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The vision of Lean Six Sigma to reduce costs in logistics practices modal shift Introduction

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ABSTRACT
Lean Six Sigma (LSS) is an important philosophy to help map the activities of service chains with practices of Modal Shift. The proposal involves the direct responsibility for service to reduce inventory in transit, comparing the costs of storage in the primary zone, the organized port, the city of Santos. The multimodal transport strategy is demonstrated by offering economies of scale in the outsourcing of public transport. This case study to review Kaizen improvements to reduce the costs of logistics services in the use of multimodal transport.
Keywords: Lean Six Sigma, Logistic cost reduction, Multimodal transport, Services.

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I. INTRODUCTION

According to [1], the complexity and interdependence of the internationalization of operations require an adequate infrastructure for transport, for adequate control of resources, given the continued attention to landmarks, regulatory barriers, and protectionist tariffs and non-tariffs that necessarily involve attention toward larger issues of ethics and social and environmental responsibility. Accordingly, it can be said that the issue of logistics is all about with these requirements of a new order through forms of control and management of international operations [1].

In the example of the need for new paradigms of control in management and logistics services, vision Lean in the early years of the 1950s was found in a specific way, through production from the automobile industry, where new paradigms have emerged for managing production through innovations that add value to the manufacturing process and allow for more productive conditions for a leaner manufacturing chain. The concept remains Lean after being developed in other segments of the example, for example in logistics services. The organizational changes required for the port sector, for example, require collaborative logistics management for a Lean process that incorporates the Six Sigma application to statistical evaluation of performances.

According to [2], in the industry of Lean production is due to the rebuilding of the new Japanese manufacturing model, which comes from the postwar period and whose way of producing has provided opportunities to envision an environment with numerous changes. The challenges are vastly different from Eastern and Western business leaders often admit. The development of the Western industry is due to new philosophies and practices of production coming from Japanese companies.

The proper management of the East model is directed in the form of continually discovering how to reduce resource consumption in production processes, and [2] argue that the principles of Toyota sustained for many years the ideal model of a production system, which has been "reinvented" and "caught" with a view of Lean manufacturing (Lean) currently applied to the industrial organization of Western markets.

According to [3], the production system of Toyota Motor Company became known worldwide as a production "Lean." However, he states that the term "Lean manufacturing" was a phrase coined by John Krafcik, a researcher at the Massachusetts Institute of Technology. However, the main "inventors" of Lean practices are the precursors of the Toyota Production System (TPS). Among them, Toyoda and Ohno have developed a production system known as "The Toyota production system." According to the creators of the TPS:*"... The purpose of this system is to minimize consumption of resources - that do not add value to the product - with hard efforts to find solutions to eliminate waste ..."*
Continuing, [2] highlight this understanding of Lean Six Sigma (LSS), with some characteristics inherent to this philosophy, reporting that in a complementary way:

- The client sets the value. A Lean company thinks more about creating value for its customers than about accelerating machines to absorb labor and overheads,
- Focus remains on the process to understand the activities, flow paths and connections that need to produce a specific product, the process to align with customer needs,
- Continuous improvement is necessary to achieve their goals. The improvement activities must progress beyond the projects daily work,
- Lean production requires the engagement of all people at all levels of business,
- In this respect, it is stated that only people can provide continuous improvement,
- The pursuit of resources in pursuit of perfection is infinite in finding opportunities for the systematic elimination of waste.

In many companies, Lean Six Sigma is reflected by innovations from organizational changes in businesses that add value to processes, which necessarily depend upon the hiring of services to eliminate waste and maximize shareholder value. The main objective is to find companies that provide the best customer satisfaction and the best level of service more quickly and safely [4].

Like [3] states, the service sector already occupies a high profile in the global context, and he states that: *"... Service operations now comprise more than 80% of U.S. GDP and are growing rapidly around the world ..."* According to [5], companies are increasingly embracing the integration of Lean and Six Sigma. The idea is for the Lean process to focus primarily on the elimination of waste - aiming to increase speed - and for Six Sigma to address the reduction of variability or uncertainty of the defects in these processes.

In this paper, the purpose is the reduction of process time and minimizing costs in logistics for the organized Port of Santos. The evolution of Lean Six Sigma is best tested by way of port productivity through innovations in the organizational models of transport from the port area of Santos.

In the example, manufacturing processes and business management environments that involve port also seek continuous improvement of processes to reduce inventory throughout the supply chain. The strategy of removing customs for the cargo transfer area at the primary port for the secondary zone is the environment in which operational analysis should be effective for purposes of transportation due to the economic sustainability of the intermodal business.

In the customs process and the process of modal shift, it is necessary to establish the company's vision by creating the main steps to be observed, with the mapping of spatial priorities in management control through the LSS, which is possible from the construction of the DMAIC (Define, Measure, Analyze, Improve, and Control) of the transport process that focuses on corporate change. It is defined through the DMAIC analysis, the customs process, and from incorporating Lean Six Sigma to stakeholders through a manager Black Belt, which guides essential procedures to minimize waste of time and freight expenses, enabling the effectiveness of Lean Six Sigma vision and multimodal logistics.

II. LITERATURE REVIEW

For [9], one of the major consequences of Lean thinking lean manufacturing is to reduce losses by eliminating activities that do not add value to the product/service end. For [10] reflected in this work is the conviction that the elimination of waste focuses on achieving a target cost based on the perception of customer value. Everyone involved in the value chain must be willing to negotiate a set of principles in the context of the Lean initiative. Value stream map complexity (CVSM) is a tool that combines three elements (as cited in [3]:

- Process flow.
- Data on how time is spent.
- Data that reflect how many different types of services/products flow through the value stream (the complexity).

A map of the traditional value stream (VSM) depicts the (s) file (s) base (s) in a value stream, with activities classified in two or three categories: value-added work (VA), job-add value (NVA), and work non-value-add to the business (BNVA).

Value-added (VA) also called "added value to the customer"

According to [3] and [11], *added value to the customer* is the work that contributes to what your customers want your product or service (and for which they paid if they knew of its existence). The distinction matters to this stage are:

- Does the task add a function, a shape, or a desired characteristic to the product or service?
- Does the task allow a competitive advantage (price reduced delivery: faster or fewer defects)?
- Would the client be willing to pay for this activity or would the client prefer us over the competition to know that we are performing this task?

Non-add value to the business (NVAB)

Are the activities for which your client does not want to pay (does not add value in his eyes) necessary for some reason (often for accounting, legal, or regulatory)?

In addition to value-added activities to the client, business, or regulatory agencies may require carrying out some functions that do not add value from the

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customer perspective [3]:

- Is this task required by law or regulation?
- Does this task support the requirements of financial statements?
- Would the process be interrupted if the task is deleted?

Non-value added (NVA)

Like [3] states, there is work that adds no value in the eyes of customers and which they are not willing to pay, and it is not necessary for purposes of NVAB.

- The task includes some of the following activities: rework, shipping, multiple signatures, counting, handling, inspection, setup, downtime, transport, handling, delay, storage.
- Adopt an overview of the supply chain once you have made these improvements. The shorter lead time and lower costs will create more revenue and consume existing capacity. If not, the excess capacity is not-value-added and must be eliminated.

Like [3] states, there are several ways to visually separate value-added work and non-value-added in the process map that will be the foundation of a value stream map of complexity. One method is to use color-coding; other methods include dividing the page into columns (VA versus BNVA versus NVA) and the placement of icons representing the steps in the appropriate columns. In the analysis, the data after the construction of the DMAIC framework shows that process improvement is the use of a dry port, or the Logistics Center Industrial Customs (LCIC), as the interest of customers using intermodal transport system See Table 1 below.

Table 1 - Strategic analysis for the use of an LCIC

	INTERMODAL TRANSPORT	D	M	A	I	C
	Bound Shares	Define	Measure	Analyze	Improve	**Control**
D	**The Problem**	Performance Targets	Lead Time	Multimodal Transport	Logistic	Time
M	**The Performance**	Priorities	Process Cycle Efficiency	Cash Assets in Process	Complexity	Productivity Indicator
A	**Analyze the Process**	Waste	Port Costs	Port Regulations	Bureaucracy	Process OTIF
I	**Propose Improvements**	Critical Path	Time Clearance	Supply Chain	Flows	Projects
C	**Sustain the Improvement**	Collaborative Logistics	Ecoefficiency	Several Indicators	Process	Innovations

Source: Authors

According to [1], to gain a competitive advantage, an exporter will store your goods in dry dock. Armed with a Certified Customs Deposit (CCD) issued by proving dry port, the exporter gets accepted and an external customer can deduct its value in the financial system internally or externally, using international rates and strong currency, with a great reduction in the amount of working capital. In turn, the importer can bring the goods from the outside and leave them deposited in a dry dock. Based on this strategy, nationalization will be done in installments by the importers, and the taxes are collected at the time, and the proportion of plots taken from the dry dock or LCIC will be considered in logistics.

2.1 The Proposed Theoretical Framework

Like [3] states, Lean Manufacturing was first applied only in production because it was seen as more appropriate than the other dimensions of business organizations, thus resulting in an enterprise view of Lean thinking. According to [12], Lean Manufacturing originated from the Toyota Production System (JIT) after the Second World War.

That is, the origin of Six Sigma terminology derives from the relationship between variation in a process or operation and customer requirements associated with that process [3]. Below this normal distribution, the highest concentration of values portrayed is one that lies symmetrically around the mean. See Figure 1 below:

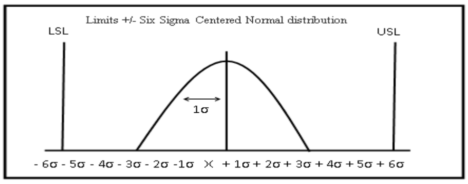

Figure 1 - Limits mean normal distribution centered. Source: [3].

The normal curve [3] is the distance between the centerline and the inflection point (where the curve begins to flatten). It is called sigma (σ), the standard deviation. Sixty-eight percent of the data fall between one standard deviation above and below the average, 95% within 2σ and 99% within 3σ. (Thus, the range between - and + 3σ3σ represents 99% of the data.)

According to [3] the numbers represent Six Sigma as the distribution of effective output that matches the range of acceptable values (customer specifications). A defect is any value that falls outside of customer specifications. The more the distribution fits within specifications, the higher the sigma level. To ensure that different processes can be compared, it is usual to standardize reporting of an "index" of defects (defects per million opportunities) rather than absolute numbers [3] described in Table 2 below:

Table 2 - Defects per million by Sigma

6	3.4	100.00%
5	233	99.98%
4	6.210	99.38%
3	66.807	93.32%
2	308.537	69.20%

1	690.000	31,00%

Source: [3].

Having "Six Sigma capability" means having a process that produces only 3.4 defects per million parts.

III. METHODS

The ratings are opinions on the importance and value of a particular type of performance, act, or result. The structure of a test evaluation can be an option on the main recommendations that allow both an external view and an analysis of internal processes. However, the case study seems more accurate in more complex scenarios. The level of service may differ substantially even in operational tests on problems and decisions.

A case study is expected to capture the complexity of a single case, and the methodology which enables this has developed within the social sciences. eh methodology is applied not only in the social sciences, such as psychology, sociology, anthropology, and economics, but also in practice-oriented fields such as environmental studies, social work, education, and business studies. The first stage in the case study methodology recommended by [6] is the development of the case study protocol. This stage is composed of two subheadings: *Determine the Required Skills* and *Develop and Review the Protocol*. The case study is ideal because it can be adapted to reality even in the test condition evaluation, where the understanding differs by proper construction under various circumstances. The reason to represent any phenomenon for a case study is the same as a play carefully tested in a well-formulated theory [6].

According [6] that suggested the researcher must possess or acquire the following skills: the ability to ask good questions and to interpret the responses, be a good listener, be adaptive and flexible to react to various situations, have a firm grasp of issues being studied and be unbiased by preconceived notions. The investigator must be able to function as a "senior" investigator [7].

As a case study, the explanatory model revealed in this article outlines the results from a literature review of concepts from an exploratory survey of Lean Six Sigma, where for the model "statement and proof" we say "how" and "why" and think about a phenomenon [6]. The case study attempts to predict and explain phenomena that, taken together, comprise the ever-changing administrative environment [8].

The preparation of this research was done to collect data that we used in the literature search, document review, interviews, and direct observations in the research environment, which was the Port of Santos. In the final stage, considerations of the draft case study are geared to contribute to the effective understanding of the issues presented in the logistics sector.

Therefore, the outline of a third party is required to obtain a pragmatic view of the concept of Lean Six Sigma. People merely represent the stakeholders in the chain, which must seek the participation of a process of value creation for continuous improvements.

IV. ANALISES AND RESULTS

4.1. Lead time and speeding the process

To analyze the lead time (time) we can consider the time it takes to deliver the product or service the request after being shot. Utilizing the equation known as Little's Law [3], we can define with the equation (1):

$$\textbf{Lead time} = \frac{\text{Amount of Work in Process}}{\text{Average Completed}} \qquad (1)$$

According [3] equation can reveal the lead time, that is, time that any item of work can be completed, by simply counting how much work is still in one place until it is concluded from the data that there is a work in process (WIP), that is, how many things we can conclude (work in progress) every day, week, etc. (average completion rate).

Like [3] states, when there is a WIP process, there will be worked to be completed. In Lean language, this means that the work will always be "inline"; waiting time is the "timeline." According to [3] it is inferred that any time during which a running process remains in the queue should be considered a delay in the Lean philosophy, no matter what the cause or underlying factor.

It is important to understand that some activities add value to customers, and value-added effectors may be a change in the process that customers are willing to pay. However, if customers refuse to pay an additional option for a new logistics system and remain in the existing system, without testing the proposed methodology because the new cost, it is possible, may not create value-added to the client and the production process hat customer or the innovation does not reflect the efficiency of the new process

4.2. Process efficiency of the cycle

Like [3] states, the critical measure of waste to any process of service is discovering what percentage of the total cycle time is spent on value-added activities and how much is wasted. The measurement used is the process cycle efficiency (PCE), which relates to the amount of time value-added to the total lead time of the process, according to equation 2:

$$\textbf{Process Cycle Efficiency} = \frac{\text{Time Value Added}}{\text{Total Lead Time}} \quad (2)$$

To analyze the process cycle efficiency with less than 10% indicates that the process has wasted many opportunities to non-value-add. Like [3] states, it is extremely important to consider the following assumptions:

1°. Most cases are considered "non-Lean," that is, has an efficiency of process cycle under 10%,
2°. A primary goal of Lean is certainly a reduction in control of the WIP (WIP if it cannot control time),
3°. The entire process from the perspective discussed must operate in and not push the system to eliminate variation in lead time,
4°. Usually, the vision shows Lean in only 20% of the activities causes 80% of the backlog,
5°. Consider the invisible work (intangible) or service cannot be improved; we need visual management, based on data,
6°. Create a value stream map of complexity on top of the generator selected value to capture the workflow and quantify waste and delays,
7°. Determine the largest time trap - Ishikawa Diagram,
8°. Identify projects to eliminate time traps (using Lean tools, Six Sigma, and/or reduced complexity) - set the CPM - Critical Path Method.

For LSS functional applicability in logistics, it takes the commitment of every manager, and they are especially familiar with the concepts to be defined in the training of employees classified as leaders or champion Black Belts. These leaders are extremely important because they have the technical attributes that accredit management in the analysis of so-called time trap processes in more detail - otherwise, they lack rigor in the final link between strategy and logistics projects to be implemented in light of the knowledge of the practices of organizational Lean Six Sigma [3].From the viewpoint of [2], Lean Six Sigma (LSS) emerges as a model of excellence to the forefront of production. In practice, innovations in business management with the LSS occur because:

- Six Sigma is headed for a strong relationship with the reduction of process variability, acting on the variation of production by avoiding rework that is usually represented with cost and quality, which are crucial to delivering business value without adding value to logistics service,
- Lean Six Sigma concomitantly focuses on eliminating waste to shorten cycle times of services and aims to accelerate the flow of the lead time logistics situation with the definition of system analysis.

The main reason for the constant search for better implementations by the enterprises, and the search for results in leaner structures, acting as global standards. In this dynamic context, the provocative new administration ideas are a reality where the administration starts to focus on the individual and the commitment of people towards the company's results. And thus, the great concern is to establish levels of priority within the own administrative segments. Organizations of different sizes and in a variety of sectors are constantly being faced with a growing competitive environment as well as relentless pressure from customers to maximize value in both products and services [13]. Lean manufacture is one of the most effective transformation initiatives available in strategic manufacture management as an effective top-down methodology for improving quality in business and their larger counterparts [14] and [15].

This integrated vision of Lean and Six Sigma envisions increasing customer value in the use of products or services to a certain inherent logistical supply chain. On the other hand, in logistics networks, it is demonstrated that Lean Six Sigma when combined can successfully integrate a broader framework and can be used to support the business value based on organizational processes used by the operator's logistics services [16]. When combined, LSS seeks continuous improvement to meet customer needs in the internal and external environment for administrative systems that identify methods for monitoring and process control in various forms of management tools that we can mention, Kanban, Kaizen, and organizational philosophies of Just in Time.

According to [17] Lean process, is a system designed to deliver customer products and services with no errors in the shortest possible time, with less effort, resources, space, and capital. An important element is to identify how people understand the main performance indicators and the strategies within the organization so that they can better prepare them for any type and practice of excellence in quality and operations. Another element to be focused on and that is critical, being able to visualize any processes or activities that do not add value and generate waste. Identifying defects becomes an opportunity for facilitating the solution of problems with a vision of excellence in LSS quality [18].

Lean is a value-focused, waste reduction strategy, which aims to eliminate non-value-added activities and all kind of waste from a process [19]. The application of Lean manufacturing and operations with a specific application in areas such as Maintenance, Tooling Shop, Services functions, and

Logistic operations is increasingly used. The academy is increasingly orientated in the application and implementation of Lean Processes [19] and [20].

4.3. Concepts of intermodal and multimodal transport

For [21], intermodally can be conceived as a transition from one mode of transport to another and is organized around concepts such as:

a. The basic nature and quantity of goods transported;
b. The modes of transport used;
c. The locations of origins and destinations;
d. The transport time and costs;
e. The value of goods and the frequency of boarding.

Intermodal transport network – One-way logistic systems connect between two or more modes using different modes of transport charging a fee. Modes are common features of a transportation system that saves loads (or people) transferred during movement between origin and destination [19].

Multimodal transport network - A set of transports offering a set of connections between origins and destinations where intermodal transport may not necessarily occur in an integrated manner [19].

Normally, this organizational model can obtain a larger amount of cargo/transport, or more frequently, especially between the port terminals. In such circumstances, the efficiency of the network lies mainly in the transport capacity of transshipment terminals inside or outside the organized port.

The reason for the investigation of the applicability of this concept in organizational practices is because LSS aims to meet the difficulties of eliminating the port environment and the methods used by unnecessary movements in the "workplace." When the barriers of time and the differences between the proposed system and the transportation model, the organization may propose continuous improvement in several ways. To measure the variations of these results, organizational models are often broadcast on the companies obtained with administrative tools for management control. The most commonly used is Kaizen.

The Kaizen tool is applied as an event to improve where people work intensively, and it is exclusively focused on improvements over sometime within or outside the organization. In this type of event, some experts are brought together for 4 or 5 continuous days to complete most of the organizational study or all of what we call a cycle following the DMAIC method, referring to a matter of high priority [3] limited to the example: *operator must make the materials reach the logistics platform faster and in the better transit time.*

4.4. The preparation of DMAIC intermodal transport logistics

The use of "Ontime in full" (OTIF), that is a widely used indicator to measure the performance of logistics customer service. This methodology is flexible and can be used to analyze the suppliers, customers, or internal processes, so modulated. In philosophy, Lean Six Sigma, and in a complementary way the OTIF, plan the structure of DMAIC and are used to approximate the processes of Lean Six Sigma for improvement and problem-solving.

As provided by [23], the methodology proposed for OTIF is established by the DMAIC, whose initials stand for the following English words: Define, Measure, Analyze, Improve, and Control:

D - Define the problem and the impact of the organization
M - Measure the performance of the organization
A - Analyze and identify the causes of the problem with performance
I - Improve the process to attack the causes of problems
C - Control the process to sustain the improvement

According to [24], OTIF is an indicator of a strategic initiative; it should be aimed at corporate strategic planning. In the analysis of Lean Six Sigma services, one vision addresses interests and needs and identifies how to establish the concept of innovation with OTIF to the business. OTIF guides the care of intermodal transportation services. It is, therefore, an indicator of observations establishing criteria to maintain adequate service to the customer's needs. The quality of service is related to the ability to minimize the transit times for modal between expectations and perceptions of customers and suppliers in the operational management of the total lead time of the customs procedure in question.

Identifying the ideal performance indicator for the value-added service while providing for the customer helps gain competitiveness. For this it is extremely important to involve factors such as availability of vehicles at the scheduled time for port terminals, minimizing delivery time to reduce the cycle time of the request, and other aspects of productivity indicators for modal scenarios complexity.

V. THE CASE STUDY

The company ITRI is used exclusively for a railway line within an intermodal terminal located in Suzano (LCIC, Cragea). This allows the transport logistics intermodal train to run express trains daily with pre-set, enabling customers the ability to use the concept "Just in Time" proposed in Kaizen. The possibility of using this method aims to provide greater logistical security and accuracy in delivering goods to customers.

In this case study, the ITRI serves as a multimodal logistics operating company and aims to operationalize the operating condition of a dry port or LCIC for the removal of customs cargo in transit through a process called DTA multimodal yard.

For this type of customs process, importers consider important service performance as the lead time of the process, like the price difference in the composition of the freight.

The inventory of operating costs makes evident the reduction of costs in the intermodal transport logistics service. Thus, it is clear that rates added to the service road can be minimized with the use of rail and intermodal logistics, because the railroad reduces costs to the carrier, such as rates of tolls, rates of scales, parking, and as well as the differentiation of port costs by type ,in the preparation of cost by the customs process.

Based on data collected from ITRI participation of representatives who report activities of LSS, Kaizen aims to identify practices that can generate added value or value-added processes from customers, which leads to an efficient intermodal transportation system. The proposal of the customer who prefers to remain anonymous is demonstrated in this copy of the slide shown in Kaizen shown in Figure 3 below.

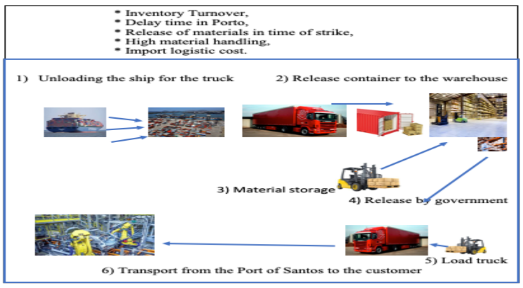

Figure 3. Stocks pre-DMAIC - Kaizen activity. (before)
Source: Resources data.

In this sense, modal road and rail are investigated from the operational performance and costs standpoint inherent in the activity of removal from the customer's areas that are proposed. On the way investigated, proposes eliminating the wasted time in the activity which may not result in reduced lead time to the activities related to the critical path, by controlling the time of the process, from the origin of the cargo from the Port of Santos (SP) to the destination in the LCIC Cragea of Suzano (SP). See Figure 4 below.

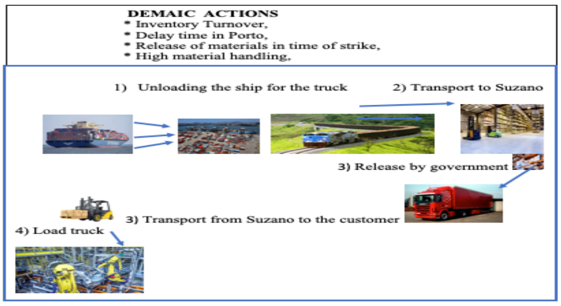

Figure 4. Stocks post-DMAIC - Kaizen activity (after).
Source: Resources data.

OTIF - Calculation based on requests handled in lead time rather than volume of services by type, according to [3] to the equation 3:

$$\textbf{KPI/Modal} = \frac{\sum \text{Number of Requests Served}}{\sum \text{Number of Requests under Lead Time}} \times 100\,\% \quad (3)$$

In this case, a solution is the application of the DTA process - "Freight Yard." The choice of the customs process is essential to the effectiveness of the modal, which may favor a strategy of changing modal freight to rail, thus avoiding wasted time with the option of nationalization of the load in the secondary zone. In the comparison below of the process cycle efficiency, the customs process in question is named DTA 1 - COMMON, as shown in Tables 3 and 4.

Table 3 - CPM: Critical Path Mapping Process DTA Common

Removals in transit customs **Action activities in a DTA 1 - common**	Activities predecessor	Duration in H / useful	Time limit
a. Maximum time (medium) in the release of cargo		0	960
b. Preparation of the order of a Common DTA	A	48	912
c. Conference on Primary zone (stored charge)	B	480	432
d. Other entrants requirement of fiscal organ interviniente	C	76	356
e. Analyze the process (clearing) impaired	D	72	284
f. Requirement of the procedural document for review	E	120	48
g. Carregamentoi the vehicle at the port (wagon)	F	116	24
h. Release of load AFNT	G	24	0
i. Transpoorte railroad	H	24	0
TOTAL		960	
		importer ITRI	

Source: Resources data

Table 4. CPM: Mapping the activities of the customs process for use of DTA PATIO

ACTIVITIES	Activities predecessor	Duration in H / useful	Time limit
a. Analyze the documents (BL invoice) dispatch		0	48
b. Preparation of the DTA - over patio	A	4	44
c. Analyze the process (custon) automatic	B	12	32
d.Removal of the area of the operator for the area of port	C	12	20
e. Loading wagons	D	6	14
f. License for the release of the physical of the AFTN	E	4	10
g. Rail transit in the custon	F	10	0
TOTAL		48	0
* Custon, Port operator		importer ITRI *	

Source: resources data.

Table 5 shows the analysis of inventory costs with the implementation of DTA - Freight Yard and can see the cost reduction based on the use of the railroad system.

Table 5. - Analysis of inventory costs with the implementation of DTA -

DTA MODE - TREATMENT WITH DIRECT LOAD PORT TERMINAL		
LOGISTICS TRANSPORT APPLIED TO ROAD TRANSPORTATION		
EXPENDITURES FOR REMOVING LOAD CONTAINER 40'	Value	US$ 1,466.90
LOGISTICS TRANSPORT APPLIED TO RAILROAD TRANSPORTATION		
EXPENDITURES FOR REMOVING LOAD CONTAINER 40'	Value	US$ 1,037.17
COMPETITIVE DIFFERENCE IN DOLLARS		US$ 429.73
FORECASTING OF MOVING CONTAINERS		6
COST REDUCTION PER PROCESS		**US$ 2,578.38**

Source: Resources data.

The modal rail in the operational aspect is not as flexible in terms of time in the operation of customs procedures. The railway compared to road transportation is only impaired in the end when lead time depends on the static capacity of railway lines, which include the port terminals and depend on trucks to move the containers inside the yard so the operators cannot minimize the queue times to the desired Key Performance Indicators (KPI) on the OTIF.

The limitations of the modes are investigated considering performance indicators because the railroad depends on the release of the railway terminal adjacent to the port due to receipt of wagons. To add value to multimodal, the logistics operator should avoid any barrier to the circumstantial restrictive customs clearance process to get the OTIF desired by customers.

Effectiveness in negotiation with port terminals is essential with the contractor services BNVA to explore an infrastructure, public or private, within the port environment. The structural factors in the management of the port intermodal have an impact on costs in different areas of the port of removal. Also, strategies may differ in the modal control of KPI lead time of the production process of the port terminals, based on OTIF, especially when changes are applied through the railroad to reduce time and costs in intermodal logistics.

VI. CONCLUSIONS

In the control system applied to the LSS, a vision was realized that the analysis of time wasted by NVA storage services is likely to be verified in stages, continuously, to reduce the residence time of the charge within the primary zone, the Port of Santos. Following the proposed structure of DMAIC and by imposing performance targets of VA activities to the customer, you can define organizational ways to minimize the risk of the variability of intermodal logistics with Lean culture at every customs process.

The concepts of organizational improvements and checking every process of Kaizen made directly with customers should be tested for best results and continuous improvement to sustain the process of DTA Patio and to reduce safety stock inventory given the greatest attention in the supply chain when nationalization of import cargoes inside the port. The results with the implementation of the methodology of Lean Six Sigma should be based on increased customer satisfaction and loyalty, after the acceleration of the supply chain through the VA increased synchronization between processes. Stakeholders as logistics service providers focus on a customs process for Lean and aim to optimize service logistics (JIT) to minimize operational risks that may cause variability in process times (Six Sigma) customs in question.

The critical path method (CPM) can be applied to identify targets and waste time on tasks BNVA, before choosing the customs process DTA multimodal yard. So, you can detail in more structure customer bottlenecks in existing operational processes between modes of transport. The complexity is monitored by the logistics manager to demonstrate the most economical modal logistics, which can significantly (impair?) the comparison of costs between the modes of road and rail

Concomitantly, the phases of the inventory of operating costs and reduction in service costs of intermodal transport, particularly through the removal of customs import cargoes in the process of DTA multimodal yard toward the port "dry," may support the strategy of modal shift in modal choice.

It is inferred that with the organizational philosophy of Lean Six Sigma to establish the performance by OTIF modal, you can adjust the process to minimize variability by losses, provided there is a decision about customs procedures and appropriate use of the modal characteristics, especially when there is interest in innovation in the use of intermodal transport systems.

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