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# **Impact of the EWEC on Development in Border Provinces: Case Study of Savannakhet Province in Lao PDR**

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# **Impact of the EWEC on Development in Border Provinces**

## **Case Study of Savannakhet Province in Lao PDR**

**RETA-6310**  
*Development Study of the  
East-West Economic Corridor*  
**Greater Mekong Subregion**

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## Executive Summary

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The present study brings together in a systematic manner the available information from recent expenditure and consumption surveys for Laos as they relate to the impact of the EWEC on different social and economic aspects of households in the Lao PDR province of Savannakhet. The intent is to provide a means of identifying the progress being made in the ADB's GMS corridor initiatives and to identify areas for further interventions. The study is part of the ADB's continuing work on the social and general welfare impact of the GMS corridors. That work includes efforts to formulate recommendations and action plans for mitigating possible negative effects from the associated economic transformation of the areas surrounding the corridors. The study also supports the ADB's other work on the impact of cross-border trade and investment on poverty alleviation. Finally, it complements new work being carried out on corridor towns, particularly those related to border town development.

The results of this study sustain a number of conclusions in terms of the transformation of the EWEC from a transport to an economic corridor. In the first place, the central districts of Savannakhet have benefited more from the transport infrastructure of the EWEC than the surrounding districts. Nevertheless, the peripheral areas surrounding the Corridor have nonetheless benefited in a substantial way from improvements in the feeder road system.

The second important finding of the study is that infrastructure development has been an effective way of directly impacting on household well-being and indirectly contributing to human endowments of those households by enhancing their consumption of education and health services. Nevertheless, the results also indicate that infrastructural developments have not been allocated among districts in the province in a way that could have produced a more equitable distribution of their effects on living standards.

The implication of this third finding is that infrastructural investment needs to better target low-income rural areas in the peripheral districts. In that way, public investments could help to reduce the growing inequality among districts in Savannakhet, especially if it were to target low-income groups in remote villages. Moreover, the empirical evidence from this study clearly supports combination of transport and communication facilities, insofar as the impact on living standards is substantially greater when these two infrastructures are jointly supplied to villages.

Measuring the Corridor's impact will require further application of detailed socioeconomic data in Savannakhet. Of particular importance are comparative data on (i) trafficking of persons and animals across border; (ii) the incidence of HIV/AIDS in expanding hospitality industry in Savannakhet; (iii) trade and investment divergence from other border provinces and accompanying social welfare shifts; and (iv) other social problems in border areas related to increased crime, drugs, prostitution, and outside cultural influences. These developmental aspects of the EWEC have important effects on living standards that extend well beyond what is indicated by the present LECS.

At the enterprise level, the relevant challenges suggest a similar analytical approach to the one adopted in this study for households. It means moving away from earlier aggregate contributions that have tried to estimate the link between output and aggregate indicators of infrastructure in the form of public capital or physical indicators. From a policy perspective aimed at transforming the EWEC into an economic corridor, it would be more fruitful to concentrate on how aspects linked to the political, institutional and regulatory environment have affected the delivery and efficiency of services in the different industries that have significant operating potential in Savannakhet.

# Savannakhet Province along East-West Economic Corridor

East-West Economic Corridor (EWEC) of Greater Mekong Subregion (GMS)





# 1. Introduction

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## 1.1 Background and Coverage

The East-West Economic Corridor (EWEC) was conceived over a decade ago as a means of providing pro-poor economic growth and development to the Corridor area.<sup>1</sup> Like other corridor initiatives of the Greater Mekong Subregion (GMS), it has both commercial and development dimensions. The commercial side focuses on creating an efficient transport system for moving goods and people in the subregion and promoting business activity in commercial nodes, while the development side supports rural and border area development along the corridor as a means of reducing poverty and increasing earnings and employment opportunities of low-income groups. Rural development is supported by the construction of secondary feeder roads along the main artery, which aims to increase mobility and thereby extend the Corridor's benefits to communities and farmers in the surrounding areas.<sup>2</sup>

Commercial expansion along the Corridor can, in and of itself, act as an engine for alleviating poverty and reducing inequality by providing needed infrastructure, trade and investments. That process can, in turn, generate income and employment for low-income and vulnerable groups. However, the contribution of commercial expansion to the development dimension appears to be low.<sup>3</sup> Instead, commercial activity and the economic transformation of the areas surrounding the Corridor has giving rise to new social issues and, at times, aggravating the level of inequality across households and geographic areas along the Corridor.<sup>4</sup> Examples include relocation of people, displacement of locals in the workforce by immigrants from neighboring countries, and loss of domestic markets as trade with neighboring countries is liberalized. The livelihoods of many farmers close to the main transport arteries have been negatively affected by the Corridor because of increased competition from low-cost producers in neighboring countries. In contrast, those without access to the main artery of the Corridor continue to sell non-timber food products (NTFPs) in local markets at prices that have little or no relation to those in commercial markets.<sup>5</sup> The Corridor has also increased the potential for trafficking of both people and wildlife, although cross-border movements through secondary roads already existed before the EWEC.<sup>6</sup>

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<sup>1</sup> For the latest strategy and action plan of the EWEC, see ADB, "East-West Economic Corridor (EWEC) Strategy and Action Plan". Manila, 2010.

<sup>2</sup> ADB, Project Completion Report on the Greater Mekong Subregion: East-West Corridor Project (Lao PDR and Viet Nam). Manila, 2008.

<sup>3</sup> ADB, Lao People's Democratic Republic and Socialist Republic of Viet Nam: Greater Mekong Subregion: East-West Economic Corridor Project". Manila: ADB Performance Evaluation Report, December 2008.

<sup>4</sup> See ADB, "East West Economic Corridor (EWEC): Phase I: Stocktaking and Updating the Strategy" Draft, RETA-6310. Development Study of the East-West Economic Corridor. Manila, February 2009.

<sup>5</sup> In Laos, remote villages often produce exclusively for local consumption at prices that have no relationship to market prices in commercial centers. See van der Weide, Roy, "The Variation in Prices for Various Commodities in Lao PDR". World Bank, 2006.

<sup>6</sup> For a recent study on the close link between economic development in commercial and boarder nodes along the EWEC and the incidence of HIV/AIDS, see Handicap International, "Development, Mobility, and HIV in South East Asia: A Preliminary Study for the Implementation of a Development-Based HIV Prevention Programme along the East-West Corridor/Highway 9 in Laos and Vietnam". Paris, 2006





These wide-ranging effects on vulnerable groups and the importance of effectively transforming the EWEC into an economic corridor to alleviate poverty and reduce inequality have motivated the present study. Its purpose is to bring together in a systematic manner the available information from recent expenditure and consumption surveys for Laos as they relate to the impact of the EWEC on different social and economic aspects of vulnerable groups in the Lao PDR province of Savannakhet. The intent is to provide a means of identifying the progress being made in the ADB's GMS corridor initiatives and to identify areas for further pro-poor interventions.

The study is part of the ADB's continuing work on the social and general welfare impact of the GMS corridors. That work includes efforts to formulate recommendations and action plans for mitigating possible negative effects from the associated economic transformation of the areas surrounding the corridors.<sup>7</sup> The study also supports the ADB's other work on the impact of cross-border trade and investment on poverty alleviation.<sup>8</sup> Finally, it complements new work being carried out on corridor towns, particularly those related to border town development.<sup>9</sup>

The study is composed of the following parts:

- **Conceptual Framework.** Following this introductory chapter, Chapter 2 reviews earlier studies and analytical approaches, and it develops the conceptual framework used in the present study to identify channels through which transport infrastructure impacts on household welfare measures.
- **Transmission Process and Data Description:** Chapter 3 describes the direct and indirect effects of transport infrastructure on development outcomes, and it describes the data used in the present study.
- **Baseline Measure of Transport Infrastructure and Local Livelihoods.** Chapter 4 provides a descriptive analysis of inter-provincial and intra-provincial performance of Savannakhet based on the direct and indirect channels through which the EWEC has likely impacted on local livelihoods.
- **Impact of Transport Infrastructure.** Chapter 5 uses district-level panel data for Savannakhet from recent household surveys to examine the effects of transport infrastructure and other determinants of household consumption and commercial activities.
- **Findings and Conclusions.** Chapter 6 summarizes the main findings and provides recommendations on ways to ameliorate the growing inequality among households in a way that ensures that the poor and vulnerable groups will share in the benefits of development along the Corridor.

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<sup>7</sup> ADB, "HIV and Infrastructure: ADB Experience in the Greater Mekong Subregion ADB Synthesis Paper". Manila, 2007.

<sup>8</sup> See, for example, S. Paitoonpong, "Thailand's Cross-Border Trade in the Greater Mekong Subregion: Selected Social Issues". CCAS Working Paper Series, undated.

<sup>9</sup> See ADB, "Economic Profiling of Towns along the GMS Economic Corridors: Background Paper for the 5<sup>th</sup> GMS Development Dialogue on 5 November 2009". Manila, November 1, 2009.



## 1.2 Profile of the Study Area

**Economic Activity:** The province of Savannakhet has the largest population of any province in Lao PDR and is composed of a lowland area in the western part and upland area in the east part. There are 15 districts, over 1,000 villages, and about 135,000 households in the province. Approximately 75 percent of the total population belongs to the Lao Loum ethnic group, with most of the remainder population belonging to the Lao Theung. Per capita income is estimated at US\$675, about three-fourths of the national average (US\$875).<sup>10</sup> The provincial capital of Kaysone Phomvihane has a population of 120,000 and is the second largest city in Laos.

**EWEC National Road No. 9:** Rehabilitation of National Road No. 9 of the EWEC in Savannakhet was funded by the ADB for the portion between Kaysone Phomvihane and Xeno and between Muang Phin and Dansavanh, and by the Government of Japan for the portion between Xeno and Muang Phin. The rehabilitation was completed in early 2007, along with the upgrading of three rural access roads connecting to National Road No. 9.<sup>11</sup> However, lack of service facilities along the route has prevented the road from having direct economic development effects on the immediate vicinity of the road.<sup>12</sup>

**Recent Performance Evaluation:** A recent project performance evaluation of the Lao PDR and Vietnam components of the EWEC concluded that the project impact has been “moderate” in terms of regional-level impacts, but it has been “significant” in terms of socioeconomic changes at the local levels.<sup>13</sup> Using perception surveys, the authors of the report found that National Road No. 9 had improved

**Table 1.1: Profile of Study Area**

Concept	
EWEC Road Section	208 km
Area (sq km)	21,774
Provincial Capitals	Kaysone Phomvihane
Population (2008)	874,660
Population Density (inh./km <sup>2</sup> )	40
Per Capita GPP (2008)	US\$ 675
Per Capita GPP relative to National Average	77%
Gross Provincial Product (GPP), of which	US\$ 590 mil
Agriculture	47%
Industry	27%
Services	26%

Source: Department of Statistics, Ministry of Planning and Investment, Government of Lao PDR.

<sup>10</sup> Department of Statistics, Statistical Yearbook 2008. Vientiane Capital, Ministry of Planning and Investment, June 2009.

<sup>11</sup> The ADB contribution consisted of two components:

- (a) In addition to rehabilitating RN9 from Muang Phin to Dansavanh at the border with Viet Nam, there was a further upgrading of 27.8 km of RN9 from Kaysone Phomvihane to Xeno to a standard consistent with that of earlier upgraded road sections east of Xeno. These improvements include widening, placing an asphaltic concrete overlay, improving related intersections, and providing 2.5 m shoulders to give a lane for light and slower traffic like motorcycles and tractors, improve border facilities, provide one fixed and four mobile scales to measure axle loads along RN9, install road marking and street lighting around Kaysone Phomvihane town, and provide off-corridor emergency flood repairs.
- (b) Rural community access construction and improvement of three access roads including small bridges, river crossing systems, pathways, and other infrastructure in the corridor influence area, which was later expanded to a total of nine rural roads connecting with RN9 (length 178 km), with bitumen applied in areas with steep grades (35 km), and the construction of Xe Namkok bridge.

<sup>12</sup> ADB, "Lao People's Democratic Republic and Socialist Republic of Viet Nam: Greater Mekong Subregion: East-West Corridor Project". Operations Evaluation Department, December 2008.

<sup>13</sup> ADB, "Lao People's Democratic Republic and Socialist Republic of Viet Nam: Greater Mekong Subregion: East-West Corridor Project". Operations Evaluation Department, December 2008.





access to markets and basic social services by opening up markets and enhanced consumer choices through cheaper prices and product availability and diversity. The rural roads component enhanced mobility and enabled rural communities including ethnic groups and women to gain access to markets, employment opportunities, and social services. Nonetheless, the evaluation found that at the regional level, the EWEC has remained a transport corridor with little evidence of transformation into an economic corridor.

**Poverty Profile:** Despite the increased levels of economic activity, poverty persists throughout Savannakhet and many people are facing challenges related to food security, access to improved water sources and sanitation, education and employment opportunities. Medical services of the province have not been provided sufficiently, for instance, health care centers are located in only 81 villages out of 1543 villages in the province. HIV/AIDS carriers have increased rapidly especially on sex workers in the province and this area is designated as a target area for comprehensive programs on HIV/AIDS prevention.

The latest household survey shows that the proportion of the population in Savannakhet that lives below the poverty line has fallen by one-third since the early part of this decade (Table 1.1). Nonetheless, the proportion of the population living in poverty remains high. For example, Savannakhet's poverty headcount is three times higher than Champsack, where rapid expansion of contract farming and plantation- and concession-based agricultural development is occurring.

Within Savannakhet itself, four of the 15 districts in the province are classified as 'poor', and three of these have been targeted by the National Growth and Poverty Eradication Strategy (NGPES) for priority development. Currently there are 20 non-government organizations (NGOs) operating in the province, primarily working in the areas of healthcare, human resource development, social development and education. Income distribution also remains uneven. In the central provinces, inequality (measured by the Gini Index) has increased, from 31 to 34, which reflects the trend in the country as a whole (from 33 to 35).<sup>14</sup> Income inequality among the population living on the Thai and Vietnamese borders has also risen, from 31 to 35 and from 26 to 26 respectively.

**Table 1.2: Lao PDR Poverty Headcount**

	1992/3	1997/8	2002/3	2007/8
<b>Lao PDR</b>	46.0	39.1	33.5	27.6
<b>Vientiane</b> (Metropolitan)	33.6	13.5	16.7	15.2
<b>Northern Lao PDR</b>	<u>50.4</u>	<u>49.1</u>	<u>36.5</u>	<u>33.7</u>
Phongsaly	72.0	57.9	50.8	46.0
Luangnamtha	40.5	51.1	22.8	30.5
Oudumxay	45.8	66.1	45.1	33.7
Bokeo	42.4	38.9	21.1	32.6
Luangprabang	58.5	40.8	39.5	27.2
Huaphanh	71.3	71.3	51.5	50.5
Xayabury	22.4	17.7	25.0	15.7
<b>Central Lao PDR</b>	<u>42.1</u>	<u>37.0</u>	<u>33.2</u>	<u>30.3</u>
Xiengkhuang	63.0	42.9	41.6	42.0
Vientiane	30.7	27.8	19.0	28.0
Borikhamxay	16.6	27.9	28.7	21.5
Khammuane	47.1	44.5	33.7	31.4
<b>Savannakhet</b>	<b>53.1</b>	<b>41.9</b>	<b>43.1</b>	<b>28.5</b>
<b>Southern Lao PDR</b>	<u>53.1</u>	<u>43.6</u>	<u>39.6</u>	<u>30.7</u>
Saravane	43.6	39.2	54.3	36.3
Sekong	67.0	49.7	41.8	51.8
Champasack	41.4	37.4	18.4	10.0
Attapeu	60.5	48.0	44.0	24.6

Source: Department of Statistics, Ministry of Planning and Investment, Government of Lao PDR.

<sup>14</sup> Based on data provided by Department of Statistics, Ministry of Planning and Investment, Government of Lao PDR. The measure of inequality is based on the Gini index, where a value of 0 represents absolute equality, and a value of 100 absolute inequality.



## 2. Conceptual Framework

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### 2.1 Review of Earlier Studies

A number of studies have examined the relationship between transport infrastructure and trade, investment and local livelihoods along the GMS corridors and elsewhere. They provide useful insights into the effects of border trade and investment effects on local livelihoods. Often their analysis is limited to a snapshot of the existing situation at the time of the study rather than offering insights about the changes in living standards from comparative data. Impact analyses of border trade are often based on opinion surveys and perceptions of changes in living standards of village people, local farmers, traders and officials. These types of perception surveys of a few villages in affected areas are usually carried out by ADB evaluations of transport infrastructure, as for example, in a recent Champasak road improvement project and another for the EWEC road project in the Lao PDR and part of Vietnam.<sup>15</sup> Those that have applied economic modeling techniques have disaggregated datasets from one-off surveys or limited their application to macro-level effects.

#### 2.1.1 Border Trade, Infrastructure, and Social Dimensions of Development

***The Complexity of Responses:*** The most comprehensive study on the relationship between Lao PDR's border trade and various social dimensions has been undertaken by the United Nations Development Programme (UNDP) in collaboration with the Ministry of Planning and Investment for the third National Human Development Report (NHDR) for Laos.<sup>16</sup> The report examines the impact of international trade on poverty, employment, gender, culture and the environment. While most of the study focuses on trade at the national level, it also addresses some of the trade effects in border districts. Within that coverage there is an analysis of the EWEC's National Road No. 9 in Savannakhet relative to informal cross-border trade, migration patterns, and illegal log trade.<sup>17</sup> The most important finding of the report is that in Laos "ensuring that trade leads to meaningful and sustainable improvements in people's lives is neither automatic nor guaranteed" (UNDP, 2005, p. vi). The reason is that although trade can generate economic growth, it can also

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<sup>15</sup> See, for example, ADB, "Champasack Road Improvement Project (Loan 1369-LAO[SF]) in the Lao People's Democratic Republic". Manila: ADB Performance Evaluation Report, November 2005; and ADB, "Lao People's Democratic Republic and Socialist Republic of Viet Nam: Greater Mekong Subregion: East-West Economic Corridor Project". Manila: ADB Performance Evaluation Report, December 2008. For general guidelines on integrating poverty impact assessment in the economic analysis of projects, see ADB, "Handbook for Integrating Poverty Impact Assessment in the Economic Analysis of Projects". Manila, Asian Development Bank, 2001; and M. Fujimura and J. Weiss, "Integration of Poverty Impact in Project Economic Analysis". EDRC Methodology Series No. 2, 2000.

<sup>16</sup> UNDP, "International Trade and Human Development: Lao PDR 2006". National Human Development Report, Vientiane, 2006.

<sup>17</sup> Informal trade general refers to movement of goods across borders outside of official checkpoints in an effort to circumvent tariffs and non-tariff barriers (NTBs) to trade like quantitative limits on imports of specific goods. In general, it is tolerated in practice, even though it is illegal in the letter of the law. Examples include trade in unprocessed wood, electronics and other items of large commercial value, as well as local trade in animals, fruits and vegetables. Smuggling can also refer to informal trade to avoid taxes and other trade controls, but it also refers to the clandestine movement of prohibited goods or people across borders, as for example arms and illegal drugs.



widen income inequalities and leave the poor and marginalized groups unaffected by change.

***Stimulating Border Trade in Local Products:*** A study by Development Analysis Network (DAN) included impact assessments of two corridors on border nodes in Laos and another two in Thailand. The first one for Laos covered the EWEC in the Lao-Vietnamese border town of Dansavanh in Savannakhet province; the second one covered the North-South Economic Corridor (NSEC) on the Lao-Thai border towns of Houaysai and Tonpheung in Bokeo.<sup>18</sup> In Thailand the study examined the impact of border trade on Sa Kaeo along the Southern Economic Corridor (SEC) and Chiang Rai along the NSEC. The study included an analysis of trading conditions at the borders and the welfare impact of that trade on occupation, livelihoods, activities, earnings, incomes, assets, expenditures, human development indicators and access to services. The study derived its findings from case studies on traded products and the use of household surveys. In Savannakhet, for example, trade with Vietnam was analyzed in terms of garlic and onion imports (representing agricultural products) and clothes (representing manufactured imports). Product exports from Laos to Vietnam, like timber, cardamom, gypsum, semi-finished wood and furniture, were not examined. The social welfare indicators for the border districts were based on Lao Expenditure and Consumption Survey 2002 (LECS 3). However, the welfare impact assessment of border trade was based on perception surveys. Overall, those perceptions were positive. Where negative perceptions were reported, they referred principally to social problems arising from increased border trade, namely, crime, drugs, prostitution and outside cultural influences. Other negative perceptions referred to increased competition for local businesses and illegal trade. Most households considered themselves to be moderately better off because of border trade. But the improvements were not directly related to employment opportunities because of the opening of border trade. Rather it was because of improved production conditions, mainly in agriculture, that were indirectly related to increased border trade, for example, better access to information, seeds and fertilizers from neighboring countries.

### **2.1.2 Importance of Border Trade to Socio-Economic Development**

***Distance to Border Matters:*** A study on Mukdahan and another Thai province (Sa Kaeo, bordering Cambodia along the SEC) examined whether households that are more exposed to cross-border economic integration have significantly higher incomes than other households.<sup>19</sup> The study used econometric estimates relating household expenditures to their characteristics, including location, cross-border activities, and distance to main roads. This approach tried to overcome shortcomings of earlier impact assessments that relied on interviews and researchers' observations and consequently suffer from a lack of reliable and comprehensive data sets. To estimate the model the authors applied cross-section regression analysis to the pooled datasets of Mukdahan and Sa Kaeo. The results showed that households involved in cross-border activities had significantly higher incomes than those not involved. But distance to the border trading points did not impact

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<sup>18</sup> Development Analysis Network, "The Cross Border Economies of Cambodia, the Lao PDR, Thailand and Vietnam", CDRI, Phnom Penh, 2005. Another study on Lao-Vietnamese border trade in Savannakhet is Leebouapao et al., "The Cross Border Economy - Structure, Importance and Role: Case Study of Lao PDR", Paper presented to Workshop and Conference on Cross Border Economy organized by NSC and NERI with support from Rockefeller Foundation, Vientiane Capital, Lao PDR, 27-28 December, 2004.

<sup>19</sup> J. Pampiemras, Y. Chalamwong, and P. Bhuthong, "Do Location and Cross-border Activity Matter in the Presence of Cross-border Economic Integration?". TDRI Quarterly Review, June 2007.



on incomes, suggesting a lack of knowledge about opportunities or lack of financial capital.

***Reducing Locations Disadvantages:*** One of the background studies for the NHDR on international trade and human development examined the impact of Lao-Chinese border trade on local livelihoods using a micro-level survey of households in different types of villages in the Sing district of Luang Namtha province.<sup>20</sup> The villages were classified into those close to the border, urban villages, and villages away from the border. Focal group interviews were also conducted with government officials, company employees and traders Luang Namtha involved in exports of sugar cane and imports of fruits and vegetables. The analysis was based on opinion surveys and perceptions of changes in living standards. Interestingly, the study found that the impact of border trade was often greater on people living away from the border than those living near to it. The explanation given for this phenomenon was that the impact of increased border trade was greater for those producing tradable goods than for those actually involved in border trading activities. Improvements in road and communications networks often reduce the importance of distance or location disadvantage for outlying villages. Other benefits included better living conditions for urban dwellers because of improvements in water supplies and access to gas, electricity and sanitation facilities, along with expanded education facilities. Beyond urban centers, rural villages benefited from greater variety of goods because of increased border trade, and improved services and production efficiencies associated with increased competition from Chinese suppliers.

### **2.1.3 Border Trade Development and the Poor**

***Proactive Policies for the Poor:*** The Asian Development Bank (ADB) conducted a study in 2007 on the distribution of benefits and costs of cross-border interactions among different groups in the GMS.<sup>21</sup> It provided quantitative data and qualitative information on the benefits and issues related to those cross-border interactions with a view to making recommendations on how to maximize the net benefits for the poor. The study covered a broad range of areas related to local living standards, employment, and other income-generating activities, along with issues like community and resource interactions, social services, information exchange, and other issues identified by the participating countries. It utilized both participatory and qualitative research methods. Notable findings included the fact that many of the benefits of the formal process of integration have been bypassing poor people and poor communities in the border areas; the decreasing access of poor households to resources like land and non-timber forest products because of increased demand from commercial enterprise; and the importance of remittances sent by cross-border migrant workers to local communities. The results were used to support the formulation and modification of national poverty reduction strategies related to regional issues affecting national efforts to reduce poverty.

***Informal Trade and the Poor:*** Several studies outside the region have provided useful insights on possible analytical approaches to border trade affects on vulnerable groups. One recent example is the World Bank's study prepared for the ADB on cross-border trade between member countries of the Central Asia Regional Economic Cooperation

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<sup>20</sup> S. Khontaphane, S. Insisiangmay, and V. Nolintha, "Impact of Border Trade on Local Livelihoods: Lao-Chinese Border Trade in Luang Namtha & Oudomxay Provinces". Vientiane, Technical Background Paper for the third National Human Development Report Lao PDR, 2006.

<sup>21</sup> Asian Development Bank, "TA 6171-REG: Reviewing the Poverty Impact of Regional Economic Integration in the Greater Mekong Subregion". Manila, 2007.



(CAREC).<sup>22</sup> It surveyed cross-border trade and its employment and income effects in Kazakhstan, the Kyrgyz Republic and Tajikistan. Since much of cross-border trade activities are not reported in foreign trade statistics for those countries, the report focuses on survey results on unreported trade. The analysis of employment and income effects in nearby areas is limited to observations about production and trading activities at local bazaars, bars and restaurants, all of which are reported as being positive.

#### 2.1.4 Infrastructure and Socio-Economic Development

Numerous studies exist on the infrastructural (road) impact on rural communities. These applications provide useful lessons for the direction of the present study. One interesting study on rural households in Peru uses ‘propensity score matching’ techniques to measure the impact of rehabilitated roads on key welfare indicators of surrounding communities.<sup>23</sup> The approach compares the welfare of households with access to non-rehabilitated roads to those where recent rehabilitation has taken place. It suggests that the welfare gains derived from road rehabilitation can be calculated from the difference between the welfare levels in the nearby communities relative to communities outside the range of the rehabilitated roads. By extension, the welfare impact of road construction in provinces can be compared with welfare levels in other provinces where such infrastructure is not available. Additionally, changes in welfare levels can be calculated and compared between the affected and unaffected areas when so-called longitudinal information on households is available.<sup>24</sup>

**Infrastructure as a Catalyst for Trade:** In the context of these transport infrastructure studies, there are recent estimates of trade flows related to various transport cost factors that apply a gravity model to predict bilateral trade and FDI flows between trading partners. The approach was initially suggested by Limao and Venables (2001) and was adapted to the GMS countries by Fujimura and Edmonds (2006).<sup>25</sup> For cross-border trade effects in neighboring areas along a transport corridor, distance between trading partners is inapplicable, so estimates of trade flows based on a gravity model are inappropriate. Moreover, whereas previous applications have estimated export flows between countries, in the case of border impact assessments it is more appropriate to estimate imports. In that way, the trade effects on neighboring area can be measured in terms of their feed-through transmissions to local economic activity and social well-being of the population. Empirical studies measuring the impact of transport infrastructure often invoke the procedure suggested by Grootaert (2002), whereby a binary variable is used to represent

<sup>22</sup> World Bank, “Cross-Border Trade within the Central Asia Regional Economic Cooperation”. Manila, Asian Development Bank, 2007.

<sup>23</sup> J. Escobar and C. Ponce, “The Benefits of Rural Roads: Enhancing Income Opportunities for the Rural Poor”. Grupo de Analisis para el Desarrollo (GRADE), Lima, Peru, undated. The ‘propensity score matching’ approach is adopted from evaluation methodologies for public projects, surveyed by J. Heckman, R. LaLonde, and J. Smith, J., “The economics and econometrics of active labor market programs. In O. Ashenfelter and D. Card (Eds.), Handbook of Labor Economics Volume 3A (Vol. 3A, pp. 1865-2097). Amsterdam: North-Holland, 1999.

<sup>24</sup> Longitudinal data refers to observations of the same variables over time, as in the case of time series for trade data or living standards surveys conducted at different periods of time.

<sup>25</sup> See N. Limao and A.J. Venables, “Infrastructure, Geographical Disadvantage, Transport Costs and Trade”, World Bank Economic Review 15: 451-479, 2001; M. Fujimura and C. Edmonds, “Impact of Cross-border Transport Infrastructure on Trade and Investment in the GMS”. ADB Institute Discussion Paper No. 48. Tokyo, Asian Development Bank Institute, March 2006; and M. Fujimura, “Cross-Border Transport Infrastructure, Regional Integration and Development”. ADB Institute Discussion Paper No.16. Tokyo, Asian Development Bank Institute, November 2004.





the absence or presence of the infrastructure.<sup>26</sup> Unfortunately, this proxy is a poor substitute for actual measures of infrastructure. But the alternative of using actual measures of infrastructural services are largely absent across countries, which hinders comparative analysis.

**Applications to EWEC's Second Friendship Bridge:** A recent ADB study examined the impact of the Second Friendship Bridge between Mukdahan and Savannakhet on trade, GPP and its consumption component in both provinces.<sup>27</sup> It used a general equilibrium model to estimate the benefits of infrastructure investments on both the adjacent provinces and trade with third countries.<sup>28</sup> The results suggested that there are very large trade and expenditure changes from the infrastructure. Despite the large impact, the modeling exercise did not capture other effects like tourism flows, which would likely generate even greater expenditure gains. The study proposed that future applications of the modeling methodology adopt a multi-household version of the model to assess the distributional impact of the infrastructural project on the adjacent provinces that would include the effects on poverty incidence and inequality. An earlier study did use a general equilibrium modeling approach to estimate the impact of rural road improvements in Laos on the poverty incidence, but the analysis was at the country level rather than the provincial level.<sup>29</sup>

## 2.2 Approach of the Study

The analytical framework used to assess the impact of the EWEC on the province of Savannakhet adapts progress made by recent studies in understanding the linkage of transport infrastructure, trade and other economic activities with poverty, inequality and other measures of household living standards. First, it maps the transmission effects from the transport corridor onto the economic dimensions of the EWEC. That mapping is based on the work McCulloch, Winters and Cirera (2001) to facilitate the presentation of how those complex links occur.<sup>30</sup> The approach allows policymakers to readily identify how critical features in provinces like Savannakhet interact with economic and social aspects of households and enterprises. It also helps to show how appropriate complementary policies in areas like feeder roads, business development services, and financial services are essential to ensuring that the households benefit from transport and economic corridor improvements.

<sup>26</sup> Grootaert, C. , "Socioeconomic Impact Assessment of Rural Roads: Methodology and Questionnaires". Draft paper prepared for the Roads and Rural Transport Thematic Group and the Transport Economics and Poverty Thematic Group. Washington, D.C.: World Bank, 2002. Note that in the case where the estimates include the full economic and social welfare impact from the road construction, the panel data from pre-road and post-road village surveys are required. In the present study, we separate the trade impact from other effects in order to calculate the effect of transport infrastructure on trade flows using time series data.

<sup>27</sup> P. Warr, J. Menon and A.A. Yusuf, "Regional Economic Impacts of Cross-Border Infrastructure: A General Equilibrium Application to Thailand and Lao PDR". ADB Working Paper Series on Regional Economic Integration, No. 35, October 2009.

<sup>28</sup> Another study also estimated the impact of cross-border road infrastructure on trade and foreign direct investment in the GMS, but at the national level and using a gravity model. See C. Edmonds and M. Fujimura, "Impact of cross-border road infrastructure on trade and investment in the Greater Mekong Subregion". Tokyo, Asian Development Bank Institute (ADBI), October 2006.

<sup>29</sup> J. Menon and P. Warr, "Does Road Improvements Reduce Poverty? A General Equilibrium Analysis for Lao PDR". Tokyo, Asian Development Bank Institute (ADBI), October 2006.

<sup>30</sup> N. McCulloch, A. Winters and X. Cirera, "Trade Liberalization and Poverty: A Handbook". London: Centre for Economic Policy Research, 2001.





Secondly, it measures transmissions effects using household data to calculate the economic impact of the Corridor on household welfare. Those effects are normally considered discrete events that permit the use of a sequencing approach to the analysis.<sup>31</sup> The procedure is one that can be readily understood by policymakers and easily applied by researchers to other border areas along the GMS corridors. The breakdown of transport infrastructure along the Corridor into its direct and indirect effects follows conventional practices in the literature.<sup>32</sup> Direct effects are reflected in time and cost savings in accessing markets, schools, hospitals and other social and economic services or centers. In border areas these savings directly impact on the volume of trade of goods and services between neighboring countries, the travel time and cost to markets, schools, hospitals and other social services, and the attractiveness of commercial and investment activities in the area surrounding the corridor.

Indirect positive effects consist of increased expenditure and production-side activities and improvements in well-being related to health, education and other social dimensions of the local population. On the expenditure side of the economic impact, there is an abundant literature showing that trade and economic growth can contribute both to poverty reduction and to human development, but it also demonstrates that the connections are neither automatic nor guaranteed.<sup>33</sup> Moreover, when growth does contribute to welfare improvements, the effects tend to be unevenly distributed. Therefore it is important to explicitly model the transmission channels of changes in trade, growth, poverty and other welfare measures in the border provinces.

Indirect negative effects range from direct economic effects on local producers arising from increased competition of cheaper products from neighboring countries to a range of social problems arising from increased border trade, namely, crime, drugs, prostitution and outside cultural influences. These effects can be measured in terms of the incidence of HIV/AIDS, human and animal trafficking numbers, crime levels in different categories and income inequalities among different types of vulnerable groups. There are also possible shifts in welfare between regions located along a country's border areas due to trade diversion effects from one border checkpoint to another.<sup>34</sup> These shifts occur because increases in intra-regional trade create additional trade in border area where the transport infrastructure is located, but at the partial expense of other border areas from which trade is diverted.

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<sup>31</sup> Grootaert, C. , "Socioeconomic Impact Assessment of Rural Roads: Methodology and Questionnaires". Draft paper prepared for the Roads and Rural Transport Thematic Group and the Transport Economics and Poverty Thematic Group. Washington, D.C.: World Bank, 2002.

<sup>32</sup> See, for example, M.G. Boarnet, "The Direct and Indirect Economic Effects of Transportation Infrastructure". Irvine, CA, University of California at Irvine, Institute of Transportation Studies, March 1996, and references therein; J. Oosterhaven and T. Knaap, "Spatial economic impacts of Transport infrastructure investments". Paper prepared for the TRANS-TALK Thematic Network, Brussels, November 6-8, 2000.

<sup>33</sup> See A. Berg and A. Krueger, "Trade, Growth and Poverty. A Selective Survey". IMF Working Paper WP/03/30. Washington, DC, International Monetary Fund, 2003.

<sup>34</sup> See Schiff, M. and L.A. Winters. "Regional Cooperation, the Role of International Organizations, and Regional Integration". Policy Research Working Paper 2872, World Bank, 2002.



## 3. Transmission Process and Data Description

### 3.1 Transmission Process

Transport infrastructure improvements, and those related to cross-border activities in particular, directly affects the movement of goods and people. While the relationship between transport infrastructure and both domestic and cross-border trade is generally positive, the effects on local livelihoods can vary greatly. Generalizations are often misleading because the effects from improved transport infrastructure can benefit some households and enterprises while hurting others.

From a practitioner's point of view, the World Bank emphasizes that the link between transport infrastructure and economic growth is a regional or macroeconomic phenomenon, while that between transport infrastructure and local livelihoods is a microeconomic one.<sup>35</sup> Transmission effects to different segments of the population depend on the specific characteristics of the households and enterprises in the area being examined, as well as the nature of their response to increased movements of goods and people accompanying infrastructural improvements. The first step in measuring those effects is to characterize the channels through

#### Box 3.1: Classification of Direct and Indirect Effects of EWEC in Savannakhet

1. Direct effects:
  - 1.1. Reduced travel time and cost to commercial markets.
  - 1.2. Increased cross-border trade in goods and services.
  - 1.3. Greater access to social infrastructural services (e.g., schools and hospitals) and social services.
2. Indirect positive effects:
  - 2.1. Secondary feedback expenditure effects (via demand) from economic growth resulting from trade, local consumption and investment expansion.
  - 2.2. Productivity and location effects (via supply).
  - 2.3. Development of commercial activity and diversification of employment opportunities that lowers household vulnerabilities to external shocks.
  - 2.4. Improvements in health, education and technical training of greater proportion of local populations.
  - 2.5. Crowding-in of domestic and cross-border investments.
  - 2.6. Spillover effects on neighboring provinces or well-being at the national level.
3. Indirect negative effects:
  - 3.1. Increased competition from foreign suppliers in local markets.
  - 3.2. Increased trafficking of persons and animals across border.
  - 3.3. Rising incidence of HIV/AIDS in expanding hospitality industry.
  - 3.4. Growing inequality between population groups near Corridor and those in remote areas.
  - 3.5. Other social problems in border areas related to increased crime, drugs, prostitution, and outside cultural influences.
  - 3.6. Trade and investment divergence from other border provinces and accompanying social welfare shifts.

<sup>35</sup> Stéphane Straub, "Infrastructure and Growth in Developing Countries: Recent Advances and Research Challenges". World Bank, Policy Research Working Paper 4460, January 2008. Available: <http://ideas.repec.org/p/wbk/wbrwps/4460.html>. Other proxies are distance, ad valorem shares of trade volumes or real freight expenditures in the form of vehicle operating costs. For a review of the empirical literature, see also Susan F. Stone, Anna Strutt and Thomas Hertel, "Assessing Socioeconomic Impacts of Transport Infrastructure Projects in the Greater Mekong Subregion". Unpublished. Presented at the 12th Annual Conference on Global Economic Analysis, Santiago, Chile. Available: [https://www.gtap.agecon.purdue.edu/resources/res\\_display.asp?RecordID=3039](https://www.gtap.agecon.purdue.edu/resources/res_display.asp?RecordID=3039).



which transport infrastructure and possible trade enhancements impact on different sectors of the population. The subsequent steps involve characterizing the transmission channels for Savannakhet through (a) commercial activities, (b) access to health, education and other social services, and (c) negative social consequences related to increased inequality, displacement of people, increased human trafficking, sexually transmitted diseases and drug use. Box 3.1 provides a summary of those possible consequences.

In measuring the magnitude of those changes in the period of analysis we have used data from the Lao Expenditure and Consumption Surveys for 2007/8 and 2002/3 for Savannakhet and comparator provinces or the country as a whole. Based on these characterizations, the next chapter applies empirical methods to study the relationships between cross-border transport infrastructure, trade and local livelihoods in Savannakhet.

### 3.2 Measuring Transmissions

There is no established quantitative method for measuring the impact of transport infrastructure or trade facilitation on development outcomes. The World Bank review of 140 different econometric specifications found that about half of the studies surveyed used macro-level estimates of production functions using output as the dependent variable; others used cross-country regressions with growth as the dependent variable; a few used cost functions to measure the impact on productivity, and about 5 percent used micro-level estimates based on household survey data to measure the effect on a variety of social indicators like poverty and inequality.<sup>36</sup> Interestingly, in assessing the impact of infrastructure on these various indicators, the results become more positive at the more disaggregated level, especially in those studies using household and firm-level surveys.

Since physical infrastructure indicators are unavailable across geographic units and time, a variety of proxies has been used by analysts. These indicators attempt to capture not only physical infrastructure, but also the quality of the services provided by that infrastructure in the form of trade facilitation measures. The underlying assumption is that transport infrastructure reduces trade costs and facilitates trade. As a result, the most commonly-used proxies have been (a) trade values relative to comparator countries or regions, (b) transport costs measured by the ratio of fob/cif values, (c) time measures of border crossing processes and driving time, and (d) public investment in infrastructure. Public investment as an indicator has fallen out of favor because of the difficulties of finding cross-sectional comparative information about transport infrastructure, especially when one of more donors are involved. Time measures of border crossings and travel time are often used in ADB operations evaluations since they provide good indicators of trade facilitating outcomes.<sup>37</sup> Nonetheless, their usefulness in gauging trade facilitation

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<sup>36</sup> Stéphane Straub, "Infrastructure and Growth in Developing Countries: Recent Advances and Research Challenges". World Bank, Policy Research Working Paper 4460, January 2008. Available: <http://ideas.repec.org/p/wbk/wbrwps/4460.html>. Other proxies are distance, ad valorem shares of trade volumes or real freight expenditures in the form of vehicle operating costs. For a review of the empirical literature, see also Susan F. Stone, Anna Strutt and Thomas Hertel, "Assessing Socioeconomic Impacts of Transport Infrastructure Projects in the Greater Mekong Subregion". Unpublished. Presented at the 12th Annual Conference on Global Economic Analysis, Santiago, Chile. Available: [https://www.qtap.agecon.purdue.edu/resources/res\\_display.asp?RecordID=3039](https://www.qtap.agecon.purdue.edu/resources/res_display.asp?RecordID=3039).

<sup>37</sup> ADB, "Transport and Trade Facilitation in the Greater Mekong Subregion - Time to Shift Gears". Operations Evaluation Department, December 2008. For the 236 km distance of the EWEC portion between Kaysone Phomvihane and Dansavanh, a recent ADB Operations Evaluation Mission interviews of road users found that travel time had been reduced from 10 to 12 hours before the construction of National Road No. 9 to 4 hours



has been found to be greater for cross-section analysis than for time series perspectives in relation to policy evaluations.<sup>38</sup>

In the Lao portion of the EWEC, there are several practical difficulties. The first is the absence of border checkpoint data for comparator countries that could provide information about transport costs by comparing the fob value of neighboring country exports with the Lao PDR's cif value of imports. The second is the lack of time-series data on trade at border checkpoint of all border provinces in Laos. A workaround solution is to use mirror-trade data available for border trade with Thailand and Vietnam across all provinces bordering these two countries. We also use existing Lao customs data on trade at the border crossings of Mukdahan- and Dansavanh-Lao Bao, and for comparator border crossings in other provinces it uses mirror trade data from the Thai customs office.<sup>39</sup>

A third issue relates to the lack of infrastructural and trade facilitation for different provinces of Laos, especially those that can be considered as comparator provinces to Savannakhet. The workaround to this particular limitation is to use relative changes in the amount of trade to measure infrastructural and trade facilitation. Finally, provincial output data is not always available for comparator provinces, and that of Savannakhet is limited to 2005-2007.<sup>40</sup> This limitation is common to studies that use household and firm-level data. The results can identify direct effects on human development, but cannot determine the impact on output.

### 3.3 The LECS

The Lao PDR expenditure and consumption survey (LECS) provides information about household consumption and expenditures as well as production activities, social welfare, and infrastructure available to households. The analysis of Savannakhet is based on comparative analysis at three levels: (a) provincial data for Savannakhet relative to all other provinces in Laos; (b) provincial data for Savannakhet relative to only border provinces having trade with neighboring countries; and (c) district-level data for Savannakhet which differentiates the districts through which the Corridor passes from those outside the Corridor area. Interprovincial data are now available to the general public from the National Statistics Center, while district-level data for Savannakhet was obtained from a special extraction from the LECS 3 (2002/03) and LECS 4 (2007/08) databases maintained by the Center.

These two LECSs provide the basis for comparative analysis since their structure and coverage are nearly the same. The sample size of 8,304 households used the same 518

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after its completion, and increasing travel speed from 22 to 59 km/hour.<sup>37</sup> Facilitation of trade associated with the implementation of the Cross-Border Transport Agreement (CBTA) reduced the time to cross the border by 69 percent for shipments to Laos from Vietnam and by 32 percent for shipments to Vietnam from Laos. In 2005 the Lao Bao–Dansavanh portion of the EWEC was selected for pilot implementation of the CBTA, and since then it has completed the single window inspection phase of the CBTA.

<sup>38</sup> Combes, Pierre-Philippe, and Miren Lafourcade, "Transport Costs: Measures, Determinants, and Regional Policy Implications for France", *Journal of Economic Geography*, 5, 319–349, 2005.

<sup>39</sup> There are no comparable data for trade in other border crossings between Vietnam and Laos. Data requested from the General Department of Vietnam Customs during the preparation of the 2009 revised strategy for the EWEC was never provided to the Asian Development Bank by the Government of Vietnam. The recent evaluation by the ADB of the EWEC reports total border trade at the Lao Bao border checkpoint but does not differentiate between exports and imports.

<sup>40</sup> Department of Planning and Investment for Savannakhet Province, "Statistical Yearbook 2007: Savannakhet Province". February 2008. Provincial domestic product before or after 2005-2007 is unavailable.



villages throughout Laos. One half of the households were common between the two surveys and the other half were different. Neither LECS 1 nor LECS 2 offers the same degree of comparative data since their coverage differed from the more recent LECSs. Despite the similarity between LECS 3 and LECS 4, there were inconsistencies in the reported results that raised questions about their reliability and prevented their use in the present analysis. The first related to village distances to roads, which in LECS 4 increased in all provinces relative to LECS 3 and averaged 1.65 times greater. These results were inconsistent with uniformly greater access to roads in both rainy and dry seasons. As a result, this important indicator for the present study was unable to be used and instead we adopted 'rural access to roads' to measure changes in transportation infrastructure.

The second data inconsistency related to productivity of business activities, which fell from 13,701 to 4,710 kip/hour between LECS 3 and LECS 4, with the decline reflected in every province in Laos. The decline was inconsistent with general increases in business activities and the increased number of households engaged in business activities. As a result, the data were not used and instead the study used agricultural productivity data, which was consistent with information about the other survey information for that sector.

In a broader sense, the LECS shortcomings and reliability issues brings to question the validity of the present study's efforts to measure the impact of the EWEC on different social and economic aspects of households in the Lao PDR province of Savannakhet. In particular, we have relied on certain LECS indicators for access to transport as the basis for that analysis. While the reader may wonder about the use of those indicators, given the aforementioned shortcomings, the study made every effort to use the most trustworthy LECS indicators in the analysis. In analyzing the LECS data and selecting the survey data that would best reflect EWEC impact the author explored the reliability of each of the selected series with staff members of the Department of Statistics. In those instances where questions could be raised about the validity of the reported survey results, the staff of the Data Service Division contacted the survey team in order to clarify any issues or difficulties that could have been encountered during the survey. In this sense, the Department of Statistics provided invaluable service in ensuring the accuracy of the data and providing transparency on any issues that could have brought into question the reliability of the survey data.

For trade data, a total of 19 major border crossings, 10 of which have available data for 2000-2008 from either Lao customs data or mirror trade data of trading partners. On the Vietnam-Lao border, the two major border crossings are at Dansavanh (Savannakhet) and Nam Phao (Bolikhamsay province).<sup>41</sup> On the Thai-Lao border, the major border crossings are at Lao-Thai Friendship Bridge 2 (Savannakhet); Lao-Thai Friendship Bridge (Vientiane province); Vang Tao (Champasak); Houayxay (Bokeo province); Muang Ngeun (Sayabouly province); the Mittaphab Bridge in Nam Heua (Sayabouly province); and Thakhek (Khammouane Province). On the Chinese-Lao border, the major crossing is at Boten (Luang Namtha province). On the Cambodian-Lao border, the major crossing is at Vern Kham (Champasack province).

Finally, LECS coverage excludes income and wealth information. Nor is provincial gross domestic product (GDP) generally available in Laos. However, GDP data was produced in Savannakhet in 2005-2007.

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<sup>41</sup> Data for the other border crossing were unavailable. Those border crossings are at Pang Hok and Muang Mai in Phongsaly province; Nam Soy in Houaphanh province; Nam Kan in Xiengkhouang province; Na Phao - Khammouane province; and Phoukeua- Attapu province.





## 4. Inter-Provincial and District-Level Analysis

### 4.1 Inter-Provincial Analysis

Table 4.1 summarizes the direct and indirect transmission channels of transportation infrastructure on households in Savannakhet and other Lao provinces. The following highlights the changes that took place between 2002/03 and 2007/08:

*Direct Effects:* Transport infrastructure affects the ability of households to carry out domestic and cross-border commercial activities and access social services in the form of health and education. The effects are separated into those associated with changes in domestic market access, cross-border trade, and access to schooling and medical assistance.

- *Market Access:* In Savannakhet the percent of households able to reach markets because of their access to roads rose from 79 to 97 percent between 2002/03 and 2007/08. This 18 percentage point increase substantially exceeded the 11 percentage point average rise in that of all other provinces. As a result of these changes, the share of rural households having road access in Savannakhet (65%) now exceeds that of any other single province in Laos, including Vientiane (58%) and Champasak (54%), which are the two other provinces where rural households have the highest access to roads.
- *Merchandise trade:* Savannakhet's cross-border trade, measured as the sum of imports plus exports, rose more than fivefold between 2002/03 and 2007/08. Total cross-border trade of all other provinces increased by less than half as much. Within Savannakhet, cross-border trade with Thailand expanded considerably more than cross-border trade with Vietnam. Trade with Thailand at the Kaysone Phomvihane – Mukdahan border checkpoint expanded from US\$98 million to US\$765 million during the period, whereas trade with Vietnam at the Dansavanh – Lao Bao border checkpoint increased from US\$47 million to US\$156 million.
- *Social Services:* Access to both education and health facilities has grown in Savannakhet by a greater proportion than that of the average of all other provinces in Laos. Education facilities are measured in terms of the percent of villages having primary and lower secondary schools, while medical facilities are measured by access to medical staff within villages. In Savannakhet, the number of villages with those educational facilities grew by 12 percent, compared with an average of 9 percent in the other provinces. Similarly, the number of villages in Savannakhet having medical facilities rose by 12 percent, compared with only an average of 5 percent in that of the average of all other provinces, although other border provinces rose by a somewhat higher rate of 7 percent.

*Indirect Effects:* Increased socioeconomic activities resulting from transport infrastructure impact on household endowments and household business activities. In principle, household endowments generally cover (a) physical assets of households, (b) human capital, and (c) social or infrastructural capital. In practice, the coverage of household endowments often reflects the availability of data. In the case of Laos, physical assets are measureable in terms of consumption on housing; human capital is reflected by the amount spent on education and medical care; and infrastructural capital is reflected in expenditures on transport and communications. The combination of these endowments





largely determines the individual's ability to engage in productive activities. Those activities reflected in the extent of business developments, as measured by the proportion of households operating a business, productivity, and entrepreneurial incomes.

#### 4.1: Inter-Provincial Analysis of Direct and Indirect Effects Associated with Transport Infrastructure

		Savannakhet			Other Provinces			Border Provinces		
		2002/03	2007/08	Change	2002/03	2007/08	%change	2002/03	2007/08	%change
<b>Direct Effects</b>										
Market Access of Rural Households	Percent road access by rural households	79%	97%	18%	73%	84%	11%	79%	84%	5%
Commercial trade	Average of Exports plus imports (mil US\$)	146	921	532%	602	2,077	245%	602	2,077	245%
<b>Access to social infrastructure services</b>										
Education	Primary & secondary school in village (%)	42%	54%	12%	44%	53%	9%	45%	54%	9%
Health Care	Percent access to medical staff	8%	20%	12%	29%	34%	5%	29%	36%	7%
<b>Indirect Endowment Effects</b>										
Household Income	1000kip/month	965	2,365	145	939	1,839	96	970	1,882	94
Household Assets	Percent of household consumption	9%	11%	2%	11%	12%	0.1%	12%	12%	0.2%
Education	Percent of household consumption	1%	1%	0%	1%	1%	1%	1%	1%	1%
Medical care	Percent of household consumption	2%	2%	0%	1%	2%	0.1%	1%	2%	0.2%
Transport & Communication	Percent of household consumption	9%	18%	9%	10%	18%	8%	11%	19%	8%
<b>Indirect Business Development Effects</b>										
Household business operations	Percent of households	23%	29%	6%	20%	20%	0%	21%	21%	0%
Entrepreneurial Income	1000kip/month per household	5,429	10,047	85%	5,896	12,323	109%	6,198	12,866	108%
Productivity	Kip/hour per household	1,299	2,509	93%	1,424	3,213	126%	1,548	3,326	115%
Barriers to Business Activities	Lack of markets, credit, knowledge (%)	63%	61%	-2%	55%	46%	-9%	53%	47%	-6%

Source: derived from data in Statistical Appendix.

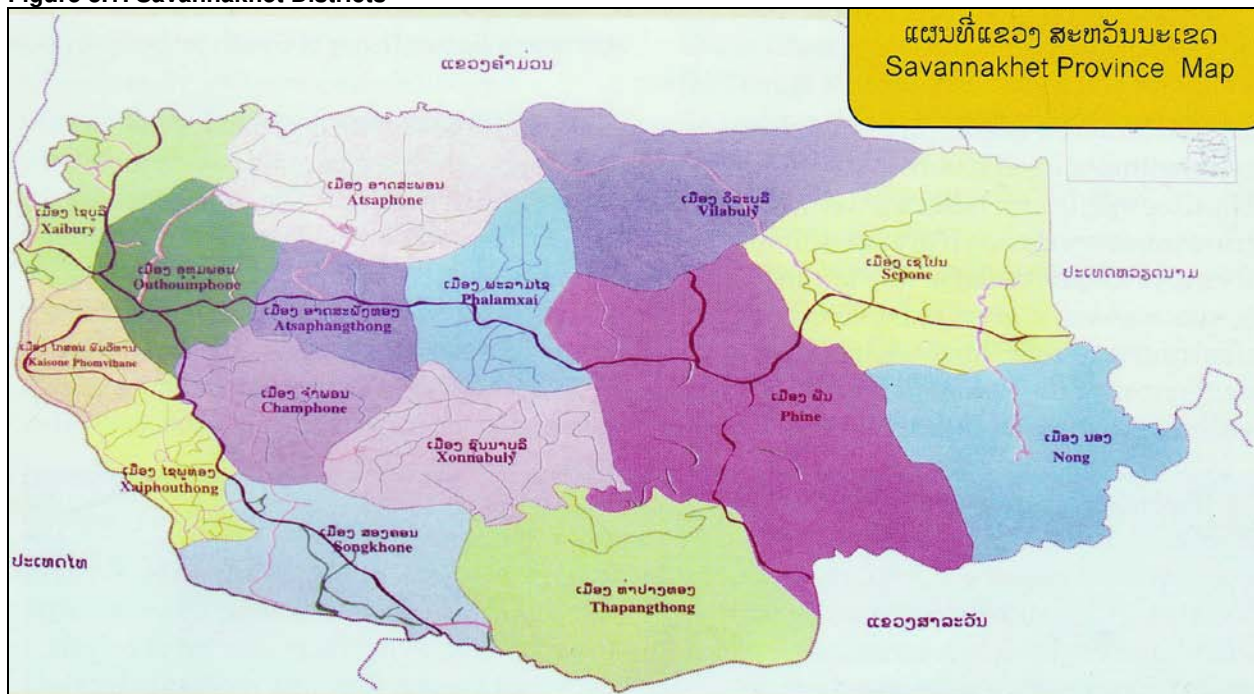
##### (a) Decomposition of Household Endowments:

- Household expenses:** The overall welfare effect deriving from transport infrastructure is reflected in changes in household consumption. Consumption patterns are viewed as a better measure of welfare than income since they tend to be more stable over time because people do not vary the composition of their expenditures as quickly as income levels, which are themselves subject to price variations.<sup>42</sup> In Savannakhet, household incomes rose by 145 percent between 2002/02 and 2007/09, compared with 94 percent in all other provinces and 92 percent in other border provinces.
- Physical assets:** The share of personal consumption expenditures allocated to housing rose from 9 to 11 percent in Savannakhet, compared with a nearly unchanged proportion of expenditures on housing in other provinces. However, the share of household expenses directed at housing in Savannakhet still remains below the average of other provinces. It is nonetheless in line with the national average for rural households, since urban dwellers tend to spend a greater proportion of their overall income on housing.
- Human capital:** Changes in the proportions of education and healthcare expenditures have been small in Savannakhet, as elsewhere in Laos. Only 1 percent of household expenditures are allocated to education and 2 percent are directed to healthcare. Indeed, Savannakhet's share of expenditures on education of 0.9 percent remains well below the national average and are one of the lowest among all provinces in the country.
- Infrastructural capital:** Expenses on transportation and communications are one of the largest budget items for households, representing nearly 20 percent of total personal consumption expenditures in Savannakhet. The proportion in 2007/08 was twice that in 2002/03 and was in line with the average of other provinces.

<sup>42</sup> Christiaan Grootaert and Thierry van Bastelaer, editors, "Understanding and Measuring Social Capital: A Multidisciplinary Tool for Practitioners". Washington, DC. The World Bank, 2002.



Figure 3.1: Savannakhet Districts



(b) Business Development:

- *Household business operations:* Savannakhet has more households engaged in non-farm activities than many other provinces. The proportion of households operating businesses increased from 23 to 29 percent between 2002/03 and 2007/08, compared with an unchanged average in other provinces. These additional business operations provided an opportunity for households in Savannakhet to generate greater incomes and increase their consumption expenditures.
- *Entrepreneurial incomes and productivity:* Despite the opportunities offered by the increase in household business operations and greater access to transport infrastructure, households in Savannakhet have not experienced as large an increase in entrepreneurial incomes or generated larger productivity increases than the average of all other provinces or other border provinces. Interviews with households conducted by the author indicate that the reason for the lower-than-expected increase in business-related incomes and agricultural productivity has been increased competition from neighboring countries. The large expansion in trade and elimination of tariffs under AFTA is believed by households and businesses to have negatively impacted on their ability to compete in local market.<sup>43</sup>
- *Barriers to Business Activities:* Constraints on business activities remain high in Savannakhet, and did not change significantly between 2002/03 and 2007/08. According to LECS results, the largest constraint on business activity is the lack of access to credit, followed closely by lack of markets due to increased foreign

<sup>43</sup> Interviews were conducted in Savannakhet in March 2009 by the author.



competition, and the lack of know-how. Lack of knowledge in Savannakhet is rated higher than many other provinces.

In this section we have examined the hypothesis that transport infrastructure improvements have had positive (direct and indirect) effects on endowments of the population in Savannakhet relative to those of other provinces. The results support the positive direct and indirect endowment effects for Savannakhet associated with transport infrastructure improvements. Normalization across indicators suggests that socioeconomic activities in Savannakhet associated with direct effects of the infrastructure have improved by twice as much as the same indicators in other border provinces of Laos, and 70 percent more than in all other provinces in the country.

Indirect effects on household endowments have improved by half as much in Savannakhet as other border provinces and the national average. However, business development in Savannakhet has lagged behind other border provinces and the country as a whole. Entrepreneurial incomes and agricultural productivity have both increased by less than in other provinces, despite a larger number of households operating a business.

These findings indicate that constraints on business activities remain much higher in Savannakhet than on average in other provinces, and the reduction in those constraints has experienced a smaller decline in Savannakhet than elsewhere. Noteworthy among those constraints are lack of market access, access to credit and knowledge transfer. These constraints are likely to reflect increased competition from neighboring countries in domestic markets and the inflow of large investment activities that are displacing micro and small scale enterprises.

#### 4.2 District-Level Analysis

Having examined socioeconomic changes in Savannakhet relative to other provinces in Laos, we now turn to the comparative analysis of developments across districts within Savannakhet. For purposes of comparison, the districts are divided into those through which the Corridor operates and those that are outside the immediate Corridor area.

As Figure 4.1 shows, the EWEC passes through the six central provincial districts of Kaysone Phomvihane<sup>44</sup>, Outhoomphone, Atsaphangthong, Phalanxay, Phine and Sepone. Neither LECS 3 nor LECS 4 included Phalanxay. The combined population of these districts, excluding Phalanxay that was not covered by the LECS, represents over 40 percent of the total provincial population. Along the northern part of Savannakhet there are three districts: Xaybuly, Atsaphone and Vilabuly. Along the south, there are six districts: Xayphoothong, Champhone, Songkhone, Xonbuly, Thapangthong, Nong.

##### (a) Household Composition and Consumption:

- *Composition of Household:* High dependency rates are often a burden on households because the economically active individuals must provide for children under the age of 15 and people above the age of 64. In Savannakhet the dependency ratio was 0.7 in 2007/08, down from 0.9 in 2002/03. The district with the largest declines was Xonbuly, which also had the largest dependency rate (equal to 1.4) in 2002/03. Only the southern district of Thapangthong had an increased dependency ratio, although that district was also the one with the lowest ratio in 2002/03. In 2007/08, the average number of individuals in each household varied from a low of 4.3 to 4.4 in the

<sup>44</sup> Kaysone Phomvihane (Lao: ໄກສອນ ພົມວິຫານ), often referred to as Savannakhet City, is the capital of Savannakhet Province in Laos. It was previously known as Khanthabouli (ຄັນທະບູລີ).



southern districts of Champhone, Xayphoothong, Songkhone, and Thapangthong and the northern district of Atsaphone, to a high of 6.2 in the southeastern district of Nong. Most other districts had about 5 individuals in each household. Interestingly, the number of individuals in each household rose in the central provinces between 2002/03 and 2007/08, while elsewhere the number of individuals in each household fell somewhat in all but three districts.

Table 4.2: Change in Socioeconomic Indicators in Savannakhet Districts, 2002/03-2007/08

	Population	Household Composition		Household Consumption	Infra-structure Average	Business Constraints	Access to health services	Access to educational services	Households operating business	Entrepreneurial Income	Productivity (revenue/hours work)
		Dependency Ratio	Consumption Units								
Province a/ b/	825,902	-0.17	-0.06	145.0%	8%	-3%	6%	13%	10%	10%	13%
Central Districts b/	326,363	-0.16	0.14	143.4%	7%	-24%	16%	3%	19%	16%	13%
Kaysone Phomvihane	112,915	-0.17	0.09	37.7%	1%	-24%	8%	5%	23%	17%	12%
Outhoomphone	80,516	-0.10	0.30	466.1%	26%	-24%	41%	0%	7%	14%	15%
Atsaphanong	39,102	-0.21	0.47	216.3%	38%	-13%	22%	0%	2%	12%	-4%
Phine	50,784	-0.16	-0.05	285.2%	17%	-5%	26%	67%	2%	23%	13%
Sepone	43,046	-0.05	0.14	136.7%	28%	-1%	-2%	-22%	3%	4%	-6%
North-South Districts b	483,834	-0.18	-0.19	158.7%	9%	11%	-1%	20%	4%	6%	13%
Xaybuly	54,441	-0.14	-0.57	138.8%	0%	27%	15%	36%	3%	9%	3%
Atsaphone	50,448	-0.04	-0.35	102.2%	38%	9%	-2%	31%	3%	3%	4%
Vilabuly	30,264	0.05	0.59	115.6%	-7%	4%	20%	57%	2%	9%	-7%
Xayphoothong	44,557	-0.07	-0.37	10.6%	-9%	-11%	58%	6%	6%	8%	5%
Champhone	101,559	-0.17	-0.18	83.0%	35%	22%	-16%	10%	8%	4%	34%
Songkhone	82,461	-0.17	-0.18	247.5%	2%	13%	1%	2%	5%	11%	22%
Xonbuly	54,441	-0.70	0.49	440.2%		0%	0%		1%	0%	-8%
Thapangthong	44,557	0.06	-0.88	44.8%	-17%	12%	-61%	68%	2%	2%	23%
Nong	21,106	-0.35	0.09	68.8%	0%	0%	0%	0%	3%	3%	-5%

a/ Includes Phalanxay, which is not covered by the LECS.

b/ Population-weighted averages.

- Consumption:** Although household consumption in the central districts has increased, on average, by a similar amount to that of the peripheral districts in the north and south, there have been large differences across individual districts. Between 2002/03 and 2007/08 one of the smallest increases in consumption expenditures occurred in the provincial capital of Kaysone Phomvihane (38%), while the largest increase took place in the neighboring district of Outhoomphone. During this period there was a large increase in commercial activity in the area surrounding the interchange between the north-south National Road No. 13 and National Road No. 9 of the EWEC. In contrast, the smallest increase in consumption expenditures took place in the southwestern districts of Xayphoothong through which National Road No 13 passes. In general, the peripheral districts experienced a smaller expansion in consumption expenditures than the central districts. The exception was Xonbuly in the south-central region of the district, where fossilized dinosaur bones were discovered in 1930 and tourist facilities are being developed. If Xonbuly is excluded, then consumption expenditures in the peripheral districts doubled between 2002/03 and 2007/08; if the provincial capital district of Kaysone Phomvihane is excluded from the central districts, then the average increase in consumption expenditures was nearly threefold larger in 2007/08 than in 2002/03.
- Inequality:** Notwithstanding these advances in the absolute value of consumption expenditures, considerable inequality continues to exist across districts, and in fact has grown between 2002/03 and 2007/08. In 2002/03 consumption expenditures ranged from a low of 247,000 kip/month in Xonbuly to a high of 2.2 million kip/month in Kaysone Phomvihane, a difference of 1.8 million kip/month. In 2007/08, the difference rose to 2.6 million kip/month, with a low of 1.1 million kip/month in the southern district of Thapangthong to a high of 3.7 million kip/month in Outhoomphone.





(b) *Business Conditions:*

- *Access to Infrastructure:* Households with electricity and with transportation access have increased in nearly all districts. In general, the access to electricity and roads has improved more in the central provinces, but the range of improvements has varied widely. The share of households with electricity increased the most in the central district of Atsaphangthong, and there were nearly similar increases in the nearby districts of Champhone and Songkhone. Road improvements allowing access during the rainy season were larger in the eastern Sepone mining district as well as the western districts of Outhoomphone and Champhone. Nevertheless, access to roads during the rainy season in Sepone remains very low.
- *Constraints on Business:* There is a clear distinction between obstacles to business operations in the central districts, where constraints have fallen, and those in the peripheral districts, where they have increased. The largest increase in reported constraints related to lack of jobs. Households in three central districts (Phine, Outhoomphone and Atsaphone) and one northern district (Vilabuly) reported a 50 to 75 percentage points increase in the difficulty of obtaining employment. Based on field interviews by the author, the likely cause of the sharp increase in employment difficulties have arisen from increased competition from neighboring countries in the local markets. More competitive pricing of products, especially from Thailand but also from Vietnam, have reduced demand for local products. Moreover, tourism-related activities remain weak notwithstanding large movements of tourists along the Corridor. Those tourists mainly transit from Thailand to Vietnam and, until recently, roadside services have been virtually nonexistent as a means of providing retail outlets for local merchants to sell their goods.
- *Access to Education:* Access to education in the form of the percentage of villages having primary and lower secondary educational facilities has increased dramatically in the peripheral districts. Only Phine in the central area of the province reported a substantial increase in access to educational facilities. Sephone reported a 22 percent decline in access to education.
- *Access to Health Services:* The share of primary and lower secondary schools in villages increase by a larger proportion in the peripheral districts than in those located along the Corridor area. The differential between central and peripheral districts reflected a substantial rise in the share of primary schools in villages, resulting in almost universal access to primary education throughout Savannakhet. It also reflected substantial increases in the percentage of villages having lower secondary education in western peripheral districts of Xaybuly, Champhone and Songkhone.
- *Business Operations:* All districts reported an increase in the share of households operating a business. The means average increase was 6 percentage points and the increased ranged from a low of 1 percentage point in Xonbuly to 8 percentage points in Champhone. An exception occurred in the provincial capital district of Kaysone Phomvihane, where the percentage increase in number of households operating a business increased by 23 percentage points to reach
- *Entrepreneurial Income:* The rise in entrepreneurial income was greater in the central districts than in those in the north or south of the province. The population weighted average increase in income was nearly two times higher in the central districts. Only Sepone reported a modest increase in entrepreneurial income that was more in line with the peripheral districts, and the resulting level of that income was about half of



that in other central districts in 2007/08. These results are in line with other findings for Sepone. It remains the central districts with the lowest overall household consumption expenditures, the lowest access to infrastructural services in the form of either electricity or access to transportation services, the lowest access to health services, and the lowest share of primary and secondary schools in villages.

- *Productivity*: Productivity of farmers generally increased in all districts, with the notable exceptions of Sepone and Atsaphangthong in the central part of the province and Xonbully and Vilabuly in the northern part of the province.
- In this section we have examined the hypothesis that transport infrastructure improvements have had positive (direct and indirect) effects on endowments of the population within Savannakhet located near the EWEC, relative to those that are located in the periphery areas of the provinces and away from the Corridor. The results support the larger and more positive consumption effects for the central districts than for those in the peripheral districts. In general, then consumption expenditures in the peripheral districts doubled between 2002/03 and 2007/08; if the provincial capital district of Kaysone Phomvihane is excluded from the central districts, then the average increase in consumption expenditures was nearly threefold larger in the central districts than in the peripheral ones.
- Overall, the largest increase in commercial activity occurred in the area surrounding the interchange between the north-south National Road No. 13 and National Road No. 9 of the EWEC. In contrast, the smallest increase in consumption expenditures took place in the southwestern districts of Xayphoothong through which National Road No 13 passes. Differential rates of improvements among districts have given rise to increased inequality at the district level. Consumption expenditures among districts ranged from 247,000 to 2.2 million kip/month in 2002/03; in 2007/08, the difference rose to 2.6 million kip/month, that is, from with a low of 1.1 million kip/month (in the southern district of Thapangthong) to a high of 3.7 million kip/month (in Outhoomphone).
- Businesses have generally experienced improved conditions but there is increased competition from neighboring countries because of improved transportation facilities and the reduction in trade barriers following full implementation by Laos of CEPT-AFTA. The largest increase in reported constraints related to lack of jobs, which businesses attribute to the increased competition from both Thai and Vietnamese supply sources. Tourisms-related activities also remain weak notwithstanding large movements of tourists along the Corridor because of the predominance of purely transit activities between Thailand and Vietnam and the lack of roadside facilities that could provide retail outlets for local merchants to sell their goods.
- Beyond these findings for district-aggregates is the fact that inequality has increased, notwithstanding the overall consumption effects from the EWEC for the central provinces. Inequality increased in all districts, regardless of the proximity to the Corridor. This finding suggests that better targeting of low-income households throughout Savannakhet could ensure that the EWEC has a more equitable impact on the development of the population throughout the province.





## 5. Impact of Transport Infrastructure

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### 5.1 Preliminaries

Development of the transport corridor infrastructure refers to both the physical infrastructure (roads and bridge) and the logistics that affect the costs involved in moving goods and services between their point of origin and their point of consumption to meet customer requirements.<sup>45</sup> The logistics performance of the EWEC can be measured by the time required for delivery, the cost, efficiency of customs clearance, quality of transport and logistics information infrastructure, ease of transporting cargos, and ability to track shipments.<sup>46</sup> The LECS measures transport infrastructure by percent of households with access to roads, as well as other indicators like average distance to nearest road, and percent of households with access to roads that are usable during the rainy season versus those that are usable during the dry season. Data issues surrounding these indicators have been discussed in the previous chapter, and in this chapter we adopt some of the indicators to represent the impact of transport infrastructure on household living standards.

The general measure of living standards, or welfare, is total household consumption. As mentioned earlier, consumption is a more stable indicator than income since household budget allocation decisions change less than do incomes over time. Household income can change due to unemployment effects and seasonality factors, whereas the distribution of consumption among food purchases, housing, transport and communication, and other large budget items tends to change gradually over time. Secondly, in consumption the expenditures allocations among food and housing, transport and communication, health and education, and recreation and entertainment incorporate welfare measures of household physical assets, human capital and social or infrastructural capital.

### 5.2 Model Specification

The present study adopts detailed household-level data to measure the impact of transport infrastructure on poverty and other social indicators. The approach draws heavily on the methodology of three prominent studies for Egypt, Papua New Guinea and Tanzania. All three studies examined the effects of road access on household level income and poverty.<sup>47</sup> Like other household-level impact assessments of infrastructure,

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<sup>45</sup> Trade facilitation in the narrow sense delimited by WTO Secretariat refers to measures that simplify or accelerate administrative procedures at border crossings; in the broader definition used by the World Bank, it includes all measures taken to reduce the time and cost from origin (production) to destination (consumption) of goods and services. See WTO Secretariat, "Trade Facilitation: National Needs Assessment Project Description". Geneva, WTO Secretariat: Trade and Finance and Trade Facilitation Division, May 2007; Wilson's article "Trade Facilitation: New Issues in a Development Context." *Trade Note No. 12*, World Bank 2003, and Shweta Bagai, Richard Newfarmer and John S. Wilson's article "Trade Facilitation: Using WTO Disciplines to Promote Development." *Trade Note No. 15*, World Bank 2004.

<sup>46</sup> Since the opening of the Second Friendship Bridge travel time has been reduced, but the Corridor remains less competitive in terms of cost of delivery than the traditional sea route, so it is likely that the corridor has yet to reach its full potential. For a review of the land route costs relative to maritime costs, as well as customs clearing charges in the Mukdahan-Savannakhet border and other logistics-related issues, see Annex B of ADB, East-West Economic Corridor (EWEC): Strategy and Action Plan". Manila, Asian Development Bank, 2009.

<sup>47</sup> For an application to Egypt, see Gaurav Datt and Dean Jolliffe, "Determinants of Poverty in Egypt". Discussion Paper No. 75, Washington D.C., International Food Policy Research Institute, 1999; for an



these studies use household consumption as the dependent variable and infrastructure-related and other potential determinants of consumption available from the survey.

The main explanatory variable of interest is road access and infrastructure affecting distance to nearest road. Road access is measured by the percent of households with and without access, while infrastructure is broken down into average distance to nearest road (in kilometers), roads that are usable in the rainy versus dry season (in percentage), and average distance to public transportation. Other variables provided by the LECS that affect household expenditures are access to education, productivity, and access to markets, jobs, and knowledge and credit related to business activities. Education helps raise living standards whether or not the individual or household is directly connected with the market economy. Productivity is measured by gross revenue per hour worked in both agriculture and business activities and therefore directly impacts on living standards, while restrictions preventing households from earning money are barriers imposed by external factors affecting the ability to generate income by households.

Based on these considerations, we specify the following model:

$$\begin{aligned} \text{Household consumption} = f(\text{access to transportation} \\ \text{infrastructure, education and health service availability,} \\ \text{barriers to business activities}) \end{aligned} \quad \dots(3.1)$$

Household consumption is measured by total expenditures on all activities, including food, clothing, housing, transportation, medical care, education, recreational activities and other expenses not elsewhere classified. Transportation infrastructure is measured by percent of households with road access and, in the case of districts in Savannakhet, the percent of households with access to roads that are usable during the rainy season. Access to education and health services is measured by the average of (a) the percent of households with primary and lower secondary schooling in their villages, and (b) the percent of households with medical staff in their villages. Barriers to business activities are measured by the average of (a) percent of households with lack of access to markets, and (b) percent of households with lack of lack of knowledge needed to effectively compete in their businesses.

### 5.3 Estimation Procedure

Three modifications have been applied to the present panel estimates to avoid possible heterogeneity, selection, and endogeneity biases. The first is associated with estimation and testing procedures that apply to panel data where there are possible differences across units (provinces or districts). In these cases the estimates of the coefficients would be inconsistent because the omitted variable explaining differences across units form part of the error term in the estimated equation.<sup>48</sup> The procedure for testing whether omitted

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application to Papua New Guinea, see Gibson J. and S. Rozelle, "Poverty and Access to Roads in Papua New Guinea", *Economic Development and Cultural Change*, 2003; and for an application to Tanzania, see Shenggen Fan, David Nyange, and Neetha Rao, "Public investment and poverty reduction in Tanzania: evidence from household survey data". DSGD Discussion Paper 18, Washington, D.C.: International Food Policy Research Institute (IFPRI), 2005.

<sup>48</sup> For details on the so-called cross-section fixed effect, see for example Montezuma Dumangane and Nicoletta Rosati, "Efficiency of repeated-cross-section estimators in fixed-effects models". March 2009. Available: [http://dge.uma.pt/portal/docs\\_para\\_download/pej\\_papers/45.pdf](http://dge.uma.pt/portal/docs_para_download/pej_papers/45.pdf). The value of repeated cross-sections (RCS) to identifiability of structural parameters in fixed-effects models is associated with the work of J. J. Heckman, and R. Robb, "Alternative methods for evaluating the impact of interventions". In *Longitudinal*



variables give rise to differences across units involves the application of separate intercepts for each unit to eliminate the unobservable variable in the residual and thereby estimate fixed effects across units. A test using the likelihood ratio has been used to determine whether there is statistical evidence of fixed effects in the model.

A second aspect of the present modeling procedure involves possible differences in household responses between those in the central provinces where the Corridor passes and the peripheral districts to the north and south of the EWEC. To address possible differences in behavioral responses, we have added a third dimension to the panel data, over and above the time and cross-unit dimensions. This procedure has allowed us to test whether households through which the Corridor traverses have responded differently from those that are peripheral to the Corridor, which may or may not have benefitted from feeder roads.

The third procedure is based on the endogenous nature of infrastructure in the consumption equation. Transport is an important budget items in consumption expenditures. Policy decision to build transport infrastructure in Savannakhet may or may not have been associated with the decision to alleviate low incomes based on the location of those households. Using this budget item to explain consumption expenditures based on ordinary least squares (OLS) could therefore produce biased and inconsistent results because of the possible endogenous nature of transport infrastructure. In order to address the statistical problem of possible causation from household living standards to roads, we have estimated the relationship for consumer expenditures using instrumental variable (IV) regression. In this approach, the set of variables, or instruments, are used that are correlated with the explanatory transport infrastructure in the equation, and uncorrelated with the disturbances. In the present case, the instrument variable is access to electricity infrastructure by households. The assumption is that having electricity infrastructure enter an area should also stimulate the building of feeder roads, and in that way reduce the traveling time to the nearest road. Testing and validating the appropriateness of this instrument allows us to eliminate the correlation between right-hand side variables and the disturbances.

#### 5.4 Results for Savannakhet

The empirical results show that there is a significant impact from public investment on roads on household level consumption in Savannakhet (Table 5.1). The results of the basic model of household consumption, assuming exogeneity of the transportation infrastructure, indicate that a 10 percent increase in household access to roads increases household living standards by 15 percent for all districts in the province (column 1 of Table 3.3). The chi-square statistic, with 13 degrees-of-freedom, is 18.0, which gives a probability value of 0.1558. This result indicates that there is statistically significant evidence of selection bias. It is therefore appropriate to take account of the cross-section fixed effects using separate estimates of the intercepts for each district.

The results are more robust for districts traversed by the EWEC. In those provinces the same increase in road access has been associated with a near doubling in overall household consumption expenditures. Moreover the robustness of the estimates for transport infrastructure is significantly greater than in the peripheral districts surrounding the Corridor. The coefficient for the variable measuring transport infrastructure is



significantly different from zero in the case of the central districts (significant at the 5 percent level), whereas the coefficient for the infrastructure variable of the peripheral districts was not significantly different from zero. For the peripheral districts, the chi-square statistic, with 8 degrees-of-freedom, is 23.3, which gives a probability value of 0.003, indicating that there is statistically significant evidence of selection bias. For the central districts, the chi-square statistic, with 4 degrees-of-freedom, is 11.8, which gives a probability value of 0.019, indicating that there is also statistically significant evidence of selection bias.

**Table 5.1: Estimates of Savannakhet Household Consumption, All districts, Central and Peripheral Districts**

	Roads Exogenous			Roads Endogenous		
	All Districts	Central Districts	Peripheral Districts	All Districts	Central Districts	Peripheral Districts
Access to Transport Infrastructure	1.53 (3.2)	1.93 (3.1)	0.14 (0.3)	3.84 (2.4)	2.18 (3.2)	0.87 (0.6)
Human Endowment: Education and Health Access	0.84 (2.7)	0.67 (1.0)	0.56 (2.4)	1.08 (1.9)	0.71 (1.0)	0.64 (2.1)
Constraints on Business: Access to markets, credit, irrigation & knowledge	-0.75 (1.7)	-1.42 (1.4)	-1.16 (2.7)	-0.61 (0.8)	-1.30 (1.3)	-1.21 (2.4)
Intercept	0.15 (0.4)	2.05 (0.3)	9.02 (2.7)	-11.4 (1.3)	0.33 (0.4)	5.69 (0.8)
$R^2 =$	0.76	0.93	0.84	0.27	0.93	0.80

Note: See text for estimation procedures.

The results for the alternative model in which transport infrastructure is assumed to be endogenous to household income are not as robust as the basic model. They nonetheless point to some useful results. For all districts in Savannakhet, the higher estimated coefficient for transport infrastructure suggests that the responsiveness of household consumption levels would have been higher if improvements in road access had paralleled electricity infrastructure improvements. In particular, there would have been larger improvements in consumption expenditures had households benefiting from electricity infrastructure also been the beneficiaries of improved transport infrastructure.

Although the present approach to measuring the impact of transport infrastructure is useful in identifying human development outcomes in Savannakhet, it does not identify the effects on economic activities of firms not owned at the household level. For the enterprise-level impact of transport infrastructure, enterprise based survey data would need to be used. That information is available and could provide the basis for future extensions to the present analysis focusing on the household effects of transport infrastructure in Savannakhet.<sup>49</sup>

<sup>49</sup> Data are available from the recurrent Enterprise Baseline Surveys of the GTZ-HRDME Programme in Lao PDR.



## 6. Summary of Findings

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The results of the empirical analysis in this study sustain a number of conclusions in terms of the transformation of the EWEC from a transport to an economic corridor. In the first place, the central districts of Savannakhet have benefited more from the transport infrastructure of the EWEC than the surrounding districts. Nevertheless, the peripheral areas surrounding the Corridor have nonetheless benefited in a substantial way from improvements in the feeder road system.

The second important finding of the study is that infrastructure development has been an effective way of directly impacting on household well-being and indirectly contributing to human endowments of those households by enhancing their consumption of education and health services. Nevertheless, the results also indicate that infrastructural developments have not been allocated among districts in the province in a way that could have produced a more equitable distribution of their effects on living standards.

The implication of this third finding is that infrastructural investment needs to better target low-income rural areas in the peripheral districts. In that way, public investments could help to reduce the growing inequality among districts in Savannakhet, especially if it were to target low-income groups in remote villages. Moreover, the empirical evidence from this study clearly supports combination of transport and communication facilities, insofar as the impact on living standards is substantially greater when these two infrastructures are jointly supplied to rural villages.

Measuring the Corridor's impact will require further application of detailed socioeconomic data in Savannakhet. Of particular importance are comparative data on (i) trafficking of persons and animals across border; (ii) the incidence of HIV/AIDS in expanding hospitality industry in Savannakhet; (iii) trade and investment divergence from other border provinces and accompanying social welfare shifts; and (iv) other social problems in border areas related to increased crime, drugs, prostitution, and outside cultural influences. These developmental aspects of the EWEC have important effects on living standards that extend well beyond what is indicated by the present LECS.

At the enterprise level, the relevant challenges suggest a similar analytical approach to the one adopted in this study for households. It means moving away from earlier aggregate contributions that have tried to estimate the link between output and aggregate indicators of infrastructure in the form of public capital or physical indicators. From a policy perspective aimed at transforming the EWEC into an economic corridor, it would be more fruitful to concentrate on how aspects linked to the political, institutional and regulatory environment have affected the delivery and efficiency of services in the different industries that have significant operating potential in Savannakhet.



## Statistical Appendix

**Table A.1: Provincial-Level Data, 2007/08**

	Savannakhet	Avg Others	Phongsaly	Luangnamtha	Oudomxay	Bokeo	Luangprabang	Huaphanh	Xayaboury	Xiangkhuang	Vientiane P.	Borikhamxay	Khammuane	Saravane	Sekong	Champasack	Attapeu
Household Characteristics:																	
Population (1000)	777.2	279	174	165.2	281.6	135	407.1	308	339.2	245.7	431.2	204	333.9	353.8	93.8	599.5	110
Household Size	5.8	6	6	5.9	6.4	5	5.9	7	5.3	6.3	5.6	5.1	5.3	6.1	6.7	5.5	5.5
Hhld Number (1000)	134	48	29	28	44	27	69	44	64	39	77	40	63	58	14	109	20
Infrastructure (% villages or km)																	
Electricity	69	53	38	52	33	54	65	44	60	40	84	74	74	50	29	67	33
Average distance nearest road	4	18	14	33	11	26	21	18	5	14	5	13	7	18	51	10	18
Reachable in dry season	100	100	100	100	100	95	100	100	100	100	100	100	100	100	100	100	100
Reachable in rainy season	87	81	55	89	65	65	77	78	85	95	100	95	73	76	79	85	92
Distance to post office Km	18	24	37	28	19	25	35	34	19	29	13	19	18	15	24	18	24
Bus village Stop	69	64	70	74	52	58	71	32	63	64	76	78	52	42	71	81	72
Average distance to public transport	11	9	9	10	6	7	6	10	15	9	8	9	8	11	10	9	11
Rural Roads Access (1000 households)	67	38.2	25	23	34	23	54	39	45	30	58	32	49	53	11	81	16
Urban	68	10	4	5	10	4	16	5	19	9	19	8	14	5	3	28	5
With Road Access	65	32	10	17	31	20	38	37	43	26	58	28	47	51	8	54	14
Without Road Access	2	6	15	6	3	3	16	2	2	4	0	4	2	2	3	27	2
Household Consumption (1000kip)																	
Food consumption	2365	1,839	1258.6	1654.6	1734.9	1279	2177.6	1471.5	3035.4	2191	1857.5	2019.1	1871.8	1455.9	1518.7	2299.5	1759.7
Clothing and Shoes	571.9	358	179.3	280.2	260.9	232.6	487.3	168.6	463.3	377.6	438.1	501.2	391.2	255.9	366.8	561.9	408.3
Houses	50.9	38	30.7	31.6	59.4	18.6	48.7	31.3	57.9	61.1	38.7	35	25.3	17.5	29.9	40.3	46.8
Household effects	267.4	212	161.4	243.6	171.5	167.2	304.9	157.9	288	171.4	249.5	258.5	331.6	123	150.8	196.4	202.8
Medical care	97.8	73	19.8	68	107.3	46.2	75.7	46.7	103.1	56.9	102.4	116.7	66.6	57.1	44.7	98	92.3
Transport and communication	49.3	29	34.7	30.1	17.6	24.2	56	10.9	29.8	21.3	35.9	40.1	18.9	20.9	21.1	48.7	31.3
Education	427.8	335	113.6	267.7	282.4	136.1	502.4	216.9	1107.2	520	233.9	330.9	259.1	179.1	211.6	509.8	159.2
Personal care	17.1	25	8.9	44	23.9	9.9	18.3	37.9	51.2	9.4	40.5	31	10.1	13.5	17.1	19.8	43.9
Recreation	62.6	45	8.6	15.8	28.6	22	43	9.9	158.9	72.6	32.9	38.1	9.3	57.2	38.4	79.9	56.1
Alcohol and tobacco	175.6	67	25.7	33	55.2	43.8	81.3	57.1	108.6	103.2	105.7	59.4	46.5	39.7	37.3	107.5	100.4
Others	44.2	43	31.6	45.8	32.6	23.3	46.3	12.9	55.4	36.6	56.2	55.3	45.2	35.6	46.1	66.9	52.2
Percent own Production	67.8	40	9.2	30.4	40.4	18.2	42.4	2.6	50.8	103.9	26	24.5	53.2	37.7	18.3	105.2	32
Access to Health Services (%)	22.5	34	55.5	34.1	37.8	42	21.6	48.8	18.5	30	26.8	26.2	32.8	42.5	35.3	20.2	30.4
Educational services																	
Primary school in village (%)	20	34	7	24	24	24	41	12	51	30	61	52	34	23	26	45	61
Lower secondary school in village (%)	53.5	53	50	58.5	40.5	50	48.5	54.5	58.5	58	58	43.5	47	53	53	53	64
Households operating business %	90	89	96	100	76	83	88	94	94	92	87	74	82	89	94	92	100
Entrepreneurial Income	17	16	4	17	5	17	9	15	23	24	29	13	12	17	12	14	28
Productivity (revenue per hours of work)	29	20	8	12	11	12	32	8	30	17	29	29	20	15	15	32	35
Business Constraints % of villages																	
Lack of markets	10,047	12,323	13,843	10,811	12,982	8,626	13,436	9,617	33,039	11,155	10,584	11,554	10,016	9,221	7,686	11,446	10,832
Lack of credits	2,509	3,213	3,224	3,189	4,054	2,702	3,601	1,610	7,667	1,813	3,050	3,187	2,054	1,764	2,195	3,020	5,070
Lack of knowledge	61	46	42	39	38	35	37	63	49	56	46	43	42	43	59	58	44
Lack of jobs	60	47	50	39	43	33	44	62	46	40	58	43	53	64	47	50	39
Lack of irrigation	69	43	42	30	14	42	38	65	57	60	34	39	32	22	71	67	33
Lack of jobs	54	48	33	48	57	29	29	62	43	68	47	48	41	44	59	56	61
Lack of irrigation	79	47	8	39	52	50	9	35	43	44	55	61	59	64	41	61	89
Lack of irrigation	69	54	33	48	48	63	15	71	49	52	50	74	68	58	59	69	50

Source: Department of Statistics, Ministry of Planning and Investment, Government of Lao PDR.




**Table A.2: Provincial-Level Data, 2002/03**

	Savannakhet	Avg Others	Phongsaly	Luangnamthi	Oudomxay	Bokeo	Luangprabang	Huaphanh	Xayaboury	Xengkhuang	Vientiane P.	Borikhamxay	Khammuane	Saravane	Sekong	Champasack	Attapeu	
Household Characteristics:																		
Population (1000)	769	256	163	138	247	135	384	270	325	222	366	213	319	306	77	572	100	
Size	6	6	7	6	7	5	6	7	6	7	6	6	6	6	6	6	6	
Number (1000)	122	42	25	23	38	25	61	37	58	30	62	38	55	51	12	97	17	
Infrastructure (% villages or km)																		
Electricity	35	29	23	6	9	14	34	26	28	41	54	54	48	18	42	26	16	
Average distance nearest road	1	7	16	16	7	8	10	9	2	8	2	5	1	1	12	2	3	
Reachable in dry season	96	67	32	47	51	76	53	41	77	83	93	74	78	83	74	64	85	
Reachable in rainy season	64	51	27	34	26	44	51	28	71	41	92	63	54	65	58	52	53	
Distance to post office Km	22	24	38	30	29	23	23	31	17	26	18	16	29	22	20	16	16	
Bus village Stop	44	43	19	34	26	46	45	23	68	18	74	53	48	52	46	50	38	
Average distance to public transport	7	13	19	23	15	10	11	19	4	18	4	5	5	8	21	3	25	
Rural Roads Access (1000 households)																		
Urban	33	8	4	5	7	2	12	6	12	6	12	10	10	4	2	23	2	
With Road Access	70	25	8	11	18	21	34	18	42	11	47	19	41	19	7	68	11	
Without Road Access	19	9	13	7	13	2	14	13	4	13	3	10	4	28	3	6	4	
Household Consumption (1000kip)																		
Food consumption	965	939	763	1,029	804	833	1,118	939	1,102	1,062	1,212	963	873	684	804	1,054	838	
Clothing and Shoes	579	562	526	597	523	558	581	610	551	637	606	597	559	451	547	611	478	
Houses	29	23	8	21	24	8	34	28	33	32	36	29	17	14	16	32	8	
Household effects	87	107	99	123	145	92	101	94	143	127	170	48	79	55	80	95	159	
Medical care	39	35	8	31	16	25	45	19	66	42	36	29	35	27	56	53	42	
Transport and communication	19	14	-	10	8	8	22	9	22	11	24	10	17	21	8	21	17	
Education	87	95	84	165	32	42	179	85	132	106	121	164	79	62	32	95	50	
Personal care	10	7	-	-	8	17	-	9	11	11	36	10	9	-	-	-	-	
Recreation	19	21	8	21	8	17	22	19	33	21	24	29	17	14	24	32	25	
Alcohol and tobacco	39	28	15	21	16	33	78	19	44	32	36	19	17	21	16	32	25	
Others	19	23	15	31	16	17	22	9	22	21	36	19	26	14	32	53	17	
Own Production (%)	29	24	-	10	8	17	22	28	44	32	97	10	26	14	8	32	17	
Access to Health Services (%)	34	40	57	41	49	50	25	50	33	42	23	37	43	48	47	23	38	
Educational services	8	29	14	20	39	23	41	15	35	24	51	46	32	20	19	29	33	
Primary school in village (%)	42	44	48	40	47	31	41	46	52	49	44	47	46	35	36	41	56	
Lower secondary school in village (%)	75	79	95	75	78	56	78	88	94	88	73	88	84	63	65	77	89	
Households operating business %	9	8	-	4	16	5	4	3	10	9	14	6	7	7	7	5	22	
Entrepreneurial Income	23	20	5	14	7	16	39	10	36	20	31	17	26	11	13	31	23	
Productivity (revenue per hours of work)	5,429	5,896	5,568	6,438	5,067	6,740	4,854	6,422	11,298	6,082	5,464	5,621	5,483	4,589	5,751	3,954	5,105	
Business Constraints % of village	1,299	1,424	882	1,242	1,033	2,455	1,280	1,099	2,513	1,535	1,715	1,227	1,570	858	1,160	1,202	1,592	
Lack of markets	63	55	37	48	64	67	59	54	49	58	62	48	57	65	53	64	39	
Lack of credits	63	54	54	38	74	64	49	45	54	62	66	49	49	61	44	67	41	
Lack of knowledge	64	59	38	51	71	83	68	60	52	59	61	37	74	63	61	64	37	
Lack of jobs	62	51	19	55	46	53	60	57	40	53	58	57	48	71	54	61	40	
Lack of irrigation	43	37	14	25	32	85	11	21	52	20	46	29	50	46	33	63	35	
Lack of irrigation	75	63	35	86	72	69	40	59	64	61	64	73	68	68	69	65	55	

Source: Department of Statistics, Ministry of Planning and Investment, Government of Lao PDR.


**Table A.3: District-Level Data for Savannakhet, 2007/08**

	Kaysone													
	Phomvihane a/	Outhoomphone	Atsaphangthong	Phine	Sepone	Xaybuly	Atsaphone	Vilabuly	Xayphoothong	Champhone	Songkhone	Xonbuly	Thapangthong	Nong
<b>Household Characteristics:</b>														
Population (1000)	112,915	80,516	39,102	50,784	43,046	54,441	50,448	30,264	44,557	101,559	82,461	51,472	31,497	21,106
Dependency Ratio	0.5	0.9	0.8	0.7	0.9	0.8	0.8	1.0	0.7	0.7	0.6	0.7	0.7	0.5
Consumption Units	4.9	4.9	5.7	5.4	4.7	4.9	4.5	5.7	4.3	4.3	4.4	6.1	4.5	6.2
Household Consumption (1000kip/mth)	2859	3693	1723	2348	1308	1675	1535	1638	1721	1857	2978	1337	1050	2046
Own Production (%)	8.2	16.4	53.2	33.0	42.7	46.1	44.7	55.5	36.9	27.8	23.3	80.9	66.4	35.7
<b>Infrastructure (% villages or km)</b>														
Electricity	88	100	100	50	50	100	33	na	50	86	60	na	50	100
Average distance nearest road Km	na	na	na	na	2.00	na	na	na	na	5.00	na	na	na	na
Reachable in dry season	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Reachable in rainy season	100	100	100	100	67	100	67	50	100	100	60	na	100	100
Distance to post office Km	10	15	14	17	22	22	16	17	13	12	32	45	23	55
Bus village Stop	88	50	100	100	50	100	67	na	50	100	40	na	50	100
Average distance to public transport	3	11	na	na	12	na	9	15	5	na	16	14	7	na
<b>Business Constraints % of villages)</b>														
Lack of markets	13	25	100	50	75	100	100	100	75	43	80	100	100	na
Lack of jobs	50	100	50	100	50	67	100	100	75	86	100	100	100	100
Lack of credits	63	0	50	100	75	100	67	50	50	86	80	100	100	100
Lack of irrigation	38	50	100	100	75	33	100	100	100	43	80	100	100	100
Lack of knowledge	25	50	50	50	50	100	67	50	25	57	80	100	100	na
<b>Access to health services (%)</b>														
Traditional Practitioner	52	93	57	na	56	27	79	100	89	55	86	100	na	100
Health Volunteer	74	93	100	100	44	100	42	na	87	37	74	100	39	na
Medical Staff	82	69	57	na	45	62	42	na	na	66	37	na	na	100
<b>Educational services</b>														
Primary school in village (%)	88	100	100	100	50	100	100	100	75	100	100	na	100	100
Lower secondary school in village (%)	25	na	na	na	na	67	na	na	na	43	20	na	na	na
Households operating business %	9.3	2.9	0.7	1.0	1.2	1.2	1.2	1.0	2.6	3.3	1.9	0.5	0.7	1.2
Entrepreneurial Income	8,365	12,406	12,435	13,684	6,889	11,133	10,745	13,500	10,083	6,213	11,999	13,892	9,909	9,134
Productivity (revenue per hours of work)	2,759	2,643	626	3,724	681	na	2,784	1,965	na	4,292	4,357	891	3,376	1,248

Source: Department of Statistics, Ministry of Planning and Investment, Government of Lao PDR.


**Table A.4: District-Level Data for Savannakhet, 2002/03**

	Kaysone													
	Phomvihane a/	Outhoomphone	Atsaphangthong	Phine	Sepone	Xaybuly	Atsaphone	Vilabuly	Xayphoothong	Champhone	Songkhone	Xonbuly	Thapangthong	Nong
Household Characteristics:														
Dependency Ratio	0.7	1.0	1.0	0.9	1.0	0.9	0.8	1.0	0.8	0.9	0.8	1.4	0.6	0.9
Consumption Units	4.8	4.7	5.2	5.4	4.5	5.5	4.8	5.1	4.6	4.5	4.6	5.6	5.4	6.1
Household Consumption (1000kip/mth)	2076.9	652.5	544.8	609.6	552.6	701.3	759.2	759.8	1555.9	1014.8	856.9	247.4	725	1212
Own Production (%)	11.6	40.1	59.5	35.0	77.0	46.3	48.1	83.9	36.9	34.5	36.2	51.0	49.5	40.2
Infrastructure (% villages or km)														
Electricity	73	na	41	na	na	100	18	57	63	54	33	na	na	100
Average distance nearest road Km	na	na	na	na	4	na	na	na	na	na	na	na	na	na
Reachable in dry season	100	100	100	100	72	100	100	100	100	100	100	100	100	100
Reachable in rainy season	100	65	100	100	27	100	na	na	100	70	88	100	100	100
Distance to post office Km	13	12	13	15	.	22	50	na	30	17	22	45	18	.
Bus village Stop	100	49	41	33	27	100	na	na	63	58	33	na	68	100
Average distance to public transport	na	2	2	1	5	na	7	26	2	2	12	45	na	na
Business Constraints % of villages)														
Lack of markets	50	49	na	62	66	65	100	100	100	41	74	100	100	na
Lack of jobs	57	48	na	62	na	35	24	41	60	53	85	na	na	na
Lack of credits	46	100	100	100	48	65	63	100	82	39	28	100	100	na
Lack of irrigation	89	75	100	100	82	35	100	100	100	23	87	100	100	na
Lack of knowledge	64	73	48	100	na	65	100	41	40	48	82	100	54	100
Access to health services (%)														
Traditional Practitioner	70	26	52	62	18	65	76	59	22	62	85	100	na	na
Health Volunteer	65	78	48	100	82	30	37	100	40	100	82	100	100	100
Medical Staff	48	26	na	62	na	na	na	na	27	43	26	na	na	100
Educational services														
Primary school in village (%)	95	100	100	33	72	66	69	43	100	100	100	na	32	100
Lower secondary school in village (%)	8	na	na	na	na	28	na	na	38	23	16	na	na	na
Households operating business %	7.0	2.2	0.6	0.7	0.9	0.9	0.9	0.7	1.9	2.5	1.4	0.4	0.6	0.9
Entrepreneurial Income	3,151	5,108	5,554	4,205	5,058	6,002	8,038	6,970	5,655	4,529	5,592	13,875	7,987	6,964
Productivity (revenue per hours of work)	1,244	1,041	1,092	1,629	1,819	821	2,017	6,003	1,024	972	1,376	4,380	1,034	2,549

Source: Department of Statistics, Ministry of Planning and Investment, Government of Lao PDR.