THE IMPACT OF AN INTEGRATED TRANSPORT NETWORK ON URBAN DEVELOPMENT IN LAO PDR

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ABSTRACT

This paper examines urban development in the Lao People's Democratic Republic that links to the improvement of the Greater Mekong Sub-region integrated land transport network. My objective is to measure the extent to which the urban structure has been changed as the result of the improvement of the integrated land transport network during the last three decades. A time-series analysis and associated indicator called 'the integrated land transport development phases' has been used to understand the evolution of the transport network itself and to identify correlation between integrated land transport network and urban development. The integrated land transport development phases reflect the degree to which the Lao PDR has integrated into the international community; and if this has been dependent on the improved cross border facilities and the improved land-linked transport network. The integration effort of the Lao PDR associated with the improvement of the Greater Mekong Sub-region integrated land transport network can be divided into four distinctive stages. Each stage has its own features attributable; and that link to the variables of the improved cross border facilities, and the improved land-linked transport network in each period. The analysis revealed that the population agglomeration and urban development was closely correlated to improvement of the integrated land transport network in each time frame. Results of the analysis showed that the integrated land transport network has impacted on economic growth and also the population agglomeration and urban development process in the Lao PDR. The improved integrated land transport network has accelerated economic growth of the country as well as provided equal economic opportunities across the country. This is reflected through an equitably increasing annual population growth rate throughout the country during the last three decades. The outcomes of this research certainly reflects the effectiveness of the Greater Mekong Sub-region initiatives in relation to policies, agreements, infrastructure and services supporting increased cross border trade and tourism. The efforts towards strengthening regional economic cooperation as such are also especially important for the development of the North-South and East West Economic Corridors (NSEC and EWEC).

Keywords: Laos / impact of transport / urban development / GMS transport networks / integrated land transport / urban development;

1. INTRODUCTION

Lao People's Democratic Republic (Lao PDR) is the sole land-locked country in South East Asia. The country is surrounded by five countries: the Kingdom of Cambodia, the People's Republic of China, the Socialist Republic of Vietnam, the Kingdom of Thailand and the Union of Myanmar. Being a land-locked country, Lao PDR remains one of the least developed countries and has no direct access to the sea. This causes difficulties in the movement of goods to outside the country; and in fact this is the main constraint to the development of the country's economy as a whole.

Optimistically, the country could use its geographical uniqueness as a land-linked country to gain benefits from transit trade and investment linkages among the surrounding countries. The benefits could be optimal as long as the country becomes a full economic partner with other countries in the region. And through this the country could also be viewed as the geographical keystone in the development of the Southeast Asian sub-region as a whole. The address made by the Minister of Communication Transport Post and Construction of the Lao PDR to the IFA/SEAPOL Conference on Cooperation Transit and Resource Management in January 2000 reflected a strong commitment and prospect of the Lao PDR: **"Our developing effort is to build up a sustainable resources bases; taking full advantage of our *land-liked* situation is to be our foremost preoccupation".**

The Lao PDR started to open its door to the world in 1982; and in 1986 the major reform through "the New Economic Mechanism" was introduced. The NEM policy marked the transformation from a centrally planned to a 'Market System", allowing all economic sectors to play an active role in the socio-economic development of the country. Under the NEM policy, the government of the Lao PDR encourages a fair market competition, promotes domestic and foreign investment including joint ventures and international trade. As the Lao PDR continues the economic growth through this direction, co-operation with the countries in the region is integral part. In 1992 with the assistance of the ADB, the six countries that share the Mekong River— Lao PDR, Cambodia, Myanmar, Thailand, Viet Nam, and Yunnan Province of the People's Republic of China (PRC)—launched the Greater Mekong Sub-region **(*GMS) Program***. The six countries entered into a program of sub-regional economic cooperation, designed to enhance economic relations among the countries.

2. THE INTEGRATED LAND TRANSPORT NETWORK PHASES

Based on empirical observation and the detailed analysis of historical patterns of the development path of the Lao PDR's transport network system, the developmental path of the Lao PDR transport network system could be divided into several phases. The "*the integrated land transport development phases"* has been used as indicator and to understand the evolution of the transport network itself; and to examine the impact of the integrated land transport network on urban development.

The integrated land transport development phases indicate the degree of integration of Lao PDR in the international community. The degree of integration is associated with the following variables:

1) Border crossing infrastructure is one variable. It is used to evaluate accessibility. Improvement of cross border infrastructure and facilities is the major aspect in the evolution of the degree of integration. If the border is totally closed, this results in a non integration level of the country with other countries.

2) The development of the land-linked transport network over time is another variable. It is used to evaluate accessibility.

Having examined the Lao PDR government policy and the above variables in each period, the integration level of Lao PDR development is reflected through four distinctive stages. Each of them has specific features attributable as follows:

Phase 1 (1976 to 1981): After the change of the government and policy system at the end of 1975, the government used the centrally planned economic system as an instrument to manage its socio-economic development. The Lao PDR entirely closed the door to the outside world.

Phase 2 (1982 to 1993): The Lao PDR started to open its door to the world in 1982; and in 1986 the major reform through "the New Economic Mechanism" was introduced. The NEM policy marked the transformation from a centrally planned to a 'Market System", allowing all economic sectors to play an active role in the socio-economic development of the country. Under the NEM policy, Government of the Lao PDR encourages a fair market competition, promotes domestic and foreign investment including joint ventures and international trade. As the Lao PDR continues the economic growth through this direction, co-operation with the countries in the region is an integral part. During this time frame the government continues its efforts in both the construction of new road networks and improvements of the inter-regional highways. At the local level the road networks have been expanded from the main districts within the province outward to those in other provinces. At the international level the road networks have been developed crossing the core districts in one side of the main provinces, which are located along the Thai border, to the other side that connects Vietnam in the western direction, China in the northern direction and Cambodia in the Southern direction. During this period the level of integration using land transportation, the level of accessibility and connectivity within GMS countries has increased gradually. However, in this phase border trade using ferry across Mekong was a dominant transport mode, which is linked to the improved land transport network within the country.

Phase 3 (1994 to 2005): The Lao-Thai "Friendship Bridge" spanning the Mekong River and linking Thanaleng (Lao PDR) to NongKhai (Thailand) opened to traffic in April 1994. It is clear that this bridge has made the transport of goods between the two countries faster and more reliable. Located at the center of an expanding regional economy, the Lao PDR could also capitalize from the economic development in three immediate neighbors.

Phase 4 (2006 to present): In 2006 the new bridge Savannakhet-Mukdahan was opened. Savannakhet is where the National Highway route number 9 (NH9) enables traffic connection with several countries. This is considered as an Asian strategic highway connecting the East with the West of the region. It stretches in an Easterly direction, from the Lao PDR -Vietnam border through Vietnam to South China Sea and giving access to Hong Kong, Taiwan, Indonesia, The Philippines, Korea, Japan and North and South America. Going in a westerly direction across the new bridge at Savannakhet/Mukdahan provides access to Thailand,

Myanmar, Malaysia, and Singapore and via the Andaman Sea, to India, Africa, Middle East and Europe.

3. THE CHANGE IN THE POPULATION DISTRIBUTION IN LAO PDR DURING THE LAST THREE DECADES

3.1 Annual Population Growth Rate of the Three Phases of Integrated Land Transport Network

Figure 1 and 2 indicate both negative and positive figures of the population growth rate in the Lao PDR during the *initial integrated land transport development phase* (1976-1981). In other words, there were both declination and growth of the population within the country along the time frame. During this phase the equal population growth rate ranges from 2.09% - 2.84%. It is noted that after 1984 Vientiane province, Luangnamtha, and Saravan were partially divided, therefore the figures are negative.

In *the second integrated land transport development phase* the growth rate varied across the country. The highest annual population growth rate, 10.52% occurred in Bokeo Province which is the town bordered by Thailand. The remaining provinces have a relative lower growth rate. The lowest growth rate is observed in Vientiane Province, Oudomxay Province, Huaphanh Province and Luangnamtha Province, with an annual growth rate of 0.74%, 1.18%, 1.67% and 1.76% respectively.

During the *third integrated land transport development phase*, the population growth rates were observed as follows:

- The highest growth rate was observed in Borikhamxay Province and Vientiane Province with an annual growth rate of 7.29% and 7.13% respectively. Borikhamxay Province is connected to RN8 *(Road No. 8 which is the East - west corridor connecting Vietnam to Thailand)*, and to R13S *(Road No. 13 which is the North - South corridor connecting China to Cambodia)* which are the major GMS strategic integrated road networks: R13 connecting Paksane – Vientiane Capital, and RN8 connecting Paksane (district of Borikhamxay Province) with Cua Lo port (near Vinh of Vietnam). Similarly, Vientiane Province is connected to the major GMS strategic integrated road network namely, R13N and R10.
-The decreased annual population growth rate in the second and third phase is observed in the border towns i.e. Bokeo Province and Phongsaly Province. The growth rate of Bokeo province during the third phase is 5.22% which has been decreased sharply compared in the second phase, 10.52%.
- The annual population growth rate of Vientiane Capital and Savannakhet increased by 2.29% and 2.28% respectively.

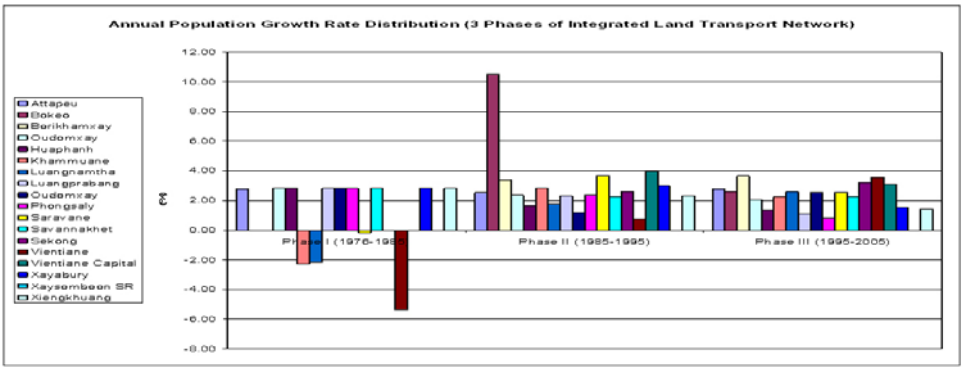


Figure 1: Annual Population Growth Rate Distribution of the Three Phases of Integrated Land Transport Network
[Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census)]

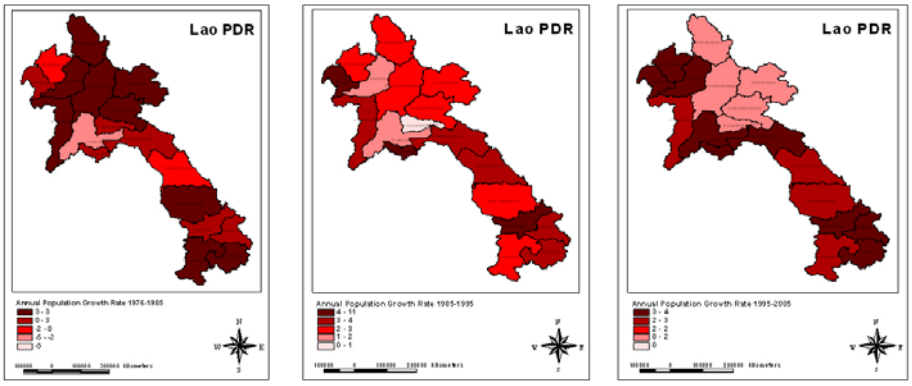


Figure 2: Annual Population Growth Rate Distribution of the Three Phases of Integrated Land Transport Network
[Source: Author's Compilation Based on Data from the National Statistic Center (Population and Housing Census)]

3.2 Variability of the Annual population Growth Rate Distribution during the Last Three Decades

In order to investigate the annual population growth rate distribution, the variability of the annual population growth rate of all provinces is analyzed. The annual population growth rate of each province is compared to the average annual population growth rate (mean value) of all provinces to obtain the value of ratio. The value of ratio equal zero (ratio = 1) implies the annual population growth rate of related provinces are equal to the average annual population growth rate. If the value of ratio lesser or greater than one (ratio <> 1), it implies the annual population growth rate of related province is lesser or greater than the average annual population growth rate. The analysis shows that in phase three, the number of provinces which have population growth rates closer to the average annual population growth rate is higher than that in the first and second phase. It is interpreted that the variability of the annual population growth rate distribution in phase three is less than that in the first and second phases.

Another method that can be used to determine the variability of the annual population growth rate distribution is the calculation of the variance and closely-related standard deviation. The standard deviation is the most common measure of statistic dispersion, measuring how widely

spread the values in a data set are. If the data points are close to the mean, then the standard deviation is small. Conversely, if many data points are far from the mean, then the standard deviation is large. If all the data values are equal, then the standard deviation is zero.

Table 1. Variability of the Annual Population Growth Rate Distribution during the Last Three Decades (Statistical Dispersion)

Province	Phase I (1975-1985)			Phase II (1985-1995)			Phase I (1995-2005)		
	Annual Pop. Growth & Mean			**Annual Pop. Growth & Mean**			**Annual Pop. Growth & Mean**		
Vientiane	-5.37	-6.55	42.92	0.82	-1.58	2.50	0.74	-2.17	4.72
Khammouane	-2.26	-3.44	11.84	1.08	-1.32	1.74	1.18	-1.73	3.00
Luangnamtha	-2.19	-3.37	11.37	1.36	-1.04	1.08	1.67	-1.24	1.54
Saravan	-0.17	-1.35	1.83	1.43	-0.97	0.94	1.76	-1.15	1.33
Attapeu	2.78	1.60	2.56	1.56	-0.84	0.71	2.29	-0.62	0.39
Oudomxay	2.80	1.62	2.62	2.06	-0.34	0.12	2.32	-0.59	0.35
Luangprabang	2.80	1.62	2.62	2.24	-0.16	0.03	2.34	-0.57	0.33
Phongsaly	2.81	1.63	2.65	2.24	-0.16	0.03	2.37	-0.54	0.29
Savannakhet	2.82	1.64	2.68	2.54	0.14	0.02	2.37	-0.54	0.29
Xiengkhuang	2.82	1.64	2.68	2.54	0.14	0.02	2.53	-0.38	0.15
Huaphanh	2.83	1.65	2.72	2.59	0.19	0.04	2.59	-0.32	0.10
Xayabury	2.84	1.66	2.75	2.61	0.21	0.04	2.81	-0.10	0.01
Champasak	2.85	1.67	2.78	2.77	0.37	0.14	2.98	0.07	0.00
Borikhamxay	-5.37	-6.55	42.92	3.13	0.73	0.53	3.41	0.50	0.25
	Mean = 1.19 Variance = 7.08 Standard Deviation = 2.66			**Mean = 2.91** Variance = 4.25 Standard Deviation = 2.06			**Mean = 2.40** Variance = 0.67 Standard Deviation = 0.82		

Source: Author's Compilation Based on Data from the National Statistic Center (Population and Housing Census)

The statistical dispersion analysis above shows that the standard deviation of the annual population growth rate tends to be decreased over time, implying that the variability of the annual population growth rate distribution has been decreasing gradually from the initial integrated land transport development phase to the third integrated land transport development phase. In other words, the more equal annual population growth rate distribution is observed in the third development phase rather that in the initial and second development phase.

It can be concluded that the tendency of the equalization of annual population growth rate distribution has increased within the country during the last three decades. And the open door policy accompanied by improved integrated land transport across the country, equal economic opportunities have been provided throughout the country. The border town functions have become less important. In addition, the migrants move to the main city to search for better social and economic opportunities, which resulting in an increased population agglomeration in individual province.

4. ANALYSIS OF THE EXTENT AND POPULATION AGGLOMERATION SHARE AND URBAN DEVELOPMENT AT DISTRICT LEVEL

This section examines overall picture of the population agglomeration during 1995 to 2005 focusing on the urban area of the districts of the 5 provinces that are border entry provinces i.e. Bokeo Province, Vientiane Capital, Khammouane Province, Savannakhet Province and Champasak Province. The analysis at this level includes the tendency of its increased/decreased percentage of the population agglomeration share. Further analysis of the equalization of the population distribution can be additionally performed by applying the statistical dispersion analysis methodology.

The analysis showed that, since 1985 most of the districts of the 5 provinces that are located along the Lao-Thai border have had the highest percentage of the population share. This is due to the fact that these districts have a long history of border trades with Thailand. However, the calculation of the population share during 1995-2005 evidenced the population growth rate at a higher level than in the earlier years in the other side of the Lao border. This phenomena has been facilitated by the expansion of the integrated land transport network from the Thai border to Vietnam, China and Cambodia border over time. The completion of the First International Bridge on the Thai border side has further facilitated the movement of goods and passengers, resulting in tremendous change in the economic activities and population agglomeration across the country. This analysis has addressed the fact that previously the population growth has taken place very obviously at the Thai border. Since the degree of the integration has increased, the population tends to settle in the other border side. This situation also implies the existence of the tendency of the equalization of the population in Lao PDR.

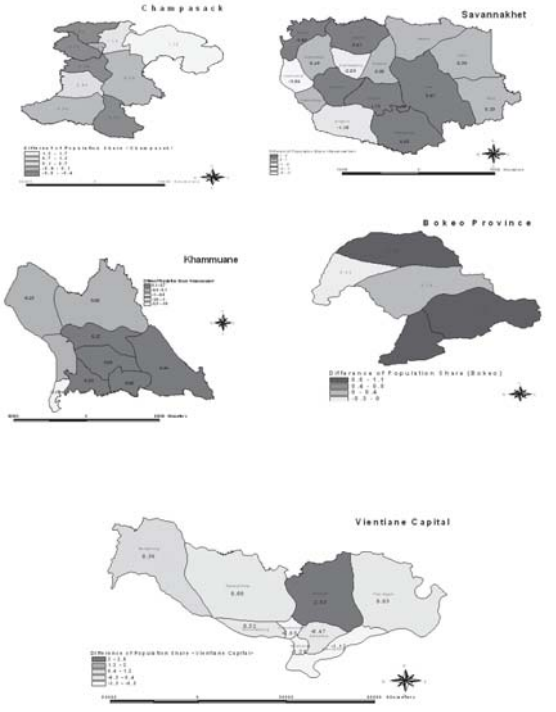


Figure 3. Different of the Percentage of Population Agglomeration Share (1995& 2005)

5. A CORRELATION BETWEEN THE IMPROVEMENT OF INTEGRATED LAND TRANSPORT NETWORK AND POPULATION AGGLOMERATION IN LAO PDR

A correlation between the improvement of the integrated land transport network and population agglomeration was conducted to verify if the former has an impact on the latter. The improvement of the integrated land transport network overtime, however, is indicated by the two indicators (1) increased traffic volume and (2) expanded and improved roads.

1) The Increased Traffic Volume

The traffic volume increased significantly in Pakmong (Junction), and Salaphoukhoun (Junction). These two areas are where the R13N (main axis road to northern part) connected to R13S. It is also observed a significantly increased traffic volume at Meung Phonthong/ Xongmek (Junction), which is an access point to Champasak-Sekong-Attapeu provinces. The increased traffic volume at a moderate level is observed at Hinboun (Junction), Gnommalat (Junction), Meung Phin (Junction) and Lack 35 (Junction); they are located along RN12 and RN9.

The correlation between the increased traffic volume and the increased annual population growth are illustrated by **figure 4**. The analysis found that the areas which are starting and ending nodes of R13N (Vientiane Province - Oudomxay Province) have a highest percentage of the increased dairy traffic and hold a highest increased annual population rate. This is also true for the other areas where are the starting and ending nodes of R13S (Borikhamxay Province and Champasak Province –Attapeu Province).

The population growth rate is also significantly high around the area of Meung Phonthong/ Xongmek junction, as it is an access point to Champasak-Sekong-Attapeu and which has a significantly increased dairy traffic.

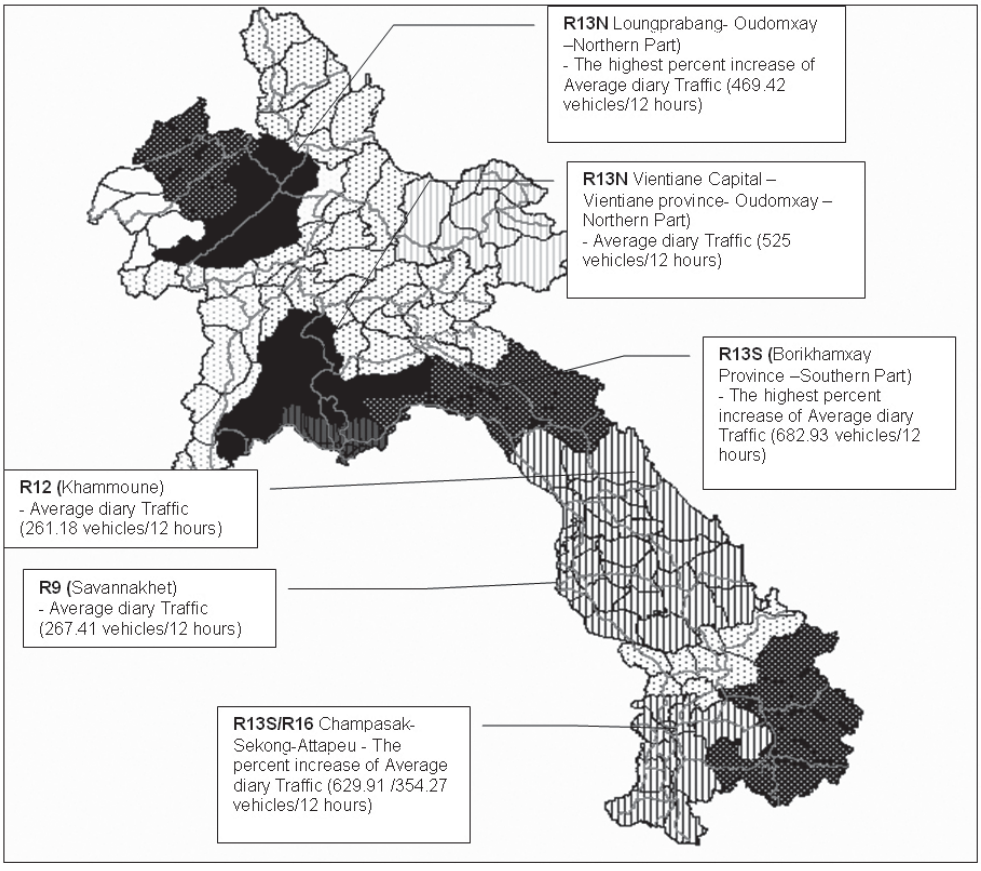
The area which is around Hinboun (Junction), Gnommalat (Junction), Meung Phin (Junction) and Lack 35 (Junction) of the RN12, RN9 has a moderate percentage of increased dairy traffic volume. The annual population growth rate of this area is average.

2) The Expanded and Improved Roads

The length of roads of the whole country reflected the degree of integration as it improves accessibility to remote areas. As discussed before, during the last three decades the transport networks have been expanded and upgraded gradually. This has brought about settlements of people along the new transport routes; and the changing pattern of the population agglomeration. It is therefore feasible to examine the correlation between the improvement of the integrated land transport network and the population agglomeration by looking at the relationship of two representing variables i.e. the length of the roads of the whole country and the standard deviation value, which refers to the dispersion of the annual population growth rate.

The correlation chart is shown in **figure 5**. The "x" axis refers to the length of the improved transport network which is increased gradually since 1976 and the "y" axis is the standard deviation value which refers to the dispersion of the annual population growth rate.

The results showed that as the length of the roads of the whole country has been increased, the dispersion of the annual population growth rate has been decreased. This correlation illustrates the impact of the improved integrated land transport network on the equalization of the annual population growth rate. In other words, the spreading of the transport network throughout the country leads to an equal population growth rate across the country.



Source: Author's Compilation Based on Data from National Statistic Center (Population and Housing Census, 1995 & 2005 and Japan International Cooperation Agency & Ministry of Communication, Transport, Post and Construction (2000). Traffic Survey Lao PDR. Vientiane, Lao PDR.)

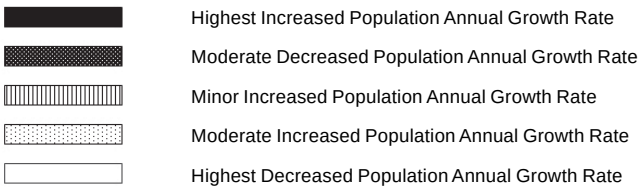
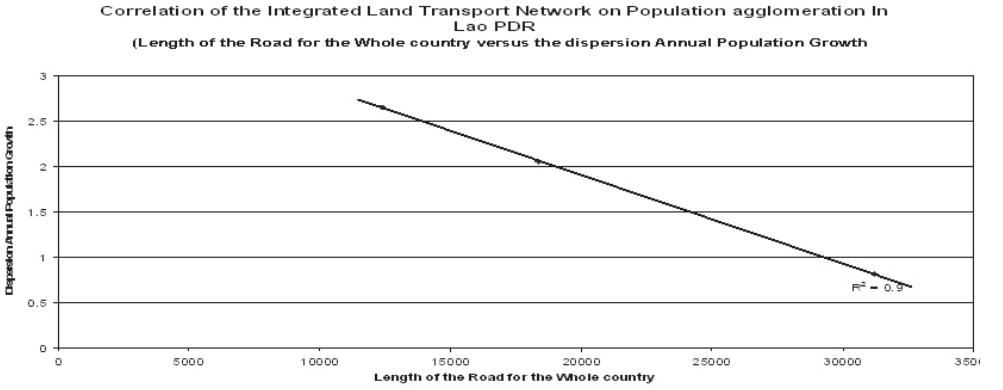


Figure 4. A Correlation of the Impact of Integrated Land Transport Network and Population Agglomeration in Lao PDR



Source: Author's Compilation Based on Data from the Ministry of Communication, Transport, Post and Construction (2005).

6. A CORRELATION BETWEEN THE IMPROVEMENT OF INTEGRATED LAND TRANSPORT NETWORK AND URBAN DEVELOPMENT IN LAO PDR

The correlation between the improvement of the integrated land transport network and urban development is identified by analyzing the growth of urban population's settlement along the main routes and the connection of the main roads to the integrated land transport network within 2 periods of time i.e. 1995 and 2003. The districts that are classified as urban area were used to examine for this.

1) Percentage of Urban Population

Table 2 has shown that the highest urban population is found in the areas that are classified as secondary town, and provincial capital of the province. *Most of these urban areas are located around the major nodes of the major roads namely, R13S/R13N and R9 (EWEC). The R13S/ R13N are the main routes of GMS strategic integrated road network directing to the Southern/ Northern part of Lao PDR (North - South corridor to connect China to Cambodia). On the other hand, the major route R9 is the GMS Asia's strategic highway that connects the East with the West.* The cities shown in Table 2 are centers of economic-social and political activities as being promoted and supported by the urban planning policy of the government. They accommodate large urban populations. Regarding the border trade effect, most of the highest urban populations are in the areas bordering Thailand, rather than Viet Nam, Cambodia or PR China.

2) The Variability of the Urban Population Distribution

The variance and closely-related standard deviation are used to measure of the dispersion of the urban population in 1995 and 2005. The analysis has shown that in 1995, the value of standard deviation is 3.48 compared to 3.18 in 2003. The results indicate the tendency of the decreasing of the dispersion of the urban population since 1995. This evidence proves that the increased degree of integration of Lao PDR to the international community (due to the

impact of integrated land transport network) resulted in the proportional increase in the equalization of urban population.

Table 2. Urban Development in Lao PDR in Each Province & Variability of Urban Population Distribution of Selected Year (1995 & 2003)

Province	Urban Area	Urban Population 1995	Urban Population 2003	Increase Urban Population (1995-2003)	Road	Node	Border	Status
Savannakhet	Savannakhet	62247	63,634	1,387	EWEC	Major	THAI	Secondary towns
Champasack	Pakse	47625	48,218	593	R13S	Major		Secondary town
Luangprabang	Luangprabang	31797	40,797	9,000	R13N			Secondary town
Khammuane	Thakhek	25768	33,107	7,339	R13S		THAI	Secondary town
Vientiane Province	Thoulakhom	21562	10,459	-11,103	R10			
Oudomxay	Xay	15056	22,389	7,333	R13N	Major		Provincial Capital
Luangnamtha	Namtha	14451	16,205	1,754	NSEC	Major		Provincial Capital
Urban Area		**1995**			**2003**			
Mean		Mean = 2.50			Mean = 2.50			
Variance		Variance = 12.08			Variance = 10.13			
Standard Deviation		Standard Deviation = 3.48			Standard Deviation = 3.18			

7. CONCLUSION

The analysis of the population agglomeration at the *provincial level* has shown that the highest decreased growth rate during phase II-III is observed in Bokeo Province, which is a border town relying on water transport for trading with neighboring country. Since 1995 land transport of the Lao PDR has been gradually improved in the way integrating with neighboring countries. The transport of goods among GMS countries is faster and more reliable as a result; and to a large degree it is a significant contributor of the increased share of freight and passenger transport by land, and the decreased of water transport of the Lao PDR. It has been evidenced that the areas which are starting and ending nodes of Road 13N (Vientiane Province, Oudomxay Province) have a highest percentage of increased dairy traffic; and concurrently a highest percentage of increased annual population growth rate. This is also true for the other starting and ending nodes along Road 13S (Borikhamxay Province and Champasak-Attapeu).

The analysis showed that since 1985 most of the districts of the 5 provinces that are located along the Lao-Thai border have had the highest percentage of the population share. This is due to the fact that these districts have a long history of border trades with Thailand. However, the calculation of the population share during 1995-2005 evidenced the population growth rate at a higher level than in the earlier years in the other side of the Lao border. This phenomena has been facilitated by the expansion of the integrated land transport network from the Thai border to Vietnam, China and Cambodia border over time. The completion of the First International Bridge on the Thai border side has further facilitated the movement of goods and passengers, resulted in the tremendous change in the economic activities and population agglomeration across the country. The analysis has addressed the fact that previously the population growth has been taken place very obviously at the Thai border. Since the degree of the integration has increased, the population tends to settle in the other border side. This

situation also implies the existence of the tendency of the equalization of the population in Lao PDR.

The correlation between the improvement of the integrated land transport network and the population agglomeration has been examined by looking at the relationship of two representing variables. The first variable represented by two indicators i.e increased traffic volume and upgraded and improved roads; and the second variable represented by the annual population growth rate. As for the first analysis of the increased traffic volume of the whole country versus the standard deviation value which refers to the dispersion of the annual population growth rate, the results showed that as the traffic volume for the whole country has been increased and the dispersion of the annual population growth rate has been decreased. As for the second analysis, the results showed that as the length of the roads of the whole country has been increased, the dispersion of the annual population growth rate has been decreased.

The correlation between the improvement of the integrated land transport network and urban development is identified by analyzing the growth of urban population settlement along the main routes and its' connected links of the integrated land transport network within 2 periods of time i.e. 1995 and 2003 in each district which classified as urban area. The analysis has shown that the highest urban population mostly is in the urban area which is classified as a secondary town and provincial capital of the province. Most of these urban areas are located at the major nodes along the major roads namely, R13S/R13N and R9 (EWEC). R13S/R13N are the main routes of GMS strategic integrated road network directing to the Southern/ Northern part of Lao PDR (North - South corridor to connect China to Cambodia). Similarly to R9 (EWEC) is a GMS Asia's strategic highway that connects the East with the West.

In conclusion, the population agglomeration and urban development was closely correlated with the improvements of the integrated land transport network in each time frame. The results of the analysis indicated the improvement of the integrated land transport network has accelerated the economic growth. It has provided equal economic opportunities across the country reflecting through the tendency of increased equalization of annual population growth rate distribution throughout the country during the last three decades. The improvement of the integrated land transport network has impacted on the economic growth and also the population agglomeration and urban development process in the Lao PDR.

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