sustainability

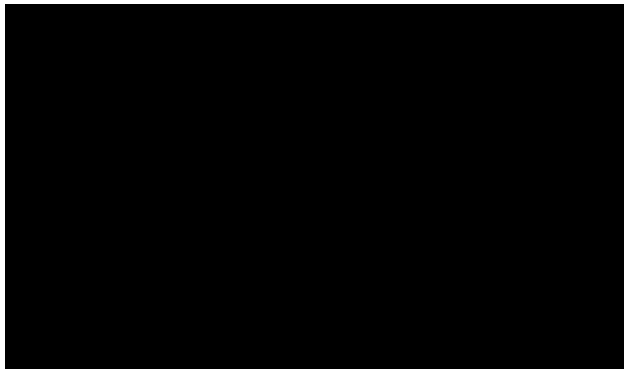
Another factor to be considered is the social and environmental cost of cargo handling. Breaks down the implementation of measures to reduce the total social costs of cargo transport in an extensive way as part of cost preferably logistical ally to the goals of less impact to society. The social costs are formed by six components, convertible into organizational objectives (SANTOS; AGUIAR, 2001, p.195):

- Contribution to the regional economy, state and national levels;
- Operational Efficiency (including traffic congestion);
- Security road;
- Environmental impact;
- Costs Community (especially the cost of road construction and maintenance);
- Urban Form.

To Ogawa (2004), modal shift must have a scientific connotation facing environmental concern, with this approach Ogawa (2004) proposes a modal exchange with high emissions of CO2 in the atmosphere by a transport that fewer hits the environment. Means acquire knowledge

to user of the cargo transport to move the goods from trucks to trains and ships. This is because with greater transport capacity have lower CO₂ emissions per unit shipped. Ogawa (2004), simplifies a coaster that emits almost 20 times less CO₂ emissions compared to a small truck.

Table 1: CO₂ emission per unit shipped by the types of transport when a ton of cargo shipped to a kilometer (g c/ton Km)²



Source: Ogawa (2004).

The decrease in social costs and reduce CO₂ emissions are a step toward sustainability. Almeida (2002) considers that sustainable development is related to the population growth and this in too, affect the ability to deal with the environment and to meet basic needs. To deal with this issue of increased consumption, proposes broad policy reforms that would change the supply problems, with assistance and technology reorientation.

Understands the difficulty of adapting technology to environmental needs, but the solution is the risks management, which currently has not been used to guide the environmental decisions.

² The methodologies used for the calculation of CO₂ emissions are not based on detailed information as the kind of fuel used per modal and available technology for modal. The emission factor presented in the inventory took as a basis the factor used in the figure of Ogawa (2004) only for analogy of CO₂ emissions between modal.

Finally, it proposes a change in perspective and attitude, both in developing countries as developed countries.

In this sense, notes the need to harmonize the integration of economic and ecological factors in the legal systems and in the decision making process of countries around the world.

For Sachs (1993, p.71), the ecology development that can be achieved with new instruments should consider alternatives to the time of the marginal and divergent conventional paradigm for restructuring costs and activities, evaluating the impact to the environment.

In the cargo transport, even with the conclusion that the concern with the environment may result in reduction of direct costs, indirect and environmental, Seidl (2008) says that there are still reasons for the shipper reluctant to use the modal shift such as : the delivery speed, service reliability and pre-existing relationship with the road transport companies.

Methodology

The present research is characterized as an exploratory case study where it searches to analyze mainly some variables related the modal shift theory. For Yin (1994) the case study is applied with objective to approach one description for reality definitive. The main characteristics in use is to question how and the reason of the facts, not being necessary as premise the control about the behavior of the event.

Gil (1999) complements that the case study shows appropriately to this type of empirical investigation is characterized for the deep and exhaustive study of an object, allowing one detailed knowledge. The case study is considered a type of qualitative analysis and what, second Laville and Dione (1999), is an investigation that allows to supply explanations in what it concerns straightly the respected case and to the elements that mark the context. The advantage

of this strategy is the possibility of deepening it offers, because the resources are concentrated in the case endorsed. The method of the case study, many times, is placed as being more appropriate for exploratory research.

The case study was performed in transport undertaking intermodal that adopts the modal shift as an alternative to reduce logistical costs. In order to take account of the objectives of the research, clarifies that the method of non-probability sampling by Gómez (2001) as the method in which the researcher chooses the sample which best suited to the study. Within this perspective, the data were collected from the leaders of the company in analysis. The sampling method non-probability is adequate due to lack of information systematized of the market and the need to know better the environment. The technique of data collection was by means of a personal interview (semi-structured questionnaire), observation non-participant, that second Godoy (1995) occurs when the researcher acts only as bystander intent, collecting data and not taking part in the context in which it is inserted. The documental research was also used, because it is a technique that prime by analysis of any material or knowledge that is susceptible to be used for consultation, study or test. The data were interpreted by means of content analysis supplied subsidies to achieve the objectives proposed.

Thus, the search is supported in methodological triangulation, as Alencar (1999) has constituted an attempt by the researcher to increase the confidence of the results, in view of the complexity of the phenomena that are the object of study of social research. The content analysis technique is used to codify and analyze the documents, then it doing descriptive explanatory statements on the literature composed of documents (BABBIE, 1999). In reality, it is an analysis and demonstration of the elements of content, with intention to clarify the different characteristics and extract its significance. The use of such analysis provides for three basic phases, second

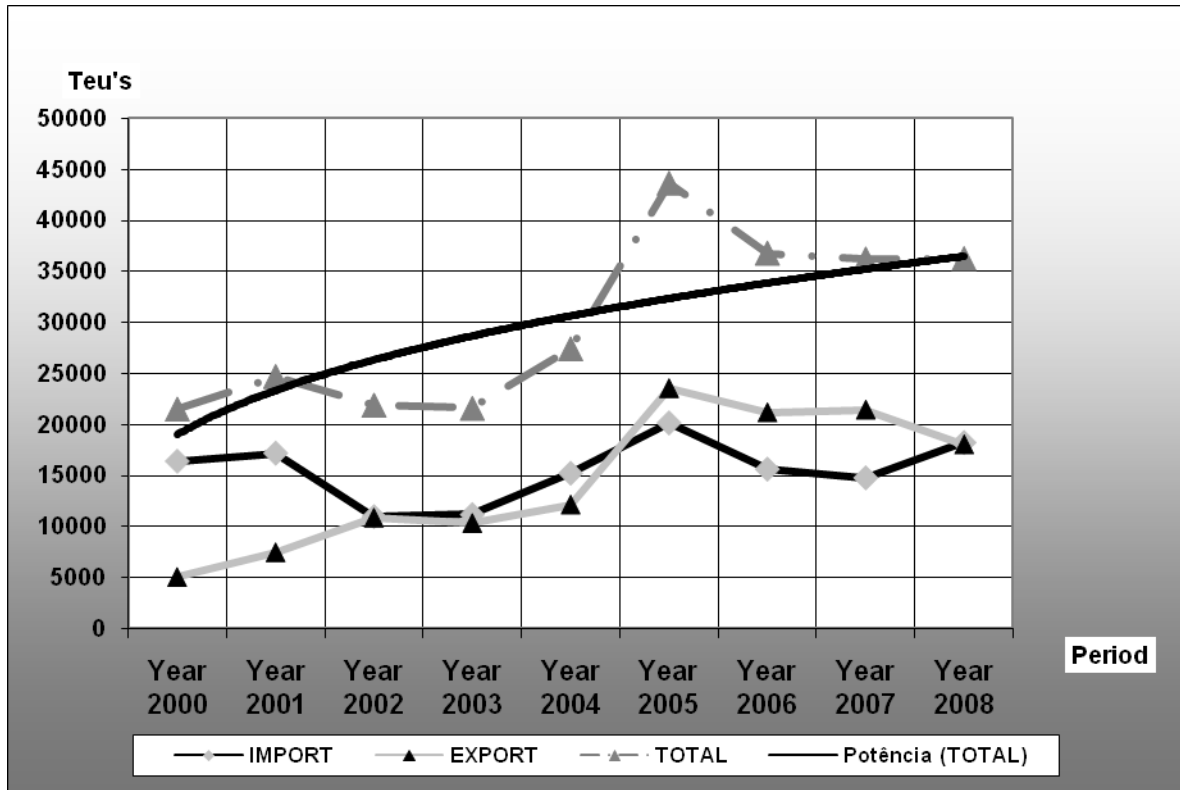
Godoy (1995) the pre-analysis – which can be identified as a stage of organization, which involving a first contact with the documents to be submitted to analysis; the holding of the material – stage of the researcher reads the documents selected, adopting a procedure for codification, classification and categorization; and the treatment of results – where the researcher used-if the raw data to make-them significant and valid, using the technical quality.

Data were analyzed collected in the company in study, whereas decision and values involved in the cost by transport of freight, showing evidence of benefits that may be obtained with the adoption of modal shift by means of content analysis.

ITRI Case study (ITRI Rodoferrovia e Serviços Ltda.)

ITRI - Rodoferrovia e Serviços Ltda., is a road-rail transporting service provider and Multimodal Transportation Operator (Operadora de Transporte Multimodal [OTM]), and duly certified by the Agência Nacional de Transporte Terrestre (ANTT) (National Agency of Haul Transportation) to perform such an activity. For intermodality practice, a railway track is used exclusively for wagon unloading inside a bonded warehouse located in Suzano (EADI-CRAGEA), which enables railway transportation logistics by offering daily express trains, with pre-fixed schedules, to its users. Users of special customs procedures are usually automotive manufacturers with huge daily cargo volume in the Port. The alignment for integration with suppliers and clients of most of these companies depends on several factors linked to the supply chain and essential for the utilization of the customs procedure of DTA with Yard dealing (SOARES, 2007).

The growing demand of general cargo and containers handled by the railway companies depends on the existing railway infrastructure for the status quo of port costs to the economic viability of this same demand.



Picture 5: Railway Transport - Loaded Container

Source: Soares (2008)

In the other hand, according to the public organisms, which control the port sector, there is a lack of technical studies on the demand of import and cabotage (coastal) cargo, specifically regarding the demand of rail transports of containers. Without these data, some port operators suggest the modal shift in areas outside the port of Santos itself. Nevertheless, it is noted that most of the containers transported by rail at the right bank of the port of Santos come from the

Grain Terminal (Warehouses 38-39) and the same transit under the Customs Transit Rules through DTA-E (=Customs Transit Declaration made electronically) .

In a very similar way to import cargo, the handling of export cargo under Customs bond requires certainly – lawfully – the observance of Customs exigencies for the Customs transit conclusion in wagons within bonded warehouses separately in the port area.

Consequently, port operators, when suggesting the handling of cargo out of the port itself, in first place jeopardize international norms of safety, such as the ones stipulated in the ISPS code which defines regulations for the international safety of ports for the entrance and exit of cargoes within the port area.

Modal shift is also applicable in the segment of cabotage cargo within the port itself. The operation of loading in wagons in cabotage occurs initially in the external unbonded areas of the port, after the discharge operations to trucks, and later cargo is transferred to rail (CBC, 2009).

In the analysis of the case of modal shift of ITRI, it is demonstrated that because of IN (law) 248/2002, the users of the Customs process denominated DTA Carga patio depend on a separated exclusive area denominated patio (yard) within the port itself for the administrative and operational management of the transportation for Customs transit within the port itself.

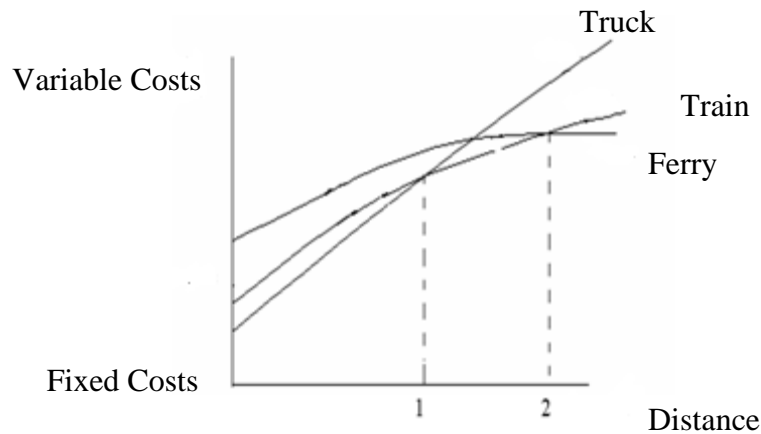
The process of Customs transit to bonded warehouses of public use (named DTA Patio) has as basis law nr. 248/2002. It is used to accelerate the Customs check outside the port itself, which due to lack of compatible infrastructure from the public up to the private management , are close to their operational limit, working in a non-efficient way does not meet the requirements within the port itself the demand for cargo stripping (container) in the expected time as required by the importers.

The outstanding aspect of the structure in the bases of this process is the fact that the port is currently congested, without space for the reception of cargo within the bonded area in the port itself for the due physical checking of the cargo by Customs – and this certainly renders impossible the clearance of our import cargo within the port of Santos.

Therefore, for ITRI, it was necessary a new kind of Customs process which allowed the organizational ecology of the port with a desirable timing for the proper handling of imports to utilize the withdrawal of the stored import cargo from the bonded area of the port of Santos.

In a sustainable way, the modal shift of containerized cargo has rendered possible the rail modal for the efficient servicing of the supply chain in the production of services and manufactures, which entrepreneurial emphasis envisages the implementation of the concept JIT (just in time) also proposed to other modalities.

As Bravo (2000), the costs curves of different modes tend to intercept it, indicating the points from which a particular mode of transport becomes more financial favorable. This reasoning is expressed in the pictures below.



Picture 4: The economic costs analysis for the combined Intermodality development
 Source: Bravo (2000)

The assumption of the administration costs will always be the efficiency with the least possible resources consumption, and the lowest possible negative impact, whether the company or the environment. In the picture above, comparing the model of Bravo (2000), focusing the Port of Santos as a point of origin of the cargo in the analysis, the combined options shown in picture 3 reflect the issue of distance in a generic way. In picture, the concept of Bravo (2000) is adapted to the reality of a freight logistics operator that carries through the road modal until the first intersection point of the recorded zone by 179 km, from this point will choose to carry the rail modal that also can be combined with the road modal until the second intersection of the 221 km limit, and the absence of road and rail terminal, from 300 km in a competitor way for the railroad and highway the possibility to explore the water modal combined with other modals. In this demonstration, the logistic operator shows the average of freights by distance and modal.

It is expected that to improve the use of the railroad should be understood that the intermodality to serve the logistics of the the Port of Santos hinterland in the State of São Paulo,

in a economic way, it is proposed to port operators better transshipment costs and related services to the rail transport to make it more attractive to the user. Otherwise, the intermodal flows remain ever less competitive keeping the transport sector with the status quo of the unimodal solution, supporting the inertia training proposed by Rodrigue; Comtois; Slack (1999).

The reason for this inertia is that the transfers cost are not attractive for the railroad because the investments in infrastructure are absorbed by the port operator but passed to the user of the Port and are accounted as investments required for the business operation of the port operator only, without seek to reduce the logistic cost of the railway operator or dry ports investors for the development and social costs reduction. So any kind of investment in infrastructure to transfer, in general, can not have a distinct impact on the modal to the user of the railroad or other modals. When the recovery of the cost of transshipment port is different in cargo delivery by modal realize that the difference in charging port in an isonomy way negatively affects the railway competitiveness mainly in intermodal management.

Blauwens et al (2006), argue that with the theory inventory proposed for the modal shift elaboration, can obtain exact information of goods flows and parameters of the characteristics of the type of transport, for a specific market segment of cargo transport, and the effects of certain policy measures to split the modals can be calculated for example according to Soares (2008), there is a full regional development.

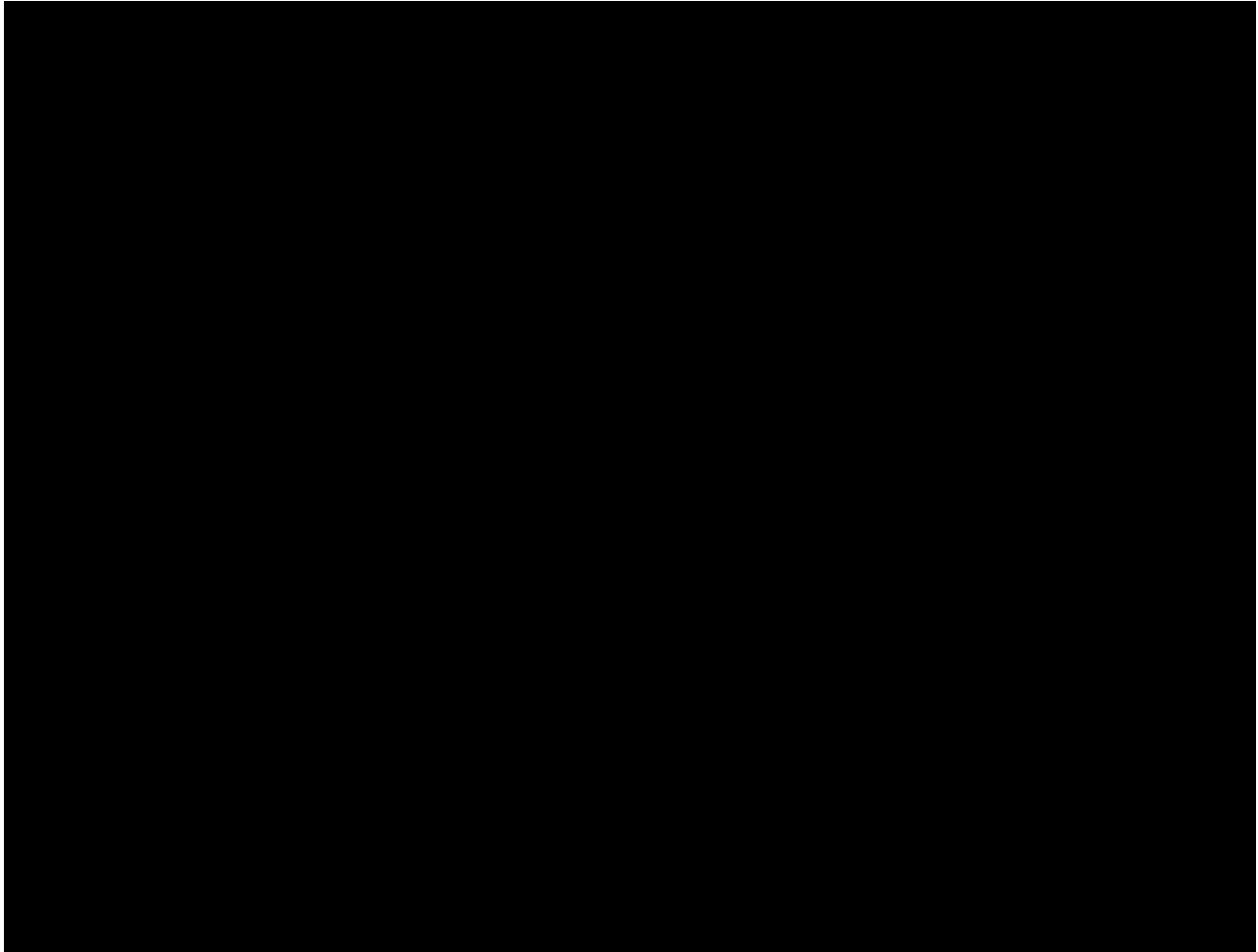
Whereas the present article deals with a hypothetical market for the transport of containers, which is "built" on the basis of a single case study that relates to the central line of specific transport (Port of Santos in the region of ABC SP), the results should not be generalized to the Brazilian market. However, the performed analysis can also be applied to other market segments in the cargo transport.

It should examine, for example, the market for most goods, which, when compared with the market for the container transport, mostly involving low-value goods. In this market, the methods of high-capacity transport with relatively low average speeds, such as navigation "inland" (river) or rail transport, is presented with a larger and more participation in the split for this modal specific market segments of transportation.

This can be clearly explained in the inventory-theoretic perspective: given the low value of the property, your inventory cost is high (due to high loading capacity and low average speed) when compared to the value of goods and commodities. However, the paradox of this analysis is that the high cost of inventory when it is more than offset by lower costs of transport (low freights) in the modal that has characteristics of high loading capacity (due be possible to exploit economies of scale) even with low speeds.

For example, the speed of transport by mode (The average time of transit) the analysis is done on the client to calculate his inventory costs in transit and the cost of stockpile security: these costs are higher for modes of transportation slower than for faster modes of transportation.

The reliability and dependence on a mode of transport (that is based on variation of lead-time) is manifested in the costing of stockpile security: that is, in order to provide the same level of service, the stockpile security should be increased when the goods are transported by a transport mode with a higher variation of the lead-time, which results in higher costs for embarked and receiver, rather than a modal with a range of low lead-time that this situation can work with lower stocks.



Picture 6: Analysis of the reduction of “port logistics costs” factor after the DTA Patio process utilization

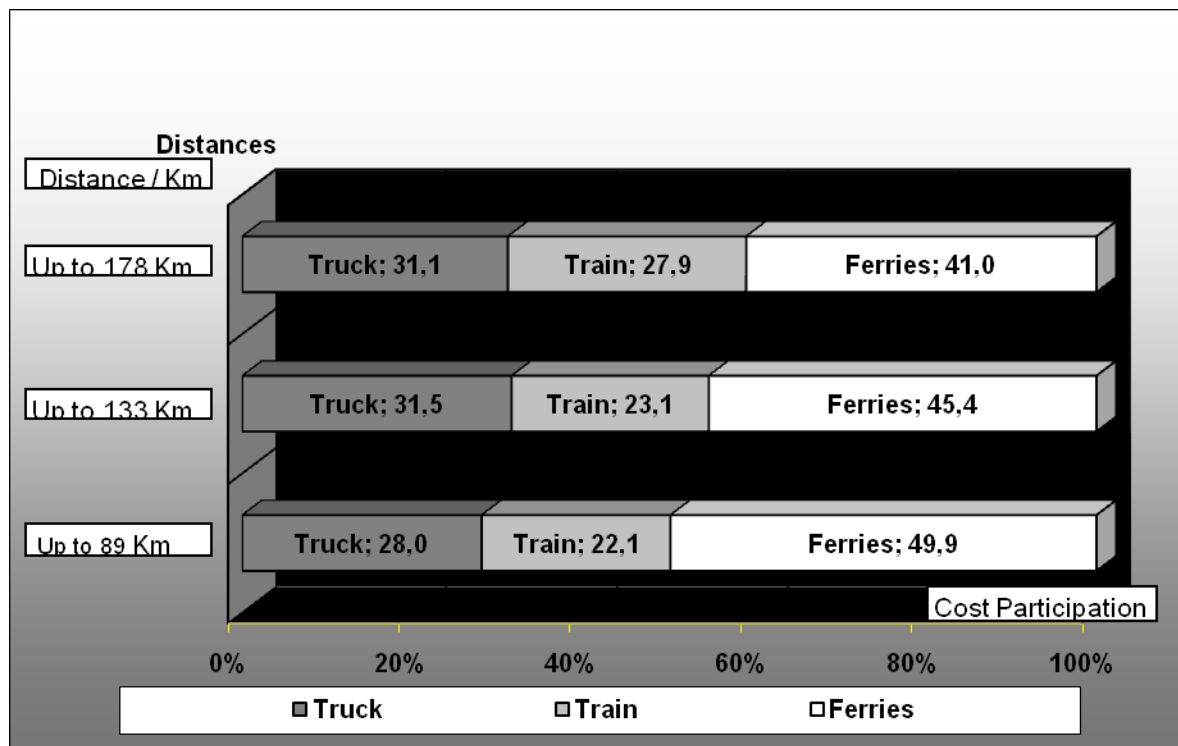
Source: Itri (2009)

In the analysis of the inventory theoretical notes-that the handling costs port differ by modal to modal. The model comparison shows that the costs of freight rail transport may be competitive even over short distances.

The port of Santos collects a differentiated rate of special customs process per modal. However, in the total cost logistical rail modal is even cheaper. In regarding the high index of sinister from road modal it receives a high rate of insurance of cargo on transport.

The greater the distance from of the vessel to the railways area of transshipment at the Port it became more expensive logistics rail.

Mainly, the new projects of transshipment areas at port it will impact on transport cost because involve more distance and accessibility by truck to vessel.



Picture 7: Syntatic Analysis behavior by Modal Shift for Container Cost of freight combined

Source: Itri (2009)

With this analysis of modal shift, was possible realize that the importance of rail in the hinterland of the port of Santos, mainly in short distance, rail is competitive and presents the lower cost of transport, and contribute to environment with reduces of CO₂ emissions, but that hypothesis can be confirmed only in inventory-theoretic.

In the end, we understand that theory of modal shift needs a holistic analysis that include each aspect of the logistics costs, considering the fixed most variable costs, distances, and then make decision of mode types.

Conclusion

Showed that the modal shift is a complex alternative, which requires attention to factors involved in the transport of containerized cargo for distances between port and hinterland, adding competitive advantage through the logistical costs of the operation in the supply chain and the most appropriate type of modal to meet the physical conditions of infrastructure and pricing identified in geographical and political area in question.

Final considerations

The use of rail modal supported by public policies or Customs regulations – as DTA Carga Pátio – may minimize the effects of logistics bottlenecks in the general cargo segment of high added value.

When cargo is containerized, we avoid the delay of delivery of the cargo to wagon (rail) or in the discharge of wagons with export cargo. In a significant way, this same means of operation of modal shift (when carried out out of the port) may increase the logistics costs for the user, rendering difficult the competitiveness of this operation.

This occurs as a result of the need of re-allocation of resources for cargo transfer, handling and local port trucks operations, usually required in this logistics of transport considering that the variable options of transfer sites are in general far from the vessel berthing point when out of the port itself. In this explorative case study, it was verified that the circumstance of the modal shift within the port itself is the situation that guarantees a better safety to the port user. From the Customs point of view, when talking about cost control, this transportation strategy depends on better productivity of the port terminal operators for the benefit of the railways which are within the port area. Consequently, the logistics could be planned having the port as a point of start, whenever there is an exhaustion of the system of movement management in the sense of organizing the operation of modal shift of cargo within SP hinterland.

Thus, the logistics does not foresee only an adequacy of the modal, but a need for analysis of the market and of the modals considering the value they add summed to the costs and inventory-theoretic, also taking into account the concern with an adequate environmental management in the port area as well as to sustainability.

Although the modal is an effective option, not many theoretical references are found on this tool in Brazil, rendering it necessary the holding of deep studies on the theme for its utilization by the companies.

It has been shown that the modal shift is a complex alternative, which requires attention to the involved factors in the containerized cargo transport from the distances between port and hinterland adding competitive advantages through operational logistics costs in the supply chain and it is the kind of modal adequate to the identified conditions in the geographical and political space in analysis.

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