5. National Market for Freight Transport in Lao PDR

5.1 Introduction

The objective of this chapter is to analyze the development of the Lao freight logistics sector with a special focus on the demand for freight logistics services and the pricing of freight transport services. The guiding research questions for this chapter are formulated as following:

1. *Who are the main actors in the domestic freight transport service sector in Lao PDR, on which administrative and spatial levels do they operate?*

2. *How are freight tariffs for domestic freight transport services determined with reference to the geography and regional development of the country?*

The chapter seeks to understand how the domestic freight service sector functions and to identify the main actors of the freight service system with reference to the above research questions. Further, importance is given to how rates for domestic freight services are determined. Initiatives mainly related to transport infrastructure construction have been promoted by the government in order to achieve better connectivity and to improve market access, whereas less focus have been given to investigation of how the structure and the geographical fragmentation of the market for freight services influences transport costs on the routes covering Vientiane and the provincial centers. Calculation of tariffs for freight services is not only dependent on the actual distance transported, the quality of the roads, and the weight of the product – therefore it is important to identify factors influencing the determination of freight tariffs at different spatial and administrative levels i.e. national and provincial. The analysis can provide knowledge about the relationship between road construction, transport market development, and the development of a better integrated national market system.

Based on empirical data, the study explores three main dimensions of the development of the Lao freight logistics sector: (i) the development of a freight logistics

sector after the formulation of the New Economic Mechanism (NEM); (ii) a study of the factors influencing the sector's spatial structure; (iii) and an in-depth analysis of the rates for domestic freight services to better understand the Lao freight logistics sector pricing structure.

The first part of the chapter seeks to map the development over time and provide a report of the current status of the Lao freight logistics sector, with special reference to the transition towards a market economy, whereas the second part explores land transport freight cost on the national market with the purpose to explore the degree of integration between the capital and the provincial centers.

Since the launch of market reforms during the late 1980s, Lao PDR has shown a strong record of economic growth. Economic reforms in Lao PDR started at a major scale in November 1986, when the New Economic Mechanism (NEM) was endorsed on The Fourth Congress of the Lao Peoples Revolutionary Party (LPRP) and major steps towards transition from a centrally planned economy to a market economy were taken (for a more detailed description on the Lao development and NEM see Zasloff and Unger 1991; Ljunggren 1993; Sisoupphanthong and Taillard 2000; Evans 1988; 1990; 1998; 1999 and 2003; and Rigg 2005). Under the NEM, the Lao government announced measures to promote the development of the private sector; deregulated price and production controls, granted managerial and financial autonomy to state-owned enterprises and decreased government involvement in distribution networks. An important part of NEM was the promotion of free circulation of goods within the country. Buying and selling restrictions of agricultural products was eased and a domestic market was created. Thus giving demand for private efficient freight transport operators. These reforms, together with Lao's participation in ASEAN and its free trade area, the Greater Mekong Subregion (GMS) program and its willingness to become a member of the World Trade Organization (WTO), have created an environment with substantial opportunities as well as substantial challenges for all types of business activities.

5.2 Analytical Framework

The rationale behind the link between transport infrastructure investment and transition to a market economy is that transport investments reduce transport costs, thus providing better scope for higher market efficiency (Jacoby 2000). The conventional estimate of the immediate benefits of infrastructure investment is the fall in unit costs for each type of traffic using the infrastructure in question, multiplied by the amount of traffic. This would represent the costs saving for existing traffic, and is believed to encourage economic performance in various ways (Banister & Berechman 2001). Logistics services, as one factor in the production of goods and services, represents a cost to individual businesses. Greater efficiency in the logistics sector can help reduce cost, which may stimulate greater demand, so that firms may enjoy enhanced scale economies, perhaps resulting in a virtuous circle of further cost reductions and sales growth (Button 1993). In addition, reductions in transport costs can have substantial effects on market conditions, since transport costs may function as an entry barrier to many smaller markets. With high transport costs, it is possible that there is only room for a small number of actors in the market, resulting in a situation with low competition and relatively high price-cost margins. When transport costs are reduced, there is not only a direct price effect in goods markets, but perhaps also an indirect competition effect that is related to reduction in entry barriers.

The main objective of the freight transport sector is to overcome distance and provide efficient transport services from one geographical location to another. The level of interconnectivity within the transport system is not only dependent on road access and quality of the physical transport infrastructure but also on the market for freight transport services. A central issue in the present context is the constraints created as a consequence of low levels of quality of the national transport infrastructure. This is an important reason for the traditionally fragmented structure of the national freight transport system in Lao PDR. This structure gives importance to local freight service operators and their ability to supply efficient transport services to different spatial levels.

A critical component for the successful integration of the local economy into national, regional and global markets – and a precondition for realizing the potential gains from trade – is an efficient and well functioning national transport logistics system. The performance of the national logistics system is an important facilitator for both export and import trade, but also for domestic distribution (Sadoulet & de Janvry 1995). Efficient distribution systems with low transaction costs are expected to transfer goods produced elsewhere to the local consumer at a competitive price, at the same time as local producers can get a competitive price for their commodities (Pelton *et al* 2002). Geographical factors such as location, distance to markets, and road accessibility naturally have a significant impact on the costs of intermediate and final goods. This means that transaction costs – including transport costs and costs for retrieving information about prices and market conditions – can have a direct effect on firms opportunities to increase their earning (Gannon & Liu 1997).

As can be seen, freight transport services are an important area for both businesses and society, and there is a great interest from a large number of actors. However, freight transport services transport has had problems meeting the high expectations. There is a lack of knowledge on the potential and design of freight transport systems within countries in transition towards market economy. For example, politicians, government agencies (e.g. rail and road administrations), and regulating bodies need information on the possible potential of freight transport, in what areas and under what circumstances the sector has it's best potential and the environmental effects of the transport system. Freight service companies need information on if and how they best should use and design their systems. Any freight transport system must be sure to have both a sustainable competitive advantage and a good market entry ability to be successful.

Researchers, studying freight transport systems and their markets, also face similar problems when trying to test how new regulations and new innovations influence the system. Questions that need to be answered include the effect of changed control

instruments (e.g. taxes and regulations), new infrastructure investments, new terminals, new technology, changed truck sizes and speed, changed transport demand are all important determinants of the efficiency of a freight transport system as illustrated in Figure 2.3 in Chapter 2. There is a need for further studies about how freight transport sector in general and, in particular, there is a need for tools to evaluate the potential in the freight transport sector and for help in designing a competitive freight transport system especially in countries where the physical barriers to trade are large. To answer these questions, it comes naturally to look towards the more quantitative tools. Some kind of calculation model of the transport system is necessary to allow for the system to be developed and tested and the potential evaluated. The use of a model gives the researcher the potential to control the design and behavior of the system.

5.3 Freight transport in Lao PDR

5.3.1 Demand for Logistics and Transport Services

Expanding trade is an important part of the market-oriented policy reforms in Lao PDR. Successful outward oriented development requires not only trade reforms, but also improvements in both the hard and soft infrastructure of trade, such as ports, roads, and railroads, customs administration, insurance, finance, and related institutional structure governing logistics services. Increasingly congested ports and insufficient transport facilities, as well as institutions focused on control rather than on trade facilitation and the lack of access to trade financing have become obstacles to business development.

During the period 1992-2005, exports of Lao PDR to the other five GMS[3] countries grew by 16 percent, on a compounded annual average basis, from US$48 million to US$314 million, accounting for almost half of its total exports, which similarly

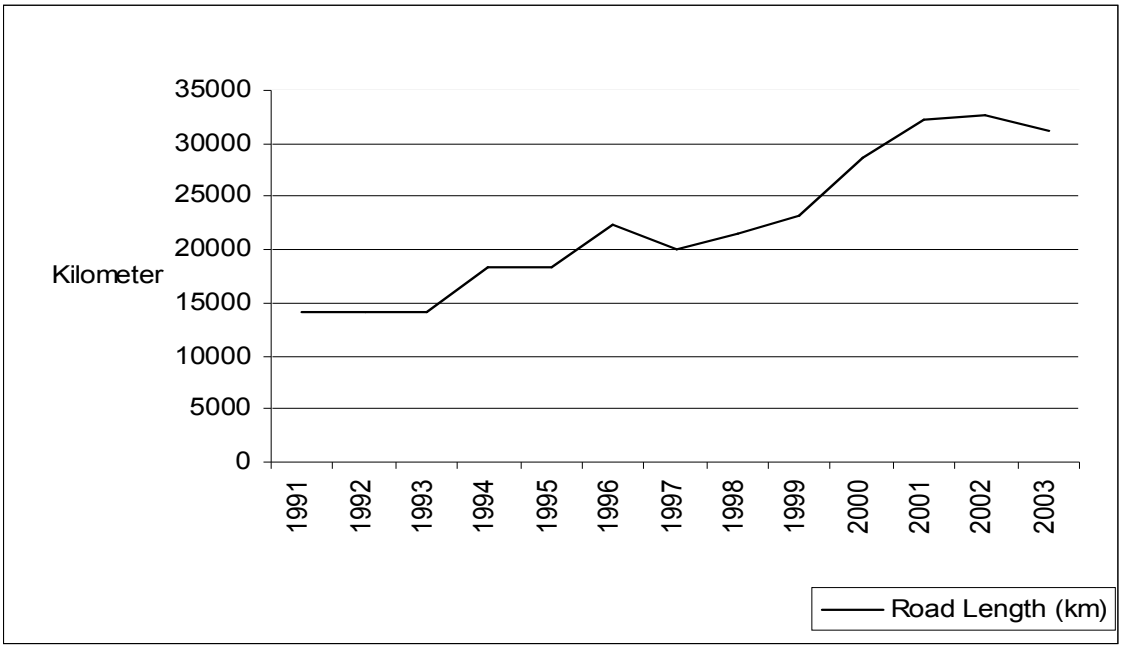
[3] The GMS member countries are: Cambodia, People's Republic of China (Yunnan & Guangxi province) Lao PDR, Myanmar, Thailand and Vietnam

grew by an average of 16 percent (IMF-DOTS). Overall, the growth of Lao PDR intra-GMS trade has been reasonably rapid and in line with the process of economic integration with regional and global markets. Trade has not only increased between the capital Vientiane and through major transit routes with Thailand, but there has also been an increased interaction between provincial center and Vientiane (Andersson *et al.* 2006).

There are four key elements that influence the transport and logistics system in Lao PDR: (1) landlockedness, which creates a dependency on transit traffic through neighboring countries; (2) a geographically scattered population; (3) high dependence on subsistence agriculture; and (4) weak transport infrastructure that impedes the integration of scattered local and provincial markets.

Large investments in transport infrastructure have been carried out with the purpose to alleviate the negative impact of these characteristics on national economic development and integration both within the country and with neighboring countries. The rapid increase in trade together with the specific characteristics of Lao PDR raises the importance of capable logistics services. Figure 5.1 illustrate the expansion if the road network from 1991 to 2003. The government policy to favor regional growth with the purpose to narrow the gap between poor and rich provinces was partly conducted by road investments (Bourdet 2000).

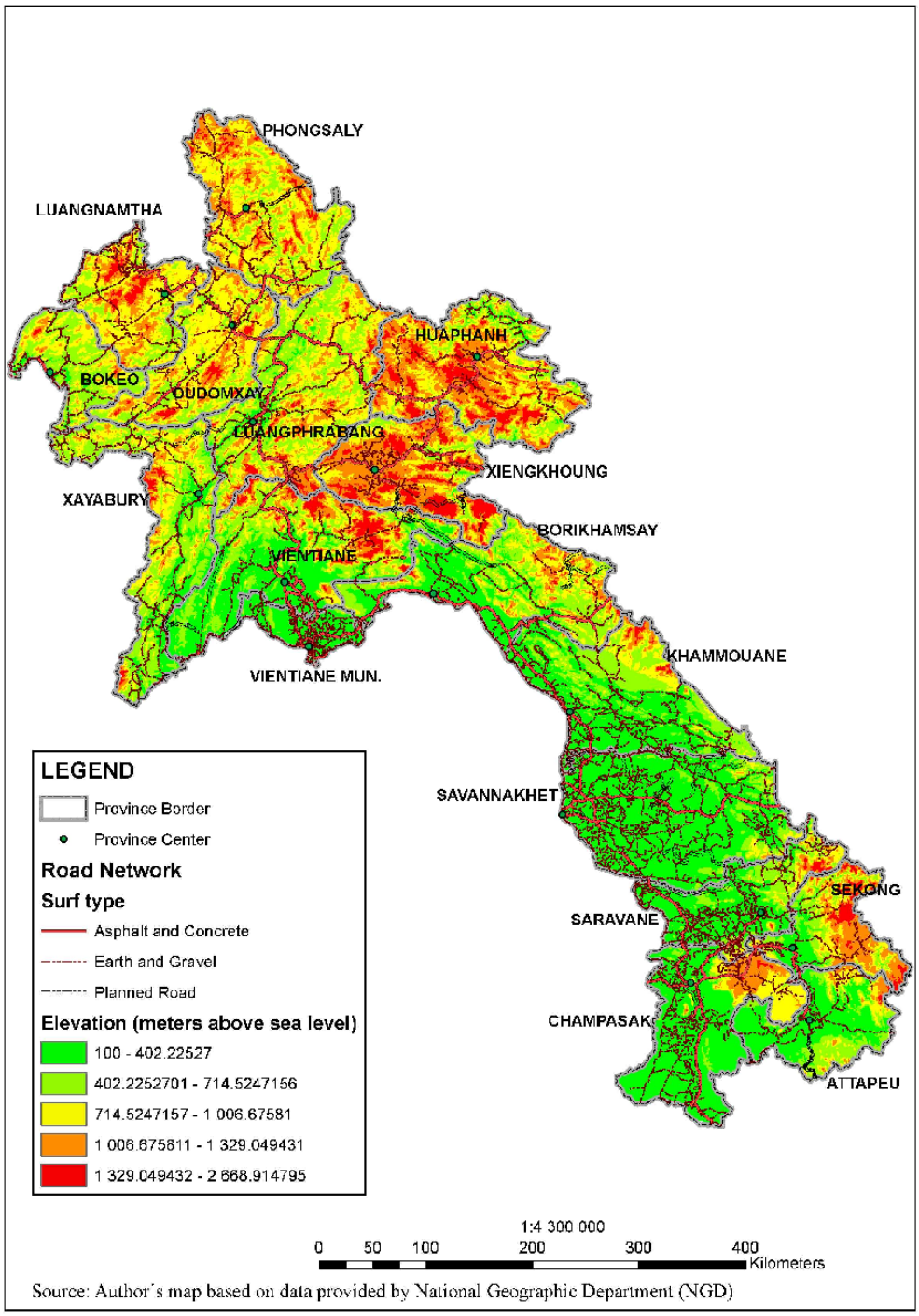
Figure 5.1 Total Road Length Year 1991 - 2003



Source: UNESCAP (2007)

There were in year 2006 a total of 31,199 km roads divided into 4,500 km of paved roads, 10,100 km of gravel road, and 16,600 km of earth roads, as Table 5.1 shows. The largest part of the road network consists of earth roads. Much of the network is not ready for all weather traffic and thus not accessible all year around. The national road system consists to 53 percent of paved roads. To upgrade and pave roads between Vientiane and the provincial centers was the focus of the heavy investments in roads during the 1990s.

Figure 5.2 Elevation and Road System of Lao PDR



Source: Author's map based on data provided by National Geographic Department (NGD)

Figure 5.2 illustrate the geographical difficulties provided by the mountainous landscape. The northern and northeastern parts of the country are located on high elevation giving a less dense road network. Whereas the central and southern parts of the country are located on lower elevation with a better network of earth and gravel roads.

Table 5.1 Total Road Length Year 2006 (in kilometer)

Surface Type	*Administrative Classification*						
	National	*Provincial*	*District*	*Rural*	*Urban*	*Special*	*Total*
Paved	3,771	198	31	14	429	54	4,497
Gravel	2,244	3,038	1,826	1,815	871	304	10,097
Earth	1,126	3,240	2,008	9,527	465	249	16,615
Total	7,141	6,476	3,865	11,356	1,765	607	31,199

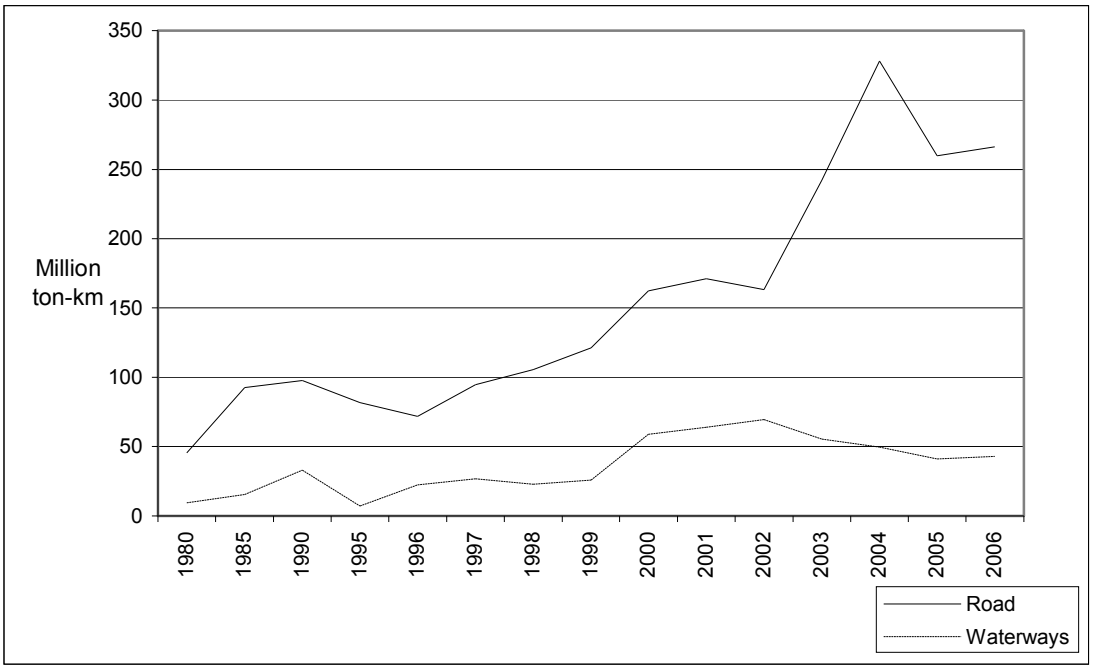
Source: UNESCAP (2007)

The development of the road system has been concentrated on improving national routes and enhancing maintenance capacity. Major transport corridors have been upgraded, with links restored between the northern and southern parts of the country (Arnold 2000). All provincial centers are to be joined to the national network with all weather roads. The road network carries the dominant share of passenger and freight movements in Lao PDR, as illustrated in Table 5.3, with a widening gap between road transport and inland water transport. National statistics indicate that road transport had a share of 70 percent of the freight transport in 2002, with almost all of the remainder being carried by river transport (UNESCAP 2007). The government has provided investments to increase the capacity of inland water transport, with about half of the 21 ports on the Mekong River rehabilitated in the last 15 years.

The demand for freight has increased very rapidly since the early 1990s, from 551,100 tons transported in 1990 to 1,946,000 tons during year 2002 by land transport. There are similar rising trends in freight tasks, which are defined in terms of the number of ton-km of goods that are moved by the Lao transport system and shown in Figure 5.3. The rapid expansion of road construction which was illustrated in Figure 5.1 and Table

5.1 can be seen in the increase of domestic freight movements. Figure 5.3 provides an illustration of the large increase of freight movements (48 percent) starting year 2001 with a downturn in year 2004.

Figure 5.3 Modal Share of Domestic Freight Movements



Source: MPWT 2007

As Table 5.2 shows, the increase from 97.7 million ton-km in 1990 to 163.4 million ton-km in 2002 is not as rapid as the increase in movement of freight. The difference between increased movement and freight and freight task suggests that the volume increase has been faster than the increase in the distance transported. This indicates that the growing trade and transport contacts are mainly concentrated to locations that are geographically close to each other.

Table 5.2 Freight Movements

Year	*Land*	*River*	*Air*	*Total*	*Land*	*River*	*Air*	*Total*
	Freight movement (1000s ton)				*Freight task (million ton-km)*			
1990	551.1	106.0	0.5	657.6	97.7	33.0	0.2	130.9
1995	950.0	476.0	1.2	1,427.2	81.6	7.1	1.8	90.5
1996	978.0	537.0	1.2	1,516.2	71.8	22.5	0.7	95.0
1997	1,029.0	604.0	1.2	1,634.2	94.7	26.6	2.2	123.5
1998	1,004.0	567.0	1.4	1,572.4	105.4	22.8	0.7	128.9
1999	1,225.0	602.0	1.4	1,828.4	121.1	25.9	0.5	147.5
2000	1,635.0	672.0	1.5	2,308.5	162.2	58.9	0.6	221.7
2001	1,543.0	739.0	1.4	2,283.4	171.1	64.0	0.4	235.5
2002	1,946.0	770.0	1.9	2,717.9	163.4	69.6	0.6	233.6

Source: UNESCAP (2007)

Table 5.3 illustrates the domestic traffic mix divided according to road type and vehicle used. National roads are the fundament of the road system connecting Vientiane with the provincial centers, and also the main object of study for the national system of freight transport services. On all types of roads, vehicles are related to agricultural production and passenger transport or freight transport, with very low frequency of passenger cars.

The road network does not generally carry high volumes of traffic. For example, the average of vehicles with four or more tires on all national roads is 370 vehicles per day, with provincial roads carrying less than a third of this number. Traffic on all-weather roads is considerably higher, especially for provincial roads, which have a greater share of access-constrained roads. However, vehicles with four or more tires account for only 30 percent of traffic on roads in Lao PDR, with the share being highest on national roads (42 percent) and lowest on rural roads (8 percent). Medium and large buses and trucks account for a substantial 36 percent of the 4 or more tires´ traffic on national roads.

Table 5.3 Traffic Mix Year 2004

	Administrative classification					
	National	*Provincial*	*District*	*Rural*	*Urban*	*Special*
Traffic mix (% by vehicle type on each road class for all roads)						
Bicycle	14	20	27	31	16	24
Mini tractor	6	13	17	17	6	16
Motorcycle & tuk-tuk	38	41	42	44	62	34
Subtotal (<4 tires)	*58*	*74*	*86*	*92*	*84*	*70*
Car	4	3	3	0	5	2
Pickup	12	8	3	2	5	8
Small bus	4	3	1	1	1	3
Medium bus	4	2	1	2	0	2
Large bus	2	0	0	0	0	0
Light truck	6	4	4	1	3	2
Medium truck	5	3	1	2	1	5
Heavy truck	3	2	1	0	0	4
Truck trailer	1	0	0	0	0	0
Total	100	100	100	100	100	100

Source: UNESCAP 2007

5.3.2 Structure of Lao Transport Industry

The Ministry of Public Works and Transport (MPWT)[4] is responsible for the planning, construction and macro-management of roads, waterways, civil aviation, transport, communication, housing and urban planning for urban and rural areas nationwide (Decree, May 12 1999). The various provincial Departments of Communication, Transport, Post and Construction (DCTPC) are responsible for the implementation, the construction and maintenance of road within their respective province or municipality as delegated by the MPWT (Agreement, 1993). Offices of Communication, Transport, Post and Construction (OCTPCs) are located at the district level and are responsible for the maintenance of roads under their jurisdiction as delegated by the provincial DCTPC in compliance with the communication management guidelines developed by MPWT (Agreement, 1993).

[4] formerly known as The Ministry of Communication, Transport, Post and Construction (MCTPC)

The Lao International Freight Forwarders Association (LIFFA) was established by ministerial decree in 2001. LIFFA currently has around 20 members composed of freight forwarders, trucking companies and customs brokers. The majority of the members are based in Vientiane where most of the transit traffic is concentrated.

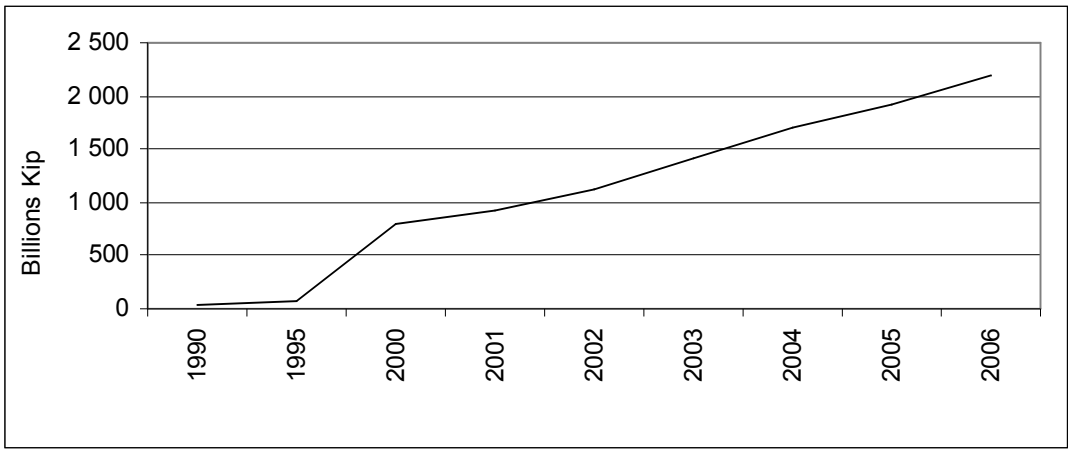
Under the 1999 road transport agreement with Thailand, Lao trucks are able to deliver and collect Lao import or export goods to and from Bangkok or Laem Chabang port. However, to date none have been able to do so. The reason may be partly that Thai authorities are still reticent about having Lao trucks on Thai road for numerous safety reasons but also because it is difficult for Lao trucks to get return traffic. This makes the transit cost high compared to just transloading the goods on Thai trucks in Nongkhai (located in Thailand across the friendship bridge over the Mekong River which connects Lao PDR and Thailand) and getting return traffic into Lao PDR from the same location.

There is a free exchange of truck operations between Lao PDR and Vietnam, i.e. Lao trucks can go anywhere in Vietnam and vice versa. Lao operators know Vietnam roads better than roads in Thailand and driving is on the same side of the road which facilitates cross border transport.

Lao trucks can go as far as Kunming in Yunnan Province in China whereas Chinese trucks may come as far south as Vientiane. However, truck operators from Lao PDR hesitate to drive on Chinese roads as there are frequent stories about informal roads tolls among truck operators in northern Lao PDR[5]. The borders with Myanmar and Cambodia are currently closed to truck traffic.

[5] Based on information from truck operators based in Bokeo and Oudomxay.

Figure 5.4 Value-added of Transport, Storage and Communications Services



Source: SWECO 1991; UNESCAP 2007

Freight services in Lao PDR are provided by private companies under regulations governed by the MPWT and provincial DCTPC. Figure 5.4 illustrates the growth of added value provided by logistics services in Lao PDR since 1990. The increase in the sector's value added is significantly faster than the increase in freight volumes and freight tasks discussed in Table 5.2.

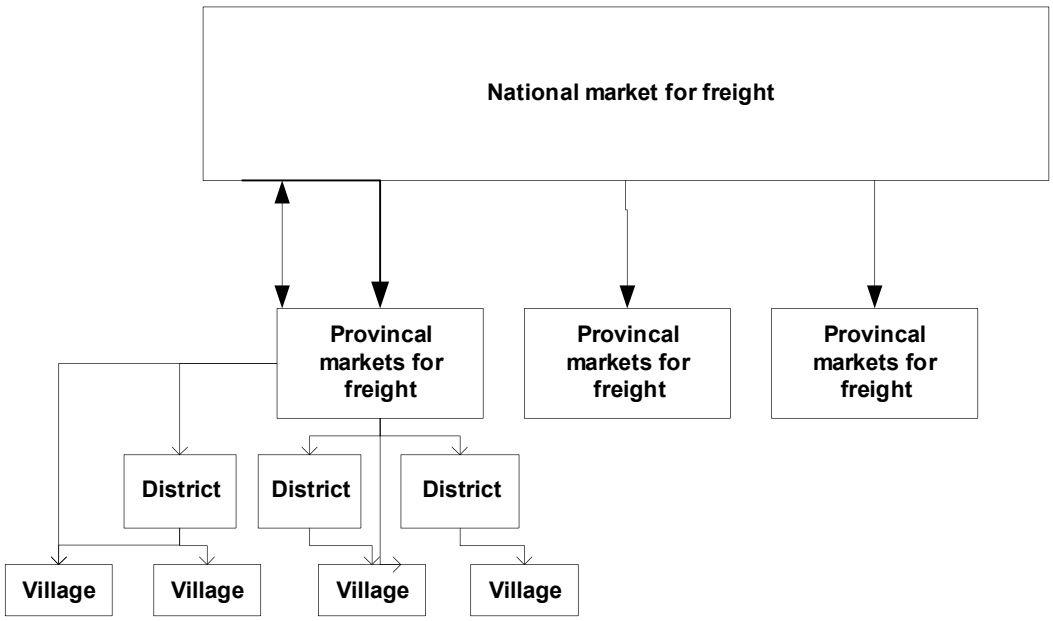
The structure of the Lao transport industry is illustrated in Figure 5.5 where three spatial levels with actors are identified. The first level is the national market for freight serving the provincial centers with freight mainly with commodities from Vientiane. The freight service providers are located in Vientiane and provide services for imported goods and products produced in Vientiane to the provincial centers. These actors have access to large vehicles and often hold access to larger contracts of freight movements. They also cooperate and subcontract to smaller freight transport service providers located in Vientiane. Larger operators based in Vientiane lack local knowledge about roads and the conditions in the provinces with force them to cooperate with smaller operators located in the province of destination. Subcontracting or sharing resources for larger shipments destinated for remote locations are not uncommon. This is of particular importance

during wet season when many local roads are flooded and damaged during long periods of time.

The possibility of getting return freight tasks from the province to Vientiane is low as the freight transport providers in the provinces protect their market. Thus this provides higher costs for transport of freight in the direction Vientiane – provinces.

The second level corresponds to provincial markets where provincial actors hold the power to supply the surrounding districts and villages with freight transport but also more importantly hold the power to transport commodities from the province to Vientiane. Firms located in provinces that produce of export commodities mainly utilize provincial freight service providers when transporting their products to Vientiane.

Figure 5.5 Structure of the Lao Market for Freight Transport



Source: Based on fieldwork and information provided by freight transport service providers.

The freight service providers based in the provinces are smaller than their competitors located in Vientiane and hold a vehicle fleet consisting of vehicles with lower capacity thus more flexible when operating. When the transported cargo is unloaded in Vientiane these smaller operators wait for new shipments from Vientiane to bring back to their origin or to deliver somewhere on the way back to their province. The waiting time for cargo can be up to several days however the possible profits from receiving cargo on the return trip make it worth waiting and this is a competitive advantage towards freight operators located in Vientiane. On the other hand freight operators located in Vientiane have difficulties to find return cargo in the opposite direction as the demand for freight is lower from the provinces to Vientiane.

The third spatial level corresponds to the districts where transportation of freight often is conducted in conjunction with passenger transport. Transport service providers located in the districts serve villages with transport of passengers and freight from both provincial and districts centers.

The organization of the sector can be found on all three spatial levels. Trucking associations at district levels have been in existence since the late 1980s. Many of them act as freight brokers as well as schedule coordinators between members. Provincial trucking associations have now been established in 7 provinces and there are plans to expand to other provinces. The MPWT is working on organizing a national association of trucking operators which may come under the umbrella of LIFFA.

In Vientiane, there are 14 trucking companies and 6 associations, with a total fleet of 1,211 trucks in number. This includes 605 6-8 tonnes trucks; 363 10-12 tonnes trucks; and 243 18-22 tonnes trucks[6]. Around 50 percent of the trucks are old Soviet trucks and the remainders are used second hand Japanese and Korean trucks. The average truck age is more than 10 years. Trucking companies are usually family businesses with staff that

[6] Interview data from the Department of Roads, MPWT

learned the trucking business “on the job”. There exist foreign-owned freight forwarders in Lao PDR but there is no foreign owned or joint-venture truck operator. Truck tariffs are subject to negotiation between individual shippers and operators.

Savannakhet Province is the 2nd most important province in Lao PDR located in the southern part of the country. The province has in total 738 trucks. This includes 280, 1-6 tons trucks; 347, 8-12 tons trucks; and 101, 14-23 tons trucks. The current truck fleet is a mixture of used Japanese/Korean trucks (10-15 years old) and Soviet era trucks (more than 20 years old). In Savannakhet, Lao trucks have access to Vietnamese roads. Some Lao trucks move freight between Savannakhet and Hue, Danang and Hanoi. In 2005, truck traffic from Vietnam was 14,361 in number and carried 37,433 tons; the traffic to Vietnam was 14,475 in number and with a cargo volume of 264,562 tons. It was reported that Vietnamese carried up to 95 percent of the total Lao PDR-Vietnam traffic. Truck traffic from Thailand in 2005 was 9,845 in number and in 146,124 tons in volume; truck traffic to Thailand was 6,238 in number and 131,946 tons in volume. Lao trucks can deliver goods to Mukdahan in Thailand by crossing the second international bridge over Mekong.

Private truck operators and freight forwarders agree that the condition of roads in Lao PDR has improved significantly in recent years. There are several reasons for this – including the rehabilitation of several roads and improved maintenance, as well as higher levels of enforcement against overloaded vehicles – however the industry has benefited from an increase in permitted maximum axle weights from 8.2 to 9.1 tons in 2002. Views vary on the extent of competition in the trucking sector. International trucking tariffs do appear high, but this is probably due to other factors. The Lao Chamber of Commerce does not consider that the industry is very competitive because it is a very small market, the players know each other and they agree on prices. On the other hand some transport service operators argue that the domestic industry is very competitive and that tariffs are consequently very low – not even covering fuel costs. The larger operators complain that the small operators are able to undercut their tariffs because they do not

pay taxes. Transport service operators also agree that weighing and enforcement of overloading is in principle a sound idea to protect roads. One operator said that the enhanced enforcement initiative against overloading had caused him to increase tariffs slightly.

Other major difficulties reported by Lao trucking operators on the transport routes were aged trucks, high oil prices, lack of return load and insufficient skills of trucking management and drivers.

Some trucking operators expressed concerns about loading charges. These charges were evident at some provincial destinations. Government officials charged the freight transport service provider a certain amount in order to provide permission to unload the goods transported. These types of charges are treats to the free competition on the national market for freight transport as they provide an increased uncertainty for the service providers.

5.4 Deregulation and Liberalization of the Transportation Service Sector in Lao PDR

The institutional infrastructure in place affects the way policy makers promote the use of certain modes of transport and therefore organizations such a trucking associations and freight forwarders' association make up a crucial component not only serving as a coordinator between the different organizational levels the country's transport sector is divided in but also to promote the transport service industry within the overall development policy formulated by the government which is to transform Lao PDR from a landlocked to land-linked (ADB 2005b). Institutional infrastructure also encompasses the availability of credit, and provision of efficient markets.

Two major strategic economic groupings provide the framework for improved regional transport integration in the region: the Association of South East Asian Nations[7] (ASEAN) framework agreements and the ADB led Greater Mekong Subregion initiatives. Acceding to United Nations agreements on international trade and transport would also be of benefit the Lao capability to reach global markets.

There are ASEAN framework agreements that directly impact on the Lao logistics industry. The first one is the ASEAN framework on the facilitation of goods in transit signed in 1998 and the second is the ASEAN framework agreement on multimodal transport signed in 2005. However, their implementation is still lacking due to difficulties in negotiating implantation protocols. The third ASEAN initiative is the endorsement of the ASEAN roadmap for the integration of the ASEAN logistics sector in 2007. This roadmap calls for enhanced liberalization of logistics service within member countries and have set the target date to 2013.

The GMS countries have also signed the GMS Cross Border Transport Agreement (CBTA) in 2007. The objective of the CBTA is to facilitate the movement of people, freight and vehicles within the GMS. In the agreement there are provisions related to exchange of traffic rights and the number of designated transit licenses per country.

The proliferation of such agreements hinders rather than helps Lao PDR. The Lao government is drowning in bilateral, trilateral and multilateral agreements covering international and transit trade, which have different operational modalities according to their respective aims.

The Lao transport and logistics industry is faced with numerous challenges. Their market will be liberalized by 2013 under ASEAN and their government has acceded to

[7] Members of ASEAN are Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Singapore, Philippines, Thailand, and Vietnam

some controversial ASEAN protocols such as the one limiting the number of transit trucks to 60 per member country while the CBTA permits up to 500 designated transit vehicles. The fear is that the local logistics industry is not even aware of the development that will occur and have no response to such development. The local industry which emerged after the introduction of NEM may disappear even before it is strong enough to survive in the expanding market.

Current issues faced by the Lao logistics industry include: relatively (compared to adjacent countries) low weight limits for trucks, which result in higher transport costs for operators (and consumers) compared to other ASEAN countries; the extent of vehicle overloading by some freight operators to reduce their costs (requiring more rigorous enforcement); regulations on the use of containers in Lao PDR; transit fees for freight services using Lao PDR as a land-link between neighboring countries; the high costs for (imported) parts; the lack of professional knowledge in the truck management and operations. A major change in the conditions for the trucking industry in many developing countries has been the decision of the governments to strictly enforce axle load regulation, (though hard pressed by the donors involved financing road construction, which made this a precondition for further support to road rehabilitation). In Lao PDR this decision has led to a reduction in payload to almost half of what trucks used to carry. Therefore the industry initially protested strongly, but appears now to have accepted the axle load regulation under the condition that these regulations, which were previously connected to heavy corruption, are enforced for all participants. Although enforcement of the axle load regulation has reduced payload and led to increased transport rates, it has also increased the travel speed (which with the heavy overloads were often very low) and reduced the vehicle maintenance costs.

5.5 The National Market for Freight

Can differences in freight costs across destinations be attributed solely to the distance the load is transported, or do other factors such as road quality, market structure and travel time matter? If the other factors influence total freight costs, are these effects

quantitatively important? The purpose of this part of Chapter 5 is to examine the national market for land transport freight using a data set with price information from a private land transport service provider located in Vientiane Municipality.

Transport infrastructure has been related to location theory and interregional trade with reference to distance between producers and customers. Here the friction of distance is depending on access to transport infrastructure. The efficiency to overcome the friction of distance is measured by transport costs. The theme is used for different purposes by several academic disciplines. Economist use transport infrastructure in explaining the functioning of markets, geographers explain activities in space, and traffic engineers use the concept to obtain information on size and direction of traffic flows. The aim of this part of the study is to combine these three perspectives with the purpose to provide an overview of the national market for land freight services and to estimate how different factors influence total freight transport costs. The relationship between freight transport costs, distance, road quality and competition is tested using a regression framework.

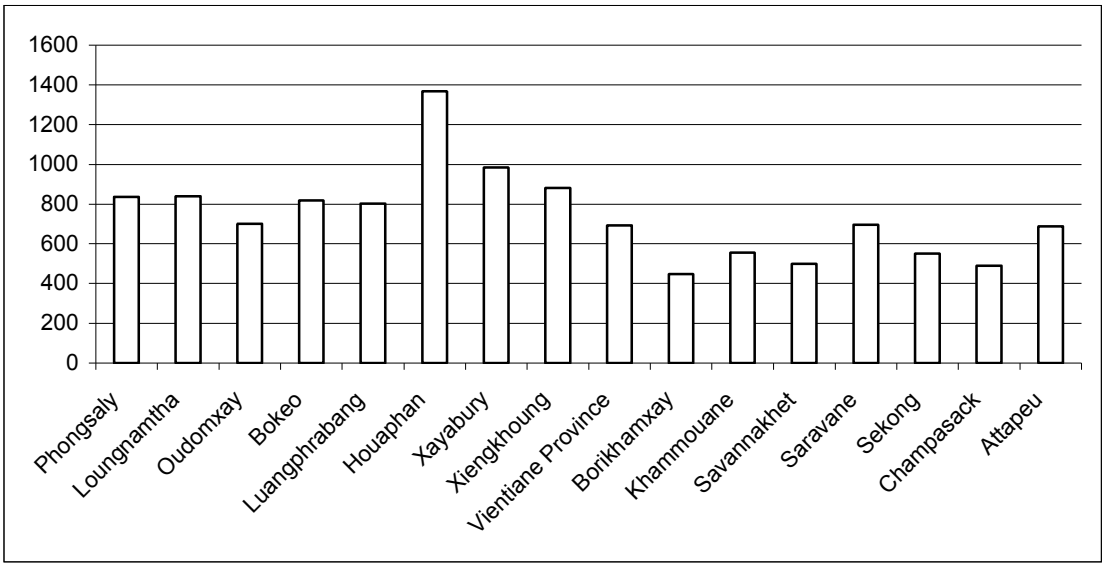
The starting point of the analysis is to convert the freight costs[8] given in price per six wheel truck load and ten wheel truck load to the provincial centers in Lao PDR into freight rates in Kip per tons – kilometer to each destination. The data provided was separated into total cost and share of fuel costs per truck load.

As shown in Figure 5.6 freight rates to the provinces located in the Northern Region; Phongsaly, Loungnamtha, Bokeo, Luangphrabang follow the same rate around 800 Kip per ton-kilometer, with Oudomxay as the cheapest destination at around 700 Kip per ton-kilometer. Oudomsay is the communication cross point for cargo between Vientiane and PRC. Xayaburi is only accessible via Luangpraphang, which explains the

[8] Freight costs were provided by one of Lao PRD's largest freight transport service providers located in Vientiane Municipality in Kip. 1 USD is approximately equivalent to 900 Kip for year 2006.

higher costs. Houaphan is located on the northeast border to Vietnam holding the highest freight rate in the country.

Figure 5.6 Freight Rates from Vientiane to Provincial Centers (year 2006 in Kip per ton-kilometer by six wheel truck based on a 12 tons load)

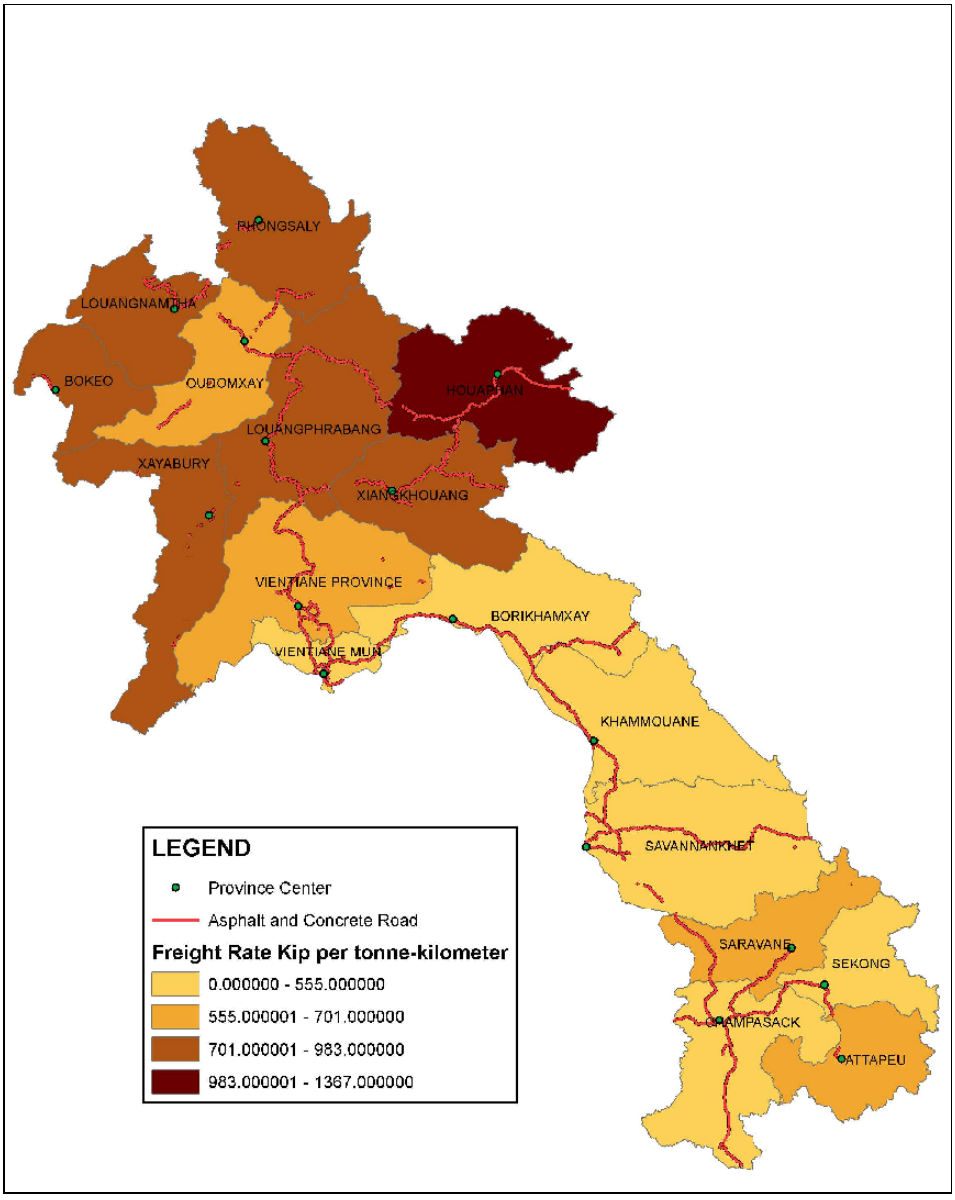


Source: Information provided by Freight Service Operator located in Vientiane Municipality, Lao PDR

Note: The calculation of freight rates are based on total cost of a six wheel truck load with maximum load of 12 tons. Distance in kilometer provided by MPWT.

The provincial centers located in the Central Region can be divided into two groups based on the difference in freight costs as illustrated in Figure 5.7; provinces located north of Vientiane including Vientiane Province, Xiengkhuang where the geography consists of hilly terrain with high freight costs.

Figure 5.7 Freight Rates from Vientiane to Provincial Centers (year 2006 in Kip per ton-kilometer by six wheel truck based on a 12 tons load)

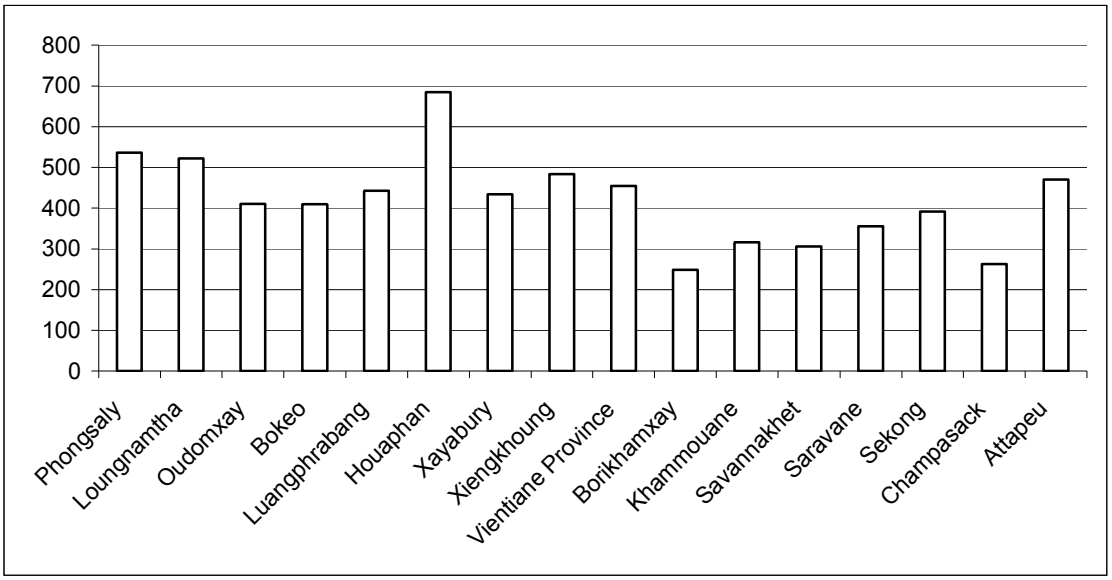


Source: Author's map based on data provided by transport service provider, National Geographic Department (NGD) and Ministry of Post, Waterworks and Transport (MPWT)

The provinces located along the Mekong River Valley consisting of Borikhamxay, Khammoune and Savannakhet hold the lowest freight costs. It is interesting to note that the freight rate based on Kip per ton-kilometer to Oudomxay is lower than for example what Louangphrabang experience. One possible explanation can be found in Oudomxay's strategic location being a node for freight transport not only between Vientiane but also for freight transport between northern Thailand and northern Lao PDR including freight flows between China and Thailand.

Figure 5.8 provide an illustration the freight rate change as a consequence when increasing the load from 12 tons (as shown in Figure 5.6 and 5.7) to 22 tons. Most provinces experience a 50 percent drop in prices when using larger vehicles with a heavier load.

Figure 5.8 Freight Rates from Vientiane to Provincial Centers (year 2006 in Kip per ton-kilometer by ten wheel truck based on a 22 tons load)



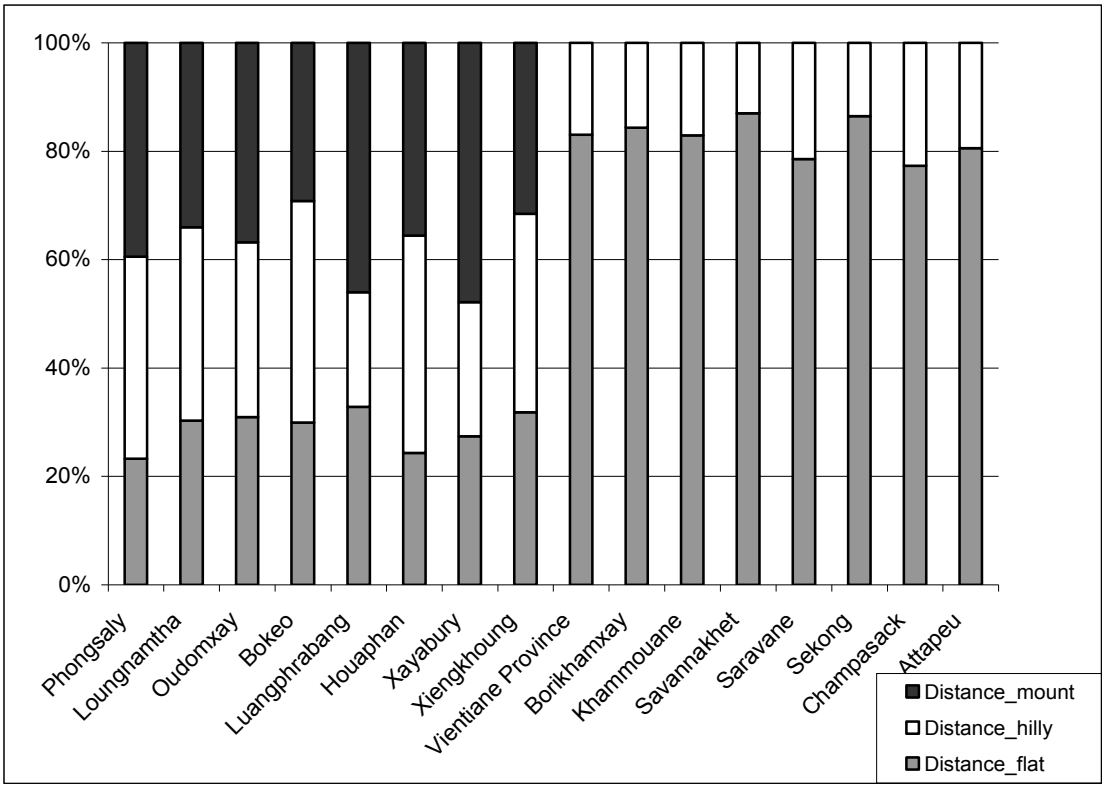
Source: Freight Service Operator located in Vientiane Municipality, Lao PDR

Note: The calculation of freight rates are based on total cost of a six wheel truck load with maximum load of 12 tons. Distance in kilometer provided by MPWT.

However, the provinces with lowest freight rates located in the central and southern parts of the country; Borikhamxay, Champasack and Attapeu experience a smaller decrease in the freight rates.

Figure 5.9 illustrate classification of the road and the share of the total route classified into mountainous, hilly and flat road sections. This classification has impact on both time consumption and fuel consumption in transport and can be used to proxy the road quality.

Figure 5.9 Road Quality on Routes from Vientiane to Provincial Capitals



Source: UNESCAP Asian Highway Database and Author's calculations.

Note: The classification used; Distance_mount, Distance_hilly, Distance_flat, are collected from Asian Highway Program (UNESCAP).

The provinces located in the south lack mountainous roads with only a small share along roads classified as hilly. The northern provinces Luangprabang, Xayabury and Oudomxay have the largest share of mountainous road length together with Houaphan located in the central parts of the country.

Information illustrated by the map in Figure 5.2 where high elevation can be found in the mountainous northern and northeastern parts of the country and the more flat areas along the Mekong River in the southern parts of the country with freight relates well with the results from the calculation of freight rates in Figure 5.6, Figure 5.7 and Figure 5.8. Figure 5.9 capture the elevation patterns shown in the map in Figure 5.2. The

findings from the analysis of freight rates together with and the geographical composition of the routes from Vientiane to the provincial centers will be used in next section.

5.6 Analysis of the Determinants for National Freight tariffs

This section studies the relationship between quoted freight tariffs between Vientiane Municipality and the provincial centers in Lao PDR in the previous section and a set of determinants in a regression framework. In a first step, the multiple regression analyzes the impact of distance, road quality and market competition on the calculated freight tariff. As a second step in the analysis a simple correlation analysis between the variables in the regression is performed. A new variable illustrating travel time is introduced as proxy for transport costs. The purpose of this last step is to check the relationship between travel time, distance and fuel consumption per kilometer and the dependent variable freight tariff.

5.6.1 Variables and Expected Signs

The theoretical concepts related to calculation of freight rates are not straight forward, as illustrated in Figure 2.3 Determinants of a Transport Tariff. The model used in this analysis uses a limited number of variables identified in the theoretical framework, as it is difficult to operationalize many of the remaining theoretical constructs due to lack of detailed data.

The primary data source for this study is a dataset provided by a private freight transport service provider located in Vientiane. The Company is one of the market leaders in the domestic freight industry at the national level and provides large volumes of freight transport to all provincial centers in Lao PDR. The company provided freight tariffs for both six-wheel trucks and ten-wheel trucks, but this analysis is limited to only six-wheel truck as it is the most common option for domestic freight transport. The resulting freight tariff dataset was divided into a total freight tariff in Kip and the share of expenses for fuel. This dataset was complemented with distance and road quality

measures provided by Department of Roads and UNESCAP Asian Highway Database, and statistics on the number of private firms in each province provided by the Department of Statistics.

The provided data on freight tariffs relates well with costs quoted in ADB 2005a. The evaluation report quotes intra-provincial freight tariffs from Champasack Province based on information from transport of freight between Pakse and Veun Kham (located on the border between Lao PDR and Cambodia) a journey of 152 kilometer on all weather National Road 13 and National Road 13 S. The evaluation report quotes 550 Kip per ton-km for freight transport in the direction Pakse – Veun Kham, which is higher than inter-provincial freight tariffs provided by the transport company located in Vientiane. However, the higher price quoted for the intra-provincial freight in Champasack Province can be explained by economies of scale as the route is shorter and the freight tariff is calculated for all commodities of smaller loads than a 12 tons load.

Table 5.4 provides a list of the variables used in the regression analysis, which is estimated by ordinary least squares (OLS). The dependent variable in the model estimating determinants for freight costs (equation (1) - (4)) is the freight rate between Vientiane Municipality and every provincial center in Lao PDR. This variable expresses the unitary cost in Kip per 6-wheel truck with a shipment of 12 tons. The freight transport service provider charges his client for the shipment to be transported by road to the destination. For every pair of origin and destination, one quotation from a freight transport service provider located in Vientiane Municipality has been obtained. The freight rate has been confirmed by several sources during field research in Lao PDR and said to be accurate and consistent with freight tariffs on the market for domestic freight transport.

The independent variables in equation (1) and their *a priori* expected signs are as follows: lnDistance is defined as the real distance between Vientiane Municipality and provincial center in kilometer and is calculated for each specific destination. Distance in

kilometer is the standard measure used to measure accessibility (Marquez-Ramos 2007). The expected sign of this variable as a determinant of the freight rate costs is positive. The variable lnFuelconsumption is defined as amount of diesel in liter consumed by the six wheel truck with a 12 tons load. The variable is a proxy to capture the quality of the road and the change in elevation on the transported route. Routes with large share of mountainous or hilly roads consume more fuel. An increase in the diesel consumption can be expected to increase the freight tariff.

The explanatory variables in equation (2) are similar to equation (1) with the addition of the variable lnBusiness. The variable is a proxy to capture the degree of competition on the market of the destination. The variable covers all registered businesses in the province of destination. An increase in this variable would cause a decrease in transport costs; hence the sign of this variable is expected to be negative. The number of private businesses established in the province of destination is expected to capture local demand for freight transport services. It may also be interpreted as a proxy for degree of competition on the destination market, since a market with a larger number of private businesses is likely to be home to a larger number of competing transport providers. Put differently, provinces with larger number of registered businesses are likely to demand more freight services, and local companies can thus be expected to provide a higher frequency of freight deliveries and therefore lower ton-km prices, taking into account pure distance and road quality effects. Low frequencies are an obstacle for freight transport service providers operating in a developing country context. Low frequencies together with a low possibility to get return freight on routes to destination without production of commodities to be sold in other provinces or for export provide a higher price. The last central variable added in Equation (3) and (4) is lntraveltime and is measured in hours and used as an alternative to distance to measure the degree of accessibility. Since the distance is highly correlated with travel time (r= 0.943) the distance variable is not included in Equation (3) and (4). The variables are summarized in Table 5.4.

Table 5.4 Variables

Variable	Definition and comments
Dependent Variable	
lnFreight	Log freight rate for 6-wheel truck loaded with 12 tonne in kip from Vientiane Municipality year 2006
Independent Variables	
lnDistance	Log distance in km from Vientiane Municipality to provincial center
lnFuelconsumption	Log consumption of litre diesel per kilometer as a proxy to measure road quality
lnBusiness	Log total number of registered busniess in the province
lnTraveltime	Log travel time from Vientaine to provincal centre in hours

Descriptive statistics for the variables included in Equation (1) to (4) are presented in Table 5.5. The number of observations is the number of provinces which are covered by the transport service operator's freight services. It should be noted that the results from a regression analysis with this low number of observations should be carefully interpreted and the results should be seen mainly as indicators of how the independent variables influence the dependent variable freight tariffs, and as a complement to the calculations provided in previous sections.

Table 5.5 Descriptive Statistics

	lnFreight	lnDistance	lnFuelconsumption	lnBusiness	lnTraveltime
Mean	15.163	6.237	8.422	7.13	2.0602
Std. dev	0.66088	0.48614	0.34043	0.69242	0.51563
No. obs.	16	16	16	16	16

5.6.2 Model Specification

The equations (1) – (4) below illustrate four alternative formulations of the regression model. Since the relationship between freight rates and distance is assumed to

be non-linear, we use a ln-ln form to investigate the strength of the relationship between the variables in the regression. The α is the constant, and β, γ, and δ are the corresponding vectors of coefficients, and ε is a normally distributed random error term.

$$\ln Freight = \alpha + \beta \ln Distance + \gamma \ln Fuelconsumption + \varepsilon \quad (1)$$

$$\ln Freight = \alpha + \beta \ln Distance + \gamma \ln Fuelconsumption + \delta \ln Business + \varepsilon \quad (2)$$

$$\ln Freight = \alpha + \beta \ln Fuelconsumption + \gamma \ln Traveltime + \varepsilon \quad (3)$$

$$\ln Freight = \alpha + \beta \ln Fuelconsumption + \gamma \ln Business + \delta \ln Traveltime + \varepsilon \quad (4)$$

5.6.3 Analysis

The results for the regression models are presented in Table 5.6. All regressions use lnFreight as the dependent variable. Equation 1 uses only two independent variables, distance and fuel consumption, while Equation 2 adds the number of businesses registered in the province of destination. A first observation is related to the signs of the coefficients. By construction, an independent variable with a positive coefficient is posited to raise the likelihood that the freight tariff increases. Since the dependent variable is in ln form, the estimated regression coefficients measure the percentage change in freight rate within the province from a unit change in the independent variable. The results indicate that distance and fuel consumption both have a positive influence on the freight tariff, as expected. It should be noted that all estimated coefficients are significant at conventional levels.

The variable number of businesses is added to Equation 2 in order to capture the role of competition and demand for freight at the destination of the freight, with an expected negative sign. Economies of scale and higher competition should provide a lower price of transport. This expected impact is confirmed by the significant negative coefficient estimate for the (ln) number of business variable, suggesting that not only distance and road quality influence the freight tariffs between Vientiane Municipality and the provincial centers. The R^2 increased slightly with the inclusion of the variable lnBusiness, from 0.981 in Equation 1 to 0.987 in with lnBusiness in Equation 2. The coefficient of the variable lnBusiness is negative and significant at a five percent level, pointing towards the hypothesis that this variable is a proxy for competition, since a higher number of private businesses in a province reduce transport costs.

Table 5.6 Regression Results (dependent variable ln freight tariff)

	1		2		3		4	
Constant	1.578	**	3.112	***	8.499	***	10.352	***
	(2.434)		(3.836)		(7.307)		(8.297)	
lnDistance	1.048	***	0.985	***	-		-	
	(19.038)		(18.772)		-		-	
lnFuelconsumption	0.837	***	0.784	***	0.538	***	0.476	***
	(10.639)		(11.352)		(10.596)		(3.707)	
lnBusiness	-		-0.098	**	-		-0.159	**
	-		(-2.547)		-		(-2.439)	
lnTraveltime	-		-		1.034	***	0.941	***
	-		-		(3.642)		(10.297)	
R-squared	0.981		0.987		0.942		0.961	
No. of observations	16		16		16		16	
F-ratio	328.573	***	313.687	***	105.297	***	98.906	***
Degree of freedom	13		12		13		12	

Note: * - significant at a ten percent level; ** - significant at a five percent level; *** - significant at a one percent level. T-values in parentheses.

Equation 3 and 4 utilize travel time in hours instead of distance in order to test the sensitivity of the results and compare the variable travel time with the variable distance. Interesting to note is that the estimations using travel time show somewhat weaker results for the Fuel consumption variable: this is due to the fact that travel time captures some of the variation in road quality that is also reflected by fuel consumption.

Table 5.7 Correlation Coefficients Matrix

	lnFreight	lnDistance	lnFuelconsumption	lnTraveltime
lnFreight	1.00	0.901**	0.663**	0.939**
lnDistance	0.901**	1.00	0.253	0.943**
lnFuelconsumption	0.663**	0.301	1.00	0.478
lnTraveltime	0.939**	0.943**	0.478	1.00

Note: ** - significant at a five percent level.

The correlation coefficients in Table 5.7 provide empirical evidence for the high correlation between lnFreight and lnTraveltime (R^2=0.939). The correlation between lnFreight and lnDistance is similarly high (R^2=0.901). This result provides important insights about which variables that can be used as a substitute or proxy for freight tariffs. Martinez-Zarzoso & Nowak-Lehmann (2007) analyze the relative importance of road transport costs in comparison with distance measures as determinants for trade flows and evaluate the importance of different factors influencing transport costs of maritime and road transport. The results indicate that transport conditions are the most important determinant for both modes, whereas quality of service is also very important for maritime transport, and transit time is also very important for road transport. Their results are consistent with the results in the regression analysis conducted here.

5.7 Summary and Conclusions

The particular concern of this chapter has been twofold; first to describe the structure of the freight transport service sector in Lao PDR and secondly to analyze the freight transport costs in the country. The chapter began to describe the freight transport service sector as outlined in the first guiding research question for Chapter 5 focused on

exploring the main actors in the domestic freight transport service sector and their operative administrative and spatial levels. The main finding from this part of the investigation can be summarized as follows: the results from the qualitative analysis indicate a fragmented national market for freight transport. Actors do not often provide services on other administrative and spatial levels than where they are located, with the exception of the larger firms located in the capital Vientiane serving the national market with freight transport services. This might decrease the competition on the overall market as the administrative and spatial levels acts as informal barriers.

The findings showed the low demand for transport for certain parts of the country provide higher freight transport costs on the route from Vientiane to the province of destination as the freight transport service providers located in Vientiane providing services to the whole country rarely obtain cargo on the return trip i.e. on the route from the province of destination to Vientiane. However, smaller freight transport service providers located in the provinces having more flexible operations and lower fixed costs can obtain cargo on their return trip from Vientiane to their province of origin as they can afford waiting for return cargo in Vientiane.

In the second part of the chapter a more detailed study of the freight rates was carried out. It is useful to recall the second guiding research question for Chapter 5: *How are freight tariffs for domestic freight transport services determined with reference to the geography and regional development of the country?*

The empirical investigation from this chapter shows that the national road transport system is relatively well integrated. However there are provinces located off the large national roads on higher altitude that experience high freight costs compared with provinces located in on lower altitude.

This chapter tested a regression model that tried to take into account other factors than only distance that influence domestic freight tariff in Lao PDR. According to our regression models analyzing the results indicate that fuel consumption as a proxy for road

quality, distance to measure accessibility, and number of private business located in the province of destinations are all significant and have an impact on the freight tariff charged. This result provides evidence to the importance of the market characteristics of the transport system. The development of the freight transport system is not only dependent on physical infrastructure but also on a well developed market for freight transport which was described and analyzed in the first part of the chapter .

Interesting to note is that travel time in hour is highly correlated with distance and can be used as a substitute to distance in the regression analysis. Moreover, the variable travel time is also highly correlated with freight tariff which is an important finding.