

## **A Review of Distribution Logistics in the Brazilian Oil Industry**

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### **Abstract**

*applied was the bibliographical research, using scientific papers and specific literature, as in printed materials and / or published on the Internet. The strategies of organizations are becoming increasingly directed to the pursuit and maintenance of efficiency and effectiveness, seeking to optimize the resources used to achieve these goals. The logistics of transportation and distribution, when properly used, it is a key factor to make the petroleum-based fuels reaching consumers at lower cost. Emphasizing that, the petroleum-based fuels are automotive gasoline, diesel, liquefied petroleum gas, aviation kerosene and fuel oil. Due to the complexity on the fuel distribution logistics in Brazil, with notice to the location of the main storage bases and delivery stations of products, evaluation of fuel bases, appropriate inventory level, compared to consumer demand and operational infrastructure of distribution, it is seen that there is a significant opportunity assessments and investments to improve the distribution logistics.*

**Keywords:** Petroleum. Fuels. Distribution. Logistics. Transportation.

### **Introduction**

The logistics process is dynamic in its conceptualization and definition of actions, with significant representation in the overview of the organization and has a proposal to make efforts to fulfill its strategic role and seek the best cost / benefit ratio. Therefore, it involves a set of related activities not only planning, but mainly to the organization, controlling and performing the tasks of storage, transport and distribution of products.

Seeks to play efficiently and effectively the flow of raw materials, in-process inventory, finished goods and related information from the origin to the point of consumption in order to meet the customers' needs and requests. Information technology is increasingly evident as a relevant factor for the logistics improvement, maintaining the priority for transportation, which manifests itself as a logistics activity of greater representativity and importance, always looking for the best options rapidity, quality and operational cost.

One of the main characteristics of transportation is the movement of products from production sites to the set destination, taking into account procedures that minimize costs and optimize resources. In this process, it should paid attention and care to reduce damages. In contrast, the operations must be performed in order to meet customer demands, observing the operational capacity of delivery and availability of transportation information. The performance of logistics activities to achieve high levels of efficiency and effectiveness means defining the correct choice of transport models. The main aspect that involves the search for more rational modal solutions is the reduction of logistics costs associated with shipping and quality customer service.

Costs related to logistics operations and demand for the product of a particular company are achieved, among other things, by high transport costs and the quality of services provided. Be aware of the transport operations prices can facilitate the decision making process for hiring a cargo handling system.

However, choosing the definition of a transport system based only on the lowest cost may not always configuring a right and coherent decision, as they may not represent the minimum cost for the entire supply logistics chain. In this way, the process of choosing and setting the mode of transportation requires analysis of prices, observing the operational structure, checking the levels of alternative options services, profile of the carrier and the possible combinations of modes. These are important considerations that must be evaluated for decision making regarding a cargo handling operation.

Within this scenario of complexity are the distribution logistics activities of petroleum-based fuels. The mapping of the situation shows certain products, several points of production and a vast territory to work attendance to all customers, thinking in terms of Brazil. Given the size of the country, significant numbers represents the entire distribution process that seeks to meet the needs of a wide range of sectors of the Brazilian economy and ensure the supply of aviation, railways, power plants and the vehicle fleet.

Substantiated by the arguments presented to the interpretation that may be deeper in the discussion and find relevant information that provides a comprehensive view on the movement of petroleum products. Thus, this article has its development according to the guidelines of the overall purpose, which is to conduct a distribution logistics analysis of petroleum fuels in Brazil, seeking to report the setting and the characteristics of the transportation. To do so, it has the specific objectives to describe the logistics process, with emphasis on the transport and distribution; report the production scenario and fuel consumption in Brazil; and observe relevant aspects to the definition of modes for the movement of fuel in order to meet the demands of customers.

To conduct this study, it was used the bibliographical research method, which consists in examining the literature for the survey and analysis of what has been produced on the subject that we take as a scientific research topic. This method was conducted at two phases: the collection of bibliographic sources, which has made the lifting of the existing literature and, right after, the collection of information, which was carried out the compilation of data, facts and information contained in the selected bibliography.

It is, therefore, a research work whose relevance is justified by the fact of seeking explanations about the logistics process that performs the distribution of fuel and, in this way, generating knowledge about this situation which enable the understanding of this subject, and also, be a motivational factor for other researchers to address this issue.

The content of this article in its evolution is structured, in addition to this introduction, which presents the main aspects of the approach, the second part describes the logistics in its range with emphasis on the distribution of petroleum fuels, the third part presents the final considerations with the main points and finally references, which are the sources of research.

## ***2. Logistics Distribution Of Oil Fuels In Brazil***

Among the organizational strategies, especially in terms of production, the prospect of market requirements stands out for the purpose of meeting and satisfying the market to which it is trying to serve. Slack, Chambers and Johnston (. 2002, p 91) are convinced to say that "no productive operation that continually fails to serve properly their market has a chance to survive in long term."

Distribution channel is the mechanism through which products and services are transferred from manufacturers to end consumers. In that way, the purpose of the distribution channel is to connect the manufacturer of a product or service to your user. From a managerial point of view, it means the distribution channel as a set of external agents involved in the process of making goods and services available for use and consumption.

In this sense, it demonstrates the importance of logistics, in particular, the distribution of products to the organization. Including for petroleum-based fuels.

### **2.1 Logistics**

Logistics brings together a number of different activities with significant participation in any development process, when it values the actions of planning, control, maximize profits and reduce costs. In this manner it evolves the expected efficiency and effectiveness. Logistics has a close relationship with management and it enables the performance of a work with positive results and with total security. Logistics is the process of planning, implementation, flow control and efficient storage of raw materials, in-process inventory, finished goods and related information from the point of origin to point of consumption in order to meet customer requirements, in the same organization. In an industrial context, the art and science of management and engineering for, produce and distribute materials manufactured or processed to a specific location and in specific amounts. In a military sense may also involve the movement of personnel / resources (MOURA, 2004, p.136).

The thought of Ballou (2001, p 21) shows this same line of reasoning that in this context is the definition of logistics mission under the corporate vision: "The mission of the logistics is to dispose the goods or the right service, at the right place, at the right time and in the desired conditions, while providing the greatest contribution to the company."

According to Novaes (2001), logistics is a concept that favors the realization of the activities and achievement of the objectives set by the organization and, without it, it becomes difficult to achieve the goals of adequate and efficient manner. The author adds that the logistics is aimed at increasing profitability and reducing costs in the evolution of the process, seeking to meet the needs and consumer preferences. When interpreting that each logistics chain link is a client of its suppliers, it is important to be aware of the needs of all process components, in order to cause complete satisfaction.

To Ching (2001), logistics demonstrates operations in three fields: supply logistics, production logistics and distribution logistics. The first is the direction for relations between companies and their suppliers, in order to develop products and ensure the quality of raw materials, components and packaging in order to meet the production requirements at the lowest possible total cost. The second field has the attention focused on the changes applied to the material for the final or finished product, trying to meet the deadline and conditions established. Finally, distribution logistics that has the responsibility of distributing the finished products, showing an appropriate level of service and customer service.

Filla (2001), defines logistics as a planning activity that intends to minimize the cost and time in highly complex distribution or production processes. Demand integrated capabilities for the purpose of recording efficiency of the production process. Logistics, however, is a tool that contributes to the reduction of operating costs and maximize organizational profits of the company in this way, logistics generates its processes so that the entire supply chain is able to evolve in a positive way. In short, logistics brings together a set of actions that seek to undertake and achieve the best performance efficiency and low cost.

Faced with the evolution of the concepts and definitions the Council of Supply Chain Management Professionals (CSCMP) presents a more current and comprehensive approach to logistics: The process of planning, implementing and controlling procedures for transportation and efficient and effective storage of goods, including services and related information from point of origin to point of consumption in order to meet customer needs. This definition includes loading, unloading, internal movements and external (CSCMP, 2013).

However, Morais (2015) observing this conceptualization of CSCMP (2013), realized the complexity of the definition and activities that logistics absorbed. Mentioning the processes of planning, implementing and controlling, it imposes to the area an administrative and strategic vision. The efficiency and effectiveness demonstrate the importance of procedures to be adopted properly and, as much as possible, improved. Logistics also has directed attention to the information about the delivery activities of the product. The reference to customer needs is associated with the importance of marketing logistics. In this way the shipping activities, landing and handling do not add value to the product, but costs are therefore optimization points by the organization. So, logistics involves a set of concepts and definitions that are attributed according to the situation undertaken and procedures, and implementation of circumstances.

### **2.1.1. Transport Logistics**

Transport logistics evidence their actions in cargo movements between the origin of the product and the consumer. Despite a simple overview, however, consists of an operational complexity, compared to the considerations that must be made regarding to: the material to be transported away, route, time, security, transport type and other variables.

Observing the concept of cargo loads, Caixeta Filho and Martins (2001) point out that research in transport have been developed in various areas of knowledge and are of high importance to the logistics activity, where transportation is usually the main element representing on average one to two thirds of logistics costs. In this way, the transport involves with the movement of goods, routing and use of the operational potential of the vehicles.

The concept of Arnold (2009) shows that the transportation system uses a number of methods for handling their raw materials or their final products, perceived as the higher cost of the distribution process, generally equivalent to a representing between 30% and 60% of distribution costs. Among the types of transportation, it has road, air, sea, rail and pipeline, in which each link in the logistics channel, each mode highlights specific advantages. Determining factors are the freight and insurance costs as well as operating costs in terminals and storage during transport.

*Keedi (2001: 25) points out that:* Transport accounts for how to make a commodity go out of their point of origin [...] to the one who is forwarding, and be delivered to your destination [...] more conveniently, the shorter time, appropriate cost, and the lowest or any problem, using the most appropriate means available for this purpose.

Araújo and Michel (2001) argue that the movement of the resources necessary for the production process of goods and services is presented as an element of essential importance, since the value related to these resources are confirmed by the provision in place, in time and in the correct amounts.

The transport activity requires careful study, with the purpose of calculating the logistics costs, as well as allowing assessment, measurement and interpretation of data to better segment joint, as a potential competitive advantage strategy and participating significantly to the consolidation costs, transport rationalization and reduction mode waste to meet the demands of consumers (MACEDO; COSTA; SILVA, 2012).

According to Caxito (2011), transport is classified with modality:

- Ground: road, rail and pipeline;
- Waterways: maritime and waterway;
- Air.

And the composition as presented and used, Caxito (2011) explains that can be:

- a) Modal or unimodal: it involves only one mode;
- b) Intermodal: it involves more than one mode and for each section / modal is made a contract;
- c) Multimodal: it involves more than one method, but governed by a single contract;
- d) Segmented: involves several contracts for various modes;
- e) Successive: when the goods to reach the final destination, must be transhipped to continue in vehicles of the same mode of transport (governed by a single contract).

With the options of transport operations, the company should seek to adopt the kind of modal that fits the most and the most viable benefit to cost, so that it can contribute to the delivery of the product safely and without generating customer damage.

### **2.1.2. Distribution Logistics**

The distribution logistics or physical distribution is defined by Ballou (2001) as part of the logistics business that takes care of the handling, storage and order processing of the final products of the company, noting that with regard to logistics costs, this activity can be seen as the most important for most organizations. The main objective of physical distribution is to enable the products to reach the client or consumer with the quality of service desired by the lowest possible cost (Novaes, 2001).

The configuration of distribution networks, as Andrade (2004), aims to provide better customer service levels, reduce costs, improve the quality of services offered to consumers and enhance the operational efficiency and effectiveness, allowing the preparation of planning and the management of a structure with facilities and their flows of materials and information. This way, it is seen that the physical distribution works with transportation with emphasis on the transfer or delivery of goods and services, which registers a significant part of the cost of a product or service, reflecting their competitiveness, and yet, essential to analyze the reliability and quickness of deliveries, meeting the deadlines.

Physical distribution of materials reveals to be a constant logistical challenge. Defining the location and function of storage facilities is a strategic decision. It is part of an integrated set of options that have the involvement of customer service policies, inventory policies, transportation and production that are intended to maintain an efficient flow of materials and finished goods throughout the supply chain. (LACERDA, 2000).

The view of Morais (2015) reveals that distribution centers have their projects aimed to allocate products in transit, not only to store them. They are spacious and automated environments, structured to receive products from different sources, accept orders, serve them with efficiency and dispatch products to customers in a region quickly, that is, a business unit that is intended to store the manufactured products or purchased for resale, and ship them to other locations, making it the most dynamic and profitable process.

Lastly, according to Bertaglia (2003), distribution logistics is a process that generally is associated with the movement of materials from one point of manufacture or storage by the customer. The activities involve inventory management functions, handling of materials or finished goods, transportation, warehousing, order management, distribution and other local analysis.

## 2.2. Fuel Oil Products in Brazil

Oil has a technical definition by the Brazilian Federal Law 9.478 of 1997 among its resolution establishes in its sixth article, item first that "oil means any liquid hydrocarbon in its natural state, such as crude and condensed oil" (BRAZIL, 1997). And the third item carved of the same article states that "Petroleum Products: products derived from petroleum refining" (BRAZIL, 1997).

According to the Brazilian National Petroleum Agency (ANP, 2015), fuels are defined as "product used for the purpose of producing energy directly from their burning or its transformation into other products also fuels". With such major oil derived fuels, has "automotive gasoline, diesel, liquefied petroleum gas (LPG), jet fuel and fuel oil" (ANP, 2015). All fuel sales is made by fuel distributors authorized by ANP as ANP No. 202/99.

## 2.3 Transport and Fuel Distribution in Brazil

By Law 9.478 / 97, it was determined the current regulatory framework of the oil industry in Brazil, which had among its objectives the introduction of competition in all segments, seeking to establish in this way, an economic efficiency (which would reverted in benefits for society as a whole - and for consumers in particular) using the increase in competition among economic agents. With regard to the fuel distribution sector, it can be identified the starting point of this new model to regulate the distribution of activity given by ANP No. 202/99 (ESTEVEES, BICALHO, 2008). The fuel distribution companies perform marketing activities wholesale automotive fuels such as gasoline, ethanol and diesel oil, supplying the retailer (service stations), end consumers and transporters-Dealers-Retailers (TRR's) (ESTEVEES; BICALHO 2008).

According to ANP (2015), the agents of active supplies in Brazil (updated September 2015), with respect to petroleum-based fuels are presented in four dimensions, as shown in Table 1:

SUPPLIERS	DISTRIBUTORS	RESELLERS	CONSUMERS
17 Oil Refineries 317 Importers and Exporters of Oil and Derivatives 45 Biodiesel Producers	206 Distribution of Liquid Fuels 22 Distribution of LPG 5 Distributors Aviation Fuels	382 TRR 40,541 Resellers Retailers fuels Net (16.065 White Flag) 60,541 LPG Dealers 236 Aviation Resellers	14.470 Supply Points (facilities)

Fonte: ANP (2015, p. 5)

As can be seen, in general, the products come from refineries, petrochemical plants and marine terminals in the case of cabotage and import, and then are transported to the primary and secondary storage. The process of distribution of automotive fuels for resale stations is carried out by different modes of transportation, observing the location and the existing logistics conditions. Note that distribution companies purchase products from different sources, then stores them in bases at different points and then sell the products with various kinds of agents: retail stations, TRR, final consumers (ESTEVEES, BICALHO, 2008).

According to information disclosed by ANP (2015), the production of petroleum-based fuels, in 2014, presented the following scenario:

- Automotive gasoline: 28.8 million cubic meters;
- Diesel oil: 49.7 million cubic meters;
- LPG (Liquefied Petroleum Gas or cooking gas): 7.6 million cubic meters;
- Aviation kerosene: 6.1 million cubic meters;
- Fuel oil: 16.3 million cubic meters.

It comes to high volumes, but those are compatible with the demands in terms of Brazil. Noting that all this amounts and products in order to reach consumers required a transportation and distribution logistics. Overall, the logistics planning of an organization has the attention directed to the modeling decisions about inventory, transportation and location of facilities. The fuel distribution operates with a very traditional logistics project, being the distribution channel verticalized and supply chain segmented. In this scenario, there are three types of flows in performance in the distribution of fuels: primary flows (from refineries to distribution bases), transfer flows (between bases) and delivery flows (from the basis to the customers). In the fuel distribution supply chain, the primary diesel and gasoline flows (withdrawals of refineries and transport for primary bases) are usually carried out by pipeline and coastal shipping.

The main modes of transfer to distribution bases are done in rail and road, while retailers deliveries are performed all by road, which most of the times are short distances (ESTEVEES, BICALHO, 2008). The location of the facilities (primary and secondary bases) is very important in fuel distribution, since the product transfers take place for the purpose of bringing the stocks closer to consumer markets in order to reduce the cost of road transportation to the gas stations. Another important factor, in addition to the location of distribution facilities, is the correct dimensioning to reduce the waiting time for loading oil trucks, that transport the product to the end customer, increasing the productivity of the asset.

The concept of productivity goes through the cycle definition, which constitutes a set of operations performed by an equipment over a period of time, returning then to their condition / starting point. The less waiting time in service to a base, the more it increases the amount of travel that trucks can do to end customers, which means saving resources for the company (ESTEVEES, BICALHO, 2008).

Another important aspect is the matter of cost of transporting fuel, which often proves to be the largest single part of logistics costs, being the cost of the mass inversely proportional to the size of load, showing that: the greater the cargo is, the lower the cost is per unit mass (ESTEVEES, BICALHO, 2008). Due to the complexity on the fuel distribution logistics in Brazil, with notice to the location of the main storage bases and delivery stations of products, evaluation of bases, appropriate inventory level, compared to consumer demand and operational infrastructure of distribution, it is seen that there is a significant opportunity assessments and investments to improve the distribution logistics.

### **3. Final**

The legal framework of the oil industry, introduced in the late 90s, established a new set of rules for the fuel distribution market, in which companies have adopted different strategies in order to suit the innovations of the market. This is because the changes meant lowering barriers the entry of new participants and increased the level of competition and competitiveness among businesses. In the case of a product that is used by all sectors of the economy, as are the fuels, the importance of logistics costs is amplified. The fuels are inputs of the whole economy and so have a strong influence on the final prices of a wide range of goods. That way logistics strategies resulting in reduction in prices could cause the multiplier effect and lead to a drop in prices from a high range of goods.

The structure of the fuel distribution logistics in a country like Brazil is a vital element for companies to both, maximize the operational from the efficiency point of view, and to minimize costs, due to the location of the main storage bases and points of delivery of products; the suitable dimensioning of the base, the desired stock level, and the kind of mode of transport being used.

**References**

- AGÊNCIA NACIONAL DE PETRÓLEO – ANP. Abastecimento em números. Ano 10, n. 48, ago. 2015.  
Available at: <<http://www.anp.gov.br/?pg=78132&m=n%FAmeros&t1=&t2=n%FAmeros&t3=&t4=&ar=0&ps=1&1449951963489>>. Accessed: 06 dec. 2015.
- ANDRADE, E.L. Introdução à pesquisa operacional: métodos e análise de decisões. 3. ed. Rio de Janeiro: LTC, 2004.
- ARAÚJO, R.R.; MICHEL, F.D. Problemas de roteirização em arcos: características e métodos de resolução. In: SIMPÓSIO DE PESQUISA OPERACIONAL DA MARINHA, 4; 2001, Rio de Janeiro. Anais..., Rio de Janeiro, 2001. p. 411-421. Available at: <<https://www.casnav.mar.mil.br/s/>>. Accessed: 29 nov. 2015.
- ARNOLD, J.R.T. Administração de materiais: uma introdução. São Paulo: Atlas, 2009.
- BALLOU, R.H. Gerenciamento da cadeia de suprimentos: planejamento, organização e logística empresarial. 4. ed. Porto Alegre: Bookman, 2001.
- BERTAGLIA, P.R. Logística e gerenciamento da cadeia de abastecimento. São Paulo: Saraiva, 2003.
- BRASIL. Lei no 9.478, de 6 de agosto de 1997. Dispõe sobre a política energética nacional, as atividades relativas ao monopólio do petróleo, institui o Conselho Nacional de Política Energética e a Agência Nacional do Petróleo e dá outras providências. Diário Oficial [da] República Federativa do Brasil, Brasília, DF, 6 ago. 1997. Available: <[http://www.planalto.gov.br/ccivil\\_03/LEIS/L9478compilado.htm](http://www.planalto.gov.br/ccivil_03/LEIS/L9478compilado.htm)>. Accessed: 22 nov. 2015.
- CAIXETA FILHO, J.V.; MARTINS R.S. Gestão da logística do transporte de cargas. São Paulo: Atlas, 2001.
- CAXITO, F. Logística: um enfoque prático. São Paulo: Saraiva, 2011.
- CHING, H.Y. Gestão de estoques na cadeia de logística integrada: supply chain. 2. ed. São Paulo: Atlas, 2001.
- COUNCIL OF SUPPLY CHAIN MANAGEMENT PROFESSIONALS (CSCMP). Supply chain management definitions. 2013. Available: <<http://cscmp.org/aboutcscmp/definitions.asp>>. Accessed em: 08 dez. 2015.
- DIAS, M.A.P. Administração de materiais: uma abordagem logística. São Paulo: Atlas, 2007.
- ESTEVES, H.B.B.; BICALHO, N.C. Aspectos técnico-econômicos da logística da distribuição de combustíveis no Brasil. In: RIO OIL & GAS EXPO AND CONFERENCE 2008; 2008, Rio de Janeiro. Anais..., Rio de Janeiro, 2008. Available: <<http://www.anp.gov.br/?dw=58912>>. Accessed: 5 dez. 2015.
- FILLA, E.B. Logística e geoprocessamento. São Paulo: IMEC, 2001.
- KEEDI, S. Logística de transporte internacional: veículo prático de competitividade. São Paulo: Aduaneiras, 2001.
- LACERDA, L. Armazenagem estratégica: analisando novos conceitos. Rio de Janeiro: Centro de Estudos em Logística (CEL), COPPEAD/UFRJ, 2000.
- MACEDO, R.M. de; COSTA, P.P.A.; SILVA, E.P.G. Análise do processo de formação de cargas e proposição de sistema de informações para este fim em empresa do segmento farmacêutico veterinário. In: ENENGRAD, 23; 2012, Bento Gonçalves/RS. Anais..., Bento Gonçalves/RS, 2012. p. 411-421. Available: <[http://xxiiienangrad.enganrad.org.br/anaisenganrad/\\_resources/media/artigos/gol/05.pdf](http://xxiiienangrad.enganrad.org.br/anaisenganrad/_resources/media/artigos/gol/05.pdf)>. Accessed em: 29 nov. 2015.
- MARTINS, P.G.; ALT, P.R.C. Administração de materiais e recursos patrimoniais. 2. ed. São Paulo: Saraiva, 2006.
- MORAIS, R.R. de. Logística empresarial. Curitiba: InterSaber, 2015.
- MOURA, A.R. Dicionário de logística. São Paulo: IMAN, 2004.
- NOVAES, A.G. Logística e gerenciamento da cadeia de distribuição: estratégia, operação e avaliação. 3. ed. Rio de Janeiro: Elsevier, 2001.
- POZO, H. Administração de recursos materiais e patrimoniais: uma abordagem logística. 4. ed. São Paulo : Atlas, 2007.
- SLACK, N.; CHAMBERS, S.; JOHNSTON, R. Administração da produção. 2. ed. São Paulo: Atlas, 2002.