

# TRANSPORT LOGISTICS, INTERNATIONAL COMMERCE AND EXPORT FLOWS IN THE NORTHERN REGION OF THE STATE OF MINAS GERAIS<sup>1</sup>

LOGÍSTICA DE TRANSPORTES, COMÉRCIO INTERNACIONAL E  
FLUXOS DAS EXPORTAÇÕES NO NORTE DE MINAS GERAIS

LOGÍSTICA DE TRANSPORTES, COMERCIO INTERNACIONAL  
Y FLUJOS DE EXPORTACIONES EN LA REGIÓN NORTE  
DE LA PROVINCIA DE MINAS GERAIS

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## Abstract

International economic relations are organized in flexible and complex trade networks spatially structured by transport logistics. This paper aims to analyze the spatial interactions between the Northern region of the state of Minas Gerais and the international markets, considering the territorial configuration of the exporting sectors, the means of transportation, and the customs areas responsible for the flow of goods, from 2001 to 2012. The research was carried out through the means of literature review, data collection and analysis from primary and secondary sources to understand the export flow networks in the region. Transport logistics applied to the flow of exported goods has been organized in a service network consisting of national and international transportation systems and customs areas.

Keywords: Transport logistics, international trade, exports.

## Resumo

As relações econômicas internacionais estão organizadas em redes flexíveis e complexas de trocas comerciais articuladas espacialmente pela logística de transportes. O objetivo foi analisar as interações espaciais entre a região norte de Minas Gerais e os mercados internacionais, considerando-se a configuração territorial dos setores exportadores, dos meios de transportes e dos recintos alfandegados responsáveis pelos fluxos de mercadorias, no período de 2001 a 2012. A pesquisa foi operacionalizada por meio da revisão de literatura, das coletas e das análises dos dados de fontes primárias e de fontes secundárias, para a explicação das redes de fluxos das exportações na região norte-mineira. A logística de transportes utilizada no escoamento das mercadorias exportadas foi organizada em uma rede de serviços constituída de transportes nacionais, de recintos alfandegados e de transportes internacionais.

Palavras-chave: Logística de transportes, comércio internacional, exportações.

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1 Translated from Portuguese by Caius Brandão (caiusbrandao@gmail.com).

## Resumen

Las relaciones económicas internacionales se organizan en redes comerciales flexibles y complejas espacialmente estructuradas por la logística de transportes. El objetivo de este trabajo es lo de analizar las interacciones espaciales existentes entre la región norte de la provincia de Minas Gerais y los mercados internacionales, considerándose la configuración territorial de los sectores de exportación, los medios de transporte y las zonas aduaneras competentes para el flujo de bienes, entre 2001 y 2012. Se organizó la pesquisa a través de revisión bibliográfica, recopilación y análisis de datos de fuentes primarias y secundarias para explicarse las redes de flujo de exportación del norte de la provincia de Minas Gerais. La logística de transportes utilizada para el flujo de bienes exportados se organiza a través de una red de servicios constituida de una red nacional de transportes, de los servicios aduaneros y de una red internacional de transportes.

Palabras clave: Logística de transportes, comercio internacional, exportaciones.

## Introduction

This paper discusses the research themes from the perspective of Economic Geography, since transport logistics, international trade, and exports are studied in this field of Geography. For instance, transportation geography promotes a broad discussion about the structures of networks and trade flows, performed by transportation systems that are established according to the needs and demands put forth by the capital, (re) configuring the resulting territory and spatial interactions.

Logistics, transportation, and commerce belong to the daily life of people and companies, for it is through them that goods circulate in local, regional, national and international markets, or vice versa, expanding the economic, political, social, and cultural relations. Trade exchange systems have become increasingly complex, articulated, and organized in transportation and communication networks to allow the flows of goods and services in the world's geographical space.

International trade consists of flows of exported and imported goods and services, as well as of people, companies, and states, in the global economic scenario. In the export context, the flows of goods in networks encompass the infrastructure of transport logistics that spatially connects manufacturing plants, customs areas – ports, airports, border checkpoints –, and international markets.

This paper formulates the following problem as its object of investigation: how companies from the Northern Minas Gerais region organize the transport logistics that articulates spatial interactions from the flows of export goods to the international markets? The goal of this

study was to analyze the spatial interactions between this region of Minas Gerais state and the international markets, taking into account the territorial configuration of the export sectors, the means of transportation, and the customs areas responsible for the flow of merchandise, from 2001 to 2012.

In carrying out this research project, a literature review was used as a methodological procedure to support the discussions about themes and concepts related to transport logistics, international trade, and exporting. The theoretical approaches have been intertwined with the collection and analysis of secondary data provided by the Ministry of Development, Industry, and Foreign Trade (MDIC) on the ALICE WEB2 online platform. This data shows the spatial interactions among the flows of exports that have circulated through the logistics of national and international transportation systems from economic subsectors.

The data grouped together into sectoral categories enabled the production of thematic maps through the means of Arcgis 9.3 software. These maps show the spatial distribution of national and international transport logistics, including the customs areas used to allow the flows of goods exported by companies with tax domicile in the North of Minas Gerais. Furthermore, the destination countries of Northern Minas Gerais products were grouped together into regional economic blocs.

In the empirical component of the investigation, data were collected through 14 semi-structured interviews with representatives from logistics and/or foreign trade departments from companies with tax domicile in the region, which are responsible for about 98% of Northern Minas Gerais exports. The information drawn from these interviews complements the secondary data as it allowed the understanding of the choices made by these businesses for using certain logistics services (domestic and international transportation systems and customs facilities). Another important aspect is the assessment of the respondents' perceptions about the infrastructure of transport logistics in the region, which is used to gain access to international trade. Based on these interviews, the study highlights the main problems of transport logistics and possible solutions to improve the bottlenecks, directly and indirectly, affecting the logistics of transportation that enables the flows of goods exported by these companies.

## Transport Logistics, International Trade, and Exports of Goods

Transport logistics plays a critical role in the operation of commercial transactions and the movement of merchandises in the international economic scenario. For Silveira (2011), the dimension of the spatial interaction of capital assets has led to the tactical and strategic development of the logistics in network, linking the processes of planning, management, control, and organization of services to promote the increase of velocity, frequency, and security of the circulatory movement in national and international geographical spaces.

Logistics promotes the articulation and spatial organization of services, named as logistics primary activities and support activities by Ballou (1993). The primary activities comprise transport, inventory maintenance, and order processing. These three types of service are responsible for the largest part of logistics costs since they coordinate service levels and task fulfillments in logistics. Support activities assist primary activities, and consist of warehousing, materials handling, protective packaging, protection, product planning, and information maintenance, among others.

When considering the organization of logistics in network, based on a more geographical discussion between companies, suppliers and clients, Monié (2011, p. 152) points out:

Spatial interactions intensify on every scale since the productive networks integrate a growing number of suppliers and clients spread in the global economic market. From now on, the competitiveness stems less from the expansion of operations in a functionally segmented universe, and increasingly more from the ability to organize this complex system of material and immaterial interrelations.

When considering all the logistics services organized in trade networks, transportation is the most visible one, because it promotes the movement of goods produced in strategic points in the geographical space. In logistical network, Ballou (1990) points out that transportation has been seen as the most significant logistics activity because it is responsible for one- to two-thirds of all logistics costs. Somehow, one company needs transportation to move its raw materials and finished goods, since without using modes of transport the movement of material goods is impossible. In this context, what does transport logistics mean?

Transport logistics is the branch of logistics responsible for planning, management, and control of services that assist in decision making. Thus, it contributes to the choice of transport mode or modes of most suitable transport to put into effect the system of flows of goods and people in the local, regional, national and international geographical area, in a fast, efficient, reliable, safe, and preferably inexpensive way. The operation of transport logistics depends on infrastructure, load terminals, information flow, and logistics services to enable the spatial articulation among suppliers, producers, service providers, traders, and consumers (Pereira, 2015). For this reason, transport logistics is a vital activity in the process of trading goods and services.

In business, thanks to communication conveniences such as the internet, telephony, and electronic commerce (E-commerce), clients and companies conduct trade transactions more easily and efficiently. However, the physical delivery of purchased goods still depends on transportation systems to carry out the operations that bring the product to the client (Tseng; Yue, 2005). In the spatial interaction of service and good flows, according to Peleteiro (1990), modes of transport maintain the trade articulations for the distribution of goods and promote the socio-economic relations among different cultures. Throughout the history of mankind, trade has been a socio-economic activity developed with the purpose of offering production surplus to potential consumers. The mission of the transport sector is to intermediate and interconnect the communication channels among producers, traders, and consumers, through the provision of services in the distribution of material goods in the domestic and international trade arena. In the spatial structure of production and consumption, trade is characterized as a local, regional, national, and international activity (Andrade, 1991). In the virtual world, with the popularization of the internet and telephony in a more recent period, after 1990, also occurred the expansion of electronic commerce (E-commerce).

When considering the international trading systems, international commerce can be defined as the one that goes beyond the national boundaries of countries and can take place in two different ways: by selling, which are the exports, and by purchasing, represented by imports (Maia, 2013). Additionally, Rock (1973) defines international trade as an exchange of goods, services, and capital between two or more countries, requiring the use of currency as payment. For Soares (2004) and Silber

(2011), international trade happens through the course of purchase and sale transactions carried out by two or more economic agents – which can be individuals, companies or states – from different countries and subject to various laws. These agents trade merchandises, domestic and international transport services, in addition to contracting insurance and promoting financial transactions.

The crossing of national and international borders, through the exporting of goods and services, led to the explanation of the concept of exporting and importing. According to Ratti (2000) and Rebono (2007), exporting means shipping merchandises from one country to another, including the selling of goods as well as export services such as freight, insurance, and banking. Importing, on the other hand, occurs through the delivery to a particular country of goods and services purchased abroad. It is important to underline that the importing and exporting of goods and services is characterized by the products being either to or from one or more foreign countries.

The on-going spatial interactions of exports and imports in the international scenario create a network of specialized services to articulate the complex networks of trade-in-goods in the world geographical space primarily. For Thoman and Conkling (1972), the growth of commerce in several countries has constituted a system that channels, directs, and controls current international trade in goods and services. The movement of goods across borders requires the support from several private companies, usually located in big trading centers, which offer and operate different types of services anywhere in the globe.

In the international market, with a type of commerce ever more articulate and integrated, the exporting and importing of goods call for operations with highly specialized services, so that the products arrive at their destination in various markets in the geographical space. The intensification of trade among developed or developing countries has laid some more true foundations of accessibility to trading routes, reaching all regions practically. It became possible through technological innovation expressed in the (re)evolution of industrial production, transportation, and communication, which increased the flows of raw materials, semi-finished and finished goods in the global market (Thoman; Conkling, 1972). The technological, economical, and social transformations intensified, increasing the demand for production, trading, and movement of goods.

However, the international economic scenario has experienced moments of instability, particularly when there were numerous disputes for new markets.

In the post-World War II period, the expansion of international trade has significantly increased the interrelationships and interdependence among various sectors and/or segments of the global economy, thus accelerating the flows of capitals, goods, raw materials, services, and information among different regions of the world. For Jacks and Pendakur (2010), the chief reason for the boom in international trade is related to increased income of the population and its convergence in consumption growth. Hence, the massive growth of commerce has demanded negotiations to reduce customs duties, increasing the demand for transport, and interrelated with technological innovation, resulted in lower rates of freight in the supply of transport services.

According to Rodrigue, Comtois, and Slack (2006), the expansion of international trade in goods and services took place with the application of technological resources in productive integration, transportation and communication efficiency, and the flexibility of financial transactions. The interactions of these elements have contributed to the reduction of production and circulation costs, allowing capital flows and consumption, above all in those strategic points of international territories, among which the Northern region of Minas Gerais can be included. In the following it is discussed the role of transport logistics in spatial interactions between the North region of Minas and the international market through exports of merchandise.

### Transport logistics and exports in the north of Minas Gerais

When opening the discussion on exports, first of all, it is necessary to mention the expansion of private capital in the Northern region of Minas Gerais, represented by national and international corporations that are the main exporters of goods. For Oliveira (2000), Rodrigues (2000), and Pereira (2015), the process of economic modernization of the Northern region of Minas Gerais was promoted after the 1960s by federal, state, and municipal government investments in infrastructure improvements, urban and regional transportation, energy and communications systems, providing tax and financial incentives for industrial, agro-industrial,

and commercial activities, resulting in attracting private capital. In this context, it is important to underline that the expansion of economic activities occurred in a concentrated way in the geographical space of Northern Minas Gerais.

Industrial activity is spatially concentrated in Montes Claros, Pirapora, Várzea da Palma, Bocaiúva, and Capitão Enéas, since these five municipalities are responsible for about 98% of all exports from the North of Minas Gerais (Pereira, 2015). Thus, the industrial sector represents the primary exporter, given that when the industries settled in those municipalities, they mostly aimed at meeting the international market demands. For this reason, transport logistics plays an important role in the flow of exports.

The arrival of modern transportation to the North of Minas Gerais resulted in the expansion of infrastructure as well as rail, waterway (Rio São Francisco waterway), and road transport services, intensifying the process of economic modernization (Pereira; Lessa, 2011). At present, there are two modes of transport in operation: rail and road, which are used for the movement of goods from the North of Minas Gerais to the customs areas.

Regarding the flows of North Minas Gerais export products, national transport is considered to be the movement of goods from production sites to customs facilities. They include ports, airports, and border checkpoints – customs facilities of primary zone – where goods are cleared and shipped to the matrix of international transport. Here, international transport is understood as the route from the Brazilian customs areas to foreign countries, by the following transport modes: sea, air, road, rail, and postal.

When considering the transport of goods, the main products exported by municipalities were grouped together into sector categories, creating the exporting sectors. To facilitate data analyses and comprehension of exporting activities, priority was given to the sectors of major representation such as chemical and related industries; textile materials and products thereof; base metals and products thereof; materials for transports; plant products; machinery, electrical and optical appliances; animal products (livestock); among other sectors. From 2001 to 2012, all these sectors exported a total value amount of approximately USD 5.3 billion and an amount in weight at around 2.1 billion kilograms (kg).



The results shown in Table 1 allow the following considerations: exporters used ports and sea transports to ship about 80.8% of the products in financial value and 96.8% of the quantity in kilograms. In the meantime, airports and air transports were used to send 15.2% of the production in financial value and 2.8% of the quantity in kilograms. Borders checkpoints and international road transport were used to export 4.0% of the products in financial value and 2.8% of the quantity in kilograms. The other sectors show very low results, inferior to 0.1%.

Table 1: North of the State of Minas Gerais: exports by productive sectors and international transports, from 2001 to 2012 (US\$/kg – 1, 000)

Sectors	Sea				Air				Road				Others			
	US\$	% US\$	Kg	% Kg	US\$	% US\$	Kg	% Kg	US\$	% US\$	Kg	% Kg	US\$	% US\$	Kg	% Kg
<b>Chemical and related industries</b>	2, 888, 542	54.0	1, 186, 967	57.1	787, 149	14.7	6, 805	0.3	3, 108	0.1	650	0.0	0	0	0	0
<b>Textile materials and products thereof</b>	641, 808	12.0	130, 273	6.3	2, 383	0.0	494	0.0	41, 580	0.8	17, 063	0.8	0.5	0	0.03	0
<b>Base metals and products thereof</b>	623, 970	11.7	428, 579	20.6	182	0.0	29	0.0	14, 900	0.3	13, 386	0.6	0	0	0	0
<b>Materials for transports</b>	8, 978	0.2	4, 873	0.2	203	0.0	96	0.0	146, 148	2.7	24, 756	1.2	0	0	0	0
<b>Plant Product</b>	88, 227	1.6	177, 693	8.6	93	0.0	130	0.0	189	0.0	1, 223	0.1	0	0	0	0
<b>Machinery, electrical and optical appliances</b>	29, 594	0.6	2, 178	0.1	13, 490	0.3	640	0.0	8, 476	0.2	551	0.0	0	0	0	0
<b>Animal products (livestock)</b>	17, 507	0.3	3, 533	0.2	1, 353	0.0	154	0.0	0	0.0	0	0.0	0	0	0	0
<b>Other sectors</b>	25, 298	0.5	76, 591	3.7	7, 691	0.1	32	0, 0	1, 246	0.0	1, 213	0.1	134	0.0	163	0, 0
<b>Total</b>	4, 323, 924	80.8	2, 010, 687	96.8	812, 544	15.2	8, 380	0.4	215, 647	4.0	58, 842	2.8	135	0	163	0

Source: MDIC/ALICEWEB2, 2001; 2002; 2003; 2004; 2005; 2006; 2007; 2008;

2009; 2010; 2011; 2012. Org. PEREIRA, L. A. G., 2014.

Sea transport concentrated the circulation of products from chemical and related industries, representing 54% in financial value and 57.1% of the quantity in kilograms, followed by the sector of textile materials and products thereof that shows 12% of capital flow and 6.3% of the quantity in kilograms. The sector of base metals and products thereof amounts to 11.7% of flows in financial value and 20.6% of the quantity in weight. The animal product sector represents 1.6% of financial value and 8.6% of the quantity in kilograms. The other sectors altogether account for 1.6% of financial flows and approximately 4.2% of the quantity in kilograms.

The circulation of goods by international air transport is concentrated in the sector of chemical and related industries, representing 14.7% of financial flows and only 0.4% of the quantity in kilograms. The discrepancy in these percentages reveals that the sector of chemical and related industries has a considerable number of value-added products, what justifies the use of air transport mode. The other sectors account to less than 1% in financial value and of the quantity in kilograms.

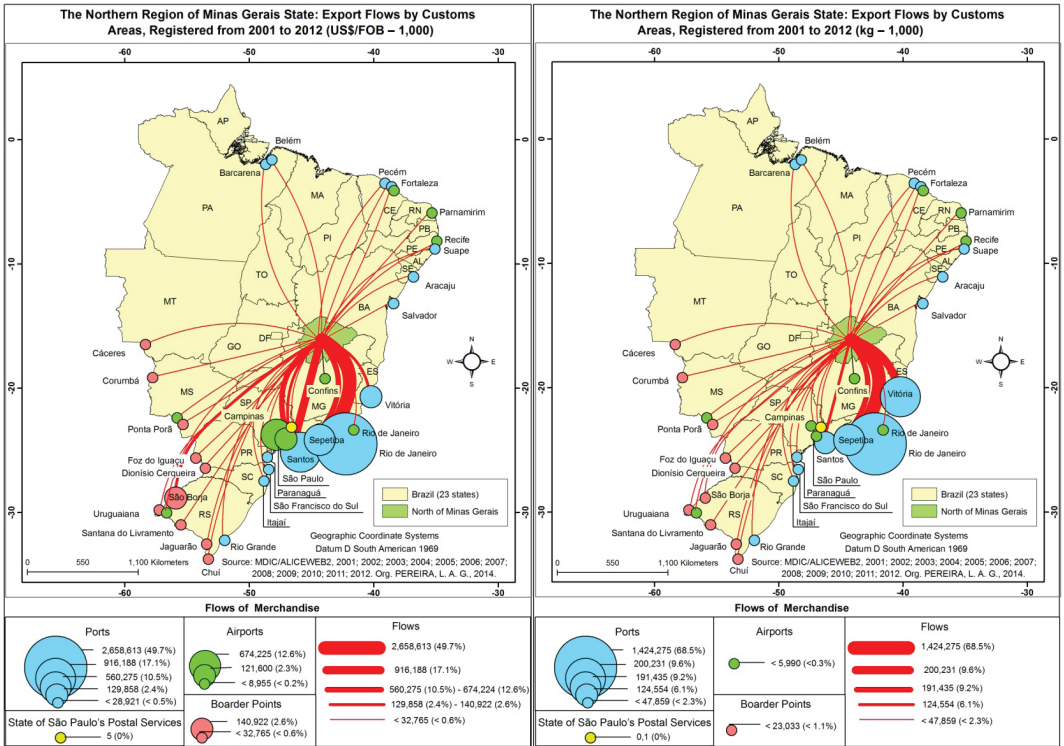
The sector of transport materials concentrates the flow of international road transport, representing 2.7% of financial vales and 1.2% of the quantity in kilograms, followed by the sector of textiles and products thereof accounting to 0.8% of financial flows and 0.8% of the quantity in kilograms. The other sectors amount to less than 1% in both segments, whereas international road transport is mostly used to send goods to the countries of the Southern Cone Common Market (MERCOSUL) and the Asia-Pacific Economic Cooperation Organization (APEC), like Chile and Peru.

This data demonstrates that the sectors exporting low value-added products prioritize sea transport due to low costs for long distances in the international arena. In the case of the sector of chemical and related industries, inorganic chemicals, silicon, represent the low value-added products, whereas insulin, enzymes, and tablets are high value-added products and use both sea and air transport modes. Since most of the flow is intercontinental, the use of sea transport by many of the sectors is justified. On the other hand, air transport is used by high added-value products, in addition to the flows of product samples, perishable goods, and to places of difficult land and sea accessibility.

When considering the circulation of goods in the geographical space by transport modes, it is important to underline that export flowsthrough customs areas are concentrated in the port of Rio de Janeiro (RJ), representing almost half of the financial flows and over two-thirds of the quantity in kilograms, what respectively corresponds to 49.7% and 68.5% of circulation. The port of Santos (SP) was the second to concentrate most flows, accounting to 17.1% of financial flows and 6.1% of the amount in weight, followed by the port of Sepetiba (RJ), which was responsible for 10.5% of the financial valueand 9.2% of the amount in weight. The port of Vitória (ES) shipped 2.4% in financial value and 9.6% of the quantity in kilograms. The other port custom areas handled less than 1.0% in financial value and of the quantity in kilograms, with exception to the port of Salvador that handled 2.3% of the amount in weight.

Exporters also used airports, mainly the airport of Campinas (SP)that handled 12.6% in financial value and 0.3% of the quantity in kilograms. Guarulhos Airport operated 2.3% in financial value and less than 1% of the quantity in kilogram. The other airports altogether attracted only 0.3% in financial value and less than 0.1% of the quantity in kilogram. The São Borja (RS) border checkpoint inspected 2.6% in financial flows and 1.1% of the quantity in kilograms. The other border checkpoints amounted altogether to 1.3% of financial flows and 1.8% of the amount in weight (see Map 1).

When studying the spatial movement of goods, it can be noted that, among the main ports, the one from Rio de Janeiro concentrated the flows of products from the sector of chemical and related industries, especially silicon, from the sector of base metals and products thereof, and from Pirapora's textile products. The port of Santos concentrated the shipping of goods from the sector of machinery, electrical, and optical appliances (liquid meters), the sector of animal products (meet), the sector of textile and products thereof (textile products from Montes Claros). The port of Sepetiba met the demands from the sector of chemical and related industries (silicon, insulin, and enzymes). The port of Vitória handled the flows from the sector of plant products (soy, derived from soy, and corn), and the port of Salvador concentrated flows of textiles and products thereof (textile products from Montes Claros), plant products (fruits) and woods.



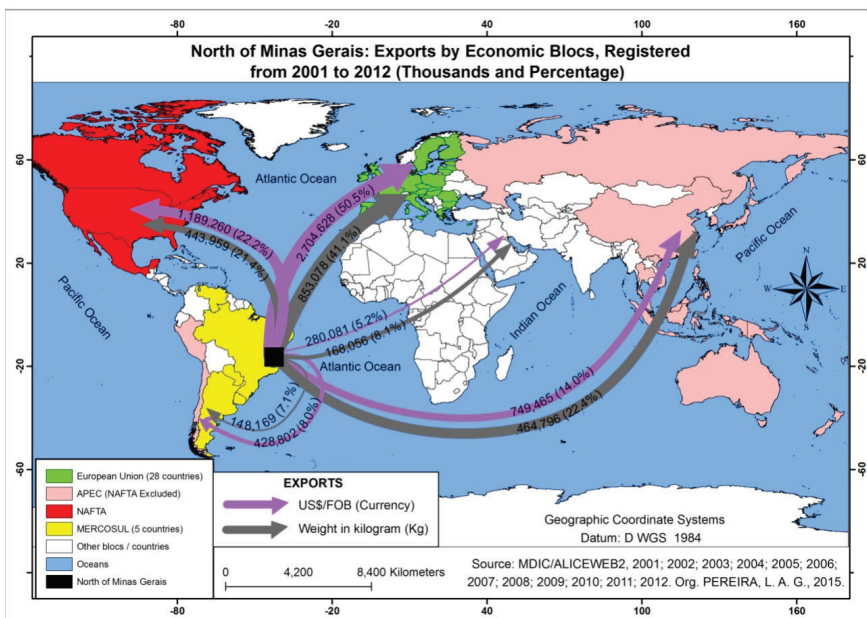
Map 01 – The Northern region of Minas Gerais state: export flows by customs areas, from 2001 to 2012(US\$/FOB – 1, 000) and (kg – 1, 000)

Source: MDIC/ALICEWEB2, 2001; 2002; 2003; 2004; 2005; 2006; 2007; 2008;

2009; 2010; 2011; 2012. Org. PEREIRA, L. A. G., 2014.

Airport flows concentrated in Sao Paulo international airport (Guarulhos) and Campinas international airport with products of chemical and related industries, mainly of pharmaceuticals. At Ponta Porã (MS) airport, the flows are from chemical and related industries, especially veterinary products. The São Borja border checkpoint concentrates the flow of products from the sector of transport materials (automotive parts), and Foz do Iguaçu (PR) and Uruguaiana (RS) border checkpoints circulate goods from the sector of textile and products thereof and the sector of the chemical and related industries (silicon). Following the clearance and shipment in the international transportation matrix, the products arrive to international markets, organized into regional economic blocs.

When crossing the Brazilian borders, the goods went to regional economic blocs: the European Union, the Free Trade North American Agreement (NAFTA), the Asia-Pacific Economic Cooperation Organization (APEC), excluded the NAFTA countries, the Southern Cone Common Market (MERCOSUL), and other economic blocs and countries. The exports from the Northern Minas Gerais region – 50.5% in financial value and 41.1% of the quantity in kilograms – flowed to the European Union. In relation to NAFTA, it was sent 22.2% in financial value and 21.4% of the quantity in kilograms. In the case of APEC, this bloc received 14% in financial flows and 22.4% of the quantity in kilograms. As for MERCOSUL, the exports amounted to 7.1% of financial flows and 8.0% of the quantity in kilograms. At last, the other blocs and countries obtained 5.2% in financial value and 8.1% of the amount in weight (see Map 2).



Map 02 – The Northern region of Minas Gerais state: exports by economic blocs, registered from 2001 to 2012 (thousands and percentage)

Source: MDIC/ALICEWEB2, 2001; 2002; 2003; 2004; 2005; 2006; 2007; 2008; 2009; 2010; 2011; 2012. Org. PEREIRA, L. A. G., 2014.

When taking into account the export flows during the semi-structured interviews, the respondents pointed out that the ports and airports mentioned above are located nearest to the region of Northern Minas Gerais. With 48 hours on road transport, it is possible to dispatch a product on an international transport mode. Besides, at these facilities, there are businesses specialized in international logistics that offer several kinds of operational – like packing, loading and unloading containers, etc.– and bureaucratic services for the clearance of goods, in addition to having greater availability of ships and cargo aircraft for many world markets.

Most companies with tax domicile in the Northern region of Minas Gerais outsources logistics activities, which is quite common in consumption structure and flexible production to expedite the flows in the national and international transportation networks. The outsourcing of transport logistics services can be explained by the complexity of exporting procedures, which require specialized logistics services. That is one of the reasons for export companies to hire them in port regions. Besides the ports, airport logistics has expanded to meet the demands from manufacturers of technology, perishable, and pharmaceutical products and services of express delivery, among others. The services specialized in airport logistics and the availability of international flights have attracted exporters to the airports in São Paulo (Guarulhos) and Campinas (Viracopos), since they have the facility to send their cargos to customs areas located near to the city of São Paulo, and also for having more direct international flights connected to international markets.

The exporting companies also use 20- and 40-foot containers, dry and reefer (refrigerated) cargos. To reduce by 50% the cost of moving containers, they are loaded and unloaded mostly in the port area. However, for security reasons, some companies that would rather pay more for the transportation of the container to the factory, storing at the plant site in order to check the conservation status of the container, and to prevent drug and arm trafficking.

During the interviews, exporters noted that they see problems in the transport logistics in Brazil, but there are no issues in the international matrix. On the other hand, it is not difficult to grasp that there is the possibility of existing problems. For instance, in the case of exports,

the goods can get retained in bonded warehouses, contracts may be terminated, and merchandises can be returned, meaning that commerce is influenced by economic, political, social, and cultural issues. There are also bottlenecks in the Brazilian transport-logistics infrastructure, what becomes an obstacle to exporting companies. This precarious nature of transport infrastructure is known as the “Brazil cost” by business owners, government officials, and researchers as it raises the costs of production and circulation of goods and services.

In the context of exporting, the main problems highlighted by the exporters from the Northern region of Minas Gerais are the following: poor maintenance of the road network infrastructure, including side roads; poor railways infrastructure; red tape in customs clearance; lack of specialized logistics service in international trade; lack of an Inland Customs Station – EADI (dry dock) - and deficiencies in the infrastructure of customs areas (ports and airports).

The challenges to overcome logistics obstructions, aiming at minimizing problems and maximizing efficiency, effectiveness, and transport logistics services are: public and private programs of ongoing investments for the improvement of road system infrastructure, modernization of the railway system, regional boosting of the international transport sector, modernization of the Brazilian customs system, installation of an Interior Customs Station - EADI (dry port) - and modernization of the customs facilities infrastructure (ports and airports).

## Final Considerations

Concerning the Northern Minas Gerais exports, transport networks that carry the products are structured in national transport, connecting the place of production to the customs areas – ports, airports and border checkpoints. To reach the destination, the international market travels through sea, air, road, rail, and postal transport modes. Among them, sea transport is the highlight with 80.7% of financial flows and 96.5% of the quantity in kilograms. International air transport represents 15.2% in financial value and 0.4% of the quantity in kilogram. The means of international transport rely on logistics services available in the customs areas.



When considering the flows of exports by customs facilities, the port of Rio de Janeiro (RJ) concentrated 49.7% in financial value and 68.5% of the quantity in kilograms, followed by the port of Santos that received 17.1% of the financial flows and 6.1% of the amount in weight. The port of Sepetiba handled 10.5% in financial value and 9.2% of the amount in weight. Campinas airport received 12.6% of the goods in financial value and 0.3% of the quantity in kilogram, followed by Guarulhos airport, in São Paulo, that handled 2.3% in financial value and 0.1% of the quantity in kilogram. The São Borja (RS) border checkpoint concentrated 2.6% in financial flows and 1.1% of the quantity in kilogram. The other border areas individually received financial flows inferior to 1.0%. In this context, the product added-value or the urgency to the deliver the product are factors that influence the preference for the mode of transport.

Regarding the national route, road transport mode is prioritized to circulate export products. Only the sectors of plant products and the textile and products thereof used rail transport on this route. Low added-value products circulated in a concentrated fashion through ports and sea transport. Whereas the high added-value products and/or with urgency in delivery were transported from airports by international air transports. In the case of South-American countries that borders Brazil, the border checkpoints, and the international road and rail transports were used.

The export sectors prioritize specialized logistics services available in customs areas to send goods to the international markets: European Union, NAFTA, APEC and MERCOSUL, among others. Regarding the flow systems, it is important to underline that the logistics transport networks used in exporting flows are complex and dynamic, requiring studies, planning, and investment (public and private) for their permanent improvement.

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