รายงานฉบับสมบูรณ์

โครงการ “TRADE, TOURISM AND SUSTAINABLE GROWTH IN 4 PROVINCES ALONG THE EAST-WEST CORRIDOR LINKING MYANMAR, THAILAND AND VIETNAM”

เสนอต่อ

สำนักงานกองทุนสนับสนุนการวิจัย (สกว.)

คณะเศรษฐศาสตร์ มหาวิทยาลัยเชียงใหม่

สิงหาคม 2559

สัญญาเลขที่ RDG5010021

รายงานฉบับสมบูรณ์

โครงการ “TRADE, TOURISM AND SUSTAINABLE GROWTH IN 4 PROVINCES ALONG THE EAST-WEST CORRIDOR LINKING MYANMAR, THAILAND AND VIETNAM”

ทรงศักดิ์ ศรีบุญจิตต์ และ ปีเตอร์ คาลกินส์

คณะเศรษฐศาสตร์ มหาวิทยาลัยเชียงใหม่

สำนักงานกองทุนสนับสนุนการวิจัย (สกว.)

EXECUTIVE SUMMARY

Of all the infrastructural investments a country or group of nations can make to serve as the platform for rapid socioeconomic development, expansion of the road network is the first and most essential. Without roads, the economic costs and construction time skyrocket for such other infrastructural projects as hydroelectric dams; electrification; sewer/drinking water/sanitation systems; importation of materiel for hotel, school and office building construction; and the provision of emergency health care networks and vehicles.

The East-West Economic Corridor system, connecting Vietnam to Myanmar and veering south through Hat Yai to Malaysia, is one of the most ambitious and carefully planned highway projects ever to be undertaken in Asia. As envisaged by the Asian Development Bank and the member nations of Southeast Asia, its impacts were to be strong economic growth, increased income per capita, inclusion of the poor in more egalitarian income distribution, the reduction of poverty, inclusive creation of jobs at all skill levels, the attraction of tourists, the facilitation of expanded trade, the specialization of production along lines of revealed comparative advantage, and the bridging of peoples and nations in general. But, as this report demonstrates, the real impacts of roads are only as strong as the weakest link in the underdevelopment profile of the city or province through which they run. This is the main message of this report. Its main recommendation is, therefore, that each individual province, with the help of its national government, must adopt concomitant policies to shore up those weak links so that the fullest advantage can be taken of those roads.

To be implementable, the assessments and recommendations flowing from a study like this one must be based upon strong statistical evidence. This report is the fruit of a generous four-year research grant from the Thailand Research Fund that explains and applies a balanced set of statistical and economic modeling tools to a) measure the level of economic and social progress, b) explain gaps in that progress, and c) generate optimal policy recommendations. The level of progress (a above) is measured by net income per capita; levels of education and employment; Gini

coefficients; the Foster-Greer-Thorbecke indices of the incidence, depth, and intensity of poverty; and the proportion of value added deriving from business and trade. Tests of means were employed to detect significant differences in each study province between rural, semi-urban, and urban subpopulations.

The gaps in progress (b above) are explained by multiple regression equations, including seemingly unrelated regression and volatility models. The dependent variables are income, the levels of consumption of groups of key necessities, the intensity of poverty, the number of tourist arrivals, and the fluctuations in the prices of key export commodities like rubber.

Optimal policy recommendations (c above) were generated through the use of Social Accounting Matrices. Not only were the goods and services with the greatest value added identified for each study site; the matrices were optimized under realistic constraints on the availability of land, labour and capital to assure that the optimal plans so generated would be feasible.

Given the depth and scope of these interlocking methodologies, only four (4) study sites could be studied in detail. Selection criteria therefore had to be very rigorous. All sites had to lie along the EWEC, be economically or strategically important in their own right, but also represent a certain point along the spectrum of pre-EWEC development or under development. These selection criteria have greatly enhanced the external validity of the present research, and allowed for clear comparisons of the impacts of the road under a wide range of conditions. The final selection of the four study areas, from east to west, is as follows:

1. Da Nang, Vietnam, **a well-developed port town** that was already connected on a major North-South highway corridor with the rest of the country.

2. Savannakhet, Laos, a country-wide but **landlocked city with untapped potential** for tourist and trade going both east to Vietnam and west to Thailand, and a fledgling but emerging business sector.

3. Hat Yai, in Songkhla province, southern Thailand an already **specialized border town** with ideal conditions for rubber production and export, and the

geographical position to serve as the gateway for tourist arrivals from and through Malaysia. And

4. Mawlamyine, Myanmar, the fourth largest city, lying on the EWEC on a **direct line between the capital Yangon and a proposed seaport**. BUT, as this report will demonstrate, each of those favourable development conditions was reversed: the capital was moved inland, the seaport project was transferred to a different site, and ethnic warfare and rebellion prevented the EWEC from being completed.

Data for all sites was collected in the years 2010 and 2011 using standardized household and firm questionnaires and the integration of all available secondary and governmental data. Because of the unique characteristics of each site, the specific research objectives and testable hypotheses differed accordingly.

The analyses reported in this document demonstrate that the most observable impacts of the EWEC lies in sites typified by **2** above (Savannakhet, Laos). Basically, all of the non-transportation conditions were in place before the advent of the EWEC. Businesses were concentrated there, but still under-developed. Thus, the road became the blood vein for business, marketing and transportation across Laos, Thailand and Vietnam. The impact of the EWEC was all the greater because that section of the highway cut strategically through a mountainous border area between Laos and Vietnam. Key segments of the Savannakhet population that had been lagging behind in income, employment, or both because of relative isolation from jobs and markets were thus able to “catch up” with the rest of the population. Poverty has been reduced, the inequality in income distribution has been partially redressed, and the city is enjoying a surge of growth because the major development condition missing had been the road.

In the same vein, this report shows that, even when the road system is as yet incomplete, it can spark growth and job creation in the most backward provinces of type **4** (Mawlamyine). That this can happen before the road is fully operation demonstrates that direct job creation from the and indirect stimulation of economic activity can bring about positive impacts in terms of the eradication of poverty. It is well known that, since the data for the present report were collected, there has been a

massive political opening of Myanmar as a country. There is thus every hope that a fully operational EWEC can generate still greater employment and poverty-reduction impacts. Myanmar has woken up, has addressed her political issues, and is on her way to economic transformation. The recommendations in the last chapter of this report may therefore be of even greater interest to her leadership. In the same mold as Savannakhet, the EWEC may soon contribute massively to economic development of Myanmar on a much larger scale.

At the other end of the spectrum, two of the four study sites have **not** been able – either in fact or in potential -- to benefit as much from the EWEC as sites of types **2** and **4**. Those are Hat Yai and Da Nang. For example, in sites of type **3** (exemplified by Hat Yai, Thailand), development was already outward-looking before the inauguration of the road project. Rubber could be produced with economies of size for export, while tourists could be "imported" from the south without creating a pan-Southeast Asian highway system. The main results noted in this report have been the enhancement of local business, and the attenuation of fluctuations in rubber prices.

Likewise, in provinces of type **4** (typified by Da Nang, Vietnam), conditions predating connection with the East-West Highway had already been enormously favorable. A seaport already lay available at the eastern edge of the province for both imports of raw materials and exports of agricultural and finished products. A major North-South road linked Da Nang to all other parts of the country, so that Da Nang was already faring as well as most other cities in Vietnam in terms of living standards, education, employment, and income distribution. Small east-west roads were adequate to drain the agricultural surplus and prospective workers from the interior. True, a wider, faster East-West connection to Laos and Thailand enhanced those effects, but it does not seem to have been essential to rapid economic development.

The policy conclusions from this report are therefore quite site-specific; and it would be both dangerous and wrong to generalize on what measures governments should put into place for the EWEC as a whole. Careful reading of this report will point to the remaining weaknesses in Mawlamyine and Savannakhet that could make the new road connections even more economically and socially productive. In contrast, large, well-linked and relatively developed urban centers like Da Nang

and Hat Yai would be better served by re-channeling their infrastructure budgets into the construction and upgrading of feeder roads, the reduction of urban traffic congestion, and the provision of public transportation.

บทคัดย่อ

รหัสโครงการ: RDG5010021

ชื่อโครงการ: TRADE, TOURISM AND SUSTAINABLE GROWTH IN 4 PROVINCES ALONG THE EAST-WEST CORRIDOR LINKING MYANMAR, THAILAND AND VIETNAM

ชื่อนักวิจัย: **ทรงศักดิ์ ศรีบุญจิตต์ และ ปีเตอร์ คาลกินส์**

[1]คณะเศรษฐศาสตร์ มหาวิทยาลัยเชียงใหม่

E-mail Address: songsak.econ@gmail.com

ระยะเวลาโครงการ: 1 มิถุนายน 2550 – 31 กรกฎาคม 2559

โครงการนี้มีวัตถุประสงค์เพื่อศึกษาผลกระทบทางเศรษฐกิจและสังคมของเส้นทางระเบียงเศรษฐกิจตะวันออก-ตะวันตก ด้วยตารางเมตริกซ์บัญชีสังคม โดยมีพื้นที่ศึกษา 4 เมืองที่เป็นตัวแทนของแต่ละประเทศดังนี้ 1) เมืองดานัง ประเทศเวียดนาม 2) เมืองสะหวันเขต ประเทศลาว 3) เมืองเมาะละแหม่ง ประเทศเมียนมาร์ และ 4) เมืองหาดใหญ่ ประเทศไทย ทั้งนี้เพื่อให้เกิดประโยชน์ต่อภาครัฐของแต่ละประเทศที่เส้นทางระเบียงเศรษฐกิจตะวันออก-ตะวันตกพาดผ่าน ในการให้ข้อเสนอด้านนโยบายการแข่งขัน และอื่นๆ เช่นการขจัดความยากจน การสร้างงาน การท่องเที่ยว และการพัฒนาอย่างยั่งยืน ตลอดจนการรวมกลุ่มในภูมิภาคและประสิทธิภาพทางการค้า

ผลจากการศึกษาพบว่าผลกระทบของเส้นทางตามระเบียงเศรษฐกิจตะวันออก-ตะวันตกเกิดขึ้นมากที่สุดที่เมืองสะหวันนะเขต ประเทศลาว ซึ่งแต่เดิมเมืองสะหวันนะเขตแม้ว่าจะนับเป็นศูนย์กลางธุรกิจในพื้นที่แถบนั้น แต่ยังคงมีการคมนาคมที่ยากลำบากและยังไม่พัฒนาทั้งด้านเศรษฐกิจและสังคมเท่าที่ควร เส้นทางของระเบียงเศรษฐกิจตะวันออก-ตะวันตกนี้ เปรียบเสมือนเส้นเลือดใหญ่ที่หล่อเลี้ยงทั้งธุรกิจการค้า การตลาด การคมนาคมขนส่ง ทั่วทั้งลาว ไทยและเวียดนาม การสร้างเส้นทางเชื่อมโยงระเบียงเศรษฐกิจตะวันออก-ตะวันตกนี้ ส่งผลกระทบในทางที่ดีเป็นวงกว้างอันเนื่องมาจากถนนตัดผ่านพรมแดนระหว่างลาวและเวียดนามซึ่งมีสภาพภูมิประเทศเป็นภูเขา สามารถช่วยลดความยากจนลงได้

ในส่วนของเมียนมาร์ซึ่งการก่อสร้างยังไม่แล้วเสร็จนั้น หากเส้นทางสายนี้ก่อสร้างเสร็จสมบูรณ์ย่อมเป็นส่วนสำคัญต่อการพัฒนาทางด้านเศรษฐกิจในพื้นที่เมาะละแหม่ง อย่างมาก

อย่างไรก็ตาม การศึกษานี้พบว่าอีกสองพื้นที่ คือ หาดใหญ่และดานังนั้น ไม่ได้รับประโยชน์จากโครงการระเบียงเศรษฐกิจตะวันออก-ตะวันตก มากเท่าที่ควรเมื่อเทียบกับสะหวันนะเขตและเมาะละแหม่ง เนื่องจากทั้งสองเมืองมีความเจริญมาก่อนหน้าที่จะมีโครงการแล้ว การเชื่อมโยงระหว่างลาวและไทยนั้น นับว่ามีความจำเป็นแต่ก็ยังไม่เร่งด่วนมากในแง่ของการพัฒนาเศรษฐกิจ

ข้อเสนอแนะเชิงนโยบายจากการศึกษานี้ค่อนข้างจะเฉพาะในแต่ละพื้นที่ ไม่เหมาะที่จะนำมาใช้เป็นของเสนอแนะโดยรวมกับทุกพื้นที่ เนื่องจากบริบทของแต่ละพื้นที่มีความแตกต่างกัน ทั้งนี้อาจจะแยกได้เป็นสองกลุ่ม คือ สะหวันนะเขตและเมาะละแหม่ง ซึ่งทั้งสองเมืองยังไม่พัฒนามากนัก การเปิดเส้นทางคมนาคมใหม่เชื่อมโยงระเบียงเศรษฐกิจตะวันออกตะวันตกจะทำให้เกิดผลที่ดีทั้งด้านเศรษฐกิจและสังคม แต่สำหรับดานังและหาดใหญ่ ซึ่งเมืองมีการพัฒนาไปมากแล้ว ไม่มีความจำเป็นที่ต้องสร้างถนนใหม่ แต่ควรปรับปรุงถนนเส้นเดิมให้มีความสะดวกสบายมากยิ่งขึ้นเพื่อลดปัญหาการจราจรแออัดและสนับสนุนการขนส่งสาธารณะให้มีมากขึ้นด้วย

คำหลัก: บัญชีเมตริกซ์สังคม ระเบียงเศรษฐกิจตะวันออก-ตะวันตก สะหวันนะเขต ดานัง หาดใหญ่ เมาะละแหม่ง

Abstract

Project Code: RDG5010021

Project Title: TRADE, TOURISM AND SUSTAINABLE GROWTH IN 4 PROVINCES ALONG THE EAST-WEST CORRIDOR LINKING MYANMAR, THAILAND AND VIETNAM

Investigators: Songsak Sriboonchitta[1] and Peter Calkins[1]

[1]Faculty of Economics, Chiang Mai University

E-mail Address: songsak.econ@gmail.com

Project Duration: 1 June 2007 – 30 July 2016

The purpose of the project is to build, evaluate and link a series of four sub-national Social Accounting Matrices (SAMs) chosen to follow the "East-West Economic Corridor" linking Myanmar, Thailand , Laos and Vietnam. The research sites of this project lies along this economic corridor within the Greater Maekong Sub-region and were selected to provide well-positioned provincial leaders with the information they need to take maximum yet sustainable advantage from the ongoing globalization and integration of the region which were Da Nang, Vietnam; Savannakhet, Laos; and Mawlamyine, Myanmar. In response to calls from national governments for greater competition policy, this study emphasized not only poverty alleviation, employment creation, tourism, and socially and environmentally sustainable development within each site; but also competition policy, regional integration, and trade efficiency along each international corridor.

The results of the study show the most observable impacts of the EWEC lies in sites typified by Savannakhet, Laos. Basically, all of the non-transportation conditions were in place before the advent of the EWEC. Businesses were concentrated there, but still under-underdeveloped. Thus, the road became the blood vein for business,

marketing and transportation across Laos, Thailand and Vietnam. The impact of EWEC was all the greater because that section of highway cut through a mountainous border area between Laos and Vietnam. The results found that poverty has been reduced, the inequality in income distribution has been partially redressed, and the road has promoted the growth of the city. In case of Mawlamyine, even the road system is yet incomplete; it can spark growth and job creation in province. It brings about positive impacts in terms of the eradication of the poverty. After the roads are fully constructed, the EWEC may soon contribute massively to economic development of Myanmar on the much larger scale. However, two of four study sites –Hat Yai, Thailand and Da Nang have not been able to benefit as much from the EWEC as sites of Mawlamyine and Savannakhet. Their developments were already outward-looking before the inauguration of the highway project. The main results of Hat Yai in this study have been the enhancement of local business, and the attenuation of fluctuations in rubber price. Likewise, in Da Nang, small east-west roads were adequate to drain the agricultural surplus and prospective workers from the interior. It is true that a wider and faster East-West connection to Laos and Thailand enhanced those effects but it does not seem to be essential to rapid economic development.

The policy conclusion from this study are quite site-specific; and it would be both dangerous and wrong to generalize on what measures governments should put into place for EWEC as a whole. The remaining weaknesses in Mawlamyine, Myanmar and Savannakhet, Laos that could make the new road connections even more economically and socially productive. In contrast, Da Nang, Vietnam and Hat Yai, Thailand would be better served by rechanneling their infrastructure budgets into the construction and upgrading of feeder roads, the reduction of urban traffic congestion, and the provision of public transportation.

Keyword: East-West Economic Corridor, Mawlamyine, Savannakhet, Hat Yai, Da Nang, Social Accounting Matrices (SAM)

CONTENTS

CONTENTS (CONTS.)

CONTENTS (CONTS.)

CONTENTS (CONTS.)

LIST OF TABLES

LIST OF TABLES (CONTS.)

LIST OF TABLES (CONTS.)

LIST OF TABLES (CONTS.)

LIST OF FIGURES

CHAPTER I:

INTRODUCTION

1. Real world problem: inadequate links among nations and low living standards

The major cross cutting challenges facing the Southeast Asian region in this decade are: (1) economic integration; (2) infrastructure development; (3) rural development and poverty reduction; (4) development of markets and a strong private sector; (5) policy and institutional reform; (6) human resource development; and (7) environmental protection. Of all the infrastructural investments a country or group of nations can make to serve as the platform for rapid socioeconomic development, expansion of the road network is the first and most essential. Without roads, the economic costs and construction time skyrocket for such other infrastructural projects as hydroelectric dams; electrification; sewer/drinking water/sanitation systems; importation of materiel for hotel, school and office building construction; and the provision of emergency health care networks and vehicles.

The research study on the impact of the EWEC road network in various aspects and dimensions of the socioeconomic development agenda is crucial to accelerating economic growth on the right track. It is also vital to formulating and the reforming national level policy as well as enhancing pan-regional cooperation among participating countries. Only then can their economies hope to achieve mutual benefits by formulating friendly trade and economic policy based on the lessons learned.

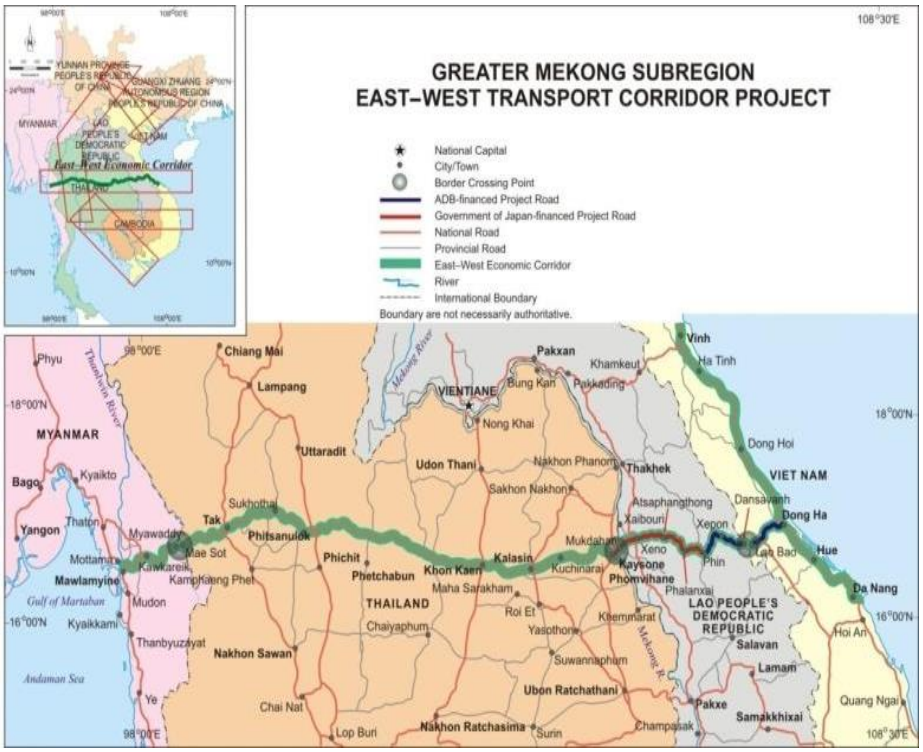


Figure 1.1: Map of Greater Mekong sub-region East-West transport corridor project

2. Overview of the TRF project

The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) was established in 1947. It serves as the main social and economic development centre for the Asia and the Pacific. The mandate of ESCAP is to foster the cooperation between its member countries and associate members to overcome the challenges of socioeconomic development by launching results oriented projects; technical assistance; and capacity building focusing on macroeconomic policy, trade, transport, social and environmental issues, and information technology. ESCAP provides the strategic links between global and country level programs, and it supports government of the member countries to overcome the socioeconomic challenges for the sustainable economic development in global context.

In this connection, the Asian Highway network is a regional transport cooperation initiatives of ESCAP aimed at enhancing the efficiency and development of the road infrastructure in Asia, supporting the development of Euro-Asia transport linkages and improving connectivity for landlocked countries. The concept of Asian Highway project was administered in 1959 with the aim of promoting the development of international road transport in the Asia pacific region for social progress and better standards of life.

The Greater Mekong Subregion (GMS) development project was established in the year 1992 by the Asian Development Bank (hereafter, ADB). The purpose of the GMS project is to spur the development and economic integration of the sub-regional Mekong economies: Thailand, Laos, Vietnam, Myanmar, and Cambodia. By connecting and linking the region's countries, it should be possible to select new resources and pursue specialization for trade with the highest economic efficiency. The Economic Corridors project is one of the efforts to achieve these purposes.

The concept East-West Economic Corridor was introduced in October, 1998 in Manila at the Eighth Ministerial Conference of the Greater Mekong River Sub-region realizing the need of the regional development considering regional competitive and comparative advantages of economic development and economic cooperation. Since then, there has been an official or unofficial economic transaction prevailing between the neighboring countries. The eight ministerial conferences agreed to develop and promote free Trade Area (FTA), Tax Alliance and Common Market (EU) in the Mekong sub regions and enhance the economic globalization maintaining national investment for international markets as well as attracting foreign direct investment in the participating countries. The East–West Corridor (EWC) Project is part of the wider East–West Economic Corridor linking Da-Nang in Vietnam and Mawlamyine in Myanmar—covering Lao People's Democratic Republic (Laos PDR), Myanmar, Thailand, and Vietnam. As a flagship project of the Greater Mekong Sub-region (GMS) Program, it was designed to improve National Road 9 linking landlocked areas in northeast Thailand to the Vietnam coast via Laos PDR. It is the second cross-border road project in the program and is in line with ADB's thrust for regional cooperation in the transport sector (ADB, 2008).

The Intergovernmental Agreement on the Asian Highway Network was adopted on 18 November 2003 by an intergovernmental meeting held in Bangkok, was open for signature in April 2004 in Shanghai, and entered into force on 4 July 2005[1].

The economic corridor has three distinctive features. Firstly, it is considered a defined geographical region. Secondly, the corridor mainly focuses on bilateral initiatives, not multi-lateral ones. Thirdly, the economic corridor requires detailed physical and space planning for infrastructure development for the most effective results. About, 1,450 km long East-West Economic Corridor passes through four countries and the East-West Economic Corridor also connects with main north-south roads, including Yangon – Dawei and Chiang Mai – Bangkok of Thailand, Road 13 of Laos, and National Highway No.1A of Vietnam.

Moreover, the summary findings of "evaluation study on the east-west project report" of ADB (2008) mentioned that the project is "*"highly relevant" to development needs at the regional and national levels. As a regional road, it addressed a strategic need to strengthen links between Laos PDR, Thailand, and Vietnam. The all-weather road aimed to expand the market for transit and bilateral trade. It also interconnects national transport networks to generate trade and efficiency*

[1] https://treaties.un.org/pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XI-B-34&chapter=11&lang=en

benefits. It was appropriately designed to support economic centers and to complement poverty reduction (via a rural road component in Laos PDR)"(ADB, 2008. p iii) and ranked as a successful project. Moreover, the report added that there is little evidence of EWC's transformation from a transport corridor into an economic corridor and the full realization of corridor-level benefits (i.e., economic activities, tourism, and trade facilitation) is limited by institutional constraints. In the case of Laos PDR, this is partly explained by inadequate complementary investments and slow private sector growth.

The lessons gleaned from the project mentioned by ADB Evaluation Study on the East-West Corridor Project Completed are: (i) The pace of the economic development along the corridors depends on the complementary interventions requiring policy and institutional changes that enable better opportunities for the private sector. (ii) Multimodal planning is important for enhancing the effectiveness of transport corridors, and (iii) ADB should use loan savings prudently by exercising due diligence at the approval and at completion stages of the project. Most of the road infrastructural development projects further alleged that these projects foster the economic development process by a) enhancing marketing linkages among the parties at local and regional levels to b) ease the mobility of products and factors based on market forces and c) generating employment opportunities through d) increased market accessibility for the rural people.

AbuzarAsra et al. (2006) introduced an approach to analyze the impact of the east-west corridor along Savannakhet route no. 9 to its neighboring countries using the accounting framework of the traditional single area I-O model. The findings of the study show the significance of the economic measurement tackles broad issues on export-import expansion, interdependence of industrial structure from Rest of Savannakhet (intra and interregional analysis), evaluating impacts or changes in final demand (production, income, and employment), and short term projections and forecast of the domestic economy (AbuzarAsra, 2006).

BounpongKeorodom et al. (2007) showed the thought of business persons that are positive toward their business investments after the completion of The Second Mekong Bridge; 20 % would increase imported goods in construction materials and machinery equipment, and 15 % would increase the export of domestic products. In addition, 17 % of the respondents saw the development of EWEC as cost and time saving in transportation and 20% would see strong competition among domestic firms as well as from foreign investment.

Benson Sim at el. (2007) constructed a modified interregional input–output (IRIO) table to link the economies of the province of Mukdahan in Thailand and the Lao PDR of Savannakhet using the Chenery-Moses model. The results showed that the value of trade of these provinces with the rest of the world was much higher than the trade between them. Industries in the services sector were found to have generally higher value-added multipliers than industries in the manufacturing sector. The agriculture and forestry industry in Savannakhet and the manufacturing industries in both provinces had high backward and forward linkages. Exports to the rest of the world and consumption were found

to have the highest employment multipliers in Mukdahan and Savannakhet, respectively. Mukdahan was also found to have higher net foreign exchange earnings, implying that the Thai province may be able to add greater value to its exports than the Lao PDR province (Benson Sim, 2007).

2.1 Trade and Investment

The aim of creating the EWEC corridor project was to help develop trade toward the north and the south to the major commercial centers of Bangkok and Ho Chi Minh and to bring practical and long-term benefits to member countries. The corridor will also aid cities and small towns along it to strengthen trans-border trade and investment attraction, to develop new economic activities by effectively using economic space, and to establish trans-national economic areas and products for entry onto global markets in Europe and America. However, most member localities are underdeveloped, highly populated and geographically remote. Their agriculture-based economy has not played an important role, and industry is not yet strongly developed.

The major driving forces for EWEC economic growth were assumed to be the differences in factor endowments among different national areas of the corridor. Such differences should allow firms in each area to exploit their comparative advantage in the production of those goods and services that are intensive in the factors with which the areas are abundantly endowed. At the sub-regional level, the driving forces identified for the EWEC were: (i) the efficiency and welfare gains from trade investment and liberalization; (ii) the firm-level economies of scale and resulting increases in competition; (iii) induced changes in foreign investment from both firms in the sub-region that are pursuing a sub-regional production strategy and foreign multinationals that are pursuing global production strategies; (iv) productivity gains from trade resulting from the greater availability of capital, skilled and unskilled labor (ADB, 2008).

Integration into the world economy is the major challenge for economic development through promotion of trade and economic liberalization from the perspective of the export and import markets of the country. Lao PDR has gradually started to access world economy since 1989, with accession to ASEAN in 1997. The country has signed a number of agreements to promote trade. These include an investment promotion agreement with Japan, and an economic cooperation agreement with South Korea to promote cooperation in the areas of trade, investment and services. The objective of the country's the Sixth Five-year Plan (2006-2010)[2] is to fully implement the integration roadmap and meet the commitments to become a member of the WTO and multi-lateral regional bodies such as AFTA and GMS. The evaluation review report of 6th Plan (2006-2010) of the Lao PDR claimed that during the five years (2006-2010), the export value of Lao PDR's goods was US$ 5.69 billion and shared 23.4% of GDP, which has exhibited an increasing trend every year. Lao PDR's key export markets include the ASEAN countries (Thailand, Vietnam, and Malaysia), the EU, China, and Australia. The main export markets were Thailand, accounting for 59.60% of the total exports (or

[2]The Sixth National Socio Economic Development Plan (2006-2010).

equivalent to US$650.78 million); Vietnam 13.37%; Australia 6.19%; and China 1.85%. Recently, Lao exports to the US have increased but the overall value is low (just 1% of total exports). Similarly, imports to Lao PDR during the same five years (2006-2010) had a value of US$6.61 billion, which covered 27.3% of GDP and showed an increasing trend. Imports into the country were also dominated by the ASEAN countries (about 76.26% from Thailand and 12.25% from Vietnam), China 8.3%, Japan 2.6%, South Korea 1.88% and Malaysia 0.6%. In the EU market, Germany covered 1.04%, France 0.7%, and other countries. Mining and agriculture and agro-processing remain important not only for meeting domestic demand but also for exports to a rapidly growing regional international market. Manufacturing and tourism firms continue to face significant constraints to investment, productivity, and growth, and these will have to be addressed (Committee for planning and investments, 2006).

Investments from the ASEAN countries in Lao PDR have increased each year since 2004. Thailand, Vietnam and China are the top three ranking countries from ASIAN region, respectively. Hydropower, mineral and tourism sectors are the most attractive sectors for foreign direct investment. Foreign direct investment (FDI) flows predominantly into the natural resource sector (particularly mining and hydropower), accounting for approximately 80% of all FDI in 2008. Investment is likely to remain a key element of Lao PDR's growth strategies and to continue its focus on exploitation of the country's natural resources over the coming years. The Government of Laos has continued to work on WTO accession (Committee for planning and investments, 2006).

2.2 Social and environment

The intention of such broad-based development strategies was to remove existing constraints to the promotion of trade and investment and to sustain economic growth in the corridor to help alleviate poverty (http://www.danang.gov.vn). The proposed project initiatives were specifically expected to improve the economic role and social status of women in the sub-region, as their burden of supporting the household and performing subsistence agricultural work should shift to economically productive and remunerative activities. Greater education associated with improved skills training must parallel the shift to higher value-added industries thus helping to improve the economic welfare of women in the Corridor. This poverty-reduction objective of the EWEC in the rural and emerging urban areas is in turn linked with alleviation. Improved regulation of trade and institutionalization of informal trade are expected to stem environmental degradation and equalize the forest-surplus and forest-deficit imbalances between countries. Countries should enhance this environmental potential by introducing policies that emphasize training, private sector participation, and data gathering in all agro-industry and manufacturing sectors.

Although authorities claim that there has been notable improvement in the overall indicators for gender equality and empowerment of women, a remaining challenge lies in identifying and addressing the causes of the great disparities that exist between urban and rural areas and between different regions.

Many studies from South Korea, Singapore, Malaysia and Taiwan such as Kim (1994), Lee (2009), SALT CENTRE, Hwa Chong Institution (2007), Aziz (2008), Sim (2009), and YU and SU (2006) have concluded that economic development issues in any developing country should be focused on gender and equality and women empowerment realizing the role of women in economic development.

The lessons learned from those studies clearly depict the vital role of women's education and involvement in economic development. It is crucial that the empowerment of women and contribution to public life be encouraged at all levels of the development agenda. The local or village level agenda and activities can accelerate higher progress, including regional and national efforts.

Currently, however, as in several other developing countries, Lao's rural societies are trapped in stereotypical attitudes and beliefs. Such thinking continues to affect girls in the family, school and society. Most females experience an unfair distribution of labor inside the home, and men are usually considered the head of households and the decision-makers at the domestic and village level. Consequently, women and girls are restricted in their ability to access education, gaining less exposure and contributing less to village and community development despite playing a significant social and economic role (Committee for planning and investments, 2006).

2.3 Migration

The motive of migration is *"the opportunity for people to obtain jobs and a better livelihood"* (ADB, 2009). Migration of workers is an important factor in economic development in the GMS. Social and economic growth in the GMS over the last 10 years has been consistently strong, particularly the improvement of transport infrastructure which contributed the movement of goods as well as people in this sub-region. GMS members have witnessed significant migration of labor between Myanmar and China, Lao PDR and Vietnam, Vietnam and Cambodia, and China and Vietnam. *"These flows are further facilitated by such factors as these countries' proximity to one another and their long porous borders, cultural similarities, population diasporas, and construction of highways"* (ADB, 2009). These factors can produce the changes in trade and connectivity within the sub-region. Although such cross-border mobility of labor is increasing with the development of new employment opportunities, social and economic disparities remain (ADB, 2009).

Table 1.1 Basic Economic and Demographic Indicators for the Greater Mekong Subregion

Indicators	**Primarily Sending Countries**			**Sending and Receiving Countries**		
	Lao PDR	Myanmar	Vietnam	Cambodia	Lao PRC	Thailand
Population(million)	6.834	48.137	86.967	14.494	1,388.612	65.905
Population growth rates (%)	2.316	0.783	0.977	1.765	0.655	0.615
Growth rate of population aged 15–39 (%), 2005–2010	2.97	0.60	1.42	2.93	(0.95)	(0.61)
Total fertility rate (children born/woman)	4.41	1.89	1.83	3.04	1.79	1.65
Net migration rate (‘000)	(3.4) (2005)	(0.2) (2005)	(0.4) (2009)	0.1 (2005)	0.4 (2009)	0.6 (2005)
GDP growth (%)	7.5	0.9	6.2	6.8	9.8	3.6
GDP/ capita ($ at PPP)	2,100	1,200	2,800	2,000	6,000	8,500

Note: () = negative. The indicators were estimated by United Nations.

Prospects: The *2006 Revision* (United Nations publication, Sales No. E.07.XIII.2).

Sources: CIA Fact Book and United Nations Department of Economic and Social Affairs. World Population. Refer to Asian Development Bank (2009).

Table 1.1 portrays the striking disparities between the primarily sending countries and the sending and receiving countries in the sub-region. The high range of Gross Domestic Product per capita (GDPC) between Myanmar at $1,200 and Thailand at $8,500 attracts increased migration. Thailand also has the lowest total population growth rate, fertility rate, and growth rate in the 15–39 age groups. In contrast, the characteristics of the primary sending countries such as Lao PDR, Myanmar, and to a certain extent Vietnam are higher fertility rates, younger populations, a larger share of working age population, lower economic growth rates, and lower per capita GDP. These factors can create the opportunities of employment at the low end of the wage scale by migrant labor from other GMS members (ADB, 2009).

2.4 Transport infrastructure development

Infrastructures have long been recognized as playing a central role in economic development and the amelioration of living standards. The term "infrastructure" covers such multiple subsectors road transport, and rail links, energy, telecommunications, power supplies, water, sanitation, ports and airports and low-income housing (NESDB and The World Bank, 2008). Barrios (2008) has classified the development intervention into four categories as follows: "*economic infrastructure e.g. credit, production support; physical infrastructure e.g. roads, irrigation; capacity building e.g. training, information dissemination; and support services e.g. marketing services, facilitation of access to basic social services"*.

Roy (2010) mentioned that any infrastructural improvement has impacts on both the economic and social sectors in general and the poor in particular. What the poor need is an opportunity for a better education, a minimal standard of healthcare services, power supplies, roads, clean water for drinking and sanitation, entry into markets, access to loans and investment capital, etc. Otherwise, closed access to schools leads to poorly educated people, lack of access to healthcare services and clean water leads to poor health, lack of access to world markets leads to heightened costs of production and transportation; time spent on non-productive activities reduces worker efficiency, etc. Thus, greater access to such infrastructure is potentially a powerful tool for improving both poverty reduction and economic development.

Jacoby (1998) estimated the household level benefits from road projects in Nepal. The results showed that poorer households get more benefit from road improvement in the remote areas. Consistent with this finding, Stone and Strutt (2009) used a computable general equilibrium to trace the benefits of the development of economic transport corridors. Their results showed the potential benefits of improving land transport and trade facilitation, particularly intra-regional trade within the Greater Mekong Subregion. Additionally, Menon (2006) analyzed the different qualities of road access of rural villages in Lao PDR. The results show that roads help cut the incidence of poverty because poor people have opportunities to get more income from road improvement which leads to reduced costs for the goods they purchase.

Today, someone could argue the Asian Highway is probably the biggest highway network of the world allowing to experience at first hand the accounts that were relayed by great explorers because the Asian Highway network is a network of 141,000 kilometers of standardized roadways crisscrossing 32 Asian countries with linkages to Europe (UNESCAP, 2012). At the beginning phase of the project (1960-1970) considerable progress was achieved. However, progress slowed down when financial assistance was suspended in 1975 and ESCAP claimed that regional political and economic changes during the period of 1980s-1990s stimulated new momentum for the Asian Highway Project. In 1992, it became one of the three pillars of Asian Land Transport Infrastructure Development project, comprising Asian Highway, Trans-Asian Railway and facilitation of land transport projects (UNESCAP, 2013).

Undeniably, transport connectivity plays a central role in regional and sub regional integration. It is critical for enhancing economic cooperation, closing development gaps and enabling sustainable development. Transport networks facilitate the movement of people, goods, labor, raw materials, finished products and ideas easily and contribute to the social, economic and environmental betterment of the region (UNESCAP, 2013). Additionally, transport is an essential element in the development of Asia and the Pacific, and has played a critical role in the region's rapid economic growth. Based on the 4th Meeting of the Working Group on the Asian Highway and Expert Group meeting on "Progress on Road Safety Improvement in Asia and the Pacific" Bangkok, Thailand held in 27 – 29 September 201,1 a total of 5499 KM has been completed so far.

To sum up, the Asian Highway network provides the critical road links between countries of the Asian and the Pacific region. While the Asian Highway network represents less than one percent of the total length of all roads in the ESCAP region, it is estimated that it connects close to one billion people or 50 % of the total urban population in the participating countries (UNESCAP, 2013). Similarly, the East-west corridor links Thailand to the Lao PDR at East and Cambodia at the west and North- South Corridor links Thailand to the Myanmar and Lao PDR at North and Malaysia at south. These two corridors are strategic Asian Highway for international trade and regional cooperation.

2.5 Road Infrastructure and Socioeconomic Development

The exploration is an important phenomenon from the beginning of the human existence and the great explorers embarked by land and sea in search of new worlds and riches. Perhaps, the purpose of travel could be explore new horizons, learn from different cultures, trade, or simply to secure food, shelter and means of subsistence for families and communities (UN, 2003). Viewed in the broadest sense, infrastructures are indispensable services to enable and accelerate socio-economic development. Where such infrastructure development projects have been implemented in a rational, well-coordinated and harmonized path, they have played a very significant positive role in the growth performance of a territory or nation. Even though development of such social and economic infrastructures is invariably associated with a huge amount of investment, most studies conclude that there is a positive relation between the level of infrastructure and the level of economic growth.

This said, the empirical findings on the precise impacts of transport infrastructure are inconclusive. Olsson (2009) stresses how additional transport capacity and transport improvements influence the economies of societies with both underdeveloped and developed road networks have long been debated. Although road projects were not the sole cause of social and economic change in rural Philippines, they did enable trade and investment, increase competition, and release a previously underutilized production potential through access to a larger market area and more attractive purchase prices of production factors (Olsson, 2009).

Gutierrez et al (2010) argued that "accessibility" is the main 'product' of a transport system and is closely related to mobility, economic development, social welfare and environmental impacts.

Therefore accessibility can be considered as a proxy for a raft of related (economic, social, environmental) effects of the transport infrastructure (Gutierrez *et al.,* 2010). Still, a caveat is in order. Since increased mobility of capital and skilled labor has substantially altered the possibilities of achieving social and economic objectives, allocational incentives and policies designed to promote these objectives may generate unintended distributional shifts as a result of induced factor flows (McCulloch & Yellen, 1997).

Cost–benefit analysis (CBA) is a long-established tool for the evaluation of infrastructure projects. When cost changes in transport markets lead to changes in transport demand, the pertaining welfare effects are measured by changes in consumer surplus based on the demand for transport (Zhu, Ommeren, & Rietveld, 2009). The social benefits differ from the transport benefits to the extent that there exists monopoly power on product markets and/or agglomeration economies. The direct welfare effect of an infrastructure improvement is measured by the user benefits using consumer surplus, while the economy-wide welfare effect is measured by social welfare (Zhu, Ommeren, & Rietveld, 2009).

In the developing economies, time savings induced by highway improvements can yield a variety of broader economic effects. These include (i) ensuring market access for producers to stimulate local production; (ii) drawing cheap labor, production inputs, and customers from a larger catchment area, thereby lowering wages and input/output prices; and (iii) altering land prices and development patterns (Gunasekera, 2008). The perception of the role of productive public expenditures as an engine of economic growth has changed markedly over the last few years. It was recently re-examined in the framework of endogenous growth theory when, following the empirical work of Aschauer (1989), new growth theory models began to take account of public spending as a factor for self-sustaining productivity gains and long-term growth (Barro, 1990; Démurger, 2001). Demurger (2001) followed a growth equation approach and found that differences in geographical location, transport infrastructure, and telecommunication facilities account for a significant part of the observed variation in the growth performances of Chinese provinces. Indeed, the transport variable appears as one of the most regularly differentiating factors in growth gap decomposition (Démurger, 2001).

Along with supportive economic and financial policies, infrastructure has long been recognized as a key element of the enabling environment for economic growth. Recently, the World Bank has also emphasized that by promoting growth, reliable and affordable infrastructure can reduce poverty and contribute to the achievement of the Millennium Development Goals by providing and supporting the delivery of key services (World Bank, 2004).

A vast range of previous studies have traced the significant impact of roads on poverty reduction through economic growth. For example, Kwon (2000) found that a growth elasticity with respect to poverty incidence of - 0.33 is good for roads and -0.09 is bad for roads at the provincial in Indonesia (Kwon, 2000).

Poverty reduction is a primary goal of development policy. However, a considerable segment of the population has to live on meager incomes with limited access to infrastructure services (Parker *et al*., 2008). "Poverty reduction requires economic growth which, when accompanied by sound macroeconomic management and good governance, results in sustainable and socially inclusive development" (ADB, 1999). In provincial China as well, Fan et al. (2002) showed the effects of different types of government expenditures on growth and rural poverty and argued that roads significantly reduce poverty incidence through increasing agricultural productivity and nonfarm employment. The estimated elasticity with respect to road density are 0.08 for agricultural GDP per worker, 0.10 for nonagricultural employment, and 0.15 for wages of non-agricultural workers in rural areas (Fan *et al*., 2002). The summaries how infrastructure investment contributes to the poverty reduction by influencing the productive sectors of the economy and creating employment for the poor after the policy interventions depicted in Figure 3 and 4.

2.6 Tourism, Economic Development and Poverty Alleviation

The United Nations World Tourism Organization (UNWTO) is a specialized international institution in the field of tourism. It offers a global forum for tourism policy issues and technical aspects of the tourism to promote the responsible and sustainable development of tourism paying attention towards the universally accessible tourism and the interest of the developing economies by playing a decisive role (UNWTO, 2009a). The UNWTO operates with its 154 member countries and more than 400 affiliated members representing local governments, tourism associations, and private sectors (UNWTO, 2010). The fundamental aim of the UNWTO shall be the promotion and development of tourism with a view to contributing to economic development, international understanding, peace, prosperity, and universal respect for, and observance of, human rights and fundamental freedoms for all without distinction as to race, sex, language or religion (UNWTO, 2009b). The concern of the UNWTO is to push and execute the global code of ethics for tourism development with the aim to ensure all the member countries, tourist destinations and businesses maximizes their positive benefits in terms of economic, social, cultural and environmental sustainability by minimizing negative social and environmental impacts (UNWTO, 2010).

Noticeably, tourism is the most incredible industry in the 20th century which witnessed a steady increase in tourism and over the last two decades of this century, the tourism industry has evolved and modernized considerably all over the world in terms of institutional development and methods of transport, and the facilities available at destination points have enjoyed an accelerated pace of improvement (Cho, 2003; Zhang *et al.*, 2009; Theobald W. F., 1998)

The WTO with United Nations Conference on Trade and Development (UNCTAD) held in 2001 urged that tourism is the driving forces in the refocusing of economic development strategies in the poorest nations (WTO/UNCTAD, 2001) . The World Summit on Sustainable Tourism Development held in Johannesburg in 2002 advocated that tourism is one of the few development

opportunities for the poor and called for concrete action (WTO, 2002). “The livelihood strategies of rural households vary enormously, but, most households rely on a range of natural resource uses and on off-farm income from employment or remittances” (Ashley, 2000a). A poverty reduction program requires strategies on a variety of complementary fronts and scales, but a prerequisite of significant progress is “pro-poor growth – growth which benefits the poor. Indeed, in most countries with high levels of poverty, tourism is a significant (contributing over 2% of gross domestic product or 5% of exports) or growing (aggregate growth of over 50% between 1990 and 1997) part of the economy” (Ashley *et al*., 2001, p. 1).

Tourism is even more significant for the world’s poorest countries where it is a mainstay of their economies, a key factor in employment and trade, poverty reduction, as well as a vital lifeline for their development to achieve millennium development goals (MDG’s). To ensure a strong likelihood of economic, political, and social benefits at the local level, full participation of communities in tourism is indispensable (Ashley & Roe, 1998). Tourism can clearly contribute to combating poverty in the less and least developed economies provided that it is closely linked to the accessibility of financing sources, especially for small enterprises and micro-businesses (Ashley & Roe, 2002). The importance of travel and tourism as a social and economic activity has reached unprecedented proportions at the international level. Tourism is therefore used in many economies as a priority sector for economic development, redistribution of wealth, poverty reduction, and employment creation (WTO, 2010).

The GMS Economic Corridors constitute a set of well-defined geographical pathways targeting the transport network for economic development and infrastructural enhancement as the basis for more effective policy and institutional interventions in the GMS region. The economic corridors are integrated with the development agenda of the concerned countries on the basis of regional cooperation to promote economic development in the GMS sub region as a whole. The key objectives of the project are to: connect centers of economic activity; facilitate trade, investment, and tourism**;** reduce transport costs; and facilitate mobility of people, goods, and resources across borders.

Against these goals, the East-West Economic Corridor (EWEC) program, one of the 11 flagship projects of the GMS program was led by the Asian Development Bank (ADB). The road networks from East to West cross the four countries of Myanmar, Thailand, Lao PDR and Vietnam. Recently, the supporting facilities of road networks were completed, connecting Mawlamyine, Myanmar at the far West to Da Nang port, Vietnam at the Far East. Infrastructure was constructed to support the physical linkages within the EWEC such as the 2nd Lao-Thai friendship bridge between Mukdahan (Thailand)-Savannakhet (Lao PDR) and the Hai Van tunnel in Da Nang, Vietnam.

The total length of the EWEC is about 1,450 km by the longest distance of the road, of which 950 km are located in Thailand. The route begins on the East from the port town Da Nang, Vietnam and passes through Laweh and Lao Bao, cities in special economic areas of Vietnam close to the border of Laos PDR. EWEC goes through Savannakhet in Laos PDR and then crosses the Mekong River to Mukdahan, Thailand by 2nd Thai-Lao Friendship Bridge (Mukdahan-Savannakhet). The road continues

through Kalasin, Khonkhaen, Petchaboon, Pitsanulok and Maesot, Tak, Thailand border, through Myanmar up to the Moh-Tama gulf in Mawlamyine. Mawlamyine in turns provides a connection from the South China Sea to the Indian Ocean, India, and other destinations throughout the Middle East. The total surface of roadways in Lao PDR is more than 32,000 km, of which 23% is national highways, 21% state highways, and the rest are local.

3. Scientific problem : unmeasured impacts to date of the EWEC

Thanks to recent initiatives of national governments and the Asian Development Bank throughout the GMS region, a series of North-South, East-West highways is poised to criss cross continental Southeast Asia. Although China, and to a lesser extent Thailand, may have plans to develop specialization for commercial development, trade, and migration and along these new growth arteries, countries like Vietnam, Myanmar, Laos and Cambodia remain essentially unprepared. This situation will lead to a further gap in the levels of GDP per capita and annual average growth rates among GMS countries, risking to destabilize the region politically, economically and environmentally. It will even reduce the benefits going to the lead economies, China and Thailand, because of reduced benefits from trade. In addition, virtually no one is in a position to predict the impacts on the shared natural resources of the region, or on the optimal relocation of labor through migration.

This study responds to and helps to prevent the exacerbation of these problems by building detailed provincial-level SAMs in four widely-ranging provinces in three countries. The project will provide and transfer working models for the 5-year planning to the four provinces, that, if faithfully applied, could generate improved income and employment for millions.

This study seeks to promote income improvement, reduce poverty, provide skilled employment, and catalyze sustainable development through enhanced trade along the new East-West growth corridor. Because GMS countries vary widely in their resource bases, human capital development, planning potential and readiness for trade, this research project will build, apply, compare and integrate open-economy planning models at the provincial level in Mawlamyine, Myanmar; Hat Yai, Thailand; Savannakhet, Laos PDR; and Da Nang, Vietnam.

The choice of the provincial level as the locus of research-development serves to a) reflect the unique local potential and constraints of typical localities along the highway and b) to formulate bottom-up, consistent, integrated, and quantifiable five-year plans. The project will also train the necessary human capital in the form of four Ph.D. economists (from Nepal, Myanmar, Vietnam, and Thailand) alongside local economists and planners in the four provinces. These personnel will become proficient in the construction, analysis, and updating of Social Accounting Matrices (SAMs) and Sufficiency Economy Matrices (SEMs) for practical strategic development. Four Ph.D. dissertations and many professional journal articles on a wide range of development issues will be published. At the

end of the project, working models will be transferred directly to the leaders and chief economists of the four provinces, and the Ph.D. students will present their results throughout Thailand and abroad.

Answers are urgently needed for the EWEC as a whole and its component provinces to the following questions policy-orienting questions:

- *What is the current structure -- in terms of both absolute and percentage value added with Provincial Domestic Product (PDP) -- of 10 key sectors (tourism, agriculture, OTOP, other handicrafts, other knowledge economy, other manufacturing, transportation, energy, telecommunications, and finance-banking) within the local economies of 4 representative provinces in the Greater Mekong Subregion?*
- *What is the current trade situation in the GMS? What are the causes and obstacles to growth in that trade? What are the combined impacts of the factors linking production, export-imports, employment and income within and among each economy?*
- *How much net employment, household income by economic class and occupation, negative or positive environmental impacts, net export value and net migration does each region generate? How much of these effects are attributable to community-based decision-making, eco-tourism, migration, gender equity, and the knowledge economy?*
- *What are the absolute values and ordinal ranking of the value-added, employment-creation, income distributional, environmental, and export multipliers of each sector? Does one sector dominate the others in its multipliers in all dimensions, or will it be necessary to favor 2 or more sectors to achieve balanced development? Is the priority set consistent with the Sufficiency Economy philosophy of the King of Thailand?*
- *What are the priority weights that provincial leaders would like to assign to value added, employment creation, income distribution, environmental sustainability, and net exports in their future development priorities?*
- *Given the weightings in 4, what is the optimal development plan for each of the four provinces in terms of PDP growth per capita, poverty alleviation, employment creation, tourism, and socially and environmentally sustainable development? Which are the key sectors to be promoted, and with what percentage of government and private investment?*
- *What levels of imports, exports, in- and out-migration, and foreign direct investment for each of the four provinces? In which sectors of the economy will these occur?*
- *To what extent can those extra-provincial flows be best met by the 3 other provinces of the study through cross-border trade, intraregional migration, intra-regional investment, and other forms of regional integration among the six countries.*
- *What are the estimated welfare benefits in terms of PDP (provincial domestic product) of the optimal patterns for each province taken separately, and for the four provinces as a whole.*

- *Is there are convergence or a divergence in the PDP per capita through regional integration? If a divergence, what complementary policies might be most effective in avoiding income polarization within the GMS? Do these have to do with income redistribution, cross-site learning, competition policy, or enhanced trade efficiency?*
- *Do women, ethnic minorities and the inhabitants of fragile, poor ecosystems benefit proportionately less than other members of society from the new patterns? If so, what specific policies at the provincial and/or transnational level could best relieve the inequities inherent in otherwise sustainable growth patterns? Would policy priorities based on the Sufficiency Economy be a more appropriate means of aiding those target groups?*

4. Goals and objectives of this study

This project was designed over a 48-month period to build, evaluate, and link a series of four (4) sub-national SAMs (social accounting matrices, to be explained in detail below), chosen in such a way as to follow the "East-West Growth Corridor" linking Myanmar, Thailand, Laos, and Vietnam. This corridor is already being studied by other researchers, national and international planners, notably the Asian Development Bank (www.adb.org/GMS/Projects), in response to calls from national governments and international bodies alike for greater "competition policy"[3] and fuller implementation of the "Chiang Mai initiative"[4] . The research sites of the present project (Mawlamyine, Myanmar; Hat Yai, Thailand; Savannakhet, Laos PDR; and Da Nang, Vietnam) lie along key economic corridors within the GMS and were selected to provide well-positioned provincial leaders with the information they need to take maximum yet sustainable advantage from the ongoing globalization and integration of the region.

This project submission is, in fact, the first of three to be submitted to the TRF, the other two seeking to fund similar doctoral studies by a total of six (6) other students coming from two further sites in Thailand; Yunnan, China; Savannakhet, Laos, Haiphong, Vietnam; and Phnom Penh, Cambodia. There are logistical and humanitarian reasons for favoring Myanmar at this time. Of all the GMS countries, Myanmar is by far the least prepared to fend off the onslaught of Chinese goods, factories, and people that will flow into the country once the roads are open. Also, by replacing Savannakhet with some point in Burma, the TRF will finance a broader geographical sweep with this first round of scholarships. Finally, Burma has a repressive regime that must be replaced in some way.

[3] This term has recently come into vogue to reflect the need to a) remove tariff and non-tariff barriers to trade (i.e., quotas or quality standards), b) make the internal industrial organization of countries more competitive, and c) encourage investments in transportation and market infrastructures that would allow competition to flourish.

[4] This last agreement, signed in May 2000, by the finance ministers of ASEAN+3 countries was the regional financing arrangement to enable countries to cope with disruptive capital flows and maintain exchange rate.

It is therefore urgently necessary that Myanmar cultivate a new generation of young economists to eventually take over the planning of the country in a more rational way.

The mandate to serve the decision-making clientele at the provincial, *tambol*, and village levels comes from the climate of decentralization that is sweeping Thailand and the other members of the GMS. This climate involves what was formerly called the "OTOP" program of having each village specialize in one product or service; the need for community-based tourism; increases in the role of civil society; the necessity of establishing production, marketing and savings cooperatives; the desire to train economists at the sub-regional level capable of understanding, using and updating planning tools; and the psychological reality that if people are not involved in planning their own destinies they can rarely become enthusiastic about working together to bring about sustainable growth. It is also consistent with the Tenth Five-Year Plan of Thailand, based upon the Sufficiency Economy Philosophy.

This said, the four target provinces were **not** chosen because they were representative, but quite to the contrary as the most likely places where such positive decentralization of planning could occur. The strategic reasoning behind this project is *a fortiori*: if specialized marketing, community based tourism, growth of civil society, cooperatives, and local management of planning cannot work in these most favored areas; they will have even less chance of success in provinces lying off the main economic corridors of the GMS region! For example, it seems to us that *Moulmein* (also called *Mawlamyine* or *Mawlamyaing* in Burmese) is the perfect locale in Myanmar to conduct this study. It is the largest town in its province, has excellent access to the sea, lies within 50 km of the new East-West highway, and is a growth center already, even before the completion of the road. That part of Myanmar has historically been a source of out migration into Thailand because of massive unemployment. Our study should be able therefore not only to track the flow of goods and services, ecological impacts and income distributional effects but also the reduction or reversal of migration flows.

Specific objectives of the study

i) To provide practical, rigorous, clear, consistent and quantifiable planning tools for key provinces along the East-West Growth corridor linking Myanmar with Vietnam.

ii) To find the single best strategy for environmentally sustainable and socially equitable growth through the innovative optimization of those tools.

iii) To compare the results of optimization of the SAMs of standard economics with innovative SEMs inspired by the King's philosophy.

iv) To identify, for the greater benefit of all partner countries in the region, the comparative and competitive advantage of key target provinces.

v) To train 4 non-Thai Ph.Ds in the King's Philosophy and the construction of regional planning models.

vi) To develop a pilot study that may be used throughout Thailand during the 2007-2011 10th Five-year Plan.

vii) To publish groundbreaking theses and top-level journal articles to expound these results

viii) To present the results of the research to local collaborators, in research workshops organized by the Thailand Research Fund, and in international conferences

5. Conceptual framework

Economic development theories have grown by accretion since the early 1950s when Nurkse and Lewis first described the possibilities of growth based upon supposedly limitless supplies of rural labor. Successively, apparently conflicting schools of thought, added such themes as controlled migration (Todaro), community development (Wilkinson), Green Revolution unimodal technology (Hayami-Ruttan), growth accounting (Solow), women in development (Boserup, import substitution (Bhagwati), export-led open economies (World Bank), environmental sustainability (Hardin), access to basic needs (Sen), the knowledge economy (Harvard), structural adjustment (IMF), market transition (World Bank), positive globalization (Singer), and the sufficiency economy (King of Thailand). In reality, these themes are all essential to balanced development, but their relative priority weightings, sequencing, and timing all differ by sub-region because of both a) the true needs of the target population and b) the policy choices of governments.

Most economists are familiar with the concepts of forward and backward linkages of consumption, production, and trade, particularly in terms of the linkages between agricultural and the industrial sector (Hirschman). This study will expand upon those linkages to reflect the impacts upon the physical environment, and the distribution of income across economic classes and household types. This is because a Social Accounting Matrix adds to the standard "economic" accounts of an input-output table (Leontief) a whole set of "social" accounts. This allows for more complete analysis and often reverses the relative priorities that should be accorded to given sectors in future planning.

This project seeks to integrate all these themes within a single model for each of four meso-economic provincial economies spanning the gamut of needs, policies, and positions along economic corridors from landlocked areas to the sea within the Greater Mekong Subregion. Two models for Thailand will seek to compare agroclimate and market infrastructure within a single cultural and political unit. The model for Vietnam will be used to explore in depth the variants of market transition from central planning. The Burma model will reflect severe underdevelopment in a market-based economy.

The project chooses the meso-economic level of analysis because micro-level households or firms are too varied and have objectives that are too limited to inform public economics. Also,

the significant ethnic and agro-climatic variability of the GMS would make macroeconomic models of the national economy, whether of the structural econometric or computable general equilibrium sort, too general to capture local needs and possibilities, including the one-village-one-product avenue.

In addition to the many theories cited above, the new theme of regional integration provides the cornerstone of the project. Kim (2005) examines the optimal path of regional integration in the East Asian region from the perspective of Korea, as a country with an intermediate level of technology in the Asian region. Based on the welfare analysis of three types of FTA regimes between technologically asymmetric countries, this paper demonstrates that the optimal path of regional integration for the country with an intermediate technology level would be to form multiple bilateral Free Trade Agreements (FTAs), i.e., Hub and Spoke type FTA between technically asymmetric countries from the very initial stage. The second best regime is the multilateral Asia wide FTA. The worst case for a country with an intermediate technology would be to form an FTA with a country with advanced technologies, and extend the FTA with the less developed countries in the later stage. These results imply that the optimal strategy of regional integration for a country with an intermediate technology level, such as Korea, is to form a Hub and Spoke type FTA rather than a bilateral FTA with Japan followed by the participation of other Asian countries. The pre-requirement for the multiple bilateral FTAs is the fundamental industrial restructuring of the Korean industries, such as reallocating the human and economic resources from the sectors of comparative disadvantage to the sectors with comparative advantage. The successful FTAs assumes the nation-wide efforts involving the massive restructuring cost including the establishment of a social-safety net during the transition period. Moreover, an Asian type of fiscal federalism is required for a genuine economic integration in the region.

Within this framework, Plummer (2003) focuses on directional and structural change in developing Asian trade patterns, with a focus on economic interaction with the United States (and using the EU as a benchmark). Several important results from his analysis are that: (1) while private-sector-led regional integration in Asia has increased for most developing Asian countries (in some cases, impressively), the United States remains the region's single most important export market; (2) the trade structure of developing Asian countries has changed significantly over the past decade, a result that resonates with the literature on structural transformation in developing Asia; (3) the economic dynamism of developing Asian exports is consistent with the changes in trade with the United States (and the EU); and (4) science and technology have become the most important sector for most developing Asian exports (and imports), and the US market has been a key protagonist in this process. In addition, the paper considers emerging policy challenges in developing the US-Asian economic relationship at various levels, using the Vietnam-US Bilateral Trade Agreement (BTA) as an *ex post* case study and considering a number of ex ante initiatives that are currently being developed.

Figure 1.2 and 1.3 present preliminary conceptual diagrams for our paper. In the top half of the diagram we see the downward pathways of impact of the East-West highway on the *supply side* in

terms of generating changes in production, income and employment. In the bottom half, we see the upward impacts of the EWEC on the *demand side* of prices and consumption expenditure shares ("Engel shares"). The arrows show the theoretical directions of impact that we can test with econometric hypotheses.

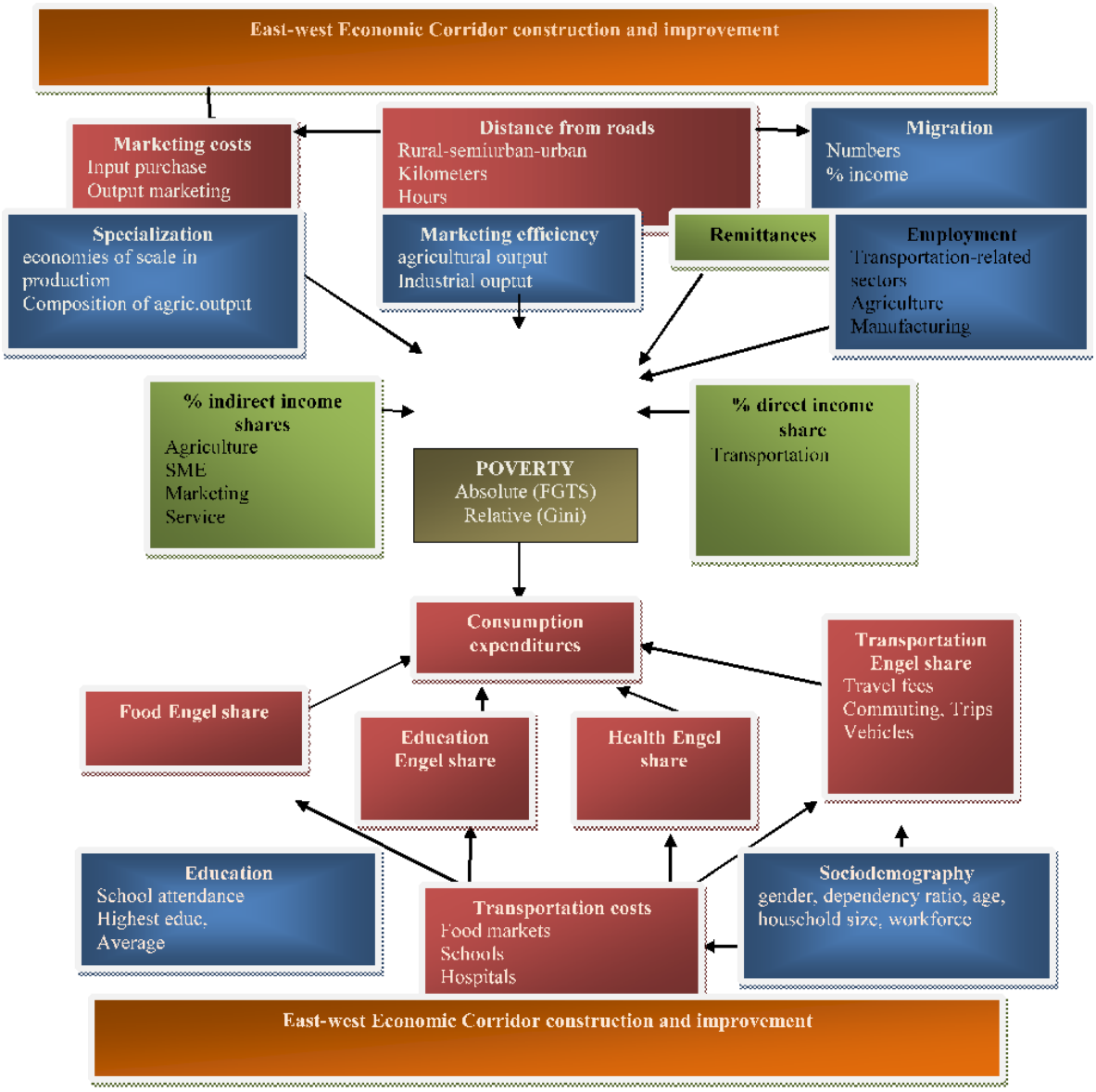


Figure 1.2: Conceptual pathways of impact of the EWEC on income, employment poverty, and consumption

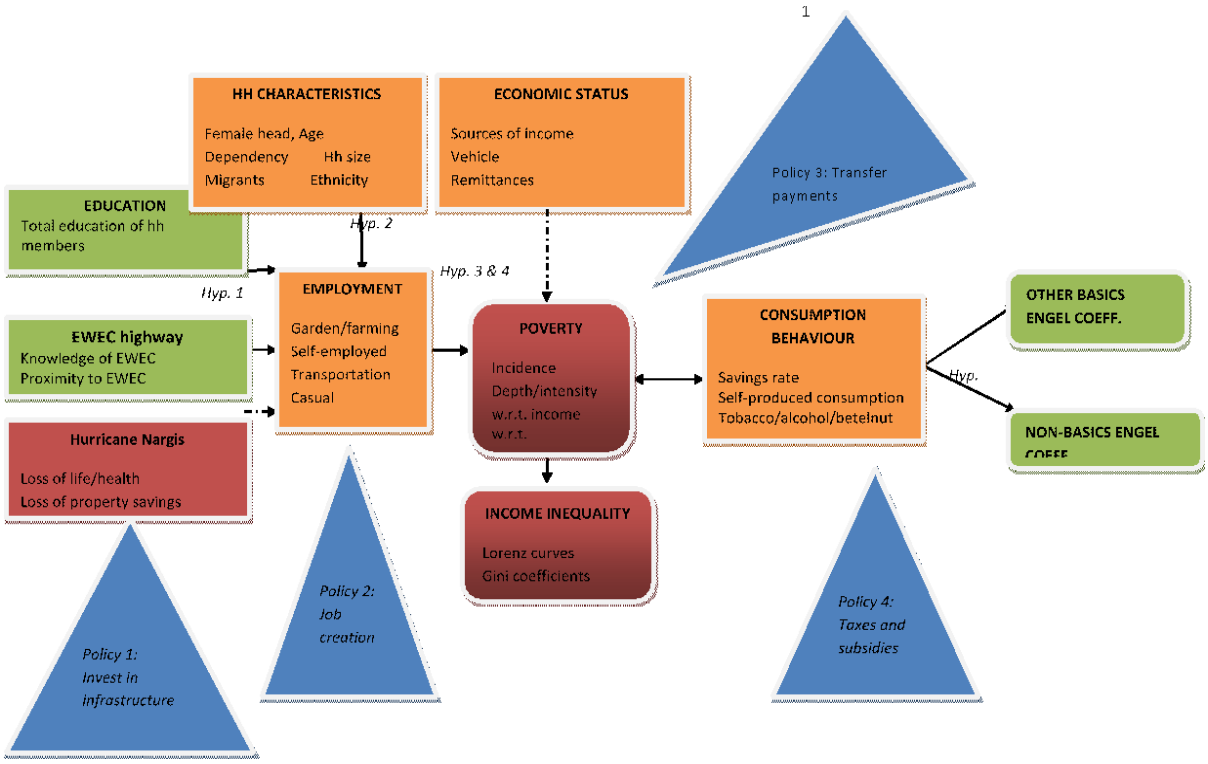


Figure 1.3 Conceptual diagram of the level, causes, effects and policies to alleviate poverty

Why does consumption figure so prominently in the above frameworks? It is because, for developing countries, consumption quantities and expenditure values are important factors to be considered for the measurement and evaluation of welfare because they vary much less and are less subject to over- or under-reporting in household surveys than direct measures of income. Furthermore, household expenditure data directly reflects consumers' purchasing power and lifestyles. Indeed, the "*correlation between consumer demographics and expenditure on recreation, hobbies and travelling reveals are the driving factors of spending*" (MGP Information Systems Ltd., 2012).Thus, it is common for consumption to be used as a proxy for overall expenditure and in turn as a superior measure of well-being than income (Committee for Planning and Cooperation, National Statistical Centre, 2011).

Taken together, the above facts summarize the dynamics of poverty creation, the resulting socioeconomic effects, and four entry points for policies that could potentially be used by government to alleviate the syndrome of poverty and inequality. The ovals show the five hypotheses that will be evaluated in the remainder of this article to test the validity of this diagram for Mawlamyine, Myanmar.

Put simply, poverty and inequality are hypothesized to be alleviated by educational and infrastructure development but reduced by natural disasters. Even absent such factors, poverty and inequality may be determined by household characteristics, economic status and employment

opportunities. Poverty should in turn induce changes in the savings rates and consumption patterns of households. Consumption patterns may be divided into food, other non-food necessities, and non-necessities or "luxuries," although the latter term in economics seems out of place for the vast majority of the Myanmar population.

Government may intervene in four ways to offset the poverty syndrome. First, it may invest in enhanced infrastructure to create the employment potential and growth impetus that forestall poverty creation in the first place. Second, job creation for the unemployed poor in strategic sectors enjoying comparative advantage can result in greater growth with equity. Third, government can make transfer payments to poor households to help them survive in the short term. Fourth, taxes and subsidies can be used to cheapen the goods on which the poor rely, and tax the commodities consumed by the rich.

6. Testable research hypotheses

In the same way that the goals differed by province, so did the testable research hypotheses. A sample of these is given below for each of the four study provinces:

Da Nang, Vietnam

1. From the national viewpoint, the road has conferred a clear advantage on Da Nang province when compared with other provinces, regions and cities within Vietnam.
2. The EWEC has led to improvements over the period 2006 through 2008 in income, output value, sources of income and expenditure patterns among rural, semi-urban and urban households
3. Within Da Nang province, proximity to the road makes people better off through job creation, specialization and reduced inequality.
4. The differences among rural, semi-urban, urban areas have become less significant over time.
5. The distribution of income (Gini) for the whole sample has grown more equal over time as economic opportunities have opened to all classes of workers
6. By subsample, however, incomes in the rural areas have grown more unequal (i.e. higher Gini).
7. The incidence, depth and intensity of poverty are highest in rural areas farthest from the road.
8. The incidence, depth, and intensity of poverty have gone down for the whole sample and each of the three subsamples over time.
9. The greatest reduction in the incidence, depth and intensity of poverty has been in the urban areas, followed by the semi-urban and rural areas.

10. Those who are closer to the road have obtained transportation employment or have jobs related to the road are better off.

In contrast, for Savannakhet, Laos, we tested the following hypotheses:

1. Household income is significantly improved by proximity to the EWEC or by involvement in the transportation-related sectors, especially in rural areas.

2. Distance from the EWEC and lack of involvement in transportation-related activities are the most statistically significant causes of the incidence, depth, and severity of poverty in the households of Savannakhet.

3. The distance from the household to the EWEC is a more significant determinant of income per capita and employment than education, health, credit, or socioeconomic category in Savannakhet province.

4. Distance from the EWEC and income per capita are the most statistically significant causes of the household's education, health, other consumption and production expenditures.

5. The agricultural sector still accounts for at least 60% of the total value added of the Savannakhet provincial economy.

6a. The value-added and employment multipliers from road construction and road-related activities (including tourism) are higher than for any other sector of the economy in Savannakhet.

6b. The export multipliers from road construction and road-related activities are higher than for any other sector of the economy in Savannakhet provinces

7a. A reallocation of investment patterns along optimal lines will result in at least a 30% increase in total value added for the Savannakhet economy.

7b. The optimal restructuring of the Savannakhet economy under resource and socioeconomic constraints is significantly different from that suggested by unconstrained multiplier analysis.

Meanwhile for Hat Yai, southern Thailand, we tested the following hypotheses:

1. Household level income is significantly different with location type of urban, semi-urban and non-municipal area.
2. The per capita household income is significantly increased by proximity to Asian Highway
3. Poverty is significantly higher in non-municipal area and also positively associated with the distance from the road head.
4. The price of natural rubber latex[5] in Hat Yai is allied with the persistent risk

[5] Here, latex refers to the natural rubber extract of type Ribbed Smoked Sheet

5. Volatility in Thai rubber prices has been more pronounced since the 2008 Hamburger crisis.
6. The conditional GARCH model provides a better fit to the data than ARIMA and other models, and can serve as a practical predictive tool to help predict and stabilize incomes in the Thai rubber industry
7. The volume of international tourist arrivals by land transport is associated with persistent volatility.
8. The conditional GARCH model captures the risk associated with international tourist arrivals by land transport than ARIMA and other models, and can serve as a practical predictive tool to help predict and stabilize incomes in the provincial tourism business in Songkhla.

Finally, for Mawlamyine, Myanmar, we sought to test the following

1. Proximity to the main road or part of the EWEC directly and significantly reduces the proportion of food consumption and transportation expenditure within overall household expenditure per capita.
2. Better transportation and proximity to highways significantly increases the knowledge people can use to focus on their income and health care.
3. There has been significant growth in equality of income in the Mawlamyine area.
4. Overall income per capita and the number of jobs in the Mawlamyine area could increase by at least 25%[6] if the above constraints were removed.
5. The income, employment, and consumption multipliers of the road infrastructure and transportation-related economic sectors are significantly higher than for other sectors.

[6]Since this part of the analysis will use the Social Accounting Matrix rather than econometrics, we cannot strictly speak of a statistical test of this hypothesis. Instead, we have set a reasonably large increase (25%) as a measuring stick to represent a significant improvement in various dimensions of the economy.

CHAPTER II:

EWEC INITIATIVE AND BACKGROUND THE STUDY SITES

1. Initiative of the EWEC

The East-West Economic Corridor system, connecting Vietnam to Myanmar and veering south through Hat Yai to Malaysia, is one of the most ambitious and carefully planned highway projects ever to be undertaken in Asia. As envisaged by the Asian Development Bank and the member nations of Southeast Asia, its impacts were to be strong economic growth, increased income per capita, inclusion of the poor in more egalitarian income distribution, the reduction of poverty, inclusive creation of jobs at all skill levels, the attraction of tourists, the facilitation of expanded trade, the specialization of production along lines of revealed comparative advantage, and the bridging of peoples and nations in general.

The concept of an East-West Economic Corridor was introduced in October, 1998 in Manila at the Eighth Ministerial Conference of the Greater Mekong River Sub-region realizing the need of the regional development considering regional competitive and comparative advantages of economic development and economic cooperation. Since the past, there have been official or unofficial economic transactions prevailing between the neighboring countries. The eight ministerial conferences agreed to develop and promote free Trade Area (FTA), Tax Alliance and Common Market (EU) in the Mekong sub regions, and enhance the economic globalization maintaining national investment for international markets as well as attracting foreign direct investment in the participating countries. The East–West Corridor (EWC) Project is part of the wider East–West Economic Corridor linking Da-Nang in Viet Nam and Mawlamyaing in Myanmar—covering Lao People's Democratic Republic (Laos PDR), Myanmar, Thailand, and Vietnam. As a flagship project of the Greater Mekong Sub-region (GMS) Program, it was designed to improve National Road 9 linking landlocked areas in northeast Thailand to the Vietnam coast via Laos PDR. It is the second cross-border road project in the Program and is in line with ADB's thrust for regional cooperation in the transport sector (ADB, 2008).

The economic corridor has three distinctive features. Firstly, it is considered a defined geographical region. Secondly, the corridor mainly focuses on bilateral initiatives, not multilateral

ones. Thirdly, the economic corridor requires detailed physical and space planning for infrastructure development for the most effective results. The nearly 1,450 km long East-West Economic Corridor passes through four countries, and the East-West Economic Corridor also connects with the main north-south roads, including Yangon – Dawei and Chiang Mai – Bangkok of Thailand, Road 13 of Laos, and the National Highway No.1A of Vietnam.

Moreover, the summary findings of "evaluation study on the east-west project report" of ADB (2008) mentioned that the project is "*'highly relevant' to development needs at the regional and national levels. As a regional road, it addressed a strategic need to strengthen links between Laos PDR, Thailand, and Viet Nam. The all-weather road aimed to expand the market for transit and bilateral trade. It also interconnects national transport networks to generate trade and efficiency benefits. It was appropriately designed to support economic centers and to complement poverty reduction (via a rural road component in Laos PDR)"* (ADB, 2008. p iii) and ranked as a successful project. Moreover, the report added that there is little evidence of EWC's transformation from a transport corridor into an economic corridor, and the full realization of corridor-level benefits (i.e., economic activities, tourism, and trade facilitation) is limited by institutional constraints. In the case of Laos PDR, this is partly explained by inadequate complementary investments and slow private sector growth.

The lessons gleaned from the project mentioned by ADB Evaluation Study on the East-West Corridor Project Completed are: (i) The pace of the economic development along the corridors depends on the complementary interventions requiring policy and institutional changes that enable better opportunities for the private sector. (ii) Multimodal planning is important for enhancing the effectiveness of transport corridors, and (iii) ADB should use loan savings prudently by exercising due diligence at the approval and completion stages of the project. Most of the road infrastructural development projects further alleged that these projects foster the economic development process by a) enhancing marketing linkages among the parties at local and regional levels to b) easing the mobility of products and factors based on market forces and c) generating employment opportunities through d) increased market accessibility for the rural people.

AbuzarAsra et al. (2006) introduced an approach to analyze the impact of the east-west corridor along Savannakhet route no. 9 to its neighboring countries using the accounting framework of the traditional single area I-O model. The finding of the study shows the significance of the economic measurement tackles broad issues on export-import expansion, interdependence of industrial structure from Rest of Savannakhet (intra and interregional analysis), evaluating impacts or changes in final demand (production, income, and employment), and short term projections and forecast of the domestic economy (AbuzarAsra, 2006).

BounpongKeorodom et al. (2007) showed the thought of business persons that are positive toward their business investments after the completion of The Second Mekong Bridge; 20 % would be

an increase of imported goods in construction materials and machinery equipment, and 15 % would be increase in export of domestic products. Additionally, 17 % of the respondents saw the development of EWEC as cost and time saving in transportation, and 20% would be strong competition among domestic firms as well as from foreign investment.

Benson Sim at el. (2007) constructed a modified interregional input–output (IRIO) table to link the economies of the province of Mukdahan in Thailand and the Lao PDR of Savannakhet using the Chenery-Moses model. The results showed that the value of trade of these provinces with the rest of the world was much higher than the trade between them. Industries in the services sector were found to have generally higher value-added multipliers than industries in the manufacturing sector. The agriculture and forestry industry in Savannakhet and the manufacturing industries in both provinces had high backward and forward linkages. Exports to the rest of the world and consumption were found to have the highest employment multipliers in Mukdahan and Savannakhet, respectively. Mukdahan was also found to have higher net foreign exchange earnings, implying that the Thai province may be able to add greater value to its exports than the Lao PDR province (Benson Sim, 2007).

2. Background of the EWEC in Da Nang

Da Nang city has the privileged position of lying both on the sea, with a deep-water seaport, and at one of the two ends of the East-West Economic Corridor (EWEC). The project, initiated by the Asian Development Bank in the 1990s in partnership with the nations of Myanmar, Thailand, Laos, and Vietnam, was designed to provide the infrastructure for linking and boosting the economies of these countries. Without roads, it was reasoned, the movement of goods, people, and information is hamstrung, and the positive benefits from trade and globalization are erased by prohibitive transportation costs.

Compared with the three other countries linked by the EWEC, Vietnam has fared well overall. Myanmar's repressive political regime has led to rebel uprisings between Mawlamyine and the Thai border at Mae Sot, such that only 18 of 100 kilometers of the road have actually been constructed. Laos, as a completely landlocked country, is facing problems of investing in attractions that will lure FDI and traveler expenditures within the country instead of transiting the country without investing or paying for anything. Thailand has done well largely because the main road helps to link the country with itself and with a second road network leading south from Kunming, China to Malaysia.

Vietnam shares some of those advantages as roads have also been improved, after decades of delay, linking North with South, and most critically, west with east. The EWEC falls into the latter category as it enters Vietnam from Laos, passes through Quang Tri and ThuaThien Hue provinces, enters Da Nang province and ends at Da Nang city. As such the road provides an enormous potential

for improving the well-being of Vietnamese throughout the country, but most particularly those living in all three provinces. The means of improving well-being are of course enhanced employment opportunities in transportation-related sectors, lower transportation costs for firms and exporters, improved upstream - downstream linkages for farmers, and reduced costs of consumption items for consumers as a whole.

It is clear that Da Nang, ThuaThien-Hue and Quang Tri, within the North Central and Central Coastal region, have increased at average or less than average rates. They are only the 6th, 3rd, and 11th largest out of 14 provinces in the zone, respectively, and have achieved a change rank of only 7 (Da Nang), 9, or 12 (ThuaThien-Hue and Quang Tri). The secondary data points to no clear impacts of the EWEC in terms of education, trade, job creation, or population growth when Da Nang is compared to other cities and provinces. But what of when primary data from the Vietnam Household Living Standards Survey (VHLSS) from 2006 and 2008 are used to analyze in depth the impacts on differing areas (rural, semi-urban and urban) on income, income distribution, and consumption within the Da Nanag sample? Here, we may find significant trends, as well as more detailed explanatory variables, that can shed further light on the impacts of the EWEC to date.

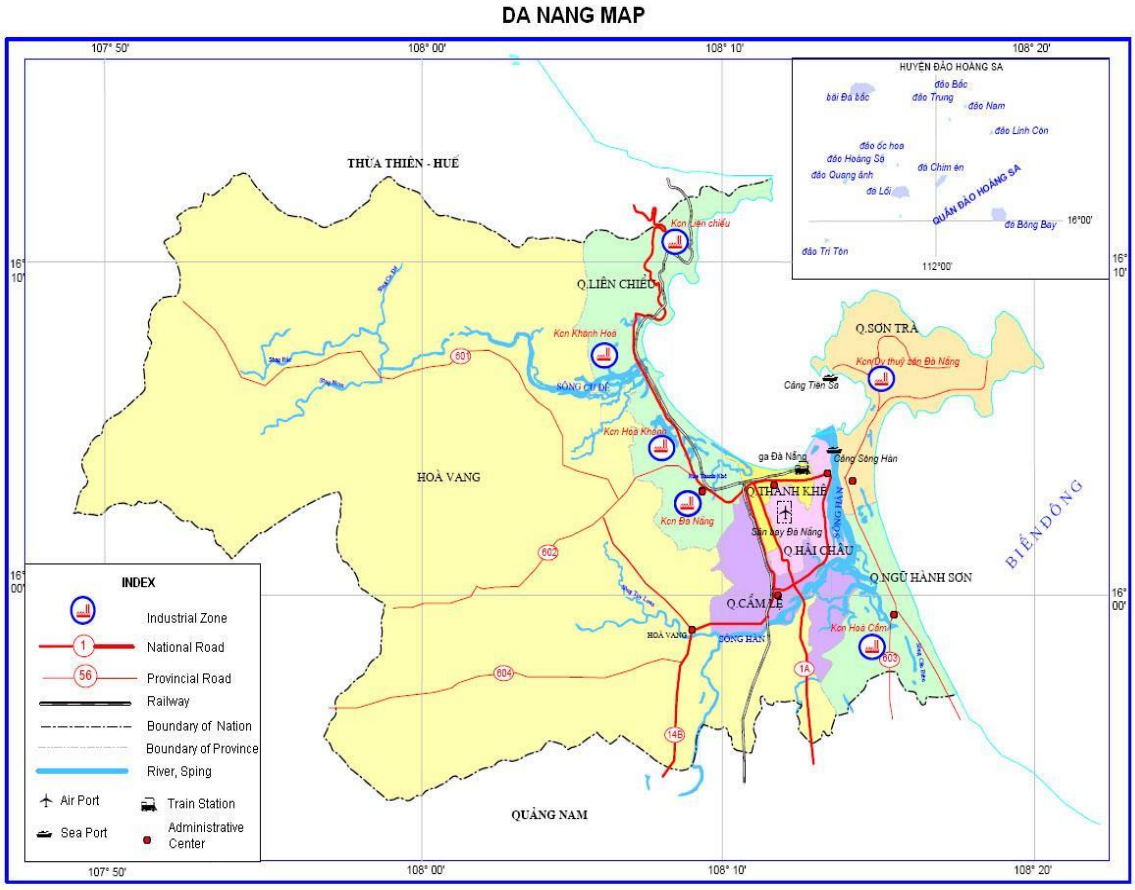


Figure 2.1: East-West Economic Corridor in Da Nang

3. Background of the EWEC in Savannakhet

Savannakhet Province in the centre of Laos lies at the junction of the East West Economic Corridor (Road no. 9) and the North-South Axis (Road no. 13). The Savannakhet population of 843 thousand represents one-tenth of the national population (2011) on 21,774 sq km. representing as one-ninth of national areas. This gives Savannakhet a population density of some 38.58. persq km which is much lower than that of neighboring points along the EWEC: Mukdahan, Thailand and Da Nang, Vietnam with 76.05 and 628.33, respectively. Almost all land in Savannakhet is underdeveloped. Given the low population density, most land is devoted to agriculture and forests; and households along the Laos section of the EWEC remain poor because jobs, resources, public infrastructure, clean water, and other facilities remain largely lacking. Hence, households feel little motivation to live or move to Savannakhet. *"Thus, this province has a big potential for development of agro-industries, transportation, and international trade"* (Warr, Menon, & Yusuf, 2009). Nonetheless, the present Gross Provincial Product per capita (GPPC) of Savannakhet is USD 525, roughly 85% of Laos PDR's national average and still lower than the corresponding figures for Mukdahan, Thailand and Hue, Vietnam.

The Mukdahan–Savannakhet border is an important gateway for trade between Lao PDR and the neighborhood countries of Thailand, Vietnam, southern China, and eventually Myanmar. Most trading companies and industry factories are located in downtown Savannakhet in order to facilitate trading activities between Lao PDR and Vietnam. This would make the use of roads for long-distance freight transport between Thailand and Vietnam more beneficial. The cross-border road network across the 2nd Lao-Thai friendship bridge allows landlocked Savannakhet, and by extension the rest of Lao PDR, to access the LaemChabang port in Thailand. LaemChabang is one of Asia's leading ports to North American and European shipping networks (Jiwattanakulpaisarn, Ruangsawasdi, &Gaywee, 2010).

In terms of present levels of investment, there are no facilities such as gas stations, restaurants, hotels, tourist information centers, or gift shops along the EWEC because most areas it passes through are forests and agriculture lands. The houses and lifestyle of most residents along the road remain poor and public infrastructure and conveniences are still largely lacking. Most of the roads are inconvenient for communication, rough and damaged due to the failure to increase investment and maintenance (http://guru.google.co.th/guru/thread?tid=31e75 474510e4b21).

This said, what investment there is along the EWEC in Laos is totally concentrated in the area of Savannakhet. So the district of Savannakhet has the potential to play a key role in investment. Moreover, a substantial number of enterprises are new generation businesses such as patrol stations and rental accommodations. If it fully lives up to its potential, the EWEC program will facilitate the transport of goods, migration of people, and stimulate economic growth, trade activities, and FDI in Savannakhet province. However, Laos still get less benefit from this program comparable with

neighboring countries because the large lack of a strong industrial base, and few products are suitable for export (Keorodom, Butphomvihane, &Vanhnalat, 2007).

The opening for use of the EWEC inaugurated the first Special Economic Zone of the country at Savannakhet. It sought to attract foreign investment because of its potential for drawing foreign currencies into the country. Investment in Laos along the EWEC and the routes connected to the remainder of the country aims to support economic exchanges along the East–West Economic Corridor. The EWEC is also connected to road No.13, the main internal route for making domestic transportation more convenient and distributing commodities to other sub-districts in the country. The EWEC also supports Laos PDR's commercial extension through Vietnam.

Savannakhet Province's economy has grown during 2005-2010 at a rate of 10.5% a year, significantly higher that of the whole country. GDP per capita has been increasing from USD 525 in fiscal years 2005-2006 to USD 897 in fiscal years 2009-2010, slightly surpassing the national level at USD 880 per person in 2009. Agriculture is the main economic sector in Savannakhet Province. In the years 2009-2010, this sector grew to 49.04% of GPP, followed by the service and industrial sectors, which reached 26.42% and 24.54%, respectively, of the total production value of the province. As a sign of the transition to a non-agricultural economy, the value of agriculture had declined gradually from 55.54% in 2005-2006 to 49.04% in 2009-2010, with corresponding increases in industry and the service sector.

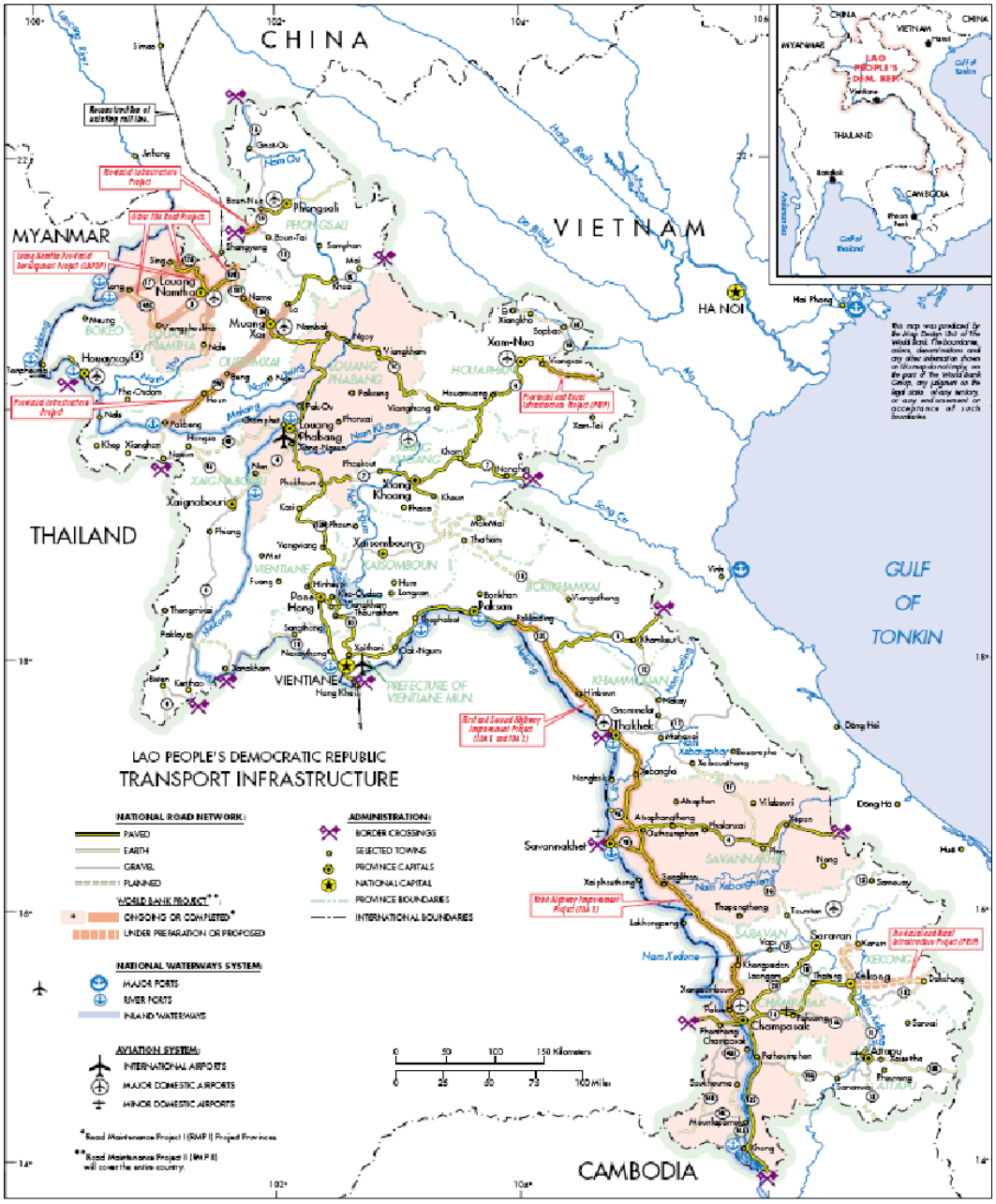


Figure 2.2: Map of Savannakhet

4. Background of the EWEC in Hat Yai

Songkhla province is one of the Thailand's most important seaports, located at the coastal belt of the Gulf of Thailand bordering with the Kedah State in Northern Malaysia (Gov/Thai PRD, 2004). Natural Rubber plantations, ocean captures, and fisheries have been operating for years, including tourism businesses. The province has become one of the leading natural rubber growing provinces in the south, and land use patterns clearly show that more than 61% of total land coverage of the province

is covered by Para rubber plantations, followed by Forest resources (14.5%). Altogether, approximately 77 % of land cover is occupied by agriculture and fisheries[1]. Songkhla province is one of the leading natural rubber (NR) growing provinces in the south. Land use patterns show that almost more than 61% of total land cover of the province is covered by Para rubber plantations[2]. These and other natural resource based occupations are the basis of income generation to local dwellers, but they are also a source of income inequality between the poor workers and the rich local and absentee land-owners of the region.

Additionally, the Hat Yai segment of Asian Highway No 4 (AH2) is a strategic road infrastructure investment for the economic development of the Songkhla as well as Thailand as a whole, and it links the North South Economic Corridor of the greater Mekong sub-region (GMS) with the Indonesia-Malaysia-Thailand growth triangle (IMT-GT) sub-region up to the Malaysian border. This may enhance product transport through reductions in transport cost and promote tourism, labor mobility, commercialization of competitive sectors, and economic globalization (ADB, 2007).

In this regard, the Asian Highway and/or its sub-branches directly or indirectly bind together the various agricultural production patches and agro-based industries of Songkhla including southern peninsular Siam, providing ample opportunities for national and international markets through land shipment. It is expected that the positive role in the economic activities of rural Songkhla has been played by the Asian Highway, and its sub-branches towards the economic prosperity thereby contributed to poverty reduction. Hence, we believed that economic and social objectives can only be attained when the rural dwellers of the province begin to attain educational levels, incomes, meaningful employment, and living standards that are comparable to those of the other Provinces. A special emphasis of this paper will therefore explore the poverty status and the possibilities for bottom-up economic planning to improve the wellbeing of the low income group of the people.

The economy of Hat Yai is influenced by tourism and businesses including plantation crops and fisheries. The province has a tropical climate, which is hot and humid, like other parts of Thailand. The economy of the province suffered a considerable negative shock in 1999 (-3.79%), 2009 (-5.63%), and 2012 (-2.85). This might be due to results of transmissions of the Asian Crisis at the provincial level in 1999, world economic downturn in 2008, and national political crises. The overall growth of GPP in the period 1995-2012 was 5.56 %. Songkhla province has played a greater role for socioeconomic development of southern Thailand. As an international marketing hub for natural rubber and other agricultural products, the province seems to be one of the driving forces or agents for socio-economic development of the peninsular Siam.

[1]The land covers is calculated from the GIS shape file. For details see chapter 5

[2]The land covers is calculated from the GIS shape file of Songkhla province and data received from the Faculty of Environmental Management, Prince of Songkhla University, Hat Yai.

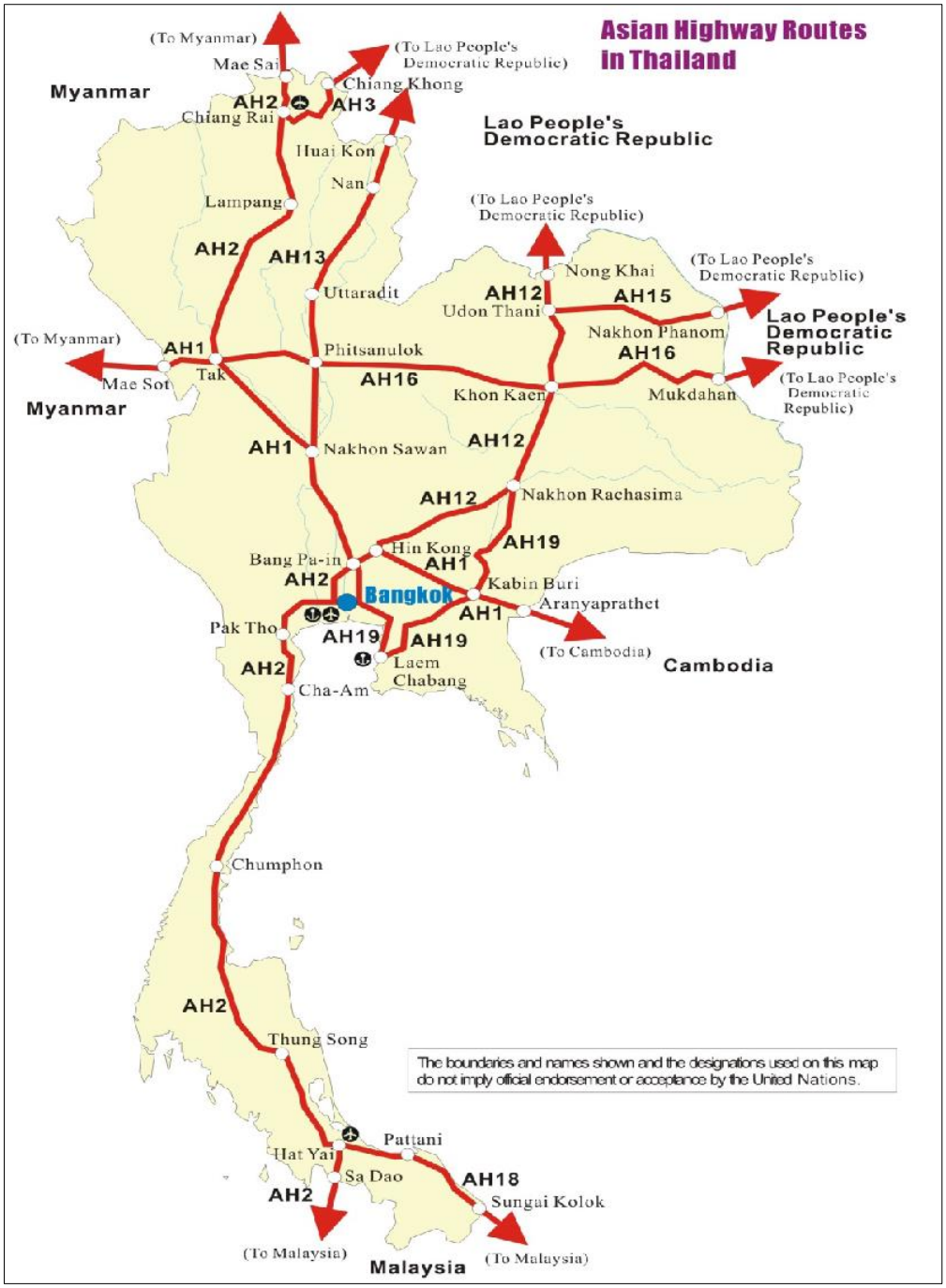


Figure 2.3: Map of Hat Yai

5. Background of the EWEC in Mawlamyine

Mawlamyine is one of the two endpoints of the EWEC corridor (the other is Da Nang, Vietnam), which should act as a huge economic and trade advantage. However, civil unrest and administrative problems have meant that in ten years only 18 of 200 kilometers of the road inside

Myanmar have actually been completed. Mon state is a state of mountain range and flat land. Bordering Bago Division in the south of Sittaung River Mouth, Kayin State in the east, Thailand and Taninthayi Division in the south and Andaman Sea and Gulf of Mottama in the West, Mon state is situated between latitudes 14°52' north and 17°32 ' north and east longitudes 96° 51 ' east and 98° 13 ' east.

Mawlamyine Township is the administrative and commercial capital of Mon state and the third largest city in Myanmar after Yangon and Mandalay. It is constituted very properly and the buildings constructed in line are found everywhere. Its land area is 54080 acres (84.48 sq miles) with a population of more than 460000 in 2008. The widest area from the East to the West is 7 miles and the widest area from the South to the North is 17 miles.

Mawlamyine is surrounded by Kyaikmayaw township in the east, Chaungsone township in the west, Mudon and Ye townships in the south and Hpa-an in the north (See figure 2.3). It is made up of 22 wards, 19 village tracts, and 48 villages. Its land area is 54,080 acres (84.48 Sq. miles) with a population of more than 460,000 in 2008. This yields a population density of 2,162/Sq. Km in Mawlamyine Township which is comparable to that in Da Nang City, Vietnam (638 /Sq. Km) while Mawlamyine district has 279/Sq. Km which is more than Savannakhet Province, Laos (46/Sq. Km)[3] but less than that in other Asian cities such as Bangkok, Thailand (3,628/sq. Km)[4]and Ho Chi Minh City, Vietnam (3,155/Sq. Km)[5]. The widest area from the East to the West is 7 miles and the widest area from the South to the North is 17 miles.

❖ **Transportation Sector in Mon State**

Myanmar has been taking the following measures undertaken with a view to facilitate economic and social development:

- extending roads and bridges to ensure smooth and secure transportation
- extending the construction of hospitals and schools
- extending the construction of railroad tracks, airstrips, international level airports, and port development works
- extending the construction of irrigation and embankments
- establishing industrials zones for industrial development

To ensure balanced development among regions, one of the major emphases has been placed on construction, renovation, and maintenance of roads and bridges in States and Divisions. Table 2.14

[3]http://www.nsc.gov.la/Products/Populationcensus2005/figure%20chapter2/2.Dencity.JPG and http://laosftz-savanpark.com/?page_id=66
[4]http://en.wikipedia.org/wiki/List_of_provinces_of_Thailand_by_populatio
[5]http://www.gso.gov.vn/default_en.aspx?tabid=467&idmid=3&ItemID=8653

exhibits road infrastructure extension in Mon State, comprising bituminous roads, metaled roads, surface roads, and earth roads.

❖ **Feature of the EWEC in Mawlamyine**

The EWEC firstly starts at Da Nang Port from Vietnam and ends at Mawlamyine Port of Myanmar. So Myawaddy-Mawlamyine road (almost 200 km) plays a vital role in the Myanmar side of the EWEC. Myawaddy-Mawlamyine road is on the way back to Phann and departs at Eindu, 24 km from Phan. Myawaddy and Mae Sot are connected by a friendship bridge.

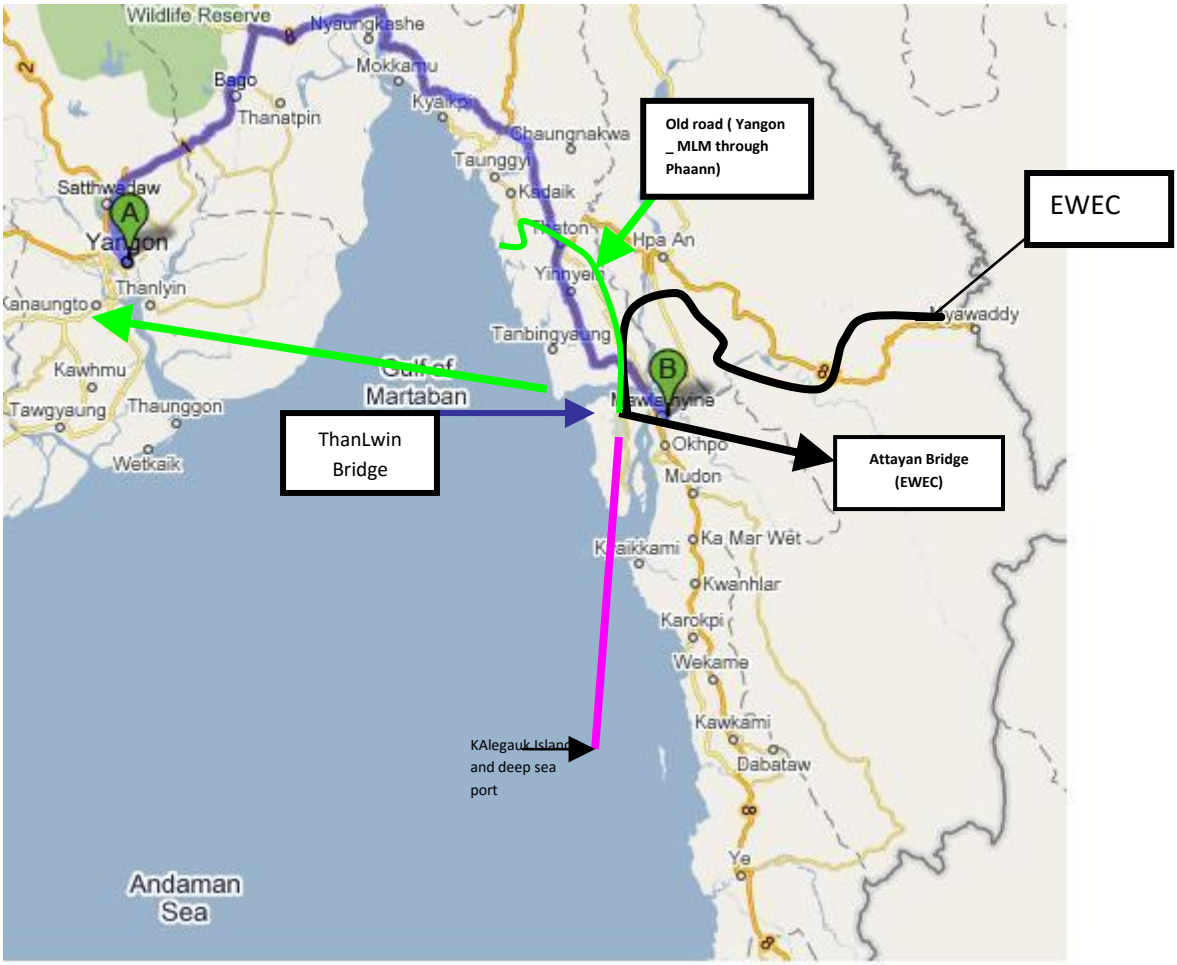


Figure 2.4: Map of Mawlamyine with EWEC

Eindu-MLM road is divided into 2 parts: Eindu-Zarthabyin and Zarthabyin-MLM route. Eindu-Zarthabyin is a 14 feet two-lane tar road up to Zarthabyinbridge, a 2900 feet Bailey Girder Bridge crossing the Gwaing River. The bridge allowance is 36 ton weight. Zarthabyin-MLM road is a

22 feet 2-lane new bituminous road which passes the MLM Industrial Zone and Attanyan Steel Girder Suspension Bridge near MLM.

Total number of bridges (above 180 feet) constructed by the Public Works increased to seven in 2008 from three in 1988. They are Attayan Bridge (Mawlamyine), Thanlwin Bridge (Mawlamyine), and Sittaung Bridge (Mupalin) in Mon State. Thanlwin Bridge (Mawlamyine) is the longest bridge in Myanmar and connects the city of Mawlamyine with Mottama. Constructed at the confluence of the Thanlwin River, the Gwaing River and the Attayan River in Mon State, the bridge has a two-mile-long motor road and four-mile-long railroad as well as pedestrian lanes. The approach structure of the rail bridge on Mawlamyine bank is 1.22 miles (1,960 m) long, and on Mottama bank is 1.42 miles (2,290 m) long. The total length of the rail bridge is 4.75 miles (7,640 m) long. The bridge was designed and built by the Ministry of Construction. Attayan Bridge (Mawlamyine) seemed to be an important one before Thanlwin Bridge (Mawlamyine) as it is the route of EWEC. It can connect from Mawlamyine to Myawaddy (Border city) and to Phann which currently is likely to be more useful than Mawlamyine as Phann is situated in the way of the Asian Highway project. Its upper structure is of a steel frame type and the bridge can withstand 60-ton loads of all vehicles. Sittaung Bridge (Moppalin) was built four miles downstream of the existing Sittaung Bridge (Theinzayat) . The bridge is connected with two approach roads - a 224.1 feet long approach road constructed on Kyaikto bank and a 783.6 feet long road on Waw bank. The bridge is a 2,392.7 feet long, 28 feet wide motorway flanked by six feet wide pedestrian ways.

- **Kalagauk Deep Sea Port In Mawlamyine**

The key work for the EWEC is the ports at each end of the corridor. To the East there is the Da Nang Port which consists of two areas, Tien Sa Seaport and Han River Port, and is fully operational throughout a capacity of 4 million MT a year. Mawlamyine port is one of the coastal ports among the other eight coastal ports in Myanmar. The port authority of Myanmar has studied that Mawlamyine has been deemed inappropriate because the Maritime access for seagoing vessels to Mawlamyine Port is not deep enough for those vessels with more than 4.5 meters draft since it is 20 knots away from the mouth of Thanlwin River.

CHAPTER III:
DATA COLLECTION AND METHODS OF DATA ANALYSES

I. Data collection

Given the depth and scope of the interlocking methodologies to be presented in chapters III and IV of this report, only four (4) study sites could be studied in detail. Selection criteria therefore had to be very rigorous. All sites had to lie along the EWEC, be economically or strategically important in their own right, but also represent a certain point along the spectrum of pre-EWEC development or under development. These selection criteria have greatly enhanced the external validity of the present research, and allowed for clear comparisons of the impacts of the road under a wide range of conditions. The final selection of the four study areas, from east to west, is as follows:

1. Da Nang, Vietnam, **a well-developed port town** that was already connected on a major North-South highway corridor with the rest of the country.

2. Savannakhet, Laos, a country-wide but **landlocked city with untapped potential** for tourism and trade going both east to Vietnam and west to Thailand, and a fledgling but emerging business sector.

3. Hat Yai, in Songkhla province, southern Thailand, an already **specialized border town** with ideal conditions for rubber production and export, and the geographical position to serve as the gateway for tourist arrivals from and through Malaysia.

4. Mawlamyine, Myanmar, the fourth largest city, lying on the EWEC on a **direct line between the capital Yangon and a proposed seaport**. BUT, as this report will demonstrate, each of those favorable development conditions was reversed: the capital was moved inland, the seaport project was transferred to a different site, and ethnic warfare and rebellion prevented the EWEC from being completed.

Data for all sites was collected in the years 2010 and 2011 using standardized household and firm questionnaires and the integration of all available secondary and governmental data. Because of the unique characteristics of each site, specific research objectives and testable hypotheses differed accordingly.

The economic data and four SAMs spanning the GMS regions contain all of the dimensions important to the GMS project: transport, energy, telecommunications, trade, investment, SMEs, tourism, and the environment. Every effort is also being made to include the idea of Sufficiency Economy in the model. Although full-blown Sufficiency Economy analysis may lie beyond the scope of the current project, the SAMs are being expanded into Sufficiency Economy Matrices (SEMs) for the benefit of future research projects.

The bulk of the data used in this project derived from intensive field surveys of approximately 300 households and 75 business enterprises in each target province. They have been completed and augmented by secondary data generated for a wide variety of survey and econometric studies. The data have been standardized so that a) there will be 15 socio-demographic categories in each provincial model and b)the value of the

expenditures and the receipts of each of the sectors in the economy balance. Given the disparate sources of the data, this is the hardest part of validating a social accounting matrix. It will also take more time than the actual analysis of the results, which can proceed very quickly under a wide range of alternative scenarios.

In addition to the economic data going into the SAM, two other types of information will be essential. The first is technical data on the environmental impacts on the air, water, land resources, and disease incidence of each sector. These will be obtained through consultation with environmental engineers in each country. The second is focus groups with provincial leaders to generate the priorities that they assign to various development goals.

1. Data collection in Da Nang

We assembled data from the Vietnam Household Living Standards Survey for 2002, 2004, 2006, and 2008. Most of the analyses in this research focus on comparison of the last two years because the impacts of the road should be visible even over a 24-month period and because the percentage of paired observations in the unbalanced panel is the highest. There are 115 observations in the household sample each year but only about two-thirds are the same between any two years. EXCEL spreadsheets were then prepared and transferred into separate SPSS files for:

- the unbalanced set of all observations in both years.
- the balanced set for the subset of identical households
- the "differences" between the two years for the balanced households. (For this step, we had to inflate the 2006 monetary values to convert them upward to real 2008 prices using the consumer price index and the producer price index for 2006 and 2008.)

We ran all regressions and statistical tests for all three datasets in order to find the most robust results and to make comparisons between the cross-section/static situation of each individual year and the dynamic evolution between 2006 and 2008. Only the most meaningful and significant results were used for the hypothesis testing.

2. Data collection and sampling in Savannakhet

Primary data for this study was collected in 2011 from households in Savannakhet, Lao PDR. Due to the incomplete nature of the LECSIV database for consumption expenditure analysis, an open ended questionnaire was designed and converted into a closed-form questionnaire and used for household level interviews of 243 households. We focused only on KaysonePhomvihane district in Savannakhet, the urban district that surrounds the EWEC road as it cuts through the province. Outhoumphone district is also included because it includes the intersection of the EWEC with the north-sound road no.13. The target population is thus limited to households who live along EWEC in both districts. This target population is divided into sub-groups, as well as rural, semi-urban, and urban categories at varying distances in time and kilometers from the EWEC. Data was collected on household characteristics, household revenue and consumption expenditures, and household expenditure on production process.

Savannakhet town in Laos PDR is situated on the banks of the Mekong River opposite Mukdahan in Thailand. The province shares borders with the neighboring countries, Thailand and Vietnam and the town is considered as a very active junction for trade among the three countries. Savannakhet province consists of 11 ethnic minorities including Lowland Lao, Phoutai, Thai Dam, Katang, Mongkong, Vali, Lava, Soui, Kapo, Kaleung and Ta-Oi. Located in the central part of the country, Savannakhet has a total area of 21,774 square kilometers and a population of 850,000 (2010). The province is subdivided into 15 districts namely: KaysonePhomvihane (previously known as Chanthabouly), Outhoumphone, Atsaphangthong, Phine, Sepone, Nong, Thapangthong, Songkhone, Champhon, Xonbuly, Xaybuly, Vilabuly, Atsaphone, Xayphouthong and Phalanxay. The capital of the province is KaysonePhomvihane. Table 3.1 show the household sample size in Savannakhet municipality is 0.17% of the population from 142,332 households in two districts.

Table 3.1 Household sample size in Savannakhet

	Total households in Savannakhet municipality	Urban	Semi urban	Rural
Universe	142,332	18,146	91,632	32,554
Sample	243	140	76	27
Sample %	0.17%	0.77%	0.08%	0.08%
Multiplying factor for averages		0.13	0.64	0.23

3. Data collection and sampling in Hat Yai

- **Primary data**

The field survey was scheduled in between July 15th – end of November 2010. PhD candidate Mr. Hari Sharma Neupane with student ID code 511651801 participating from Nepal was assigned for this work. This field survey was part of his academic work. To facilitate the field survey and collection of the secondary information from various sources, the establishment of a field office at Hat Yai was provisioned and established accordingly. Mr. Neupane is a non-Thai speaker, and it is customary to hire assistants who speak both Thai and English language to facilitate and run interviews smoothly with local dwellers. Hence, necessary financial support and human resource management was also provisioned to complete the field work efficiently. Master's students Mr. TanunSuttikawee, Miss PreerayaJindamanee, JanjiraSritawee, and PassarapornChaemmanee were hired granting full authority to the field office as per the financial condition of the TRF.

The household sector, firm sector, and hotel and tourism sectors were included in the field survey to assure inclusion of each category of the economy in the sample. Participatory Rural Appraisal, Rapid Rural Appraisal, and interview with detailed questionnaire were the main approaches adopted in the field survey. Out of 125 Tambons in Songhkla province, six Tambons were selected for household survey. For firm survey, the list of the firms established in the Songkhla province was collected from the Industrial Office Songkhla. With the help of this list, firms were contacted for information and the names of firms kept confidentially. The name of the Tambon, sample size in each Tambon and other sectors, and status of the field survey is presented in Table 3.2 below.

Table 3.2 Number of sample allocated, Tambon and status of the field survey

S.N.	Name of the Tambon/Sector	No. Sample Allocated	Remarks
1	KoYo	30	Completed
2	Boryang	30	Completed
3	Phang La	40	Completed
4	Tha Kham	40	Completed
5	KhongHae	40	Completed
6	Khuanglang	40	Completed
7	Hat Yai	40	Completed
8	Hotel and Tourism	40	data of completed survey of 30 observations has been lost because of **heavy flood,** and other work is postponed
9	Firm Survey	45	Flood adversely affected the area of data collection. Recognizing the people's' sentiments after flood, the data collection work is postponed.

❖ **Secondary data: Sources, Nature and Limitation**

The secondary data was collected from the provincial and district level governmental and nongovernmental institutions, for instance, the Provincial Industrial Office, Provincial Trade office, Immigration office Songkhla, and their sub offices at the Malaysian border, Tourism Authority of Thailand, Songkhla, Sports, Tourism and Recreation office, Songkhla, National Rubber Research Centre, Hat Yai, Central Rubber Market Hat Yai, Hat Yai and Songkhla Municipality, Faculty of Environmental Management, Prince of Songkhla University, and data bank of Chiang Mai University. The World Wide Web page of these and other relevant institutions were also visited.

The daily tourist arrivals data set used in this study were gathered from the Songkhla Immigration Office. Other information about tourism was collected from the Songkhla Office of the Tourism authority of Thailand and the Songkhla Provincial Tourism Sports and Recreation Centre. Songkhla province has two immigration ports bordering with Malaysia, namely, Sadao and NarttayaPutchoo. Of these, Sadao is the main immigration port. Due to the unavailability of data on international tourists travelling by land to Songkhla province after arrival at Bangkok port, as well as the lack of disaggregated data between Thai and foreigners at the NarttayaPutchoo Immigration Office, only data from the Sadao Immigration port was considered.

Finally, the data used for the rubber price volatility analysis was gathered from various sources. The daily bid price of the NR products RSS3 and LAT for the year 2004-September to September 2010 (Thai calendar 2547-2553) was obtained from the webpage of Songkhla Provincial Agriculture Office (http://songkhla.doae.go.th/). Data on world rubber consumption and production was collected from the webpage of Thai Rubber Association (http://www.thainr.com/en) and from the web page of Indian NR (http://rubber.wordpress.com/).

4. Data collection and sampling in Mawlamyine

Mawlamyine Township was chosen not because it is typical or representative of Myanmar as a whole, but precisely because of its above-average geographical and logistical potential for poverty alleviation. If the causes and effects of poverty cannot be determined there, and no workable policies can be applied, then *a fortiori* it will be virtually impossible to accomplish these aims in even more disadvantaged areas of Myanmar.

The unprecedented primary data used in this study was collected in May-July 2009 from 375 households in Mawlamyine Township, Mon State, Myanmar. A stratified random sample was selected based on the known percentages of the population living in rural, semi-urban, and urban areas. Interviews running between 50 and 90 minutes per household were conducted to collect income and expenditure data in a closed questionnaire format for minutely detailed subcategories of employment category, food, clothing, transportation, housing, health, insurance, communication, and education.

II. Methods of data analysis

To be implementable, the assessments and recommendations flowing from a study like this one must be based upon strong statistical evidence. This report is the fruit of a generous four-year research grant from the Thailand Research Fund that explains and applies a balanced set of statistical and economic modeling tools to a) measure the level of economic and social progress, b) explain gaps in that progress, and c) generate optimal policy recommendations. The levels of progress were measured by net income per capita; levels of education and employment; Gini coefficients; the Foster-Greer-Thorbecke indices of the incidence, depth, and intensity of poverty; and the proportion of value added deriving from business and trade. Tests of means were employed to detect significant differences in each study province between rural, semi-urban, and urban subpopulations.

The gaps in progress were explained by multiple regression equations, including seemingly unrelated regression and volatility models. The dependent variables are income, the levels of consumption of groups of key necessities, the intensity of poverty, the number of tourist arrivals, and the fluctuations in the prices of key export commodities like rubber.

Optimal policy recommendations were generated through the use of Social Accounting Matrices. Not only were the goods and services with the greatest value added identified for each study site; the matrices were optimized under realistic constraints on the availability of land, labour, and capital to assure that the optimal plans so generated would be feasible.

1 Tests of means

For each of the three target areas in each of the four study provinces, statistical analysis on household data was conducted to identify and correct outliers. Then three levels of analysis were performed:

a) average values for three geographic (rural, semi-urban, urban) and five income-class household categories (wealthy, upper middle, middle, lower middle, poor) for a total of fifteen separate categories were calculated. They were placed appropriately as dummy variables in the following two steps.

b) test for significant differences in income per capita as a result of distance to the EWEC or employment in transportation related sectors.

2. Poverty analyses

The Foster Greer and Thorbecke (FGT) Index is a set of widely-used poverty indicators. There are three measurements of poverty, which are the incidence of poverty or Head-Count Index (HCI), the depth of poverty or the Poverty Gap – (PG^1), and the severity of poverty or the Squared of Poverty gap (PG^2).

2.1 The incidence of poverty: Head-Count Index – HCI

$$HCI = \frac{1}{N}\sum_{i=1}^{M}\left[\frac{(z - y_i)}{z}\right]^0 = \frac{M}{N} \quad (1)$$

Where N is the number of people in the sample/population; M is the number of poor people/households or those whose income levels are less than a given poverty line (z); and Y_i is the income level of i^{th} person/household

This index measures the incidence of poverty. In other words, it shows the percentage of people/households in a region or a country living in poverty. Furthermore, given an income distribution, this index is a measure of that amount of poverty in that income distribution. It is the proportion of individuals or households (depending upon the survey unit) in the distribution whose incomes are below (or equal to) the poverty line. If the line is denoted by z, then the HCI is the value of the cumulative density function (CDF) at z.

2.2 The depth of poverty or the Poverty Gap – PG^1

$$PG^1 = D^2(y) = \frac{1}{N}\sum_{i=1}^{M}\left[\frac{(z - y_i)}{z}\right]^1 \quad (2)$$

Is the Poverty gap corresponding to second order stochastic dominance for comparing poverty across two populations. It measures the depth of poverty, i.e., how poor on average are those in the subpopulation with inadequate incomes. It may be interpreted as the shortfall of the poor's income from the poverty line expressed as an average for all people/households in the population.

2.3 The severity of poverty or the Squared Poverty Gap – PG^2

$$PG^2 = D^3(y) = \frac{1}{N}\sum_{i=1}^{M}\left[\frac{(z - y_i)}{z}\right]^2 \quad (3)$$

This index reflects the third order of stochastic dominance for determining which of two populations is the poorest for eventual policy intervention. It measures the severity of poverty, which gives more weight to the poorest since they are farthest from the poverty line z and the measure is based on the squares of that gap.

2.4 The Lorenz curve and Gini Coefficient

The Lorenz curve is a common tool for plotting inequality of wealth or income between two or more groups. The numbers of income recipients are plotted on the horizontal axis in cumulative percentages. The vertical axis shows the share of total income received by each percentage of population. It also is cumulative up to 100% making both axes equally long. The entire figure is enclosed in a square and a diagonal line is drawn from the lower left corner of the square to the upper right corner. This diagonal represents the perfect equality of income distribution since every point on it shows that the cumulative percentage of income received is exactly equal to the cumulative percentage of income recipients. The Lorenz curve shows the actual quantitative relationship between the percentage of income recipients and the percentage of the total income they did receive in a given year.

The farther the Lorenz curve lies from the diagonal of perfect equality, the greater the degree of inequality represented. The extreme case of perfect inequality would be represented by the congruence of the Lorenz curve with the bottom horizontal and right-hand vertical axes. The greater the degree of inequality, the greater the bend and the closer to the bottom horizontal axis the Lorenz curve will be. The Gini coefficient is a measure of inequality of income or wealth distribution that is intimately connected to the Lorenz curve. It is defined as a ratio with values between 0 and 1. A low Gini coefficient indicates more equal income, while a high Gini coefficient indicates a more unequal distribution. A zero Gini coefficient corresponds to perfect inequality (everyone has the same income); whereas a coefficient of one corresponds to perfect inequality where one person holds all income. The Gini coefficient requires that no one has a negative net income or wealth.

The Gini ratio is defined as the ratio of the different areas in the Lorenz curve diagram. If the area between the line of perfect equality and Lorenz curve is **A**, and the area under the Lorenz curve is B, then the Gini coefficient is A/(A+B). Since we know that the total area below the perfect equality line of the Lorenz curve diagram, A+B = 0.5, then, the Gini ratio, G = A/(0.5) = 2A = 1-2B. If the Lorenz curve is represented by the function Y = L(X), the value of B can be found by integration:

$$G = 1 - 2\int_0^1 L(X)dX \tag{4}$$

The simplified form of the formula for Gini coefficient is,

$$Gini = \sum_0^{n-1} X_i Y_{i+1} - \sum_0^{n-1} X_{i+1} Y_i \tag{5}$$

Where X_i = Cumulative percentage of population and Y_i= cumulative percentage of income per capita under study. The Gini index is the Gini coefficient expressed as a percentage, and it is equal to the Gini coefficient multiplied by 100. The Gini index is more widely used. The status of the income and wealth distribution among the sample population will be constructed and the Gini ratio calculated so that the results may be generalized for policy suggestions.

3. Income and poverty regressions

Ordinary least-squares (OLS) regression analyses were exemplified by Thurow (1967), who searched for the causes of poverty in the United States by using a multiple regression model. The percentages of families in poverty, living on farms, nonwhite, with no workers, and headed by those with less than eight years of schooling were hypothesized to be the key independent variables that explained poverty. An index of industrial structure and dummy variables for two states were also added to the equation. The results showed that a weak labor force participation rate, low quality workforce, lack of off-farm employment opportunities, and inadequate industrial structure explained the incidence of poverty.

We first conducted simple regressions to explain income per capita, the incidence of poverty and the dynamic change income as a function of distance and transportation-related employment as well as other economic and dummy variables.

In Mawlamyine, a *double truncation regression* model with poverty dummy variables for other basic (health, education and clothing) expenditure was run. Instead, the present article relies largely upon double-truncated regression analysis, the use of which is fairly innovative in poverty analysis. To our knowledge, only Takayama (1979) has employed a censored income distribution truncated from above by the poverty line to overcome the theoretical and practical limitations of the Gini coefficient and to transform the latter into a measure of poverty. Takayama felt that a similar approach could be applied to other measures of poverty. The truncated regression model is a kind of censored regression model in that either the low or "left" end, the high or "right" end, or both can be cut to the natural extreme values of the actual sample (Franses and Paap, 2004). This should theoretically provide a better fit and higher explanatory value to the model.

We also employed econometric models of the Logit and Probit classes to explore the conditions of inequality which determine which households are poor (1) vs. not poor (0) with respect to the poverty line, while identifying the characteristics of the poor and non-poor.

Probit and Logit models are the most widely used members of the family of generalized linear models in the case of binary dependent variables. Such models constitute an appropriate technique to determine the probability of a household remaining poor. This class of models explains the behavior of dichotomous dependent variables that can assume a value of one or zero depending upon the particular specification adopted; they compute the conditional probability of the dependent variable being equal to one (Zampino, 2010; Sikander& Ahmed, 2008).

The dependent poverty variable can be defined in multiple ways including the income, expenditure, and calorie intake methods. In this research, the dependent variable is a dummy variable with "poor" households living below 1.25 US dollars per day per person (1) distinguished from "non poor" households living above 1.25 dollars (0).

Lemieux (2012) introduced binary response models: Probit, Logit, and linear probability models following Wooldridge (2002). Consider the models:

$$E(y|x) \equiv (Pr(y = 1|x) = G(x\beta) \tag{6}$$

This is an index model as it constrains the effect of x to go through the index$x\beta$. The function $G(\cdot)$ in the linear probability model is the identity function. An obvious problem is the inconsistent nature of the probability model whereby nothing can prevent $x\beta x\beta$from going below zero or above one. Therefore, Probit and Logit models are popularly employed to define probability models, where $G(\cdot)$ becomes a cumulative distribution function that is standard normal in Probit models.

Lets start with the general model as follows:

$$y^* = x\beta + ey^* = x\beta + e \tag{7}$$

Where: y^*: denotes the dependent variable (the latent variable)

x: denotes the characteristics vector of household as binary variable (0 or 1).

β: denotes parameters vector

e: denotes the residuals (errors)

The binary variable (poor or non-poor) expression is defined as follows

$$y^* = \begin{cases} 1 & y^* > 0 \\ 0 & y^* < 0 \end{cases} \tag{8}$$

The dependent variable captures a status of household as being either poor or non-poor that can be interpreted as the utility difference between choosing y^* = 1 and 0. The probability that y^* = 1 can be derived from the dependent variable and the decision rule. Assuming *e* follows a standard normal distribution,

$$Pr(y = 1|x) = Pr(y^* > 0) = Pr(e > -x\beta)$$
$$= 1 - \Phi(-x\beta) = \Phi(x\beta) \tag{9}$$

"The link function relating the linear predictor η= x□ to the expected value μ is the inverse normal cumulative distribution function, □$^{-1}$(μ)=η" (Hahn &Soyer, 2005). Therefore, equation (9) is a Probit model.

The specification of the Logit model assumes that *e* is a logistic cumulative distribution. Therefore, the Logit model is given by

$$Pr(y = 1|x) = \exp(x\beta)\,/[1 + \exp\,(x\beta) \tag{10}$$

Unlike the Probit, the Logit approach became popular because of the closed form of the function $G(\dot{})$ in the model. Thus, the Logit model assumes a logistic distribution, ln (μ/1-μ) = η. However, the estimate models are qualitatively similar in the case of Logit and Probit models.

Both the Logit and Probit are estimated by maximum likelihood estimation, which can be solved iteratively by numerical methods. Unlike the case of OLS, β in the binary choice model cannot be interpreted as the effect of *x* on the dependent variable *y*. Therefore, the marginal effects are computed to show the change in the probability when a unit changes in the independent variables. Additionally, Lemieux (2012) mentioned that marginal effects of Probit and Logit models are more likely similar and close to the linear probability model coefficients.

For selecting an acceptable model, we employed three different criteria of model adequacy: a high likelihood ratio, high McFadden R^2, and high percentage of correct predictions. The likelihood ratio explains a significantly smaller deviance. The McFadden's R^2 is used to explain the percent of variation. The percentage of correct predictions is used to capture the goodness of fit on the observed data.

Using such Probit and Logit estimations, Rajaram (2009) estimated the likelihood of a female household head being poor. He found that such households to be marginally poorer than male-headed households. In the same year, Baslevent and El-hamidi (2009) determined the factors which affected the retirement preferences of Egyptian government sector employees as between early retirement and post-retirement employment. Using a Bivariate Probit model, they found that those who planned to work after their retirement tended to choose early retirement.

4. Seemingly unrelated consumption expenditure regressions

The 'seemingly unrelated regression equations (SURE) model' was developed by Arnold Zellner in 1962. The model is a generalization of a linear regression model that explains a set of dependent variables when error variables are reasonably correlated. Separate analysis of univariate models may lead the covariate effect to inefficiently estimate the result (Alaba, Olubusoye, &Ojo, 2010). The model can be estimated through equation-by-equation using standard ordinary least squares (OLS) which is well known that the least squares estimators are best linear unbiased estimators by Gauss Markov theorem and maximum likelihood estimators when single equation normal likelihood functions are employed (Zellner, 2006). Thus, 'seemingly unrelated regression equations (SURE)

model' gives us the model that the estimated results are efficient in the coefficients and standard errors. Following Greene (2002), a seemingly unrelated regressions (SUR) model can be written as

$$y_i = X_i\beta_i + \varepsilon_i \qquad i=1,\ldots,M$$

Where *y* is vector of dependent variables, *X* is $K \times K$ matrix, *i* is number of regressors, and *M* is the number of equations.

The disturbance formulation is

$$\mathrm{E}\left(\varepsilon_i\varepsilon_j'\middle|\mathrm{X}_1,\mathrm{X}_2,\ldots,\mathrm{X}_\mathrm{M}\right) = \sigma_{ij}\mathrm{I}_\mathrm{T} = \Omega = \begin{bmatrix} \sigma_{11}\mathrm{I} & \sigma_{12}\mathrm{I} & \cdots & \sigma_{1\mathrm{M}}\mathrm{I} \\ \sigma_{21}\mathrm{I} & \sigma_{22}\mathrm{I} & \ddots & \sigma_{2\mathrm{M}}\mathrm{I} \\ \vdots & \vdots & & \vdots \\ \sigma_{\mathrm{M}1}\mathrm{I} & \sigma_{\mathrm{M}2}\mathrm{I} & \cdots & \sigma_{\mathrm{MM}}\mathrm{I} \end{bmatrix} = \Sigma \otimes \mathrm{I}$$

Where $\Sigma = \begin{bmatrix} \sigma_{11} & \sigma_{12} & \cdots & \sigma_{1M} \\ \sigma_{21} & \sigma_{22} & \ddots & \sigma_{2M} \\ \vdots & \vdots & & \vdots \\ \sigma_{M1} & \sigma_{M2} & \cdots & \sigma_{MM} \end{bmatrix}$

Σ is variance and covariance matrix. $\Omega = \Sigma \otimes I$ with $\Omega^{-1} = \Sigma^{-1} \otimes I$

The generalized regression model applies to the stacked model is written as followings,

$$\mathrm{y} = \begin{bmatrix} \mathrm{y}_1 \\ \mathrm{y}_2 \\ \vdots \\ \mathrm{y}_\mathrm{M} \end{bmatrix} = \begin{bmatrix} \mathrm{X}_1 & 0 & \cdots & 0 \\ 0 & \mathrm{X}_2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \mathrm{X}_\mathrm{M} \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \vdots \\ \beta_\mathrm{M} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \vdots \\ \varepsilon_\mathrm{M} \end{bmatrix} = \mathrm{X}\beta + \varepsilon$$

The efficient estimator of SUR is the Generalized Least Squares (GLS). The GLS estimator is given as following;

$$\hat{\beta} = [X'\Omega^{-1}X]^{-1}X'\Omega^{-1}y = (X'(\Sigma^{-1} \otimes I)X)^{-1}X'(\Sigma^{-1} \otimes I)y$$

The important result is in the SUR model when the error terms are uncorrelated between the equations; truly unrelated and all equations have the same set of regressors, the efficient estimator is single-equation ordinary least squares; and OLS is the same as GLS. Hence, for linear SUR models *"it is well known that the greater the correlation of the errors, the greater the efficiency gain when using SUR"* (Alaba, Olubusoye, &Ojo, 2010).

5. Volatility models

Volatility models are extensively adopted to capture and predict risk in financial markets. However, these models are also successfully adopted in other sectors of the economy, for instance agricultural finance as in ref. (Huang B.-W. , Chen, Chang, &McAleer, 2009). Such models are quite popular in the analysis and prediction of international tourist arrivals as in ref. (Shareef&McAleer,

2005). The volatility in prices of some agricultural products is similar to that of financial volatility (Huang B.-W. , Chen, Chang, &McAleer, 2009). The volatility of prices of NR extract, namely Rubber Sheet and Ribbed smoked Sheet and Latex, also follows a similar pattern to financial volatility and is similarly influenced by petroleum prices. Uncertainties in the prices of NR adversely affect financing in NR based industries, as well as the livelihoods of small holders rubber growers.

Unit root test

It is customary to check the stationary behavior of the time series data before one works out other features of the prediction model. The economic literature widely agrees that many important time series economic variables display asymmetric adjustment paths, while the standard time series models assume linearity and symmetric adjustments. Moreover, if adjustment is approximately symmetric, the Dickey-Fuller test is more powerful than any other test (34). A study variable series y_t (RSS3 or LAT in our case) is said to be stationary if the mean, variance, and covariance of the series remain constant over time (Lim, McAleer, & Min, 2009). If the y_t is correlated at higher order lags, the assumption of white noise disturbances, ε_t, is violated and the Augmented Dickey-Fuller (ADF) test allows us to perform a parametric correction for higher-order serially correlated error processes. This is done by both assuming that they_t series follows an $AR\,(p)$ process and adding p lagged difference terms of the dependent variable, i.e., Δy_{t-i} in the test regression model (Maddala, 1992; QMS, 2007).

The formulation of an ADF test using p lags of the dependent variable is presented in equation (1), where Δy_t is the first difference of y_t and p is the lag-length of the augmented terms for y_t. The lags of Δy_t capture any dynamic structure present in the dependent variables in order to ensure that ε_t is not autocorrelated (Brooks, 2008). The unit root test is carried out under the null hypothesis $\varphi = 0$ against the alternative hypothesis of $\varphi < 0$. If the null hypothesis in the ADF test, $\varphi = 0$, then y_t is said to be stationary.

$$\Delta y_t = \alpha + \delta trend + \varphi y_{t-1} + \sum_{i=1}^{p} \quad \theta_i \Delta y_{t-i} + \varepsilon_t \qquad (1)$$

In this paper, we use ADF unit root tests for the daily price series y_t of the respective variables (RS, RSS3 or LAT) over the full sample size of 1519 observations (September 2004 to September 31, 2010, excluding holidays), with and without a deterministic trend. The time trend is included in the test in all the cases, i.e., level (y_t), first difference (Δy_t), and logarithm transformation of the respective variables ($logy_t$ and $\Delta logy_t$). The ADF auxiliary regression in logarithmic form with deterministic trend is presented in equation (2).

$$\Delta lny_t = \alpha + \delta trend + \varphi ln\, y_{t-1} + \sum_{i=1}^{p} \quad \theta_i \Delta ln\, y_{t-i} + \varepsilon_t \qquad (2)$$

wherelny_t is the logarithm of the respective series at time t, $\Delta ln\, y_{t-i}$ is the lagged first difference,ε_t is the error term, and $\alpha, \delta, \varphi\ and\ \theta$ are the parameters in need of estimation.

We used Eviews package 6 for the ADF test of the unit root null hypothesis, $H_0 : \varphi = 0$, against$H_1 : \varphi < 0$. Alternatively, Phillips and Perron proposed another non-parametric method for unit root test to overcome the problem of serial correlation in 1988. This "PP" (Phillips-Perron) method estimates the non-augmented DF test, and modifies the t-ratio of the α coefficient so that serial correlation does not affect the asymptotic distribution of the test statistic. The test is based on the statistic obtained from equation (3) (QMS, 2007)

$$\underline{t}_{\alpha} = t_{\alpha} \left(\frac{\gamma_0}{f_0}\right)^{1/2} - \frac{T(f_0 - \gamma_0)(se(\widehat{\alpha})}{2 f_0^{1/2} s} \quad (3)$$

where$\hat{\alpha}$ is the estimate, and t_{α} is the t – ratio of α, $Se(\widehat{\alpha})$ is coefficient standard error, and S is the standard error of the test regression. γ_0 is the consistent estimate of the error variance defined as$(T - k)S^2/T$, with k number of regressors and f_0 is an estimator of the residual spectrum at frequency zero. Conversely, Dickey and Fuller (1979) have shown that regressions in first differences have little power against the alternatives of a stable near random walk model. Divino and McAleer (2010) have asserted that "it is well known that traditional unit root tests, primarily those based on the classic methods of Dickey and Fuller (1979, 1981) and Phillips and Perron (1988), suffer from low power and size distortions." Although such limitations deal with adopting other modified tests methods as suggested by Perron and Ng (1996), Elliott, Rothenberg, and Stock (1996), and Ng and Perron (2001).

These suggested modified unit root test methods are also subject to low power and size distortions under the short run persistence implied by GARCH component. However, such size distortions might be even greater for the traditional Dickey–Fuller test, despite the sensitivity of the modified tests to the degree of volatility in the GARCH process (41). Hence, we have adopted the modified ADFGLS (MADFGLS) test and the modified Phillips-Perron test, which both use generalized least square (GLS) de-trended data and the MAIC in order to choose the truncation lag (MPPGLS).

6. Social accounting matrices (SAMs)

We employed a Social Accounting Matrix (SAM) in gathering insights for development strategy formulation particularly when addressing the issues of growth and distribution. A Social Accounting Matrix is one of the most appropriate tools to analyze the current situation of an economy as well as for planning and policy making. The SAM provides a closed form, economy-wide accounting of linkages between activities (and/or commodities), factors, households, domestic institutions (e.g., investment, government), and foreign institutions in a tabular format that is transparent and amenable to multiplier analysis similar to that popularized by Leontief (Tarp, Holst, & Rand, 2002).

SAMs have been broadly used in developing countries to assess the distributive effects of policies on households (Midmore& Harrison-Mayfield, 1996). Pyatt and Round (1985) documented several examples of SAM models that have been applied to the policy analyses of a wide range of countries.

Subsequently, Zarate-Hoyos (2000) used a SAM model to examine the aspects of labor migration from Mexico to the United States. Bautista (2000) made use of SAM multipliers to assess the effects of agricultural growth on income and equity. Malan (2001) discussed the problem of income distribution in South Africa using a SAM. As predicted a quarter-century ago (Cohen 1986), SAM analysis has indeed proved useful in gathering insights for development strategy formulation, particularly when addressing the issues of growth and distribution.

SAMs also provide an ideal experimental environment to investigate the impact of infrastructure investment and have been applied in various research fields in different countries. In the US, Adelman and Robinson (1986) used a SAM for investigating the impacts of various exogenous factors on agriculture, with the focus on the relationship between the agricultural and non-agricultural sectors. Roberts (1992) used a SAM to investigate the roles of agriculture in the economic development of the UK economy. Reininga (2000) constructed a SAM for the Netherlands to examine its consistency and suitability as a database for economic policy analysis. Sanz and Perdiz (2000) used SAM multipliers to measure the inequality among different groups of Spanish households. Nokkala and Kola (2000) analyzed the effects of EU structural and agricultural policies on rural areas of different economic structures in Finland. SAMs are often built at the national level, less popular at the village level, not regularly used for the regional level, and rarely done at the provincial levels. The principal reason for this pattern is the lack of data availability. At the national level, SAMs are normally built top-down from input-output tables and national accounts, and then modified by national household and firm surveys. At the village level, SAMs are typically built bottom-up with data from micro-level household and production surveys. At the provincial level, official data are lacking because they have been aggregated into the national level while household surveys are much more costly than at the village level.

The use of optimized SAMs or OSAMs can be traced back to the linear programming method. Several researchers have used OSAMs to single out the best economic policies for various contexts. Sharify (2000) proposed a linear programming model linked to a SAM for Iran, set the equation of priorities of production activities as an objective function for planning, and specified the exact levels of resource and social constraints. Al-Kahtani and Schreiner (1993) constructed a general equilibrium model using a linear programming algorithm for the Saudi Arabian economy. They found that reducing agricultural subsidies would have a significant impact on commodity and factor prices. Harris et al. (2008) programmed the relationship between grazing permits and the rest of the economy to propose an optimal economic plan for Elko County, Nevada. These examples confirm that OSAMs are a good way to both help policy makers to manage an economy and indicate how to achieve maximum social welfare.

The basic SAM is a square matrix, the dimensions of which are determined by the institutional setting underlying the economy under consideration. Each account is represented by a combination of one row and one column with the same label. Each entry represents a payment to a row-account by a

column account. Thus, all receipts into an account are read left-to-right across the corresponding row while payments by the same account are recorded top-to-bottom down the corresponding column. A SAM which is developed from an input-output (Leontief) table, represents flows of all economic transactions that take place within an economy (regional or national). It is at the core, a matrix representation of the National Accounts for a given country, but can be extended to include non-national accounting flows, and created for whole regions or areas. SAMs refer to a single year, providing a static picture of the economy. According to Calkins (2007), SAMs add to the standard "economic" accounts of an input-output table the whole set of "social" and environment accounts; therefore SAMs allow for more complete analysis and future planning.

Table 3.3: A Basic Social Matrix (SAM)

ACCOUNT			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	TOTALS
Production	Commodities	(1)		Intermediate consumption		Household consumption		Government consumption	Fixed capital formation and change in stocks	Exports	Demand for products
	Activities	(2)	Domestic sales								Sales of commodities
Factors of production		(3)		Gross value added payments to factors						*Net* factor income from RoW	Factor income receipts
Institutions (Current accounts)	Households	(4)			Labour and mixed income	Inter-household transfers	Distributed profits to households	Current transfers to households	Labour and mixed income	*Net* current transfers from RoW	Current household receipts
	Corporate enterprises	(5)			Operating surplus			Current transfers to enterprises	Operating surplus	*Net* current transfers from RoW	Current enterprise receipts
	Government (&NPISHs)[1]	(6)	*Net* taxes on products			Direct taxes	Direct taxes			*Net* current transfers from RoW	Current government receipts
Combined capital accounts		(7)				Household savings	Enterprise savings	Government savings	Capital transfers	*Net* capital transfers from RoW	Capital receipts
Rest of World (combined account)		(8)	Imports						Current external balance		Aggregate receipts from RoW
TOTALS			Supply of products	Costs of production activities	Factor income payments	Current household outlays	Current enterprise outlays	Current government outlays	Capital outlays	Aggregate outlays to RoW	

As further explained by Calkins (2007), before a SAM can be used for impact multiplier analysis or optimization, it must be converted from monetary terms to a macro-social linear SAM through a sequence of six steps.

Step 1 is to give a complete verbal and statistical description of the pre-policy or pre-project sectoral structure of domestic production and value added of the economy.

In step 2, the SAM is first converted into an "A" matrix of average expenditure propensities by dividing each endogenous element in the transaction matrix by its respective column sum.

Step 3 is to construct the SAM multiplier matrix to visualize the total effects of increasing the output of a given sector on all other sectors of the economy. The coefficients on the diagonal are the multipliers of each sector upon itself; the off-diagonal elements are induced production and sales through augmented Hirschman-style forward and backward linkages with the rest of the economy. The total multipliers of each column represent the sum of the production and commercial multipliers.

A SAM Multiplier is represented by the formula:

$$Y = AY + X \tag{1}$$

where$Y$ is a matrix of endogenous income; total value added, A is a matrix of average expenditure propensity; the proportion of expenditure of each column account to row account and X is a matrix of exogenous accounts. In SAM structure, I is an identity matrix and$(I - A)^{-1}$ is an inverse of the matrix $(I - A)$. Look at how an injection in one part of an economy affects other parts of the economy upon the total value added Y. So the model can be rewritten as:

$$Y = (I - A)^{-1}X = M_a X \tag{2}$$

Where $M_a$is the SAM Multiplier matrix which shows how the incomes of the endogenous sectors of our matrix would be affected at the margin by a change in exogenous demand.

Step 4 is a preliminary visual interpretation of the multiplier matrix, with special attention to the sectors that interest planners most.

Step 5 is to simulate the economic impacts of spending, say, 1 million USD on each target sector as part of a general development program in the province.

A typical SAM models the interaction between production activities (sectors of an economy) and the commodities used (intermediate goods used for production). In our study, the transportation sector (trucks, cars, busses) and road infrastructure (EWEC, minor roads, bridges), will be broken out within the production activities in order to measure their multiplier effects: (1) Production factors; capital, land and labor, (2) Institutions; households, firms and government, (3) Capital accounts; financial side of an economy, and (4) Rest of the world; export, import, and other financial flows.

Last, a SAM incorporated with linear programming will be used to optimize the provincial economy subject to resource constraints and to generate the corresponding implementation plan.

The linear programming is used to solve optimization problems which minimize or maximize a linear function subject to linear constraints to determine how to achieve the best outcome. The standard form of the linear programming can be written as:

$$Maximize\ V = v * x \quad (3)$$

$$subject\ to\ (I - A) \geq 0 \quad (4)$$

$$r \leq b \quad (5)$$

$$s \geq or \leq c \quad (6)$$

$$x \geq 0 \quad (7)$$

where *V* is total township value added, *v* is value added for each activity, *x* is the output level of each activity in million Kip, *r* is the resource constraint, *s* is sufficiency economy constraint, *b* and *c* are maximum or minimum permissible of each constraint. The simultaneous satisfaction of all constraints of all vectors of *x* in linear programming is called a feasible solution.

7. Sufficiency Economy Matrices (SEMs)

The proposed project serves as a test case of the application of an important new methodology, optimizable Social Accounting Matrices (SAMs), to the elaboration of coherent, detailed strategies for communities and entire provinces in anticipation of the opening of new roads. The SAMs will also pioneer the inclusion, not just of environmental and income distributional parameters, but also the three principles and two conditions of the King of Thailand's sufficiency economy. Separate optimizations of the SAMs and Sufficiency Accounting Matrices (SEMs) are permitting, for the first time, the calculation of the exact benefits to be derived from the faithful application of the King's vision to bottom-up regional development as opposed to standard international economics.

The innovations should not be underestimated. For example, it is not usual practice for SAMs to be *optimized*, to find the best development strategy for a community or province. In the 1970s, Thorbecke and his students at Cornell University developed social accounting matrices (SAMs); "social" matrices to "account" not only for the intersectoral impacts of growth in one productive sector but also the influence of such growth on income distribution, government revenues, and income to the holders of labour, capital, and land resources. The literature suggests, however, that it is rare to optimize either the Leontieffsubmatrix (LM) or the SAM. Vassileva and Calkins optimized a Leontieff matrix for Bulgaria`s progressive entry in the European community. Recently, Sivakumar et al (1999) published one of the few studies in the literature where the SAM is converted to a linear program and optimized to guide agro-industrial strategies for a community. Zhai and Wang (2002) used the most recent version of the Chinese SAM to evaluate rural-urban migration and urban unemployment effects of China's accession to the WTO. For Vietnam, Tarpet al(2002, 2003) used a SAM to analyze the structure of the Vietnamese economy in 2000, three years after the onset of the Asian financial crisis.

They found that agriculture and human capital investment through training are critical to improving national income. They also showed how reduction in trade barriers as Vietnam globalizes will affect income distribution. They relied, however, on detailed matrix decomposition and comparative multiplier analysis, rather than optimization, to arrive at their conclusions. None of the three other aggregate level SAMs constructed for Vietnam (Khan 1997, Nielsen 2001) or the Central Region (Bautista 2001) have been optimized. Only Calkins and Ngo (2004) proceeded to that final step.

These SAMs of this study are also being expanded to include *'ethics'* and the other key concepts of the King's Philosophy. This refers to the distribution of income, not only as Gini coefficients and decile ratios, but also the rural-urban income gap and differential returns to female and male labourers or household heads. In the rapidly shifting dimensions of the GMS economy, poverty, unemployment, Gini coefficients, exports, migration, and markets are all fragile and difficult to predict on an individual basis. Integrating all of these, a SAM can efficiently detect the most technically efficient and environmentally sustainable policies and projects driven by employment creation and poverty reduction (development); market growth (transition); and trade (globalization). More specifically, the geographical distribution of job creation and income must be specifically tracked. Furthermore, concerns for environmental 'reasonableness' lead us to include physical measures of environmental quality (engineering measures as cm of topsoil, BOD of waterways, and motorcycle and factory emissions) to ensure that communities do not simply barter one objective (increased PPP per capita) against another (sustainability).

CHAPTER IV:

ANALYSES OF POVERTY AND WELL-BEING

I. DA NANG

1. Income inequality and Gini coefficients

To determine poverty, we used measures of both absolute poverty and relative poverty. One way to measure the impact of the road and globalization over time that does not depend on the exact identity of households is to calculate the Gini coefficient of relative income and the Foster-Greer-Thorbecke (FGT) measures of absolute poverty.

Table 4.1: Trends in the inequality of income distribution in the Da Nang VHLSS survey samples

Year	Sample	Quintile ratio	Decile ratio	Gini coefficient
2002	Rural	10.50	20.51	0.385
	Urban	6.71	12.51	0.343
	Semi-urban	5.77	8.31	0.346
	Total	11.50	21.81	0.430
2004	Rural	2.85	3.83	0.198
	Urban	4.89	7.01	0.488
	Semi-urban	4.57	6.70	0.340
	Total	4.83	7.20	0.326
2006	Rural	4.28	5.34	0.278
	Urban	3.45	4.49	0.247
	Semi-urban	11.76	22.81	0.604
	Total	6.25	11.22	0.416
2008	Rural	6.04	8.34	0.385
	Urban	5.68	7.57	0.346
	Semi-urban	3.21	5.11	0.228
	Total	5.44	7.45	0.336

The volatility of these ratios and the switching of relative severity between years seem very improbable. The data for each year may therefore have been collected from samples that changed too greatly. On the other hand, one can believe that the data does represent the real changes that have occurred; there are interesting implications for testing the Kuznets inverted U curve for the changes of inequality in the successive stages of the development process. The rural area goes down and then steadily upward, the urban area upward, downward and then back to its original level, and the semi-urban area is constant, undergoes a huge rise, and then drops to the lowest value of the three areas.

In terms of hypothesis testing, we may accept hypothesis five which states that *"The distribution of income (Gini) for the whole sample has grown more equal over time as economic opportunities have opened to all classes of workers"* Except for the year 2006, there has been a steady downward trend in both the quintile and decile ratios and the Gini coefficient for the sample as a whole. However, we must reject hypothesis 6, which holds that *"By subsample, however, incomes in the rural areas have grown more unequal (i.e. higher Gini)."* There are ups and downs for each subsample, and the area of inequality in the rural sample in 2008 is virtually the same as it was in 2002.

We turn now to hypotheses 7, 8, and 9 to the incidence (head count), depth (average level) and intensity (level squared) of the three subsamples. We are still calculating the values for these figures for 2008. Already however, it is clear from the data from 2006 (Table 4.2), that the incidence, depth and severity of poverty are all highest in the rural sample, followed by the semi-urban and finally the urban samples. This means that a higher percentage of rural dwellers are poor, they are on average poorer than in the other areas, and the cases of extreme poverty are also higher. Thus, at least for 2006, we may tentatively accept hypothesis 7, to the effect that "*The incidence, depth and intensity of poverty are highest in the rural areas farthest from the road.*"

Table 4.2: Comparative incidence, depth and intensity of poverty between the urban, semi-urban and rural samples

TOTAL SAMPLE for 2006	Incidence	Depth	Intensity
Sum across poor households	35	1512	2996439
Sum across all households	**30.7%**	**13.3**	**26285**
URBAN SAMPLE			
Sum across poor households	9	297	622403
Sum across all households	**16.7%**	**5.5**	**11526**
SEMI-URBAN SAMPLE			
Sum across poor households	14	465	701171
Sum across all households	**38.9%**	**12.9**	**19477**
RURAL SAMPLE			
Sum across poor households	12	838	1917644
Sum across all households	**50.0%**	**34.9**	**79902**

2. Econometric equations to explain poverty and income

Table 4 3: Regression analysis to explain income/capita by transportation, 2008

Dependent variable: Income/capita, 2008	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	5484	2674		2.05	.043
% income from 83, 93, 91 in total income	-28043	35964	-.059	-.78	.437
% migration income in total hh income	1883	2544	.054	.74	.461
% expenditures in travel fees, excursions in Vietnam, and excursions outside of Vietnam in total expenditures	158106	38429	.292	4.11	.000
% expenditures on bicycles, automotive, motorbikes in total expenditures	-98392	189194	-.038	-.52	.604
No of hhlabour (aged 17-60)	-2170	656	-.253	-3.31	.001
Average education/hh member (= total years education / total hh members)	1818	312	.472	5.82	.000
Medical expenditures per capita	2		.305	4.29	.000
Rural, semi-urban, or urban	45	1073	.003	.04	.966
Adjusted R-squared = 0.456 F-statistic = 12.843 (.000)					

The interpretation of this regression (Table 4.3) is as follows. Shares of transportation expenditures and transportation-related income are not significant determinants of the intensity of net income per capita. The distance from EWEC, as reflected in urbanity, is not significant in determining net income per capita. Nor is migration share in income a significant determinant of income. However, percentage expenditures on travel inside and outside Vietnam do contribute to net income per capita, perhaps because of knowledge and social bridging capital. As the size of the workforce (the number of workers in the household) increases, it is harder to increase income per capita; this suggests disguised unemployment. Education and medical expenditures increase income per capita, probably as a result of making labour more productive

Table 4.4: Regression analysis to explain the intensity of poverty

Dependent variable: Intensity of poverty, 2008	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
Constant	.177	.025		7.19	.000
% expenditures on bicycles, automotive, motorbikes in total expenditures	2.492	1.941	.119	1.28	.202
% income from 83, 93, 91 in total income	.374	.343	.096	1.09	.278
% migration income in total income of hh	-.050	.025	-.176	-2.05	.043
Average education /hh member	-.014	.003	-.442	-5.21	.000
Semi_urban (0,1)	-.031	.018	-.151	-1.70	.092
Adjusted R-squared = 0.228; F-statistic = 7.688 (.000)					

Already, we can see that the determinants of poverty are not the simple mirror-image or negation of the determinants of income (Table 4.4). Also, equation (c) is unstable. The results of this regression also point to three facts. First, transportation expenditures and transportation-related income are not significant determinants of the intensity of poverty. Secondly, migration, education, and living in the semi-urban area do however reduce the intensity of poverty. Finally, the intensity of poverty is significantly higher in the semi-urban areas relatively far from the EWEC.

Table 4.5: Regression to explain the dynamic change income between 2006 and 2008

Dependent variable: Change in income, 2008/2006	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
(Constant)	2.158	.315		6.84	.000
Total expenditure	.000	.000	-.312	-1.88	.067
Age of household head (years)	-.012	.007	-.277	-1.86	.070
Change_members	-.119	.041	-.488	-2.92	.006
% income from sales and marketing	-.933	.500	-.266	-1.87	.069
Total years of education of all hh members	.009	.006	.293	1.46	.151
Change_hh	.201	.141	.207	1.43	.161
Adjusted R-squared = 0.175 F-statistic = 2.631 (.030)					

The equation shows that total expenditures are negatively correlated with the increase in income over a two-year period; implying that savings and investment are more important than consumption. Furthermore, the age of the household head and % income from sales a marketing are negatively correlated with improvements in income. Change in members is also negative; this shows that larger families tend to consume more than they produce - another sign of disguised unemployment. Meanwhile, total years of education promote a positive change in income, but this is not significant. Moving to the city (change in household) is not a significant determinant of the ratio in income between 2008 and 2006. The model is nonetheless unstable to taking out the non-significant variables, so we may be in the presence of multi-collinearity. We need to calculate and test other new variables.

II. SAVANNAKHET

1. Income inequality and Gini coefficients

This section of the paper analyses poverty and income distribution from the household data survey. The research employed the Gini coefficient to measure the inequality of income or wealth distribution, and the three Foster Greer and Thorbecke (FGT) indices of absolute poverty to explore the relationship between household factors and income.

Table 6 shows a 243-household comparative survey in urban, semi-urban, and rural areas revealing that urban area has highest income per capita which has a wide range difference comparable with rural and semi-urban areas. This is the result of EWEC road and the growth of the business sector in the province. However, the poorest group is semi-urban households, whose average income is only slightly less than that of rural area. When considering the tercile ratios, the urban area seems to have a very bad situation, with high inequality and a wide range between groups. The rural area seems to have the lowest inequality. One possible reason could be that despite superior employment opportunities and infrastructures, the urban areas' highly competitive labor market and population density cause economic inequality and other socio-economic problems. Policies to encourage populations to remain in urban areas might therefore constitute a viable option for reducing inter-household inequalities.

Table 4.6: Poverty and income distribution in Savannakhet

	Income/capita (million kip)	[1]Rank Income[1]	**Tercile ratio**	Rank tercile
Urban	878.81	3	5548.605	3
Semi-urban	312.55	1	3335.111	2
Rural	324.27	2	205.6	1
Total sample	505.21			

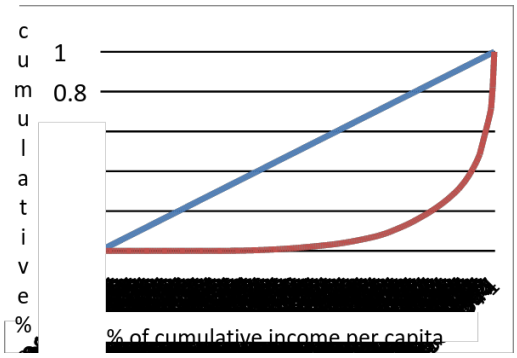
[2][1] We use "1" for the best or highest rank. For rank income, 1st is the highest rank which show lowest income and on rank tercile 1st is the best situation of income distribution.

1

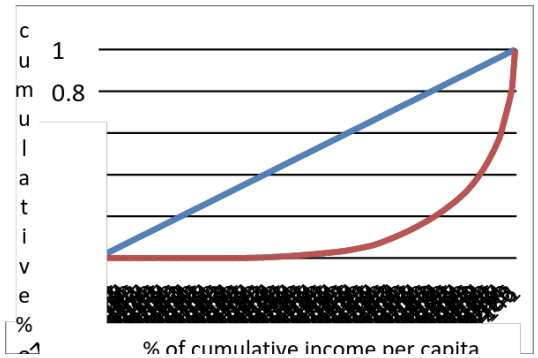
2

To support the income distribution study, we constructed Lorenz curves for Savannakhet province overall and by sub-region

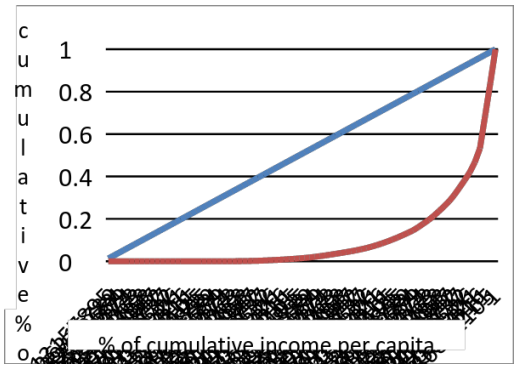
Figure 4.1: The Lorenz curves of Savannakhet and its sub regions



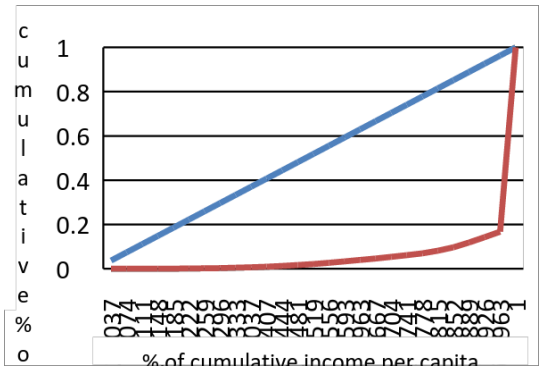
3a. Savannakhet



3b. Urban area



3c. Semi-urban area



3d. Rural area

We then calculated Gini coefficients to measure the inequality of income distribution overall and by sub-population (Table 4.7). When we consider the Gini index by area, the calculation points to the same direction with tercile ratio. The rural area has the best situation and the semi-urban area is the worst but the ratios of all areas are still extremely high and virtually identical. Therefore, this province clearly needs public policy to address the issue of income inequality, particularly in the semi-urban areas.

2. Incidence, depth, and intensity of poverty

Table 4.7: Gini Indices

Income	Overall	Urban	Semi-urban	Rural
Gini index	0.82	0.79	0.8	0.89
Incidence	55.56%	55.00%	60.53%	44.44%
Depth	42.86%	42.38%	47.55%	32.17%
Intensity	38.86%	38.80%	43.18%	27.02%

Source: Calculated from the survey data.

Table 4.7 also reports the FGT indices, which include the incidence (Head-count index), depth (Poverty gap), and intensity/severity (Poverty gap squared) of absolute poverty, used to gauge the extent of economic deprivation within the province with respect to the international poverty line. This equals 1.25$ per day (World Bank poverty criteria), or 3,687,503.75 Kip per year as of May 2010. The Lorenz curves are shown in figures 3a - 3d. It is clear that the semi-urban area has the highest incidence, depth and intensity of poverty, followed by the urban area. This is because the economic contribution of both industry and service sectors in Savannakhet province is growing gradually (figure 2). Population density and infrastructures in those areas cause employment opportunities to be highly competitive on labor markets, leading to income inequality and other socio-economic problems. This situation may have deepened the income gap between households whose primary occupation is agriculture compared with other occupations. While rural areas, however, the incidence, depth and intensity of poverty are the lowest. In other words, although inequality in the rural areas is high, they are not desperately poor.

3. Econometric equations to explain poverty and income

First of all, we employed the Ordinary least squares regression to see the household expenditure pattern on each expenditure while ignoring any correlation between the error terms of all four equations. Twenty variables were assumed to determine the share expenditure of food, healthcare, transportation and non-food items. In this step, we focused only on the absolute variables (income per capita, age of household head, distance of EWEC, total years of education of all members, household size, landholding per capita, living space per capita and total workers) and ignored dummy variables and share of income by source in order to reflect any significant impact on household expenditures. Moreover, we assumed the distance of EWEC played an important role in determining households' food, health, transportation, and non-food item expenditures.

Table 4.8: The ordinary least square regression results for household expenditures

Variable	Independent variable			
dependent variable	FOOD_EXP	HEALTH_EXP	TEANS _EXP	NON FOOD_EXP
C	**0.59*** **	**0.03* **	**0.27* **	0.10
	(0.14)	**(0.09)**	**(0.16)**	(0.08)
Y	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	0.000	(0.000)
AGE	-0.001	0.000	0.002	-0.001
	(0.003)	(0.000)	(0.003)	(0.008)
DISTANCE	**-0.007** **	-0.000	0.004	**0.004* **
	(0.003)	(0.001)	(0.004)	**(0.002)**
EDU	0.000	0.000	-0.000	0.001
	(0.001)	(0.000)	(0.002)	(0.001)
HHSIZE	**-0.04** **	**-0.006** **	**0.05*** **	-0.01
	(0.07)	**(0.002)**	**(0.02)**	(0.01)
LAND	0.01	-0.003	-0.01	0.001
	(0.01)	(0.002)	(0.02)	(0.009)
SPACE	0.000	0.000	-0.000	**0.000** **
	(0.195)	(0.000)	(0.000)	**(0.000)**
TOTAL_WORKER	0.02	**0.003* **	**-0.03** **	**0.02** **
	(0.01)	**(0.002)**	**(0.01)**	**(0.01)**
SHARE_AGRI	0.03	-0.004	-0.009	-0.007
	(0.05)	(0.008)	(0.064)	(0.034)
SHARE_BUSINES S	0.04	-0.006	-0.10	0.08
	(0.10)	(0.014)	(0.12)	(0.06)
SHARE_FIN	-0.07	**0.03*** **	0.002	0.04
	(0.06)	**(0.01)**	(0.07)	(0.04)
SHARE_HHINDUS	-0.02	-0.009	-0.07	**0.12** **
	(0.09)	(0.013)	(0.11)	**(0.06)**
SHARE_SERVICE	**0.12* **	0.005	**-0.19** **	0.06
	(0.06)	(0.009)	**(0.07)**	(0.04)
FEMALE	0.01	0.005	-0.05	**0.04* **
	(0.04)	(0.005)	(0.04)	**(0.02)**
URBAN	-0.04	0.006	0.02	0.01
	(0.04**)**	(0.006)	(0.05)	(0.03)
RURAL	**0.21*** **	0.009	**-0.24*** **	0.02
	(0.08)	(0.010)	**(0.09)**	(0.05)
EM_AGRI	0.03	0.004	-0.05	0.01
	(0.05)	(0.007)	(0.06)	(0.03)
EM_COMMERCE	-0.03	-0.004	0.10	-0.07
	(0.08)	(0.010)	(0.01)	(0.05)
EM_HHINDUS	**0.24** **	0.001	**-0.34** **	0.10
	(0.12)	(0.068)	**(0.14)**	(0.07)
EM_HIRED	**0.13** **	-0.01	-0.10	-0.04
	(0.06)	(0.01)	(0.07)	(0.03)
EM_SERVICE	0.002	**-0.02* **	0.06	-0.02
	(0.092)	**(0.01)**	(0.11)	(0.06)
R-squared	0.18	0.15	0.19	0.14
Adjusted R-squared	0.10	0.07	0.11	0.06
S.E. of regression	0.26	0.04	0.31	0.16
Akaike info criterion	0.27	-3.72	0.59	-0.71
Schwarz criterion	0.59	-3.40	0.92	-0.39

Note: (1) the result show the coefficient and the standard error is in the parenthesis. (2) *significant at 1%, **significant at 5%, ***significant at 10%.

Table 4.8 shows the ordinary least square regression results of all expenditures. The variables that "significantly affect food expenditure" are the distance from the EWEC and household size. Healthcare expenditures show that household size and total workers "significantly affect healthcare expenditure." The transportation expenditures show the same significant variables as for healthcare expenditures. The distance from the EWEC, living space per capita, and total workers are "significant in determining non-food items expenditure."

As the next step, we used the Wald coefficient test to determine whether or not those variables that were not significant in the models should be taken out of the model. This test enables us to add a set of variables to an existing equation and to ask whether the set makes a significant contribution to explaining the variation in the dependent variable. We set up the coefficient of those insignificant variables equal to zero. The null hypothesis was that the additional set of regressors was not jointly significant; which means the coefficients would be equal to zero. Whenever those variables are not jointly significant (Quantitative Micro Software, LLC, 2004), we may omit them from each model. The results of the Wald coefficient test are shown in table 4.9.

Table 4.9: Wald coefficient test result.

Wald Test:	Test Statistic	Value	df	Probability
Equation: FOOD_EXP	F-statistic	0.75	(6, 216)	0.61
Chi-square		4.47	6	0.61
Equation: HEALTH_EXP	F-statistic	0.33	(6, 216)	0.92
Chi-square		2.01	6	0.92
Equation: TRANS_EXP	F-statistic	0.95	(6, 216)	0.46
Chi-square		5.73	6	0.45
Equation: NONFOOD_EXP	F-statistic	0.23	(5, 216)	0.95
Chi-square		1.14	5	0.95

The Wald coefficient test results showed a high level of probability that prevented us from rejecting the null hypothesis that the insignificant variables were indeed equal to zero. The probabilities of the F-statistic and Chi-squared were not significant at the 5% level. As a result, we cannot reject the null hypothesis that the additional set of regressors are not jointly significant. Thus, we can omit those variables which are not significant in the models.

III. Hat Yai

1. Income inequality and Gini coefficients

In accordance with household survey, the monthly average household income is highest in the urban area (THB 39,188) followed by rural area (THB 38, 609), while lowest in the semi-urban area (THB 33,294). The average household size is 3.73 persons with monthly per capita income of THB 11,433 (Table 4.10). Interestingly, the monthly average household income is greater in the rural area than the semi-urban areas. This might be due to good price of Para rubber and other agricultural commodities complimented by high accessibility option of the Asian highway and its network.

Table 4.10: Descriptive statistics of the household level income, Songkhla (THB)

Location	Total Number	Mean Income	Std. Deviation	Std. Error	Minimum	Maximum
Urban	77	46614.89	42362.88	4827.69	10000	300000
Semi-urban	86	33293.67	36794.36	3967.63	10000	275000
Rural	112	38609.13	24190.39	2285.77	8000	175000
Total	275	39188.45	34370.932	2072.64	8000	300000
Household size	1026	3.73	-	-	1	8
Average per capita income		11,433				

Source: Household Survey 2010

Additionally, the multiple comparison Tukey HSD test also confirms that the mean household income is significantly different in accordance with location type (Table 4.11). However, the mean income of households between rural and urban and rural and semi-urban area is not significantly different. Therefore, we can argue that good accessibility along the Asia Highway and its network might cause to fetch the higher prices of agricultural commodities in the rural area and consumer surplus due to easy mobility of factors of production in lower cost.

Table 4.11: Multiple Comparisons Tukey HSD test for household income by location

(I) location type	(J) location type	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Urban	Semi-urban	13321.22*	5351.15	.036	710.62	25931.82
	Rural	8005.76	5049.22	.254	-3893.31	19904.83
Semi-urban	Urban	-13321.22*	5351.15	.036	-25931.82	-710.61
	Rural	-5315.45	4890.148	.523	-16839.66	6208.75
Rural	Urban	-8005.76	5049.22	.254	-19904.83	3893.31
	Semi-urban	5315.45	4890.15	.523	-6208.74	16839.66

**The mean difference is significant at the 0.05 level.

The official poverty line for the Songkhla province is THB 1,654 per person per month (55 THB/day, approx. US $ 1.75) in the year 2010 (Thai year 2553). This poverty threshold is quite higher than the international poverty measurement line, i.e., US $ 1 or 1.25 per day. As per the given poverty threshold, the incidence of the poverty in the survey household data is very low and the headcount poverty ratio is 1.17%. The official statistics of the proportion of poor in Songkhla is 2.01% in 2010[3]. Therefore, our result is comparable and since we concentrated along the Asia High way, and the incidence of poverty might be lower than the other part of the province. However, the income inequality in the province is higher, and the income inequality ratio of the overall household sample is more than 36%.

Table 4.12: Income inequality among the households by location, Songkhla

S.N.	Location Type	Gini Ratio (Area under Lorenz Curve	Gini Ratio (Covariance)
1	Urban	0.4329	0.4471
2	Semi-urban	0.3507	0.3608
3	Rural	0.2963	0.2998
	Total Sample	0.3607	0.3636

Data source: Household Survey 2010

The income gap among the sample household is highest in urban areas followed by semi-urban areas. The Gini ratio for the former is more than 44% and more than 36% for the later. The income inequality in the rural area is considerably low as compared to the urban and semi-urban locations (Table 4.12). Therefore, policy needs to address the issue of income inequality in Songkhla.

IV. MAWLAMYINE

1. Income inequality and Gini coefficients

A given level of absolute poverty may or may not signal a problem of inequality in income distribution. In order to determine the level of inequality among our survey units, we have drawn the Lorenz curves (Figure 4.2) and calculated the Gini coefficient for our rural, semi-urban and urban subsamples. From these results, we may conclude that there is much greater inequality in income and consumption levels in the urban areas than in the other two areas of Mawlamyine Township. In contrast, rural areas have greater equality than urban areas under both income and expenditure criteria.

[3]Source: http://social.nesdb.go.th/SocialStat

Although inequality under the income criterion in rural areas outpaces the semi- urban areas, the reverse is true under the consumption criterion.

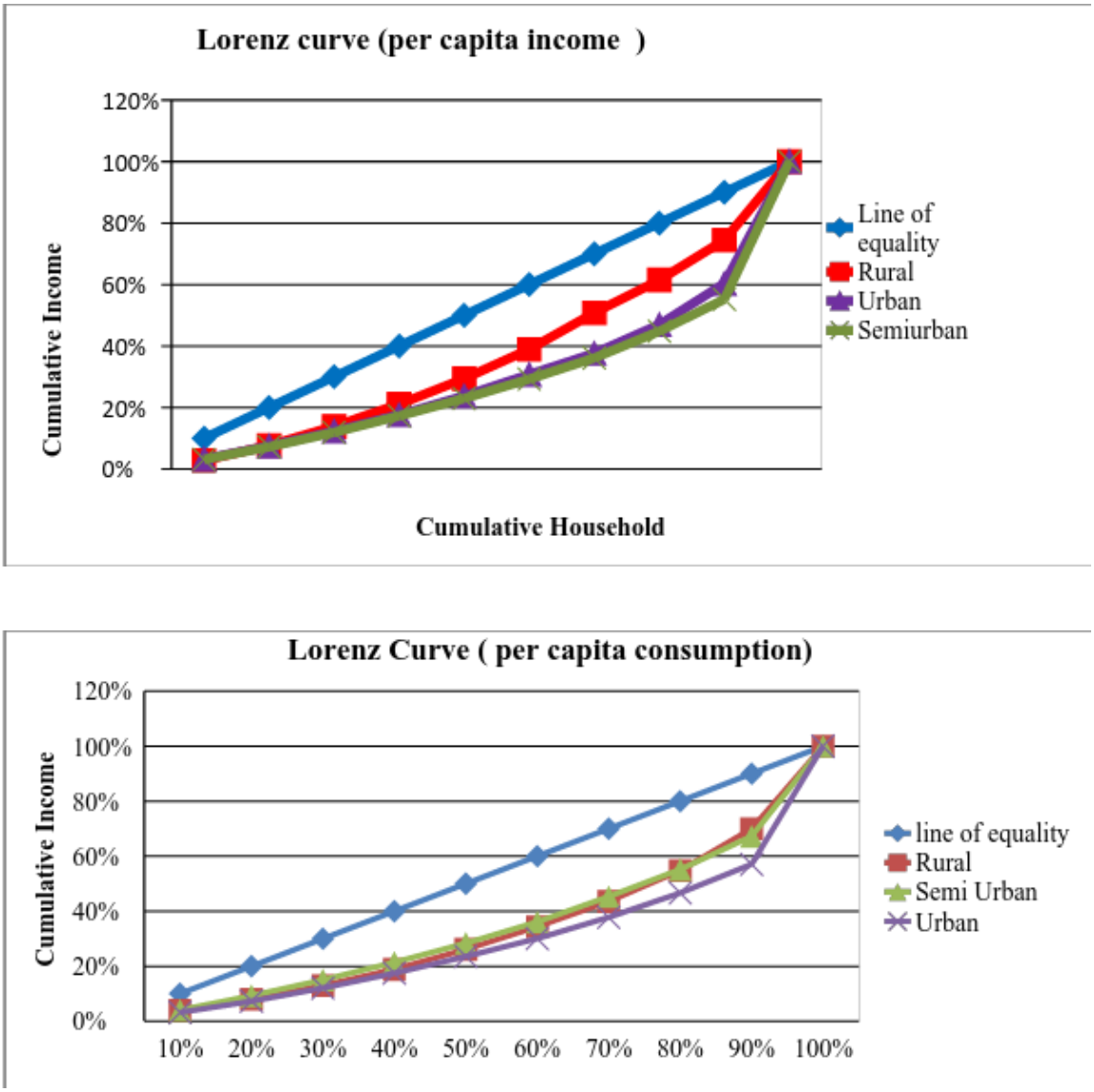


Figure 4.2: Consumption- and income-based Lorenz curves of Mawlamyine.

Semi-urban wards are just adjacent to the urban wards, yet poverty and income-based income inequality are much higher than in the rural areas. One reason might be that such semi-urban areas as ThiriMingala, Tharyaraye and Zayyarthiri quarters were first settled in 1989, Hlaingtharyar in 1991 and Zayyarmyaine in 2004 by families resettling from other areas of the country, leading to lower levels of economic development. As those semi urban areas have been only recently opened up, public utilities such as water and electricity systems are not yet well developed. This evidence fails to reject

hypothesis 2, which states that *Income inequality is highest in the urban areas because of the influx of migrants from rural areas and lowest in the rural areas where it is difficult for the remaining population* to *amass wealth.* The policy implication for this is that well-published relief programs should be aimed at the urban poor to reduce the income gap and social unrest in metropolitan areas.

2. Incidence, depth, and intensity of poverty

The estimated incidence in Mawlamyine (Table 6) of 33% of poverty under per capita income computation and 59% under per capita consumption are far worse than the official 2005 figures for Mon State. Assuming those government figures to be accurate and calculated using comparable methodologies across years, our 2009 findings demonstrate that the HCR has increased, as the ADB has surmised (ADB, 2010). This is all the more dramatic in that Mon State is one of the States and Divisions with less than average poverty.

Table 4.13: Poverty under per capita income and expenditure

	Income-based poverty			**Consumption-based poverty**		
Sample Population	Incidence	Depth	Intensity	Incidence	Depth	Intensity
Urban	22%	0.040	0.010	56%	0.143	0.052
Semi-urban	44%	0.114	0.040	67%	0.220	0.088
Rural	28%	0.088	0.042	47%	0.171	0.078
Entire	**33%**	**0.083**	**0.03**	**59%**	**0.184**	**0.074**

Source: Authors' calculations for 2009.

Moreover, the semi-urban area seems to have the highest incidence of poverty, followed by the rural area for per capita income and urban for per capita consumption. Clearly, a differential dynamic in poverty incidence by area is at work. Nor is this differential dynamic new. In 2004-05 on average, only 22% of the population of Mon State (21 % rural, 23 % urban) was estimated to be under the poverty line. However, the countrywide rural poverty ratio had increased significantly from 22% to 32%.

We are now in a position to reject hypothesis 1, to the effect that *Education and proximity to the EWEC have reduced the incidence, depth and intensity of poverty over time in rural, semi-urban, and urban areas despite the negative effects of the 2008 Hurricane Nargis.* It seems rather that natural disasters and the unrealised potential of development have led to an increase in rural and semi-urban poverty levels. The policy implications from this rejection of hypothesis 1 are that the government should invest both monetary capital and management supervision to increase the road infrastructure and educational institutions. The semi-urban areas with the highest incidence of poverty should be given priority targeting for anti-poverty programs. In the meantime, in-kind aid such as a special food

scheme policy should be seriously considered for poor families with a high severity of poverty. Adequate caloric sources should be given first and then, if necessary, small protein supplements.

3. Econometric equations to explain poverty and income

Having measured the levels of absolute poverty and relative inequality in Mawlamyine, we now use our survey data to determine which variables and conditions most significantly determine income per capita and the intensity of poverty. Table 4.14 reports an OLS regression to identify the determinants of income per capita in the Mawlamyine area.

Table 4.14: Factors that explain income per capita

	B	Std. Error	Beta	t-statistic	Sign.
(Constant)	398405	200078		1.99	.047**
Percent income from small-scale merchandising and sales	1217452	221622	.28	5.49	.000***
Dependency ratio	223444	64264	.18	3.48	.001***
Household females	-207742	65815	-.18	-3.16	.002***
Total household education (years)	9364	3849	.14	2.43	.015**
Distance from EWEC (km)	30656	93880	.02	0.33	.744
Adjusted R-squared				.112	
F-statistic				10.137	.000***
Degrees of freedom				359	

**** = significant at the .01 level or better, ** at the .05 level and * at better than .10.*

Income per capita in Mawlamyine area is significantly increased by the *percent income from small scale merchandising jobs*. Government could therefore consider promoting sales and jobs in that area. In contrast to the previous literature, however, the *dependency ratio* bears a positive effect on family income per capita. This is consistent with the Myanmar tradition whereby the family supports both elderly parents and children living with grandparents when parents are working at border areas and must send money back for their children's school fees. In addition, the more *females* in the family, the less the income per capita is. This finding is consistent with those of Kyaw and Routary (2006) reported earlier. Apart from those females living in metropolitan areas and educated females, females do not usually travel to seek income but simply remain with parents or guardians. It is not surprising that having a greater number of females lessens family income per capita. Here our regression further shows that education is important to increasing family income, but that when all these other variables are taken into account, distance front the EWEC is no longer significant.

Table 4.15: Multiple regression equation to explain the intensity of poverty per capita

	B	Std. Error	Beta	t	Sig
Mawlamyine-employed females	.019	.004	.287	4.316	.000***
Migrant females	.031	.010	.160	2.993	.003***
Mawlamyine-employed males	.010	.004	.174	2.558	.011**
Migrant males	.011	.007	.098	1.668	.096*
Motorcycle ownership (1, 0)	-.020	.008	-.136	-2.304	.022**
Dummy variable for urban areas	-.020	.009	-.139	-2.241	.026**
Distance from EWEC (km)	.005	.005	.071	.993	.321
Adjusted R-squared				.186	
F-statistic				13.181	.000***
Degrees of freedom				365	

Of course, what causes some households to suffer extreme poverty is not always the opposite of what causes other people to have extreme wealth. We therefore estimate in Table 4.15 the causes of the intensity of poverty as the dependent variable in an OLS regression equation. Since the intensity-of-poverty dependent variable gives most weight to the poorest in society, it comes as no surprise that having to resort to *migrant female workers* significantly drives up the intensity of poverty. Surprisingly, the same problem affects *female workers at Mawlamyine, male workers in Mawlamyine* and, to a lesser degree, even *migrant males*. Since it is observed that most migrants from Mawlamyine are blue collar workers working at border and factories in Thailand, migrants of either gender should reduce, not intensify, poverty unless of course migration is unsuccessful.

Taken together, we can reject hypothesis 3, to the effect that *the intensity of income poverty is increased by living in large female-headed households with a high dependency ratio, high distance from the EWEC, living in rural areas, and reliance upon casual jobs.* In fact, none of these variables are significant in the poverty equation of Table 4.15 and only rurality is significant. Meanwhile, *female head* is significant only in the income equation (Table 4.14); the *dependency ratio* bears the wrong sign in the income equation, and employment, whether in migration or in Mawlamyine for both genders, seems paradoxically to increase the intensity of poverty.

Table 4.15 also leads us to reject hypothesis 4, that *the intensity of income poverty is reduced by education, jobs in transportation, metal-working/blacksmithing, and living in urban areas.* Only motorcycle ownership and urban residence significantly reduce poverty, and neither of these two variables were specified in the hypothesis. Motorcycles are not only a means of commuting, marketing, and migration; they are also the principal asset in operating a cycle taxi. This suggests a possible subsidy policy for motorcycle ownership in rural and semi-urban areas. Finally, the non-significance of the *distance from EWEC* variable strengthens our conclusion that the EWEC has not lived up to its job- and growth-creating potential.

Two types of policy implications flow from our analyses of hypotheses 3 and 4. First, transportation and mobility-related job creation should form the nucleus of the anti-poverty thrust in Mawlamyine. If people living in rural and semi-urban areas can be partially subsidised to afford motorcycles, they can undertake jobs in the business, sales, transportation and other services sectors. Otherwise, the entire positional advantage of Mawlamyine as a major transit and border trade city at the terminus of the EWEC will remain unrealised.

Secondly, adult education will also be necessary. Technical training for landing non-agricultural, non-manufacturing jobs could be a powerful government policy to reduce the intensity of destitution below the poverty line. Such a policy appears especially urgent since in the results of our firm and household surveys, the business and transportation sectors were far from flourishing in 2009. This is particularly true in the case of females, who must be equipped with knowledge to seek higher paying jobs outside the household, notably in the transportation, business and service jobs. Although metalworking jobs are not currently a significant force in reducing the food Engel coefficient, these and other traditional cultural employment within the handicraft sector should be maintained against the day when jobs in building the transportation infrastructure will no longer be available. A combination of wage-rate subsidies and low-interest loans may be envisaged to promote investment and job-seeking in these areas.

Three policy conclusions flow from our analyses of hypotheses 5. First, consistent with the writings of Todaro and Smith (2003), rural-based employment and welfare improvement programs should precede any effort to promote rural-urban migration. Families should be encouraged to remain in rural areas, and to unite larger family units under a single roof. Education and female migration can then be used to achieve a healthier balance among food and non-food basic necessity consumption.

Second, public healthcare institutions and personnel should be upgraded. Based on our survey experience, most of the younger generation from rural areas are paying inadequate attention to education and healthcare. Third, within non-food necessities, health care plans for dependents should be checked. The factor that a high dependency ratio induces families to spend more on education, health, and clothing is especially serious because, health institutions and personnel are already lacking in the public institutions to which the poor would normally go. Investments in the public health sector would therefore be a “pro-poor” policy. The above results can guide actions to reduce the twin problems of inequality and poverty in the near future.

Table 4.16: The effect of poverty on other basic expenditures

Dependent= Engel coefficient for basic needs	a) Before Wald test				b) AfterWald test			
Variable	Coefficient	Std. Err.	z-Stat.	Prob.	Coefficient	Std. Err.	z-Stat.	Prob.
Constant intercept term	0.11	0.03	3.86	0.000	0.07	0.02	4.91	0.000
POVERTY								
Intensity poverty in expenditure	-0.11	0.06	-2.09	0.037	-0.13	0.05	-2.66	0.008
OTHER ECONOMIC STATUS								
Value of remittance (kyats)	0.00	0.00	2.49	0.013	0.00	0.00	1.66	0.097
Own motorcycle (1 = yes, 0 = otherwise	-0.02	0.01	-1.55	0.121				
EDUCATION								
Total years of education	0.00	0.00	5.52	0.00	0.00	0.00	5.09	0.000
Know about EWEC (Yes=1, otherwise =0)	-0.03	0.01	-2.06	0.04	-0.02	0.01	-1.84	0.066
EMPLOYMENT								
Get tips from clients or superiors	0.11	0.04	2.91	0.004	0.11	0.04	2.87	0.004
Do health-care services (1,)	0.20	0.09	2.25	0.025	0.19	0.09	2.15	0.032
Grow fruit and vegetables (1,0)	0.06	0.03	1.96	0.05	0.07	0.03	2.10	0.036
Casual jobs	-0.02	0.01	-1.87	0.061	-0.02	0.01	-1.44	0.151
Migrant females	0.02	0.01	1.74	0.082	0.02	0.01	1.66	0.097
Migrant males	-0.01	0.01	-1.13	0.257				
CONSUMPTION BEHAVIOUR								
HH savings rate (% savings/total income)	-0.02	0.01	-1.62	0.105				
Value of self-consumed products per/ yr(kyats)	0.00	0.00	-0.91	0.361				
HH STRUCTURE/SOCIODEMOGRAPHY								
Dependency ratio	0.02	0.01	3.56	0	0.02	0.01	3.98	0.000
Distance from EWEC	-0.02	0.01	-2.02	0.043	-0.02	0.01	-1.90	0.057
Rural	0.03	0.02	1.79	0.073	0.02	0.02	1.38	0.168
Age of household head	0.00	0.00	-1.29	0.198				
Female household head (1,0)	0.01	0.01	0.49	0.628				
Urban	0.00	0.01	-0.15	0.884				
Log likelihood	*375.57*				*370.49*			
Akaike information criterion	*-1.9644*				*-1.975*			

CHAPTER V:
THE CONSTRUCTION OF SOCIAL ACCOUNTING MATRICES

1. Establishment of the matrix

In this part, we have constructed and employed a Social Accounting Matrix (SAM) to gather insights for economic development strategy and policy formulation. We applied and compared investment multipliers to visualize the total effects of increasing the output of a given sector on all other sectors of the economy and linear programming to optimize the provincial economy subject to resource constraints and provide the corresponding implementation plan. All these methods were combined to propose a strategic plan for maximizing the net developmental benefits from the EWEC for the Savannakhet economy. Table below summarizes structure and impacts of the optimal solution under the seven scenarios. Scenario 1 is The "Benchmark Scenario" that reproduced the actual total values of each activity column according to our 2010-11 dataset. The value added of the improvement in provincial product in Scenario 1 was 9,506,019.13 million Kip. The value added of the transportation was 4,515,357.39 million Kip and the share of value added of the agriculture sector was 4.82%.

Next, for scenario 2 we added a labor constraint following Classical theory which assumed that the economy tends to full employment equilibrium. This optimization was called the "Neoclassical" labor-constraint model. The optimal level of this scenario was 9,512,681.09 m Kip, or a barely perceptible increase of 0.04% of current NPP; the value added of transportation and capital and financial sector increased slightly. The constraint's shadow prices showed how much the objective function of net provincial product (NPP) would increase by one unit of amount of resources available. The shadow price reveals that adding one more laborer to the Savannakhet economy would give a marginal value of 2.90 m Kip.

Third, scenario 3 involved a "Human Capital" labor-with-education constraint model designed to increase labor productivity. The optimal level of this scenario was 12,366,475.17 m Kip, or an increase of 30.09% over current NPP. Others sector also went up 30% on average in optimal production level. The results were consistent with the King's philosophy principle of "knowledge" because labor cannot be fully used without an equal increase (30%) in education or training programs. The labor constraint and educational investment constraint were binding, and their shadow prices reflected their marginal value to Savannakhet economy of adding one extra laborer and taking away 1 m Kips of education investment.

Scenario 4 -- the “Growth with Equity” human capital plus income-to-poor constraint model – was used to gauge the extent to which planners could help disadvantaged household groups to achieve a higher level of human development. Poor families focus on absolute cash-in-pocket rather than relative income. This social concern is consistent with the King’s principles of a) “ethics” and b) “balance,” not to mention c) “self-immunization” of the higher classes and government against social unrest. The optimal level was 12,366,475.17 m Kip, or an increase of 30.09% over current NPP. The total output of each sector also went up by 30% on average. The existing of 30% unemployed labor was still accompanied by an equal increase of 30% in education/training programs. The shadow prices display the result as same as previous scenario. Then, both labor and education contribute to economic product in Savannakhet province.

Scenario 5 was the “Sufficiency Economy” growth-with-equity plus reduction-of-“bads” constraint model. In this scenario we applied a subset of the King’s principles to the model. We required that the consumption of “bad” habits be reduced by 5%, which must be translated into a 5% increase in educational investment (now 35% instead of 30%). That constraint further was presumed to enhance worker health, leading to an increase in effective labor availability if 5%. This reasoning is consistent with the King’s philosophy principle of Self-immunization. Unfortunately, the searches for an optimal solution under these conditions proved infeasible because the SAM structure assumes that fixed proportion s of income are spent on each item.

Table 5.1: Summary table of the structure and impacts of the optimal solution under the 7 scenarios

Current values	Summary of changes in	Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 6		Scenario 7	
		Simulation	% error	Optimal value	% of current	Optimal value	% of current	Optimal value	% of current	Optimal value	% of current	Optimal value	% of current
IMPROVEMENT IN PROVINCIAL PRODUCT													
9,506,019	Value added	9,506,019	0.00%	9,512,681	0.07%	12,366,475	30.09%	12,366,475	30.09%	13,308,220	40.00%	13,308,411	40.00%
EWEC DEVELOPMENT													
4,515,357	Transportation	4,515,357	0.00%	4,516,920	0.03%	5,871,993	30.04%	5,871,993	30.04%	6,321,396	40.00%	6,321,492	40.00%
3,281,038	Employment	3,281,038	0.00%	3,281,038	0.00%	4,265,350	30.00%	4,265,350	30.00%	4,593,454	40.00%	4,593,454	40.00%
7,609,405	Capital &financial	7,609,405	0.00%	7,616,026	0.09%	9,900,825	30.11%	9,900,825	30.11%	10,652,824	40.00%	10,653,142	40.00%
INCOME REDISTRIBUTIONS													
585,589	Rural hh	585,589	0.00%	585,614	0.00%	761,298	30.01%	761,298	30.01%	819,820	40.00%	819,824	40.00%
2,314,037	Semi-urban hh	2,314,037	0.00%	2,314,097	0.00%	3,008,326	30.00%	3,008,326	30.00%	3,239,621	40.00%	3,239,649	40.00%
915,977	Urban hh	915,977	0.00%	915,982	0.00%	1,190,777	30.00%	1,190,777	30.00%	1,282,359	40.00%	1,282,367	40.00%
678,197	Bottom 20% income	678,197	0.00%	678,197	0.00%	881,656	30.00%	881,656	30.00%	949,476	40.00%	949,476	40.00%
1,359,086	Bottom 40% income	1,359,086	0.00%	1,359,085	0.00%	1,766,811	30.00%	1,766,811	30.00%	1,902,720	40.00%	1,902,720	40.00%
KING'S BALANCE/SUFFICIENCY													
5,052,343	Value of social "bads"	5,052,343	0.00%	5,061,239	0.18%	6,579,602	30.23%	6,579,602	30.23%	7,075,407	40.04%	7,073,440	40.00%
15,723	Donations & religious expenses	15,723	0.00%	15,713	-0.06%	20,427	29.92%	20,427	29.92%	22,012	40.00%	22,012	40.00%
SOCIAL ADVERTISING (Each household group are limit on Engel expenditure transfer from tobacco/alcohol to education (mi het mi pon))													
	RHH1									-190,367		-178,817	
	RHH2									-6,871		-88,504	
	RHH3									-265,662		-254,112	
	RHH4									-6,654		-85,474	
	RHH5									-11,632		-155,167	
	SHH1									-42,198		-583,081	
	SHH2									-409,694		-398,144	
	SHH3									-805,355		-793,808	
	SHH4									-63,192		-877,009	
	SHH5									-541,386		-529,857	
	UHH1									-11,472		-152,928	
	UHH2									-443,496		-431,946	
	UHH3									-16,365		-221,420	

Table 5.1: Summary table of the structure and impacts of the optimal solution under the 7 scenarios (conts.)

SOCIAL ADVERTISING (Each household group are limit on Engel expenditure transfer from tobacco/alcohol to education (mi het mi pon))			
UHH4		-202,339	-190,790
UHH5		-16,801	-227,534

Current values	Summary of changes in	Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 6		Scenario 7	
		Simulation	% error	Optimal value	% of current	Optimal value	% of current	Optimal value	% of current	Optimal value	% of current	Optimal value	% of current
CHANGES IN SECTORAL BALANCE OF OPTIMAL PLAN													
4.82%	% VA from primary sector	4.82%	0.00%	4.82%	-0.05%	4.82%	-0.05%	4.82%	-0.05%	4.82%	0.00%	4.82%	0.00%
6.57%	% VA from industrial sector	6.57%	0.00%	6.56%	-0.05%	6.56%	-0.05%	6.56%	-0.05%	6.57%	0.00%	6.57%	0.00%
4.61%	% VA from "bads"	4.61%	0.00%	4.70%	1.85%	4.70%	1.85%	4.70%	1.85%	4.61%	0.03%	4.61%	0.00%
2.88%	% VA from transport/EWEC	2.88%	0.00%	2.87%	-0.06%	2.87%	-0.06%	2.87%	-0.06%	2.88%	0.00%	2.88%	0.00%
7.07%	% VA from tourist/services	7.07%	0.00%	7.06%	-0.06%	7.06%	-0.06%	7.06%	-0.06%	7.07%	0.00%	7.07%	0.00%
67.20%	% VA from construction	67.20%	0.00%	67.15%	-0.09%	67.15%	-0.09%	67.15%	-0.09%	67.20%	0.00%	67.20%	0.00%
1.74%	% VA from business	1.74%	0.00%	1.74%	-0.07%	1.74%	-0.07%	1.74%	-0.07%	1.74%	-0.01%	1.74%	0.00%
1.18%	% VA from financial sector	1.18%	0.00%	1.18%	-0.07%	1.18%	-0.07%	1.18%	-0.07%	1.18%	-0.01%	1.18%	0.00%
3.10%	% VA from wholesale/retail	3.10%	0.00%	3.09%	-0.38%	3.09%	-0.38%	3.09%	-0.38%	3.10%	0.00%	3.10%	0.00%
0.79%	% VA from public utilities	0.79%	0.00%	0.79%	-0.21%	0.79%	-0.21%	0.79%	-0.21%	0.79%	0.00%	0.79%	0.00%
0.05%	% VA from health/education	0.05%	0.00%	0.05%	-0.07%	0.05%	-0.06%	0.05%	-0.06%	0.05%	-0.28%	0.05%	-0.02%
0.01%	%VA from welfare sector	0.01%	0.00%	0.01%	-0.13%	0.01%	-0.13%	0.01%	-0.13%	0.01%	0.00%	0.01%	0.00%

Scenario 6 (the “Sufficiency Economy” model) added the “bad” habit consumption constraint with possible household spending transfers from “bads” to education: Education is an important key priority to increase household welfare that should help to alleviate poverty alleviation and improve income distribution through the equalization of opportunity. We wished to reduce the consumption of “bads” by a full 75%, while increasing education expenditures by a corresponding amount. This involved social advertising to motivate awareness of the long-term harmfulness of consuming bads, as well as the long-term benefits of households to investing in education, resulting in a transfer into education of money previously spent on tobacco, cigarettes and alcohol. The optimal level of this scenario was 13,308,220.16 m Kip, an increase of 40% over current NPP. The Engel coefficient on tobacco and alcohol was highest in rural areas, on average 0.026752. Moreover, only the labor constraint was binding on the Savannakhet economy. Its shadow price +2.9 m Kip reflects the marginal value of adding one more labor on an annual basis to ease that constraint.

Finally, scenario 7 involved the “Sufficiency Economy” model with household spending transfers from “bads” to education but a budget limitation on social advertising. The poorest groups are suffering from tobacco use or “bad” habits. The strategies to reduce smoking by supporting education to people may be a more important predictor of smoking than material circumstances. This result is consistent with the King’s principles of Knowledge and may help people to awareness of the effect of “bad” habits and reduce those behaviors. Moreover, this scenario 7 results shows the optimal value of value added in Savannakhet economy which the optimal level 1 is 3,308,411.28 m Kip, or an increase of almost 40% over current NPP. Others sector have also gone up 40% on average in optimal production level. For example, the value added of transportation is now 6,321,492.49 m Kip, employment is valued at 4,593,453.75 m Kip, and the highest value added on income distribution is for semi-urban households: 3,239,648.88 m Kip. Unfortunately, however, the value added of “bad” habits also increases by almost 40% because household can access “bad” products as a consequence of the improvement of road infrastructure. The percentage value added from the agriculture sector in the changes in sectoral balance of optimal plan is 4.821%. The % value added of the road-related activities such as transportation sector is 2.875%, tourist and personal service sector is 7.067%, business service sector is 1.737%, wholesale and retail trades is 3.098%, and, especially on construction sector, are growing up to 67.204. Shadow price still shows the same result with scenario 6 of adding one more to labor on an annual basis to ease that constraint.

Table 5.1 shows that a reallocation of investment patterns along optimal lines increases value added of the Savannakhet economy by almost 40%. The table also reflects the strong result of the optimized SAM that is significantly different plans for the objective of economic development versus that of poverty reduction, lending critical importance to education and the ethics of sufficiency economy. Moreover, the optimal restructuring (scenario 7) of the Savannakhet economy under resource and socioeconomic constraints is also significantly different from that suggested by unconstrained multiplier analysis (scenario 1). The final Savannakhet **SAM** was composed of 47 production and sales activities, four social welfare activities, eight production factors, 15 household categories (five quintiles

in each of three distance Savannakhet), and connections with five exogenous sectors outside of Savannakhet (Table 5.2).

Table 5.2: Savannakhet SAM structure

Number	Name	Number	Name
	Goods		**Financial**
1	Rice	41	Banking and financial service
2	Noodles	42	Installment payment
3	Wheat flour and bread	43	Insurance
4	Vegetables		**Trade**
5	other crop	44	Wholesale and retail trade
6	Fruit		**Collective goods**
7	Dairy products	45	Electricity and water supply
8	Beef and pork	46	Health care and medicine
9	Chicken and duck	47	Education
10	Fishery products		**Social welfare activities**
11	Transformed agricultural products	48	Donations (direct donation)
12	Food, food processing and beverages	49	Religious function
13	Clothing and textiles	50	Community base
14	Cosmetics and house wares	51	Social transfer
15	Wooden products		**Factor of production**
16	Furniture and major equipment	52	Agricultural labor
17	Electrical appliances	53	Merchant labor
18	Animal and agriculture machines/equipment	54	Service labor
19	Fertilizer and pesticide	55	Industrial labor
20	Handicrafts, gifts, souvenirs	56	Other labor
	Bads	57	Capital
21	Tobacco, cigarettes and alcohol	58	Houses, buildings, and land
22	Lottery	59	Enterprises
	Direct EWEC impacts		**Households**
23	Local transportation service	60	RHH1
24	Retail and wholesale vehicles	61	RHH2
25	Retail for fuel, gas	62	RHH3
26	Vehicle repair and maintenance	63	RHH4
	Indirect tourism and recreation impacts	64	RHH5
27	Reading activities/materials, stationery	65	SHH1
28	Communication	66	SHH2
29	Recreation	67	SHH3
30	Special occasion travel and tours	68	SHH4
31	Accommodation	69	SHH5
32	Massage	70	UHH1
33	Other activities (spa, coiffure)	71	UHH2
34	Hotel	72	UHH3
35	Restaurant	73	UHH4
36	local petty shop	74	UHH5
37	Other Tour services		**Other institutions**
38	construction service	75	Government
39	business service	76	ROLAO
40	labor and labor related service	77	ROVIETNAM
		78	ROTHAILAND
		79	ROW
		80	Other expenditures

Empirical results

After the construction of the Savannakhet SAM, multiplier analysis and linear programming were employed. The multiplier analysis was used to quantify the direct impacts from the EWEC highway on economic development, the employment, road-related activities, trade and poverty. Then, linear programming was used to measure the current and potential economic impacts of that highway. A linear programming problem consists of an objective function which is minimized or maximized subject to a set of constraints which are sometimes expresses as strict equalities but usually take the form of greater-than-or-equal-to or less-than-or-equal-to weak inequalities. We assumed that the gross township product (GPP) may be expressed as the sum of multiples of unit budgets of 1 million Kip for each existing economic activity, production factor, household type or other institution. The social profit from each of these activities is known as its "value added" to the economy through payments to locally-owned production factors. The sum across all activities of such value added yields what we will term in this research the net provincial product (NPP) or social profit. For each sector we shall seek to determine by how output should be increased or decreased to maximize NPP under a series of seven economic "scenarios" or assumption sets. More specifically, our objective in the present research will be to explore the maximization of township value added by using various numbers of constraints which allow the land, labor, capital of the township itself to be used fully or underused; which require minimal income to the poor; and/or which apply educational and ethical constraints. In addition, no activity may be produced at a level less than 0.

2. **Scenario 1: The "Benchmark Scenario": reproduction of the 2010-2011 data**

Scenario 1 is, however, not an optimization, but rather a simulation of the actual economic situation of Savannakhet in the time period when the data was collected: 2010-11. Table 3 reports the benchmark scenario: the reproduction of our 2010 – 2011 data. This simulation will serve as the baseline or benchmark of comparison with the results of the six remaining scenarios. Table 3 also includes a summary of five parts to be simulated in the six remaining scenarios:

- Improvement in provincial product
- EWEC development
- Income redistributions
- The King of Thailand's Sufficiency Economy concepts of balance and sufficiency
- Changes in the sectoral balance of optimal plan. The simulation results using the actual total values of each activity column in the SAM balanced matrix are expressed in the "Simulation" column. The name of this column will be changed to "Optimal value" in all future models.

The total value added (net provincial product) is 9,506,019.13 m Kip. For EWEC development, the values added of transportation, employment, capital and financial sector are 4,515,357.39 m Kip, 3,281,038.39 m Kip and 7,609,405.32 m Kip, respectively. For income redistributions the highest value added is accessed by Semi-urban households (2,314,036.53 m Kip),

largely because of the SAVAN-SENO Park, a special economic zone that covers more than 600 hectares.

Table 5.3: The "Benchmark Scenario": reproduction of the 2010-2011 data

Current values	Summary of changes in	Simulation	+/- % change
	IMPROVEMENT IN PROVINCIAL PRODUCT		
9,506,019.13	Value added	9,506,019.13	0.00%
	EWEC DEVELOPMENT		
4,515,357.39	Transportation	4,515,357.39	0.00%
3,281,038.39	Employment	3,281,038.39	0.00%
7,609,405.32	Capital and financial sector	7,609,405.32	0.00%
	INCOME REDISTRIBUTIONS		
585,588.91	Rural household income	585,588.91	0.00%
2,314,036.53	Semi-urban household income	2,314,036.53	0.00%
915,977.16	Urban household income	915,977.16	0.00%
678,197.12	Bottom quintile income	678,197.12	0.00%
1,359,085.53	Bottom two-quintiles (40%) income	1,359,085.54	0.00%
	KING'S BALANCE/SUFFICIENCY		
5,052,343.13	Value of social "bads"	5,052,343.13	0.00%
15,723.22	Donations and religious expenses	15,723.22	0.00%
	CHANGES IN SECTORAL BALANCE OF OPTIMAL PLAN		
4.82%	% VA from primary agricultural sector	4.82%	0.00%
6.57%	% VA from industrial sector	6.57%	0.00%
4.61%	% VA from habit-inducing "bads"	4.61%	0.00%
2.88%	% VA from transportation/EWEC sector	2.88%	0.00%
7.07%	% VA from tourist and personal service sector	7.07%	0.00%
67.20%	% VA from construction sector	67.20%	0.00%
1.74%	% VA from business service sector	1.74%	0.00%
1.18%	% VA from financial sector	1.18%	0.00%
3.10%	% VA from Wholesale and retail trade	3.10%	0.00%
0.79%	% VA from public utilities	0.79%	0.00%
0.05%	% VA from health and education	0.05%	0.00%
0.01%	%VA from welfare sector	0.01%	0.00%

The bottom two-quintiles (40%) of households earn 1,359,085.54 m Kip. The highest value added of King's sufficiency is in social "bads" (5,052,343.13 m Kip). The greatest sector share in the optimal plan is 67.204% from the construction sector, followed by the tourist and personal service sectors with 7.067%. The construction sector has more value added as a consequence of the growth of the business and industrial sectors in recent years.

From the benchmark scenario, we can see that the percentage errors are 0 in every part. We have succeeded in reproducing a simulation result that is no different from the original values. In subsequent scenarios, we will add constraints that will transform this simulation to optimal values.

3. Scenario 2: The "Neoclassical" labor-constraint model

The second scenario is inspired by the neoclassical labor-constrained model. Classical economists assumed that the economy tends to full employment equilibrium. Unemployment would be temporary because the unemployment (surplus labor) would cause wages to fall and demand for labor to increase. Equilibrium would soon be restored to full employment. There would be sufficient demand to employ everyone in the economic system (the Biz/ed Team).

The constraint is a restriction on the amount of resources available. With no constraints at all, the model becomes technically "unbounded," and there can be no optimal solution. We therefore employed a single neoclassical labor constraint to generate the optimal value level for the Savannakhet economy. The labor constraint sets an upper bound on the total payment (value added) to labor resources. This limit was calculated from the current expenditures on labor employment from each activity in the initial SAM balanced matrix. We assumed that the same total level of expenditure can be paid to all labor in wages and salaries as in the benchmark solution, but within this amount there can be a transfer of labor from one sector to another sector. In addition, the spirit of the SAM (that income in each sector must be greater than or equal to expenses of that same sector) was also imposed as a set of constraints on each economic activity, household type, or institution.

Table 5.4 shows the resulting optimal solution. The maximum possible level of NPP for of this scenario is 9,512,681.09 m Kip, an increase of only 0.04% of current NPP. This relative inflexibility is probably due to the limited density of the matrix, giving small scope for improvement in the optimal level solutions of this and subsequent scenarios. Nonetheless, even small changes can clearly show the direction of change in which certain key activities should be increased/encouraged or decreased/discourage through government programs and encouragement/ discouragement of private and foreign investment.

The results show that the value of social "bads" in the sense of the King's balance/sufficiency principles have gone up by 0.18% in total Gross Provincial Product (NPP), followed by the capital and financial sector (0.09%), which has benefited from EWEC development.

Table 5.4: The "Neoclassical" labor-constraint model

Current values	Summary of changes in	Optimal value	+/- % change
	IMPROVEMENT IN PROVINCIAL PRODUCT		
9,506,019.13	Value added	9,512,681.09	0.07%
	EWEC DEVELOPMENT		
4,515,357.39	Transportation	4,516,920.34	0.03%
3,281,038.39	Employment	3,281,038.39	0.00%
7,609,405.32	Capital and financial sector	7,616,025.81	0.09%
	INCOME REDISTRIBUTIONS		
585,588.91	Rural household income	585,614.15	0.00%
2,314,036.53	Semi-urban household income	2,314,096.74	0.00%
915,977.16	Urban household income	915,982.20	0.00%
678,197.12	Bottom quintile income	678,197.12	0.00%
1,359,085.53	Bottom two-quintiles (40%) income	1,359,085.44	0.00%
	KING'S BALANCE/SUFFICIENCY		
5,052,343.13	Value of social "bads"	5,061,239.35	0.18%
15,723.22	Donations and religious expenses	15,713.03	-0.06%
	CHANGES IN SECTORAL BALANCE OF OPTIMAL PLAN		
4.82%	% VA from primary agricultural sector	4.82%	-0.05%
6.57%	% VA from industrial sector	6.56%	-0.05%
4.61%	% VA from habit-inducing "bads"	4.70%	1.85%
2.88%	% VA from transportation/EWEC sector	2.87%	-0.06%
7.07%	% VA from tourist and personal service sector	7.06%	-0.06%
67.20%	% VA from construction sector	67.15%	-0.09%
1.74%	% VA from business service sector	1.74%	-0.07%
1.18%	% VA from financial sector	1.18%	-0.07%
3.10%	% VA from Wholesale and retail trade	3.09%	-0.38%
0.79%	% VA from public utilities	0.79%	-0.21%
0.05%	% VA from health and education	0.05%	-0.07%
0.01%	%VA from welfare sector	0.01%	-0.13%

One activity that has gone down in optimal production level is donations and religious expenditures by 0.06%. Moreover, almost all percentage changes in sectoral balance in the optimal plan are negative except for the value from habit-inducing "bads". The highest % change is in wholesale and retail trade by 0.38%, followed by the value added from public utilities 0.21%. Again, although these changes may seem small, positive changes in trade and utilities point the way to the most growth-producing sectors which should be promoted in the future. The prominence of trade implies that the governments should continue to promote investment in the transportation sector.

The SAM formulation further reveals that the labor constraint is binding on the Savannakhet economy. The constraint's shadow prices shows by how much the objective function would increase if one additional unit of resources were made available. In this case, adding one more laborer to the economy yields a shadow price or marginal value of 2.90 m Kip.

4. Scenario 3: The "Human Capital" labor-with-education constraint model

Human capital is a set of skills or characteristics that potentially increase the ability of labor to work more productively. Economists believe that the expenditures on education/training and health care are the most important investments in human capital. They regard that knowledge/skills and health are true physical assets for human beings (Becker, 1975). To construct this scenario, we added a second constraint -- on educational investments in human capital. Because of the current state of relative underdevelopment of PDR Lao and the fact that large cities attract migrants from the countryside, we assume that there exists 30% disguisedly or completely unemployed laborers in the Savannakhet economy. Furthermore, in accordance with human capital theory, this labor cannot be fully used without an equal increase (30%) in education/training programs. This reasoning is consistent with the King's philosophy pre-condition of "knowledge," as explained above.

Table 5.5 shows by how much each sector's outputs should optimally be increased or decreased. We can see that the optimal level of this scenario is 12,366,475.17 m Kip, an increase 30.09% over current NPP. Each sector has gone up 30% on average in optimal production level. The changes in sectoral balance of optimal plan exhibit a slightly decrease for the exception of habit-inducing "bads".

The labor and educational investment constraints in this scenario bear shadow prices of +2.9 m Kip on the labor constraint and -1.68 m Kip on the educational investment constraint. These values reflect the marginal value to the Savannakhet economy of adding one extra laborer and taking away 1 m Kip of educational investment, respectively. Thus both labor and education contribute to economic product. But since labor cannot be fully used without an equal increase in education/training programs, promoting education is very important issue in designing an optimal production plan for Savannakhet. We feel it is especially important to provide equal educational opportunities to women.

Table 5.5: The "Human Capital" labor-with-education constraint model

Current values	Summary of changes in	Optimal value	+/- % change
	IMPROVEMENT IN PROVINCIAL PRODUCT		
9,506,019.13	Value added	12,366,475.17	30.09%
	EWEC DEVELOPMENT		
4,515,357.39	Transportation	5,871,993.08	30.04%
3,281,038.39	Employment	4,265,349.91	30.00%
7,609,405.32	Capital and financial sector	9,900,824.93	30.11%
	INCOME REDISTRIBUTIONS		
585,588.91	Rural household income	761,298.37	30.01%
2,314,036.53	Semi-urban household income	3,008,325.91	30.00%
915,977.16	Urban household income	1,190,776.95	30.00%
678,197.12	Bottom quintile income	881,656.25	30.00%
1,359,085.53	Bottom two-quintiles (40%) income	1,766,811.07	30.00%
	KING'S BALANCE/SUFFICIENCY		
5,052,343.13	Value of social "bads"	6,579,602.48	30.23%
15,723.22	Donations and religious expenses	20,426.94	29.92%
	CHANGES IN SECTORAL BALANCE OF OPTIMAL PLAN		
4.82%	% VA from primary agricultural sector	4.82%	-0.05%
6.57%	% VA from industrial sector	6.56%	-0.05%
4.61%	% VA from habit-inducing "bads"	4.70%	1.85%
2.88%	% VA from transportation/EWEC sector	2.87%	-0.06%
7.07%	% VA from tourist and personal service sector	7.06%	-0.06%
67.20%	% VA from construction sector	67.15%	-0.09%
1.74%	% VA from business service sector	1.74%	-0.07%
1.18%	% VA from financial sector	1.18%	-0.07%
3.10%	% VA from Wholesale and retail trade	3.09%	-0.38%
0.79%	% VA from public utilities	0.79%	-0.21%
0.05%	% VA from health and education	0.05%	-0.06%
0.01%	%VA from welfare sector	0.01%	-0.13%

5. Scenario 4: The “Growth with Equity” human capital plus income-to-poor constraint model

Economic growth is intimately tied to poverty reduction in many aspects. What the poor need is an opportunity for better opportunity to access the productive and stable jobs, a better education, a minimal standard of healthcare services and higher incomes (Roy, 2010). As a result, growth with equity can help them to achieve from increasing income to a higher level of human development (United Nations Development Programme (UNDP), 2009).

In the following scenario, we constrained NPP subject not only to a labor constraint and an educational investment constraint but also to a minimal income-to-poor-households constraint. As before, we posit that there exists 30% disguisedly or completely unemployed laborers in the Savannakhet economy, accompanied by an equal increase (30%) in education/training programs. But economic development must further be concerned with the balanced sharing of new NPP across all quintiles of the population. Therefore we add a third constraint that requires at least a 30% increase in the absolute incomes of bottom two quintiles (40%) of the population.

The results of scenario 4 (Table 5.6) show an optimal NPP level of 12,366,475.17 m Kip, up 30.09% from current NPP. Each sector has gone up 30% on average in optimal production level. The changes in sectoral balance in the optimal plan are minor, except for the habit-inducing "bads". (We will have to deal with those in subsequent scenarios).

The fact that income to the poorest 40% of households has increased by 30% does not necessarily mean that the Gini coefficient will improve, however, since the incomes of the top three quintiles will also go up. In any case what counts most for a hungry family is its absolute cash-in-pocket rather than its relative income. This social concern is consistent with the King’s principles of a) ethics and b) balance, not to mention c) self-immunization of the higher classes and government against social unrest.

Both the labor constraint and the educational investment constraint in this scenario are binding. The shadow prices of +2.9 m Kip on the labor constraint and -1.68 m Kip on educational investment constraint reflect their marginal values to the Savannakhet economy. However, this could be the short run model and the education would begin to really yield growth in the medium to long run. Then, promoting on education could constitute one key priority of Savannakhet.

Table 5.6: The "Growth with Equity" human capital plus income-to-poor constraint model

Current values	Summary of changes in	Optimal value	+/- % change
	IMPROVEMENT IN PROVINCIAL PRODUCT		
9,506,019.13	Value added	12,366,475.17	30.09%
	EWEC DEVELOPMENT		
4,515,357.39	Transportation	5,871,993.08	30.04%
3,281,038.39	Employment	4,265,349.91	30.00%
7,609,405.32	Capital &financial sector	9,900,824.93	30.11%
	INCOME REDISTRIBUTIONS		
585,588.91	Rural household income	761,298.37	30.01%
2,314,036.53	Semi-urban household income	3,008,325.91	30.00%
915,977.16	Urban household income	1,190,776.95	30.00%
678,197.12	Bottom quintile income	881,656.25	30.00%
1,359,085.53	Bottom two-quintiles (40%) income	1,766,811.07	30.00%
	KING'S BALANCE/SUFFICIENCY		
5,052,343.13	Value of social "bads"	6,579,602.48	30.23%
15,723.22	Donations and religious expenses	20,426.94	29.92%
	CHANGES IN SECTORAL BALANCE OF OPTIMAL PLAN		
4.82%	% VA from primary agricultural sector	4.82%	-0.05%
6.57%	% VA from industrial sector	6.56%	-0.05%
4.61%	% VA from habit-inducing "bads"	4.70%	1.85%
7.07%	% VA from tourist and personal service sector	7.06%	-0.06%
67.20%	% VA from construction sector	67.15%	-0.09%
1.74%	% VA from business service sector	1.74%	-0.07%
1.18%	% VA from financial sector	1.18%	-0.07%
3.10%	% VA from Wholesale and retail trade	3.09%	-0.38%
0.79%	% VA from public utilities	0.79%	-0.21%
0.05%	% VA from health and education	0.05%	-0.06%
0.01%	%VA from welfare sector	0.01%	-0.13%

6. Scenario 5: The "Sufficiency Economy" growth-with-equity plus reduction-of-"bads" constraint model

The King of Thailand's sufficiency economy philosophy rests upon three pillars which are
(1) Moderation (*po-pieng*): doing something at sufficiency level not too little or too much

(2) Reasonableness (mi het mi pon): the decision at sufficiency level must consider the factors involved and carefully consider the expected outcomes

(3) Self-immunization or Risk-avoidance (phum-khum-kan): preparation of the effect or the change in the future by considering the probability of a given situation.

To function and interact properly, these three pillars require two essential pre-conditions:
(4) Knowledge (khwam-ru): the theoretical or practical understanding of a subject

(5) Virtue or ethics (khunathaam): notably honesty, diligence, and generosity (The Chaipattana Foundation, 2012).

These concepts are necessary in order for a nation, province, household, or individual to become

(6) "Balanced" and

(7) "Sufficient."

In this research, the social system integrating these seven concepts will be quantitatively evaluated in two ways. First, we shall estimate the absolute and relative income multipliers of each activity upon 15 household categories. Second, we shall optimize the value added per capita from each of an expanding set of constraints consistent with the King's philosophy.

One problematic aspect of the syndrome of poverty is the rising use of both legal and illegal drugs such as tobacco, cigarettes and alcohol (collectively termed habit-inducing "bads," as opposed to conventional consumption "goods" such as food and clothing). Substance abuse is wider-spread in lower socio-economic groups with limited education. The poor have the highest cigarette expenditures, causing illness for which their cash-poor or even indebted households can hardly afford the medical care. Indeed, the rate is highest among the temporary or long-term unemployed, especially in the agriculture sector. The delays in treatment due to lack of knowledge and disposable income actually increase the cost of treating the disease (Haustein, 2006). The fact that *"tobacco is consumed more by groups for which it is, in relative terms, more expensive, is paradoxical"* (Bobak, Jha, Nguyen, & Jarvis, 2000).

Therefore, "balance" or "sufficiency" in consumption and spending habits requires a Buddhism-inspired middle way that could help people to increase their awareness of the harmful effects of their consumption of "bads." The obvious way out is to provide poor households with better opportunities to access education and escape from poverty. Bobak et al. (2000) have found that strategies to reduce smoking by supporting education to people may be a more important predictor of

smoking more than material circumstances. This finding is consistent King of Thailand's sufficiency economy precondition of "knowledge" (Bobak, Jha, Nguyen, & Jarvis, 2000).

In addition to all previous constraints in our model, scenario 5 further requires that consumption of cigarettes, alcohol and tobacco be reduced by 5%, which must be simultaneously translated into a 5% increase in educational investment (now 35% instead of 30%). The health benefits to workers are also estimated in the model to increase effective labor availability by 5%. This reasoning is consistent with the King's philosophy pillar of "self-immunization."

Unfortunately, the model so specified fails to yield an optimal solution because the structure of a SAM assumes that fixed proportions of income be spent on each item. In other words, if one increases the absolute income of the poorest two quintiles by 30%, it will be mathematically impossible to reduce the absolute value of money spent on tobacco, cigarettes and alcohol in Savannakhet province.

7. Scenario 6: The "Sufficiency Economy" model with household spending transfers from "bads" to education

We must now overcome the non-feasibility of the previous model with fixed consumption ratios (scenario 5). In the present scenario we therefore introduce 15 new columns, one for each type of household, to allow each type of household to transfer spending from tobacco/cigarettes/alcohol to **education**. The optimal results will allow policy makers to determine which households' government programs should target to most efficiently meet the remaining sufficiency economy constraints in the model.

Specifically, we wish to reduce tobacco, cigarette and alcohol consumption by not just 5%, but a full 75%, while increasing education expenditures by a corresponding amount. This will involve social advertising or promotion programs targeting high-tobacco-using households to teach the long-term harmfulness of consuming bads and the long-term benefits to households and society of investing in education. In other words, the program is designed to teach the population about the King's principle of "reasonableness".

For the moment, these activities are not limited fiscally: in other words, there is no assumption about the cost of social advertising or the total budget that might be involved.

The results of Table 5.7 show an optimal provincial income level (NPP) of 13,308,220.16 m Kip, an increase of 40% of current NPP. Each sector has gone up 40% on average in optimal production level. The changes in sectoral balance of optimal plan are again slight except the habit-inducing "bads", transportation/EWEC sector, and wholesale and retail trade. Moreover, social advertising reflects the feasibility of reducing the absolute value of money spent on tobacco, cigarettes and alcohol in Savannakhet province. Clearly, promoting education remains an important issue in Savannakhet optimal production plan. The Engel coefficient on tobacco and alcohol is highest in rural

area on average 0.026752. Only the labor constraint is binding; its shadow price of 2.9 m Kip reflects the marginal value to the economy of adding one more labor on an annual basis to ease that constraint.

Table 5.7: The "Sufficiency Economy" model with household spending transfers from "bads" to education

Current values	Summary of changes in	Optimal value	+/- % change
	IMPROVEMENT IN PROVINCIAL PRODUCT		
9,506,019.13	Value added	13,308,220.16	40.00%
	EWEC DEVELOPMENT		
4,515,357.39	Transportation	6,321,395.68	40.00%
3,281,038.39	Employment	4,593,453.75	40.00%
7,609,405.32	Capital and financial sector	10,652,823.76	40.00%
	INCOME REDISTRIBUTIONS		
585,588.91	Rural household income	819,820.30	40.00%
2,314,036.53	Semi-urban household income	3,239,620.89	40.00%
915,977.16	Urban household income	1,282,358.61	40.00%
678,197.12	Bottom quintile income	949,475.96	40.00%
1,359,085.53	Bottom two-quintiles (40%) income	1,902,719.60	40.00%
	KING'S BALANCE/SUFFICIENCY		
5,052,343.13	Value of social "bads"	7,075,407.01	40.04%
15,723.22	Donations and religious expenses	22,012.06	40.00%
	SOCIAL ADVERTISING (*reasonableness*) to promote Engel expenditure transfer from tobacco/alcohol to education		
	RHH1	-190,367.01	
	RHH2	-6,870.66	
	RHH3	-265,662.47	
	RHH4	-6,654.22	
	RHH5	-11,632.32	
	SHH1	-42,197.63	
	SHH2	-409,693.67	
	SHH3	-805,355.01	
	SHH4	-63,192.45	
	SHH5	-541,386.31	
	UHH1	-11,472.35	
	UHH2	-443,496.00	
	UHH3	-16,364.65	
	UHH4	-202,338.61	
	UHH5	-16,801.41	
	CHANGES IN SECTORAL BALANCE OF OPTIMAL PLAN		
4.82%	% VA from primary agricultural sector	4.82%	0.00%
6.57%	% VA from industrial sector	6.57%	0.00%
4.61%	% VA from habit-inducing "bads"	4.61%	0.03%
2.88%	% VA from transportation/EWEC sector	2.88%	0.00%
7.07%	% VA from tourist and personal service sector	7.07%	0.00%
67.20%	% VA from construction sector	67.20%	0.00%
1.74%	% VA from business service sector	1.74%	-0.01%
1.18%	% VA from financial sector	1.18%	-0.01%
3.10%	% VA from Wholesale and retail trade	3.10%	0.00%
0.79%	% VA from public utilities	0.79%	0.00%
0.05%	% VA from health and education	0.05%	-0.28%
0.01%	%VA from welfare sector	0.01%	0.00%

8. Scenario 7: The full "Sufficiency Economy" model with household spending transfers from "bads" to education but a budget limitation on social advertising

In contrast to the previous model, we limit the cost of social advertising just enough to generate non-zero shadow prices on the value to society of a transfer by each of the 15 separate household types of their spending on "bads" to spending on education, as shown in the social advertising section of table 5.8. Of interest here is not so much the amount of advertising to be done in each household type (as derived from the previous optimization), but rather the maximum cost that government can pay for such advertising in each category of households. Such values will help government planners to evaluate the costs and benefits of social advertising to each potential household class.

The results in Table 8 confirms that social advertising still can effectively induce Savannakhet households to reduce the absolute value of money spent on tobacco, cigarettes and alcohol. In other words, promoting education is still a key priority in Savannakhet optimal production plan. More education could help awaken households to the negative effects of "bad" habits. To the extent that they substitute better behaviors, they may become more productive, land better jobs, and increase family welfare.

Table 5.8: The "Sufficiency Economy" model with household spending transfers from "bads" to education but a budget limitation on social advertising

Current values	Summary of changes in	Optimal value	+/- % change
	IMPROVEMENT IN PROVINCIAL PRODUCT		
9,506,019.13	Value added	13,308,411.28	40%
	EWEC DEVELOPMENT		
4,515,357.39	Transportation	6,321,492.49	40%
3,281,038.39	Employment	4,593,453.75	40%
7,609,405.32	Capital and financial sector	10,653,141.66	40%
	INCOME REDISTRIBUTIONS		
585,588.91	Rural household income	819,824.16	40%
2,314,036.53	Semi-urban household income	3,239,648.88	40%
915,977.16	Urban household income	1,282,367.31	40%
678,197.12	Bottom quintile income	949,475.96	40%
1,359,085.53	Bottom two-quintiles (40%) income	1,902,719.73	40%
	KING'S BALANCE/SUFFICIENCY		
5,052,343.13	Value of social "bads"	7,073,440.03	40%
15,723.22	Donations and religious expenses	22,012.47	40%

Table 5.8: The "Sufficiency Economy" model with household spending transfers from "bads" to education but a budget limitation on social advertising (conts.)

Current values	Summary of changes in	Optimal value	+/- % change
	SOCIAL ADVERTISING (*reasonableness*) to promote Engel expenditure transfer from tobacco/alcohol to education		
	RHH1	-178,817.01	
	RHH2	-88,503.96	
	RHH3	-254,112.47	
	RHH4	-85,473.83	
	RHH5	-155,166.89	
	SHH1	-583,081.43	
	SHH2	-398,143.77	
	SHH3	-793808.04	
	SHH4	-877,008.68	
	SHH5	-529,856.95	
	UHH1	-152,927.52	
	UHH2	-431,946.04	
	UHH3	-221,419.64	
	UHH4	-190,790.12	
	UHH5	-227,533.99	
	CHANGES IN SECTORAL BALANCE OF OPTIMAL PLAN		
4.82%	% VA from primary agricultural sector	4.82%	0.00%
6.57%	% VA from industrial sector	6.57%	0.00%
4.61%	% VA from habit-inducing "bads"	4.61%	0.00%
2.88%	% VA from transportation/EWEC sector	2.88%	0.00%
7.07%	% VA from tourist and personal service sector	7.07%	0.00%
67.20%	% VA from construction sector	67.20%	0.00%
1.74%	% VA from business service sector	1.74%	0.00%
1.18%	% VA from financial sector	1.18%	0.00%
3.10%	% VA from Wholesale and retail trade	3.10%	0.00%
0.79%	% VA from public utilities	0.79%	0.00%
0.05%	% VA from health and education	0.05%	-0.02%
0.01%	%VA from welfare sector	0.01%	0.00%

NPP rises slightly to 13,308,411.28 m Kip, 40% of current provincial product. The optimal production level of each sector has also gone up 40% on average. As usual, however, changes in sectoral balance remain barely perceptible. The Engel coefficient on tobacco and alcohol remains highest in the rural area (0.027), followed by the semi-urban and the urban areas (0.010 and 0.009, respectively). The shadow price in this scenario is as same as previous scenario which only labor constraint is binding. Its shadow price +2.9 m Kip still reflects the marginal value of adding one more labor on an annual basis to ease that constraint.

CHAPTER VI:
DISCUSSIONS OF THE RESULTS

The preceding analyses have demonstrated that the real impacts of roads are only as strong as the weakest link in the underdevelopment profile of the city or province through which they run. This is the main message of this report. Its main recommendation is, therefore, that each individual province, with the help of its national government, must adopt concomitant policies to shore up those weak links so that the fullest advantage can be taken of those roads.

The present chapter will be devoted to more detailed hypothesis-testing of these findings. The equations and other analyses in this chapter once will reported in this document once again attest that the most observable impacts of the EWEC lies in sites typified by **2** above (Savannakhet, Laos). Basically, all of the non-transportation conditions were in place before the advent of the EWEC. Businesses were concentrated there, but still under-developed. Thus, the road became the blood vein for business, marketing and transportation across Laos, Thailand and Vietnam. The impact of the EWEC was all the greater because that section of the highway cut strategically through a mountainous border area between Laos and Vietnam. Key segments of the Savannakhet population that had been lagging behind in income, employment, or both because of relative isolation from jobs and markets were thus able to "catch up" with the rest of the population. Poverty has been reduced, the inequality in income distribution has been partially redressed, and the city is enjoying a surge of growth because the major development condition missing had been the road.

In the same vein, this chapter confirms that, even when the road system is as yet incomplete, it can spark growth and job creation in the most backward provinces of type **4** (Mawlamyine). That this can happen before the road is fully operation demonstrates that direct job creation from the indirect stimulation of economic activity can bring about positive impacts in terms of the eradication of poverty. It is well known that, since the data for the present report were collected, there has been a massive political opening of Myanmar as a country. There is thus every hope that a fully operational EWEC can generate still

greater employment and poverty-reduction impacts. Myanmar has woken up, has addressed her political issues, and is on her way to economic transformation. The recommendations in the last chapter of this report may therefore be of even greater interest to her leadership. In the same mold as Savannakhet, the EWEC may soon contribute massively to economic development of Myanmar on a much larger scale.

At the other end of the spectrum, two of the four study sites have **not** been able – either in fact or in potential -- to benefit as much from the EWEC as sites of types **2** and **4**. Those are Hat Yai and Da Nang. For example, in sites of type **3** (exemplified by Hat Yai, Thailand), development was already outward-looking before the inauguration of the road project. Rubber could be produced with economies of size for export, while tourists could be "imported" from the south without creating a pan-Southeast Asian highway system. The main results noted in this report have been the enhancement of local business, and the attenuation of fluctuations in rubber prices.

Likewise, in provinces of type **4** (typified by Da Nang, Vietnam), conditions predating connection with the East-West Highway had already been enormously favorable. A seaport already lay available at the eastern edge of the province for both imports of raw materials and exports of agricultural and finished products. A major North-South road linked Da Nang to all other parts of the country, so that Da Nang was already faring as well as most other cities in Vietnam in terms of living standards, education, employment, and income distribution. Small east-west roads were adequate to drain the agricultural surplus and prospective workers from the interior. True, a wider, faster East-West connection to Laos and Thailand enhanced those effects, but it does not seem to have been essential to rapid economic development.

1. Results of hypothesis testing in Da Nang

Student t tests and one way ANOVA

Hypothesis 2 states that *"the EWEC has led to improvements over the period 2006 through 2008 in income, output value, sources of income and expenditure patterns among rural, semi-urban and urban households."* To test this hypothesis, we pooled the data for the two years and added a zero-one variable for 2008 to divide the sample into two groups. We then tested for significant differences

for the values of a given variable between the two gaps. Positive *changes* are indicated in green in Table 9, negative changes are in red. It is clear that immigration and SME income have gone up, as have educational expenditure, the dependency ratio, and the proportion of the population living in the urban areas. Meanwhile, agricultural output as a proportion of income has gone down, as has the percentage of income in transportation and transportation-related fields, expenditures on bicycles and expenditure on medical services. One could argue that decreased medical and vehicle costs; and increased migration, urbanity, and educational expenditures reflect the favourable impacts of the road, lending support the hypothesis. But the drop in transportation related employment needs to be supported by further research. We therefore give conditional acceptance to hypothesis 2.

Oneway ANOVA is employed as a second way to show the possible impacts of the road within the VHLSS datasets, we show all significant differences for 2008 based on proximity to the EWEC, which we hypothesize can be roughly approximated by the distinction urban (very close), semi-urban (medium-close), and rural (far). We have to use this rough guide because we do not yet have exact data on the kilometers from each *dia_ban* to the EWEC, but that would be the ideal.

Table 6.1 only reports those variables that differ significantly with distance. The most favourable location is listed with its mean value, along with the gaps associated with the other two locations. The general trend in these comparisons is that proximity to the EWEC (i.e. urbanity) has helped to improve economic development, create jobs and specialization, and reduce income inequality. We thus fail to reject hypothesis 3, that "Within Da Nang province, proximity *to the road makes people better off through job creaton, specialization and reduced inequality.*"

The two columns of table 6.3 show to what extent, the EWEC has intensified (+) or reduced(-) over time the significance of differences among the three types of locality for a given variable. Unlisted variables remained in the same in levels of significant differences.

We are now in a position to evaluate hypothesis ten, to the effect that *"The differences among rural, semi-urban, and urban areas have become less and less significant over time."* The results are in fact quite mixed, so that we must reject the hypothesis. Specifically, the road has, over the period 2006 through 2008, reduced significant differences among rural, semi-urban and uban areas in terms of household income two years before, income ratio this year/2 years before, incidence and intensity of poverty, total expenditure, income from factory labour, value of fruit crops harvested, income from livestock, and % agricultural production costs in cash and kind. However, over the same period (2006 and 2008) the road has been associated with increasing significant divergences by rural/semi-urban and urban in income, depth 2 years before, intensity two years before, total income from transportation related activities, % salaries from transportation related activities, both narrowly and broadly defined, % expenditures on bicycles, automotive, motorbikes in total expenditures, % income from sales and marketing, and % gross agricultural output value of livestock, including milk and eggs.

Table 6.1: Student t tests of significant differences in means of key variables between the 2006 and 2008 VHLSS surveys

Student t tests of significant differences in means of key variables between 2006, 2008	Mean in 2008	Mean in 2006	2008-2006	% change 2008/ 2006	F	Sig.	t		Sig. (2-tailed)
Significant changes									
Locality	22.5	15.5	7.0	44.9	6.7	.010	4.00	.000	***
House number	14.8	14.3	.5	3.8	7.2	.008	2.31	.022	**
Sum(83,93)	254.2	4803.7	-4549.5	-94.7	74.1	.000	-4.25	.000	***
% salaries from 83 + 93 in total income	.0	.1	-.1	-93.7	107.0	.000	-4.71	.000	***
Sum(83,93, 91)	394.2	5351.5	-4957.3	-92.6	82.4	.000	-4.47	.000	***
% income from 83, 93, 91 in total income	.0	.1	-.1	-91.9	119.2	.000	-4.94	.000	***
Income migration	14414.8	20.9	14393.9	68945.7	155.1	.000	5.89	.000	***
% migration income in total hh income	.2	.0	.2	52345.2	255.3	.000	6.59	.000	***
Total expenditure	66416.0	41415.5	25000.4	60.4	11.2	.001	4.24	.000	***
% expenditures on bicycles, automotive, Motorbikes in total expenditures	.0	.0	.0	-44.2	1.7	.193	-3.74	.000	***
Income from small-scale family enterprises	17632.8	10394.4	7238.4	69.6	23.6	.000	2.93	.004	***
% gross agricultural output value of grain Crops including rice	.1	.2	-.1	-61.6	.1	.754	-3.19	.002	***
% gross agricultural output value of Soybeans, peanuts, sesame, and other leguminous crops	.0	.0	.0	-77.3	12.8	.000	-2.74	.007	***
% gross agricultural output value of vegetables	.0	.0	.0	-70.7	17.8	.000	-1.75	.090	*
% gross agricultural output value of fruits	.0	.1	-.1	-98.2	59.1	.000	-2.37	.025	**
% gross agricultural output value of Livestock,	.1	.2	-.2	-67.1	7.6	.007	-3.17	.002	***
including milk and eggs	.2	.4	-.2	-40.2			-2.43	.021	**
Average educational expenditure per student	2605.9	1282.4	1323.6	103.2	2.4	.122	3.76	.000	***
Medical expenditure	3201.4	29962.9	-26761.4	-89.3	72.9	.000	-4.00	.000	***
Medical expenditures per capita	792.5	6205.9	-5413.4	-87.2	62.5	.000	-6.07	.000	***
Dependency ratio	1.65	.07	1.59	23.64	75.68	.00	26.19	.00	***

Table 6.2: One-way ANOVA analysis of significant differences by proximity to EWEC, 2008

Dependent Variable	Extreme sector	Other sectors	Mean Difference	Std. Error	Sig.
Income/capita	Urban	Rural	3455	2738	0.210
		Semi-urban	4471	2504	0.077
Income/capita four years before	Urban	Rural	11723	4724	0.023
		Semi-urban	9607	4273	0.037
Incidence	Rural	Semi-urban	0.21	0.13	0.094
		Urban	0.24	0.12	0.046
Depth	Rural	Semi-urban	0.11	0.05	0.020
		Urban	0.10	0.04	0.030
Intensity	Rural	Semi-urban	0.04	0.02	0.098
		Urban	0.04	0.02	0.084
Depth_two years before	Semi-urban	Rural	0.01	0.10	0.950
		Urban	0.18	0.08	0.033
Intensity_two years before	Semi-urban	Rural	0.01	0.08	0.897
		Urban	0.17	0.07	0.020
Overall rank in total sample	Rural	Semi-urban	9.19	8.33	0.272
		Urban	15.99	7.79	0.042
Overall rank in total sample 2006	Urban	Rural	-21.98	12.14	0.077
		Semi-urban	-21.05	11.17	0.066
Sum (83,93)	Urban	Rural	-438	162	0.008
		Semi-urban	-411	148	0.007
% salaries (83 + 93)/ total income	Urban	Rural	-0.01	0.00	0.004
		Semi-urban	-0.01	0.00	0.073
% income (83, 93, 91)/total income	Urban	Rural	-0.01	0.01	0.014
		Semi-urban	-0.01	0.01	0.099
Expenditures in travel fees, excursions in Vietnam, and excursions outside of Vietnam in total expenditures	Semi-urban	Rural	-1104	637	0.086
		Urban	-1035	545	0.060
% expenditures in travel fees, excursions in Vietnam, and excursions outside of Vietnam in total expenditures	Semi-urban	Rural	-0.01	0.01	0.099
		Urban	-0.01	0.00	0.055
Expenditures on bicycles, automotive, motorbikes in total expenditures	Semi-urban	Rural	124	90	0.171
		Urban	143	77	0.065
% expenditures on bicycles, automotive, motorbikes in total expenditures	Semi-urban	Rural	0.00	0.00	0.007
		Urban	0.00	0.00	0.000
Income from hired labour in manufacturing	Semi-urban	Rural	3312	3786	0.384
		Urban	5695	3237	0.081
% income from hired labour in manufacturing	Semi-urban	Rural	0.04	0.06	0.454
		Urban	0.10	0.05	0.051
Income from sales+ marketing	Urban	Rural	4610	2716	0.092
		Semi-urban	4512	2484	0.072
% income from sales & marketing	Urban	Rural	0.07	0.04	0.065
		Semi-urban	0.07	0.03	0.048
Gross agricultural output value of grain	Rural	Semi-	3984	787	0.000

Dependent Variable	Extreme sector	Other sectors	Mean Difference	Std. Error	Sig.
crops		urban			
		Urban	4791	735	0.000
Value of rice harvested(‘000 VND)	Rural	Semi-urban	2857	627	0.000
		Urban	3575	586	0.000
Value of vegetable and annual plants harvested(‘000 VND)	Rural	Semi-urban	270	79	0.001
		Urban	316	73	0.000
Value of industrial crops harvested (‘000 VND)	Rural	Semi-urban	491	96	0.000
		Urban	491	90	0.000
Value of fruit harvested(‘000 VND)	Rural	Semi-urban	20	24	0.400
		Urban	45	22	0.047
Value of by-products(‘000 VND)	Rural	Semi-urban	347	80	0.000
		Urban	365	74	0.000
Agriculture output value	Rural	Semi-urban	5754	3672	0.120
		Urban	9082	3433	0.009
% gross agricultural output value of grain crops+ rice	Rural	Semi-urban	0.25	0.05	0.000
		Urban	0.31	0.05	0.000
% gross agricultural output value of soybeans, peanuts, sesame, + leguminous crops	Rural	Semi-urban	0.04	0.01	0.000
		Urban	0.04	0.01	0.000
% gross agricultural output value of vegetables	Rural	Semi-urban	0.02	0.00	0.001
		Urban	0.02	0.00	0.000
% gross agric. output value of fruits	Rural	Semi-urban	0.00	0.00	0.285
		Urban	0.00	0.00	0.015
% gross output value of livestock, + milk and eggs	Rural	Semi-urban	0.19	0.05	0.000
		Urban	0.22	0.05	0.000
% agricultural production costs in cash and kind	Rural	Semi-urban	1704	1906	0.373
		Urban	3444	1782	0.056
Labor force (aged 17-60)	Rural	Semi-urban	-0.56	0.34	0.106
		Urban	-0.59	0.32	0.068
Education of hh head (years)	Urban	Rural	3.69	0.98	0.000
		Semi-urban	2.00	0.90	0.027
Education (code 0-12)	Urban	Rural	2.14	0.64	0.001
		Semi-urban	1.15	0.59	0.053
Total years of education of all household members	Urban	Rural	10.03	3.63	0.007
		Semi-urban	3.83	3.32	0.250
Average education/hh member	Urban	Rural	2.09	0.69	0.003
		Semi-urban	1.37	0.63	0.032
Total education expenditure/year	Urban	Rural	3050	1060	0.005
		Semi-urban	2009	969	0.041
Aver. educ. expenditure/student	Urban	Rural	2189	579	0.000
		Semi-urban	1383	530	0.010

Table 6.3: Changes in significant differences between 2006 and 2008

Change in significance 2008 over 2006	
Become significant	Cease to be significant
Income	HH income two years before
Depth two years before	Income ratio this year/2 years before
Intensity two years before	Incidence
Sum (83,93)	Intensity
% salaries from 83 + 93 in total income	Overall rank in total sample
% income from 83, 93, and 91 in total income	Total expenditure
% expenditures on bicycles, automotive, motorbikes in total expenditures	Income from hired labour in manufacturing
% income from sales and marketing	Value of fruit crops harvested('000 VND)
% gross agricultural output value of livestock, + milk and eggs	Income from livestock
	% agricultural production costs in cash and kind

Correlation matrix to identify significant independent variables and detect multi-collinearity

The correlation matrix (Table 6.4) was developed in SPSS with significant levels of each correlation from the 2008 dataset. It shows the various transportation related variables along the top of the matrix vs. the well-being, income, and production variables on the side. Of course, a simple correlation cannot say anything about the direction of causality, and we will have to go on to do regressions. In the table all non-significant correlations (sig. < .10) have been erased to facilitate reading. Positive correlations are indicated in green, negative correlations in red and multi-collinearity (Pearson rho > 0.50) to be avoided in the regressions in violet. Since SPSS gives tests of significance, this type of table can actually be used for hypothesis testing.

Table 6.4: Correlation matrix of significant correlations between Transportation-related, well-being and production variables

Pearson corr. with 2-tailed sign. tests between Transportation and Well-being related variables	Urbanity (2, 1, 0)	sum (83,93)	% salaries from 83 + 93	% income from 83, 93, 91	income from sales and marketing	income from sales and marketing	Income migration	% migration income	total expenditure	expenditures on vehicles	% vehicle expenditures	expenditures in pleasure travel	% expenditures in pleasure travel	Males + females 17-60	Education of hh head (yrs)	Highest diploma attained	Total years education of hh	Average education in hh	Education expenditure / yr	expenditure / student	Medical expense/capita
Income	.25		-.20	-.20			.36		.54	.34		.33	.31	.33	.43	.44	.52	.54	.34	.48	.34
	.01		.04	.04			.00		.00	.00		.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
HH income 2006																	.33		.26		
																	.02		.08		
Income/capita		-.18	-.19	-.19			.29		.71	.41		.51	.37		.39	.44		.49		.26	.40
		.06	.04	.05			.00		.00	.00		.00	.00		.00	.00		.00		.01	.00
Income/capita K2006							.26										.27		.31		
							.08										.06		.03		
Income ratio 2008/2006							-.34	-.31	-.28	-.25											
							.02	.03	.06	.09											
Income/capita 2004	.48												.45								
	.03												.04								
Overall rank in total sample	-.19	.22	.26	.22			-.24		-.56		.17	-.37	-.31		-.53	-.51	-.18	-.54	-.21	-.33	-.24
	.04	.02	.01	.02			.01		.00		.07	.00	.00		.00	.00	.05	.00	.02	.00	.01
Overall rank in total sample 2006	-.27																				
	.07																				
Rank in urban							-.33		-.74	-.26		-.42	-.37		-.64	-.64	-.24	-.66	-.28	-.45	-.31
							.02		.00	.06		.00	.01		.00	.00	.09	.00	.05	.00	.03
Rank in semi-urban		.31	.40	.41					-.62		.41				-.37	-.36		-.31			
		.07	.02	.01					.00		.01				.03	.03		.07			
Rank in rural									-.50			-.49	-.38		-.38	-.35		-.46			-.37
									.01			.01	.05		.05	.07		.02			.06

Pearson corr. with 2-tailed sign. tests between Transportation and Well-being related variables	Urbanity (2, 1, 0)	sum (83,93)	% salaries from 83 + 93	% income from 83, 93, 91	income from sales and marketing	income from sales and marketing	Income migration	% migration income	total expenditure	expenditures on vehicles	% vehicle expenditures	expenditures in pleasure travel	% expenditures in pleasure travel	Males + females 17-60	Education of hh head (yrs)	Highest diploma attained	Total years education of hh	Average education in hh	Education expenditure / yr	expenditure / student	Medical expense/capita
Rank in					-.58	-.58				-.68	-.76										
rural 2006					.08	.08				.03	.01										
incidence	-.17	.19	.23	.21			-.17		-.42	-.08	.16	-.21	-.18		-.43	-.42	-.15	-.40	-.21	-.27	-.20
	.06	.04	.01	.03			.08		.00	.41	.09	.02	.06		.00	.00	.11	.00	.02	.00	.04
Depth	-.18	.18	.25	.21			-.23		-.38			-.17	-.15		-.54	-.42	-.25	-.48	-.19	-.28	-.16
	.06	.06	.01	.02			.01		.00			.07	.10		.00	.00	.01	.00	.05	.00	.08
Intensity			.21	.16			-.22	-.16	-.33						-.52	-.37	-.24	-.45		-.24	
			.02	.09			.02	.08	.00						.00	.00	.01	.00		.01	
incidence_2	-.17	.20	.15	.17				-.02	-.17			-.19	-.18						-.16	-.19	
006	.07	.03	.12	.08				.85	.08			.04	.06						.08	.05	
depth2006	-.20	.23	.17	.20								-.19	-.17						-.16	-.18	
	.03	.02	.08	.04								.05	.07						.08	.05	
Intensity_	-.21	.23	.17	.21								-.18	-.17						-.16	-.17	
2006	.02	.01	.08	.03								.06	.08						.09	.07	
Income					.32	.28		.19				.33	.33	.21		.18					
from small-					.00	.00		.04				.00	.00	.03		.06					
scale																					
family																					
enterprises																					
% income		.23	.21	.27	.26	.28		.28	-.16		.17								-.28	-.26	
from small-		.01	.02	.00	.00	.00		.00	.08		.07								.00	.01	
scale family																					
enterprises																					
Income							.26	.30						.18							
manu-							.00	.00						.06							.84
facturing																					
% income		.27	.30	.22			.21	.32													
manufac-		.00	.00	.02			.02	.00													

Pearson corr. with 2-tailed sign. tests between Transportation and Well-being related variables	Urbanity (2, 1, 0)	sum (83,93)	% salaries from 83 + 93	% income from 83, 93, 91	income from sales and marketing	% income from sales and marketing	Income migration	% migration income	total expenditure	expenditures on vehicles	% vehicle expenditures	expenditures in pleasure travel	% expenditures in pleasure travel	Males + females 17-60	Education of hh head (yrs)	Highest diploma attained	Total years education of hh	Average education in hh	Education expenditure / yr	Average edu. expenditure / student	Medical expense/capita
turing																					
Income fr.	.18				1.00	.94	.16	.16			.18				.17						
sales and marketing	.06				.00	.00	.09	.10			.05				.08						
% income	.19				.94			.19			.16										
fr. sales & marketing	.04				.00			.04			.09										
gross agri.	-.49	.16	.21	.19					-.19	.01	.19				-.29	-.24	-.22	-.29	-.23	-.24	
output	.00	.10	.03	.05					.04	.91	.05				.00	.01	.02	.00	.01	.01	
Value of grain crops																					
Value of rice	-.48	.18	.24	.21					-.19		.19				-.29	-.24	-.22	-.29	-.24	-.25	
('000VND)	.00	.05	.01	.03					.04		.05				.00	.01	.02	.00	.01	.01	
Value of	-.35										.24			-.16	-.24	-.17	-.20	-.24			
vegetable & annual plants	.00										.01			.09	.01	.06	.03	.01			
Value of	-.41																			-.18	
industrial crops	.00																			.06	
Value of	-.19										.28				-.20			-.18			
fruit crops	.04										.00				.04			.06			
Value of	-.39													-.22	-.22	-.18	-.19	-.21		-.11	
by-products	.00													.02	.02	.06	.05	.03		.24	
Livestock income																					
Agriculture	-.24														-.20	-.18					
output	.01														.03	.05					

Pearson corr. with 2-tailed sign. tests between Transportation and Well-being related variables	Urbanity (2, 1, 0)	sum (83,93)	% salaries from 83 + 93	% income from 83, 93, 91	income from sales and marketing	sales and marketing	Income migration	% migration income	total expenditure	expenditures on vehicles	% vehicle expenditures	expenditures in pleasure travel	% expenditures in pleasure travel	Males + females 17-60	Education of hh head (yrs)	Highest diploma attained	Total years education of hh	Average education in hh	Education expenditure / yr	expenditure / student	Medical expense/capita
% gross agri. output value of grain crops &rice	-.51 .00	.32 .00	.40 .00	.35 .00				.16 .10	-.22 .02		.18 .06				-.29 .00	-.25 .01	-.24 .01	-.25 .01	-.27 .00	-.29 .00	
% gross output value of soybeans, peanuts, sesame, + legume crops	-.35 .00																			-.17 .07	
% gross output value of vegetables	-.37 .00	.20 .03	.27 .00	.22 .02					-.19 .05		.20 .04			-.20 .03	-.33 .00	-.21 .03	-.27 .00	-.25 .01	-.18 .06		
% gross output value of fruits	-.23 .01	.27 .00	.33 .00	.32 .00							.28 .00				-.28 .00	-.18 .05	-.18 .06	-.20 .03			
% gross output value of livestock, milk+ eggs	-.38 .00	.24 .01	.21 .02	.18 .05					-.17 .07						-.33 .00	-.25 .01	-.19 .04	-.27 .00		-.19 .05	
% ag. prod costs (cash +kind)	-.18 .05														-.21 .03	-.18 .06					

2. Results of hypothesis testing in Savannakhet

Hypothesis 1: *household income is significantly improved by proximity to the EWEC or by involvement in the transportation-related sectors.*

To find out the answer of Hypothesis 1, we analyze the data to compare the relative income of the three areas as shown in table 6.5 The table details the one-way ANOVA t-tests of significant differences in mean among fifteen (15) income groups and three geographical locations (urban, semi-urban, and rural) using. The analysis reveals that some socio-economic variables; age, household size, space, total land occupied in the rural areas are significantly higher than urban area at different level of significance. While the expenditure on fertilizer and pesticides and other agriculture production in rural household are significantly higher than the other because their occupations are engaging in agriculture sector. Moreover, the road infrastructure results also showed that the rural area is far from the EWEC road and take more time to reach the EWEC than urban and semi-urban areas.

Additional, the level of household head education in urban area is significantly higher than semi-urban and rural areas. The expenditures on furniture, electrical appliance, education, car, vehicle insurance, and accommodation are also significantly higher than other. So, these might be the benefit from the EWEC road that households who live in the urban area are easily to access the public infrastructure for their educations and the markets to consume goods and service.

Table 6.5: T-tests to compare the relative income of the three areas

ANOVA	F	Sig.	highest value area	Other area	Mean Difference (I-J)	Std. Error	Sig.
Age	2.97	0.05**	rural	urban	3.29*	1.47	0.03**
				semi-urban	1.82	1.57	0.25
HH size	7.71	0.00***	rural	urban	0.94*	0.32	0.00***
				semi-urban	0.25	0.34	0.45
Distance (km)	92.66	0.00***	rural	urban	16.42*	1.22	0.00***
				semi-urban	12.16*	1.3	0.00***
Time (minute)	69.43	0.00***	rural	urban	23.98*	2.08	0.00***
				semi-urban	16.73*	2.22	0.00***
Fertilizer and pesticides	2.96	0.05**	rural	urban	0.05*	0.03	0.04**
				semi-urban	0.02	0.03	0.4
Other agriculture production	4.25	0.02**	rural	urban	2.92*	1.16	0.01***
				semi-urban	1.34	1.24	0.28
Space (sqm.)	4.91	0.01***	rural	urban	259.96*	93.42	0.01***
				semi-urban	129.44	99.58	0.19
Total land area (rai)	4.58	0.01***	rural	urban	2.10*	1	0.04**
				semi-urban	0.33	1.07	0.76
Furniture	2.72	0.07*	urban	semi-urban	0.42*	0.21	0.05**
				rural	0.53	0.32	0.09*

ANOVA	F	Sig.	highest value area	Other area	Mean Difference (I-J)	Std. Error	Sig.
Electrical appliance	2.6	0.08*	urban	semi-urban	0.27	0.22	0.21
				rural	0.69*	0.32	0.03**
Education	3.28	0.04**	urban	semi-urban	0.07	0.05	0.16
				rural	0.17*	0.07	0.02**
Car expense	5.3	0.01***	urban	semi-urban	23.67*	7.89	0.00***
				rural	22.63	11.64	0.05**
Vehicle insurance expense	3.12	0.05**	urban	semi-urban	0.06*	0.03	0.03**
				rural	0.07	0.04	0.09
Accommodations	3.67	0.03**	urban	semi-urban	0.35*	0.14	0.01***
				rural	0.34	0.21	0.10*
HH head education	12.75	0.00***	urban	semi-urban	0.53*	0.18	0.00***
				rural	1.27*	0.27	0.00***

Source: Calculated from the survey data.

Next, we tested the significant correlation of potential explanatory variables with key transportation-related variable of the three areas (general) as shown in table 9. The “total significant correlation” in the column shows the number of significant variable in each row variable. The result shows the row variables that vary significant with positive and negative correlation. The road under-development has positive correlation with some socio-economic variables such as age, household size, space, and total land occupied. So, in rural area household head are old people and have more family members. And they have more own space and land occupied. Other expenditures show that other agriculture production and fertilizer and pesticides also have positive correlation with the road under-development. Living in rural area are increased those expenditures which involved with their occupation in agriculture sector.

Conversely, the road under-development has negative correlation with the expenditures on furniture, education, cigarette and alcoholic, food and beverage, accommodation, electrical appliance, and reading material. Additional, levels of household head education also go down in rural area. These figures confirm that rural people still derive less benefit from the EWEC road. They cannot enter input/output markets, access a better education, minimum standards of power supply or clean drinking water. Moreover, the result also confirms that living in rural area might take long time and live so far from the road development and other facilities.

Table 6.6: Significant correlations of potential explanatory variables with key transportation-related variables

Correlations		Total significant correlations	Road under-development (1=urban, 2=semi-urban, 3=rural)	Motorcycle and cycle expense	Car expense	Fuel cost for vehicle expense	Vehicle repairing and maintenance expense	Vehicle insurance	Cost for special occasion travelling expense	Income per capita
Furniture	Pearson	7	-0.14	0.38	0.42	0.55	0.34	0.5	0.47	
	Sig. (2-tailed)		*0.03***	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	
Education	Pearson	6	-0.16	0.14	0.24	0.22		0.34	0.23	
	Sig. (2-tailed)		*0.01****	*0.03***	*0.00****	*0.00****		*0.00****	*0.00****	
HH head education	Pearson	6	-0.31	0.13	0.17	0.12	0.11	0.15		
	Sig. (2-tailed)		*0.00****	*0.04***	*0.01****	*0.06**	*0.08**	*0.02***		
Time (minute)	Pearson	6	0.59	-0.16	-0.18	-0.17	-0.12	-0.16		
	Sig. (2-tailed)		*0.00****	*0.02***	*0.01****	*0.01****	*0.06**	*0.01****		
Type of hh	Pearson	6	-0.24	0.19	0.15	0.15		0.14	0.12	
	Sig. (2-tailed)		*0.00****	*0.00****	*0.02***	*0.02***		*0.03***	*0.07***	
Distance (km)	Pearson	5	0.63	-0.11	-0.16	-0.15		-0.14		
	Sig. (2-tailed)		*0.00****	*0.10**	*0.02***	*0.02***		*0.03***		
Cigarette, alcoholic expense	Pearson	5	-0.04	0.3		0.34	0.29	0.14		
	Sig. (2-tailed)		*0.50***	*0.00****		*0.00****	*0.00****	*0.03***		
Food + beverage expense	Pearson	4	-0.11	0.23		0.22	0.15			
	Sig. (2-tailed)		*0.08**	*0.00****		*0.00****	*0.02***			
No. of HH member	Pearson	3	0.24	0.23						-0.139
	Sig. (2-tailed)		*0.00****	*0.00****						*0.03***
Accommodation	Pearson	5	-0.16		0.31	0.26		0.39	0.12	
	Sig. (2-tailed)		*0.02***		*0.00****	*0.00****		*0.00****	*0.06**	
Size (sqm.)	Pearson	4	0.2			0.36	0.27	0.25		
	Sig. (2-tailed)		*0.00****			*0.00****	*0.00****	*0.00****		
Electrical appliance	Pearson	6	-0.14		0.38	0.49	0.28	0.45	0.27	
	Sig. (2-tailed)		*0.03***		*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	

Correlations		Total significant correlations	Road under-development (1=urban, 2=semi-urban, 3=rural)	Motorcycle and cycle expense	Car expense	Fuel cost for vehicle expense	Vehicle repairing and maintenance expense	Vehicle insurance	Cost for special occasion travelling expense	Income per capita
Reading materials	Pearson	4	-0.12		0.32			0.38	0.18	
	Sig. (2-tailed)		*0.06**		*0.00****			*0.00****	*0.01****	
Total land area (rai)	Pearson	2	0.18				0.23			
	Sig. (2-tailed)		*0.00****				*0.00****			
Type of house	Pearson	1	-0.42							
	Sig. (2-tailed)		*0.00****							
Other agriculture production	Pearson	1	0.18							
	Sig. (2-tailed)		*0.00****							
Age	Pearson	1	0.16							
	Sig. (2-tailed)		*0.02***							
Fertilizer &pesticides	Pearson	1	0.15							
	Sig. (2-tailed)		*0.02***							
Lottery	Pearson	5		0.34	0.22	0.19	0.15		0.77	
	Sig. (2-tailed)			*0.00****	*0.00****	*0.00****	*0.02***		*0.00****	
Cosmetic +home app expense	Pearson	4		0.25		0.21	0.26		0.18	
	Sig. (2-tailed)			*0.00****		*0.00****	*0.00****		*0.01****	
Other cost	Pearson	3		0.15		0.38	0.16			
	Sig. (2-tailed)			*0.02***		*0.00****	*0.01****			
agriculture expense	Pearson	3		0.13		0.16	0.15			
	Sig. (2-tailed)			*0.04***		*0.01****	*0.02***			
livestock expense	Pearson	3		0.2		0.18	0.19			
	Sig. (2-tailed)			*0.00****		*0.00****	*0.00****			
costume expense	Pearson	1		0.16						
	Sig. (2-tailed)			*0.01****						

Correlations		Total significant correlations	Road under-development (1=urban, 2=semi-urban, 3=rural)	Motorcycle and cycle expense	Car expense	Fuel cost for vehicle expense	Vehicle repairing and maintenance expense	Vehicle insurance	Cost for special occasion travelling expense	Income per capita
other activities	Pearson	4		0.3		0.16	0.22		0.26	
	Sig. (2-tailed)			*0.00****		*0.01****	*0.00****		*0.00****	
communication	Pearson	6		0.34	0.18	0.61	0.44	0.39	0.16	
	Sig. (2-tailed)			*0.00****	*0.01****	*0.00****	*0.00****	*0.00****	*0.01****	
elec and water	Pearson	6		0.46	0.21	0.7	0.42	0.33	0.37	
	Sig. (2-tailed)			*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	
recreation	Pearson	6		0.22	0.5	0.26	0.21	0.37	0.6	
	Sig. (2-tailed)			*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	*0.00****	
installment	Pearson	6		0.12	0.33	0.25	0.27	0.45	0.13	
	Sig. (2-tailed)			*0.06**	*0.00****	*0.00****	*0.00****	*0.00****	*0.04***	
religious fn	Pearson	2			0.18	0.13				
	Sig. (2-tailed)				*0.00****	*0.04***				
health care expense	Pearson	3			0.28	0.21		0.24		
	Sig. (2-tailed)				*0.00****	*0.00****		*0.00****		
Agric. machine	Pearson	1					0.19			
	Sig. (2-tailed)						*0.00****			
Agric. transport	Pearson	1					0.18			
	Sig. (2-tailed)						*0.00****			
dependent ratio	Pearson	2						0.11	0.12	
	Sig. (2-tailed)							*0.10**	*0.07**	
gender	Pearson	1								0.12
	Sig. (2-tailed)									*0.06***

Source: Calculated from the survey data.

After we analyzed data to compare the relative income of the three areas by one-way ANOVA and test the significant correlation of potential explanatory variable. Then, we test the Quantile regression to explain the income per capita to answer hypothesis 1. Quantile regression is particularly useful because this method can estimates the potential differential effect of covariate on various quantiles in the conditional distribution.

Table 6.7 displays the top variables part are vary significantly and positively with income per capita and the bottom variables part are vary significantly and negatively. From top of the table we see that gender of household head (female=0, male=1) (GENDER), agriculture transportation expenditures (AGRITRANS_ EXPENSE) and health care expenditure (HEALTH_EXPENSE) could household increase income per capita.

Gender is one of key factor that affects household income. The result shows that male could increase household welfare. In fact, women empowerment is the one of social problem in Savannakhet province that effect to the economic development in this province. The result confirms that this problem still remains. This result is consistent Apata at el. (2010). So, promoting equal opportunity for women in employment still would constitute one key priority on reducing poverty in Lao PDR. More spending on agriculture transportation expenditures are indirectly increased household income because transport agriculture products to the input/output market household have to pay more payment for transportation. So, household could get income back from sell those products. And good health would support household member enable fully functional and effective. Moreover, the table also report that other variables could affect income per capita significantly and positively.

Conversely, the bottom of the table shows that Total number of members in household (SIZE), total land occupied (LAND), Distance from the EWEC (km) (DISTANCE), agriculture machine/equipment expenditure (AGRIMAC_EXPENSE), food and beverage expenditure (FOOD_EXPENSE), and vehicle expenditure (VEH_EXPENSE) all decrease income per capita. Generally, welfare increases if households are limited in size. So, households with larger size are more likely to be poorer than those with smaller size (Gounder, 2011). Household's land occupied also effect to household income because more land holdings households have to pay more land maintenance to improve land conditions that used in agricultural. Households or farms located at a greater distance are expected to be poorer due to the high transactions costs that impinge upon their incomes (Gounder, 2011). Furthermore, reduce those expenditures could help household to save cost and increase their income per capita.

Therefore, as a result we cannot reject hypothesis 1 because income per capita is significant improved by proximity to the EWEC or by the involvement in the transportation-related sectors.

Table 6.7: Quantile regression analysis to explain income per capita

Dependent Variable: INCOME_CAP Method: Quantile Regression (tau = 0.9)				
Variable	Coefficient	Std. Error	t	Prob.
C	34.24	10.7	3.2	0.00***
GENDER	19.68	10.83	1.82	0.07*
AGRITRANS_EXPENSE	58.64	21.34	2.75	0.01***
HEALTH_EXPENSE	3.08	1.42	2.18	0.03**
TIME	0.62	0.53	1.16	0.25
EDU_EXPENSE	13.62	12.26	1.11	0.27
OCC_EXPENSE	15.08	13.01	1.16	0.25
SIZE	-5.79	1.88	-3.08	0.00***
LAND	-0.54	0.3	-1.82	0.07*
DISTANCE	-0.78	0.47	-1.66	0.10*
AGRIMAC_EXPENSE	-6.23	1.96	-3.18	0.00***
FOOD_EXPENSE	-0.89	0.42	-2.14	0.03**
VEH_EXPENSE	-0.12	0.03	-3.79	0.00***
ELECWA_EXPESE	-2.87	2.27	-1.26	0.21
INST_EXPENSE	-3.79	3.71	-1.02	0.31
Pseudo R-squared	0.09			
Adj. R-squared	0.04			
Quasi-LR statistic	49.65			
Prob(Quasi-LR stat)	0			

Source: Calculated from the survey data.

Hypothesis 2: *Distance from the EWEC and lack of involvement in transportation-related activities are the most statistically significant causes of the incidence, depth, and severity of poverty in the households of Savannakhet.*

To find out the answer of hypothesis 2, we uses one-way ANOVA t-tests of significant differences in mean as shown in table 6.8 to compare the Foster Greer and Thorbecke (FGT) measurements of poverty: which are the incidences of poverty or Head-Count Index (HCI), the depth of poverty or the Poverty Gap (PG_1, and the intensity of poverty or the Squared of Poverty gap (PG_2). Since no measures of absolute poverty are differ significantly by location, Table 6.8 confirms our previous findings (no significant differences in mean income by location), probably for the same reasons as outlined above.

One can see that the household income per capita and level of household head education are very important for poverty alleviation. Those variables affect all the three Foster Greer and Thorbecke (FGT) Indices. Low level of income per capita and household head education must be associated with greater vulnerability to poverty. However, we can see that car expenditures have a positive effect on the incidence of poverty which shows the share of the population whose income or consumption is below the poverty line. Then, spend large amount of money to purchase car could effect to household income. This implies that some households may not be able to increase their income if they try to take fuller advantage of the EWEC.

Table 6.8: T-tests to compare three measurements of poverty: Foster Greer and Thorbecke Index.

ANOVA	F	Sig.	Extreme area	Other area	(I-J) Mean Difference	Std. Error	Sig.
Incidence	1.06	0.35	semi-urban	urban	0.06	0.07	0.44
				rural	0.16	0.11	0.15
Depth	1.17	0.31	semi-urban	urban	0.05	0.06	0.42
				rural	0.15	0.1	0.13
Intensity	1.28	0.28	semi-urban	urban	0.04	0.06	0.5
				rural	0.16	0.1	0.11

Source: Calculated from the survey data.

Finally, we test the Quantile regression analysis to explain the intensity of poverty. We use the intensity as the dependent variable because the intensity gives a stronger differentiation of the dependent variable than simple depth (poverty gap) and it is the square of the poverty gap. So, explaining the intensity/severity should give more robust results than explaining the depth of poverty. The result of the regressions also shows the top variables part are significantly and positively effect on intensity poverty and the bottom variables part are significantly and negatively. From the top of the table we see that the living space (SPACE), distance from the EWEC (km) (DISTANCE) and installment expenditure (INST_EXPENSE) can explain the intensity of poverty positively. The amount of living space has implications for the energy required to heat (or cool) the space and the number and size of appliances that can fit into the dwelling. So, more those requirement may affect to the intensity. Living at a greater distance from main road or markets or other public infrastructures are likely to be poorer than those located nearer because the high transactions costs are affect to their incomes. However, we can see that other variable (C) could explain the intensity of poverty with significantly and positively.

Conversely, at the bottom part of table display that area (AREA), level of household head education (HEAD_EDU) and agriculture machine/equipment expense (AGRIMAC_EXPENSE) could explain the intensity negatively. Then, this result still confirm that level of household head education are key priority for poverty alleviation which low level of household head education could affect more intensity of poverty. Therefore, we cannot reject hypothesis 2 which distance from the EWEC are significant cause intensity of poverty.

3. Results of hypothesis testing in Hat Yai

The results of unit root test of the RSS3 and Latex series and their transformed variables were obtained through the econometric software package EViews 6.0. The results revealed that the null

hypothesis of a unit root is rejected for the transformed variables of price of each category of NR produce in the CRM, Hat Yai (the first difference and log difference). The series RSS3 or LAT shows similar patterns. These series, whether in level or logarithm transformed form, may not be stationary. However, the unit root test clearly depicts that the first difference and log difference of the each series are stationary. These empirical results allow us to use the univariate conditional mean and conditional volatility models to estimate the bid price behavior of NR produce in Hat Yai.

The outcomes of unit root test obtained from the EViews Package 6.0 are presented in Table 6.9.

Table 6.9: Unit root test statistics for daily price of various categories of Rubber products

Variables	$MADF^{GLS}$ statistics		MPP^{GLS} statistics	
	Z{1}	Z {1,t}	Z{1}	Z {1,t}
RSS3 (Y1)	-0.85	-2.32	-1.73	-2.37
dY1	-11.25***	11.23***	-34.08***	-34.11***
log Y1	-0.94	-2.32	-1.82	-2.4
dlogY1	-9.42***	-9.41***	-37.66***	-37.66***
LAT(Y2)	-1.02	-2.46	-1.83	-2.46
dY2	-10.92***	-6.44***	-32.36***	-32.25***
log Y2	-0.98	-2.24	-1.79	-2.33
dlogY2	-10.75***	-10.33***	-32.19***	-33.41***

The critical values for MADFGLS are -2.57 and -1.94 when Z={1} and -3.47 and -2.89 for Z {1,t}at 1% and 5% significance level respectively and that of for MPPGLS are -3.43 and -2.87 when Z={1} and -3.96 and -3.41 when Z={1,t} correspondingly. These results are on lag length 23; values with *** denotes null hypothesis of a unit root is rejected both at the 1% and 5% level of significance.

Conditional mean and conditional volatility Models

The rubber industry is an integral part of the modern economy and is a well-known source of foreign exchange in such rubber growing tropical countries of Southeast Asia as Thailand, Malaysia, Singapore, Vietnam and the other countries of Mekong Sub region. Thailand holds the topmost rank in the world in terms of production and export of NR since 1990s. Hence, the volatility in the price of NR products plays a decisive role in both the export market and in the livelihood of millions of rubber growing small holders in the country.

Recently, researchers have turned their attention towards the risk associated with economic variables. For instance, international tourist arrivals are carefully monitored in the tourism industry, the prices of agriculture commodities in agricultural finance, and the adopted conditional volatility models of the ARCH family to predict the risk of returns for these industries and to capture symmetric and asymmetric effects using daily, weekly and monthly data example, (Huang B.-W. , Chen, Chang, & McAleer, 2009; Lim.a & McAleer, 2000; Yang, Lin, & Han, 2010).

The stochastic autoregressive conditional heteroskedasticity (ARCH) process was introduced by Ref. (Engle, 1982) and the generalized ARCH(p, q) model of Ref. (Bollerslev, 1986), also termed the GARCH (p, q) model, consisting both autoregressive (AR) and moving average (MA) process. The

formulations of ARCH (q) process given by Engel and GARCH (p, q) process extended and generalized by Bollerslev are presented in equations (4) and (5). A given time series Y_t can be modeled $Y_t = x_t'\beta + \varepsilon_t$, where x_t are the set of variables affecting conditional mean of Y_t and ε_t is the disturbance term with mean zero and conditional variance σ_t^2.

$$\sigma_t^2 = \sigma^2 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 \quad (4)$$

$$\sigma_t^2 = \omega + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2 + \sum_{j=1}^{p} \beta_j \sigma_{t-j}^2 \quad (5)$$

Since the early 1990s, these models have been extensively chosen to empirically capture the time variant conditional variances of a wide range of time series financial data. Recent theoretical developments and their results for univariate and multivariate time series models with conditional volatility errors and a wide range of univariate and multivariate, conditional and stochastic, models of volatility are extensively reviewed by ref. (Li, Ling, & McAleer, 2002) and ref. (McAleer, 2005). The conditional variance of the error terms is time variant and the residual series of such selected models should follow the white noise process. The lag structure of the model can be determined by adopting Akaike and Schwarz information criteria, although it is very common to impose a GARCH(1, 1) specification in advance (Coshall, 2009; Huang B.-W. , Chen, Chang, & McAleer, 2009).

$$y_t = \varphi_1 + \varphi_2 y_{t-i} + \varepsilon_t ; \qquad |\varphi_2| < 1$$

$$h_t = \omega + \sum_{i=1}^{p} \alpha_i \varepsilon_{t-i}{}^2 + \sum_{j=1}^{q} \beta_j h_{t-j} \quad (6)$$

The general form of the GARCH (p, q) formulation is presented in equation (6). Likewise, the univariate stationary form of AR (1) - GARCH (1, 1) model for each category of rubber pieces and transformed variable (i.e. logarithm and first difference or growth rates, as appropriate) at CRM, Hat Yai is given by equation (7):

$$y_t = \varphi_1 + \varphi_2 y_{t-1} + \varepsilon_t ; \qquad |\varphi_2| < 1 \quad (7)$$

Where, y_t denotes the daily prices of each category of NR products (RS, RSS3 and LAT) for t = 1, … n and ε_t is an error process.

The shock or movement in monthly international tourist arrivals is denoted by,

$$\varepsilon_t = v_t\sqrt{h_t} ; \qquad v_t \approx \text{iid } (0,1) \quad (8)$$

$$h_t = \omega + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1} \quad (9)$$

Where, $\sigma_v^2 = 1$, and $\{v_t\}$ is a white-noise process and the conditional and unconditional means of ε_t are equal to zero. The conditional variance of the error process is h_t. The AR (1) process in equation (8), can easily be extended to univariate or multivariate ARMA (p, q) processes (Ling & McAleer, 2003). The conditional variance of ε_t is the ARMA process as expressed in equation (9), where $\omega > 0, \alpha \geq 0$ and $\beta \geq 0$ are the sufficient conditions to ensure $h_t > 0$; and α and β are the ARCH and GARCH terms, respectively. The ARCH effect designates the short run persistence of a shocks while the GARCH term represents the long run persistent of the shock, that is $(\alpha + \beta)$. The larger the value of both α and β, the more plausible it becomes to increase the conditional volatility, but

in different ways and a higher value of α indicates a more distinct shock in the subsequent period (Enders a, 2004; Ling b & McAleer, 2003).

Since the GARCH process is the function of unconditional shock and consistent in second moment and need to investigated, if ε_t is finite and $\alpha + \beta < 1$ and it the well established necessary and sufficient condition (Huang B.-W. , Chen, Chang, & McAleer, 2009). Under normality, the necessary and sufficient condition for the existence of the fourth moment is $(\alpha + \beta)^2 + 2\alpha^2 < 1$ (41). Parameters mentioned in the conditional variance equation above are generally estimated by employing the maximum likelihood method under the conditional normality assumption, $\varepsilon_t = v_t\sqrt{h_t}, v_t \sim N(0,1)$ and $h_t = \sqrt{\omega + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1}}$ with normality test statistics $v_t = \varepsilon_t / h_t$. Thus, the sample statistics would be $\widehat{v_t} = \hat{\varepsilon}_t / \hat{h}_t$ and are termed standardized residuals. Moreover, even if the conditional normality assumption does not hold, parameters are estimated by applying quasi-maximum likelihood (QML) methods and the conditional log-likelihood function is presented in equation (10).

$$\sum_{t=1}^{n} l_t = -\frac{1}{2}\sum_{t=1}^{n}\left(\log h_t + \frac{\varepsilon_t^2}{h_t}\right) \quad (10)$$

The QML estimator is efficient only if v_t is normal (Brooks, 2008; Divino & McAleer, 2010; Huang B.-W. , Chen, Chang, & McAleer, 2009; Ling a & McAleer, 2002) However, QML estimators are consistent if the second moment of ε_t is finite. Global QML estimators are asymptotically normal if sixth moment of ε_t is finite (Ling a & McAleer, 2002; Ling b & McAleer, 2003). Local QML estimators are asymptotically normal if fourth moment of ε_t is finite (Baillie, Bollerslev, & Mikkelsen, 1996) for GARCH (p, q). Literature suggested that the non-negativity condition of GARCH (p, q) model might be violated by the estimated model, and it is assumed that the positive and negative sock in prices of NRare same in the symmetric GARCH process, under the condition of conditional variance, h_t and it can able to capture thick tailed and volatility clustering (Enders a, 2004). Additionally, Glosten et al (1993) proposed GJR (1, 1) model suited to capture the ”leverage” effect and asymmetry behavior which is defined as:

$$h_t = \omega + [\alpha + \gamma I(v_{t-1})]\varepsilon_{t-1}^2 + \beta \log h_{t-1} \quad (11)$$

Where, $\omega > 0, \alpha + \gamma \geq 0$ *and* $\beta \geq 0$ and asymmetry of the series is captured by the coefficient, γ. The regularity condition for GJR (1, 1) is $\alpha + \beta + \frac{1}{2}\gamma < 1$ and ε_t and v_t have the same sign. It is expected that the value of coefficient, $\gamma \geq 0$, particularly when handling financial data because negative shocks increase the risk, this fact also holds for prices of NR (for growers) (Cited in Huang, Chen, Chang, & McAleer, 2009). The exponential GARCH model or EGARCH ($\log h_t = \omega + \alpha|v_{t-1}| + \gamma v_{t-1} + \beta \log h_{t-1}$), is suggested to capture the asymmetric effect in the data series; this model allows no restriction on parameters (α, β and γ) required to ensure $h_t > 0$, if, $|\beta| < 1$ is a sufficient condition for consistency of asymptotically normal values of Quasi-maximum likelihood estimators. It was noted that GARCH and GJR models are dependent upon lagged unconditional shocks, while EGARCH depends upon lagged conditional shocks to the standardized residuals (v_{t-1}) Extensions of several of these results for asymmetric conditional volatility models are given in ref. (McAleer b, Chan, & Marinova, 2007).

Table 6.10: Estimated models and parameters and their respective standard errors

Parameters	Logarithm of daily international tourist arrivals(LY)			Log difference of daily international tourist arrivals (DLY)		
	GARCH	GJR	EGARCH	GARCH	GJR	EGARCH
Constant	7.614*(0.028)	7.667*(0.025)	7.670*(0.027)	-0.0005(0.0004)	0.024*(0.010)	0.071*(0.011)
AR(1)	0.479*(0.035)	0.525*(0.037)	0.580*(0.028)	0.565*(0.024)	-0.714*(0.176)	-0.857*(0.097)
MA(1)	0.260*(0.047)	0.214*(0.040)	0.183*(0.029)	-0.989*(0.004)	0.756*(0.164)	0.900*(0.086)
ω	0.131*(0.0153)	0.065*(0.015)	1.378*(0.154)	0.125*(0.013)	0.045*(0.010)	-0.072**(0.034)
GARCH/GJR α	0.208*(0.042)	0.205*(0.044)	-	0.258*(0.046)	0.567*(0.009)	-
GJR γ	-	-	-	-	-	-
		0.285*(0.045)			0.644*(0.002)	
GARCH/GJR β	-0.141(0.097)	0.396*(0.144)	-	-	0.570*(0.048)	-
				0.121***(0.072)		
EGARCH α	-	-	-	-	-	-0.076*(0.020)
			0.164*(0.065)			
EGARCH γ	-	-	0.608*(0.038)	-	-	0.438*(0.010)
EGARCH β	-	-	0.321*(0.063)	-	-	0.914*(0.017)
Diagnostic test						
Second moment	0.670	0.457	-	0.136	0.815	-
LM(1):nR^2[Prob.]	0.973[0.324]	0.125[0.723]	0.178[0.673]	0.529[0.467]	3.097[0.078]	0.438[0.508]
LM(2) nR^2[Prob.]	1.304[0.521]	7.375[0.025]	3.24[0.197]	0.642[0.725]	-	1.05[0.591]

Note: *, ** and *** denotes the estimated coefficients are statistically significant at the 1%; 5% and 10% level of significance respectively. Figures in parenthesis are standard errors and figures in bracket are probabilities.

4. Results of hypothesis testing in Mawlamyine

Having measured the levels of absolute poverty and relative inequality in Mawlamyine, we now use our survey data to determine which variables and conditions most significantly determine income per capita and the intensity of poverty. Table 6.11 reports an OLS regression to identify the determinants of income per capita in the Mawlamyine area.

Table 6.11 Factors that explain income per capita

	B	Std. Error	Beta	t-statistic	Sign.
(Constant)	398405	200078		1.99	.047**
Percent income from small-scale merchandising and sales	1217452	221622	.28	5.49	.000***
Dependency ratio	223444	64264	.18	3.48	.001***
Household females (persons)	-207742	65815	-.18	-3.16	.002***
Total household education (years)	9364	3849	.14	2.43	.015**
Distance from EWEC (km)	30656	93880	.02	0.33	.744
Adjusted R-squared				.112	
F-statistic				10.137	.000***
Degrees of freedom				359	

**** = significant at the .01 level or better, ** at the .05 level and * at better than .10.*

Income per capita in Mawlamyine area is significantly increased by the *percent income from small scale* merchandising *jobs*. Government could therefore consider promoting sales and jobs in that area. In contrast to the previous literature, however, the *dependency ratio* bears a positive effect on family income per capita. This is consistent with the Myanmar tradition whereby the family supports both elderly parents and children living with grandparents when parents are working at border areas and must send money back for their children's school fees. In addition, the more *females* in the family, the less the income per capita. This finding is consistent with those of Kyaw and Routary (2006) reported earlier. Apart from those females living in metropolitan areas and educated females, females do not usually travel to seek income but simply remain with parents or guardians. It is not surprising that having a greater number of females lessens family income per capita. Here our regression further shows that education is important to increasing family income; but that when all these other variables are taken into account, distance front the EWEC is no longer significant.

Of course, what causes some households to suffer extreme poverty is not always the opposite of what causes other people to have extreme wealth. We therefore estimate in Table 6.12 the causes of the intensity of poverty as the dependent variable in an OLS regression equation.

Table 6.12: Multiple regression equation to explain the intensity of poverty per capita

	B	Std. Error	Beta	t	Sig
Mawlamyine-employed females	.019	.004	.287	4.316	.000***
Migrant females	.031	.010	.160	2.993	.003***
Mawlamyine-employed males	.010	.004	.174	2.558	.011**
Migrant males	.011	.007	.098	1.668	.096*
Motorcycle ownership (1, 0)	-.020	.008	-.136	-2.304	.022**
Dummy variable for urban areas	-.020	.009	-.139	-2.241	.026**
Distance from EWEC (km)	.005	.005	.071	.993	.321
Adjusted R-squared				.186	
F-statistic				13.181	.000***
Degrees of freedom				365	

Since the intensity-of-poverty dependent variable gives most weight to the poorest in society, it comes as no suprise that having to resort to *migrant female workers* significantly drives up the intensity of poverty. Surprisingly, the same problem affects *female workers at Mawlamyine, male workers in Mawlamyine* and, to a lesser degree even *migrant males.* Since it is observed that most migrants from Mawlamyine are blue collar workers working at border and factories in Thailand, migrants of either gender should reduce, not intensify poverty, unless of course migration is unsuccessful.

Further research will clearly be required to explain these paradoxical results. For now, we may use a correlation matrix (Table 6.13) to identify other significant bivariate relationships between the intensity of poverty and other potential causal factors.

Table 6.13 adds to the information in Table 6.12 that rurality, farming, growing vegetables and other field crops, working as agricultural labourers; the personal service, liquor and tobacco sectors; and household size may be included in the variables that increase the intensity of poverty. Clearly, special help will be needed for those engaged in farming and living in the rural sector. This sends a signal for the researchers and policy planners how to set up the economic development policy for integrated rural development and higher-paying non-farming rural job creation.

Taken together, Tables 6.12 and 6.13 lead us to reject hypothesis 3, to the effect that *the intensity of income poverty is increased by living in large female-headed households with a high dependency ratio, high distance from the EWEC, living in rural areas, and reliance upon casual jobs.* In fact, none of these variables is significant in the poverty equation of Table 6.12 and only rurality is significant in Table 6.13. Meanwhile, *female head* is significant only in the income equation (Table 6.11); the *dependency ratio* bears the wrong sign in the income equation; and employment, whether in migration or in Mawlamyine for both genders seems paradoxically to increase the intensity of poverty.

Table 6.13: Some factors associated with high poverty intensity

Total significant correlations	Head count according to income per capita		Head count according to expenditure per capita		Depth of poverty below the income poverty line		Intensity of poverty below the income poverty line	
	Corr	***Sign.***	**Corr**	***Sign.***	**Corr**	***Sign.***	**Corr**	***Sign.***
		110		***137***		***94***		***68***
FACTORS ASSOCIATED WITH HIGHER POVERTY								
Do agricultural work (1,0)					0.09	*0.008*	0.09	*0.094*
Personal service employment					0.10	*0.068*	0.10	*0.060*
Mawlamyine-employed females							0.10	*0.060*
Distance from EWEC (km)	0.09	*0.092*			0.10	*0.045*	0.11	*0.043*
Migrant females	0.18	*0.000*	0.18	*0.00*	0.16	*0.002*	0.12	*0.018*
Grow other field crops (1,0)	0.10	*0.045*			0.12	*0.019*	0.14	*0.009*
Income is earned from agriculture (1,0)					0.09	*0.076*	0.14	*0.006*
Degree of rurality					0.15	*0.005*	0.16	*0.001*
Family agricultural labourers (persons)					0.10	*0.065*	0.19	*0.000*
Get gifts from friends /relatives (1,0)	0.09	*0.080*			0.19	*0.000*	0.20	*0.000*
Do liquor and tobacco business (1,0)					0.17	*0.001*	0.21	*0.000*
House members (persons)	0.10	*0.061*			0.19	*0.000*	0.21	*0.000*
Household females (persons)	0.11	*0.043*			0.20	*0.000*	0.21	*0.000*
Grow vegetables (1,0)	0.11	*0.030*	0.10	0.*07*	0.18	*0.000*	0.25	*0.000*

Note : correlations with a significance estimate of 0.10 or higher have been judged nonsignificant and removed from the table.

Table 6.11 also leads us to reject hypothesis 4, that *the intensity of income poverty is reduced by education, jobs in transportation, metal-working/blacksmithing, and living in urban areas.* Only motorcycle ownership and urban residence significantly reduce poverty; and neither of these two variables was specified in the hypothesis. Motorcycles are not only a means of commuting, marketing, and migration; they are also the principal asset in operating a cycle taxi. This suggests a possible subsidy policy for motorcycle ownership in rural and semi-urban areas. Finally, the non-significance of the distance from EWEC variable strengthens our conclusion that the EWEC has not lived up to its job- and growth-creating potential.

Again, we may enrich these results for policy purposes by consulting the bivariate correlations between various measures of poverty and potential factors that reduce poverty (Table 6.14). These include remittances per migrant (i.e., the monetary value of migration as opposed to the number of people sent); owning the means of transportation (esp. a car or motorcycle); employment in sales, business, transportation, and other sources; education required to obtain those jobs, consumption of self-produced goods, and finally proximity to the EWEC ("central place attraction").

Two types of policy implications flow from our analyses of hypotheses 3 and 4. First, transportation and mobility-related job creation should form the nucleus of the anti-poverty thrust in Mawlamyine. If people living in rural and semi-urban areas can be partially subsidised to afford motorcycles, they can undertake jobs in the business, sales, transportation and other services sectors. Otherwise, the entire positional advantage of Mawlamyine as a major transit and border trade city at the terminus of the EWEC will remain unrealised.

Secondly, adult education will also be necessary. Technical training for landing non-agricultural, non-manufacturing jobs could be a powerful government policy to reduce the intensity of destitution below the poverty line. Such a policy appears especially urgent since in the results of our firm and household surveys, the business and transportation sectors were far from flourishing in 2009. This is particularly true in the case of females, who must be equipped with knowledge to seek higher paying jobs outside the household, notably in the transportation, business and service jobs.

Table 6.14: Some factors associated with reduced poverty

FACTORS ASSOCIATED WITH REDUCED POVERTY	Head count according to income per capita		Head count according to expenditure per capita		Depth of poverty below the income poverty line		Intensity of poverty below the income poverty line	
	Corr	Sign.	Corr	Sign.	Corr	Sign.	Corr	Sign.
Remittances per migrant (kyat)	-0.39	0.000	-0.32	0.002	-0.32	0.002	-0.25	0.021
Vehicle ownership (Car=3, motorcycle=2, bicycle=1, nothing=0)	-0.37	0.000	-0.46	0.000	-0.29	0.000	-0.20	0.000
Central place (one over squared distance from EWEC)	-0.11	0.033			-0.15	0.004	-0.15	0.004
Sales value of services (kyat)	-0.17	0.001	-0.11	0.045	-0.13	0.013	-0.09	0.080
Space per capita (sq m/person)	-0.18	0.001	-0.22	0.000	-0.14	0.007		
Petty sales employment	-0.15	0.003	-0.11	0.043	-0.11	0.034		
Total labour in business (persons)	-0.18	0.001	-0.25	0.000	-0.11	0.035		
Income is earned from other sources (1,0)	-0.16	0.003			-0.11	0.037		
Percent income from small-scale merchandising and sales	-0.18	0.001	-0.24	0.000	-0.11	0.041		
Consumption of own-produced business output (kyat)	-0.13	0.012	-0.14	0.007	-0.10	0.045		
Income from transportation (kyat)	-0.14	0.009	-0.10	0.064	-0.10	0.062		
Total education of all members of the household (years)	-0.17	0.001	-0.24	0.000				
Family labour in business (persons)	-0.16	0.002	-0.25	0.000				
Total value of self-consumed products per year	-0.10	0.064	-0.17	0.001				
Total labour in transportation (persons)	-0.09	0.093	-0.09	0.089				

Although metal-working jobs is not currently a significant force in reducing the food Engel coefficient, these and other traditional cultural employment within the handicraft sector should be maintained against the day when jobs in building the transportation infrastructure will no longer be available. A combination of wage-rate subsidies and low-interest loans should be promoted in these areas.

CHAPTER VII:
POLICY IMPLICATIONS

Given the unique characteristics of each of the four study provinces and the types of location they represent, the policy conclusions from this report are quite site-specific. Indeed, it would be both dangerous and wrong to generalize on what measures governments should put into place for the EWEC as a whole. Careful reading of this report points to the remaining weaknesses in Mawlamyine and Savannakhet that could make the new road connections even more economically and socially productive. In contrast, large, well-linked and relatively developed urban centers like Da Nang and Hat Yai would be better served by re-channeling their infrastructure budgets into the construction and upgrading of feeder roads, the reduction of urban traffic congestion, and the provision of public transportation. The present chapter is devoted to adding more specific details to those general policy conclusions.

1. Policy implications for Da Nang

This study has measured, explained, and compared the impacts of that project on income levels, income distribution, and poverty incidence and intensity of rural, semi-rural, and urban households in Da Nang province between the years 2006 and 2008 using t-tests, one-way ANOVA, Gini coefficients, Foster-Thorbecke-Greer indicators, and multiple regression analyses.

The results of this study led us to strongly reject the hypothesis, to the effect that **"***From the national viewpoint, the road has conferred a clear advantage on Da Nang province when compared with other provinces, regions and cities within Vietnam. Within Da Nang province, proximity to the road makes people better off*." Except for possible specialization effect in agriculture and a shift of industrial production outward to Quang Tri province, there is little evidence from the national data that the road has had any impact on key macroeconomic variables. We have found that, from official statistics at the national viewpoint, the road has not conferred any clear advantage on Da Nang province when compared with other provinces, regions, and cities within Vietnam. The only exception may be increased agricultural specialization. However, from the viewpoint of a carefully selected sample of 114 households it is clear that

proximity to the road makes people better off. Transportation employment is not significantly correlated with income because skill levels required for that sector are quite variable, but the transportation sector has provided new jobs to the least well-off. Generally, the incidence and depth of poverty are highest in the rural areas farthest from the road. However, the intensity of poverty is most acute in the semi-urban area because some households are totally left out of development, being neither specialized producers of agricultural products nor employed in businesses that can benefit from the road.

To maximize advantage from the road, the government needs to provide human capital training to allow workers to qualify for higher-level jobs, particularly in the semi-urban areas.

2. Policy implications for Savannakhet

In this report, we have constructed and employed a Social Accounting Matrix (SAM) to gather insights for economic development strategy and policy formulation. We applied and compared investment multipliers to visualize the total effects of increasing the output of a given sector on all other sectors of the economy and linear programming to optimize the provincial economy subject to resource constraints and provide the corresponding implementation plan. All these methods were combined to propose a strategic plan for maximizing the net developmental benefits from the EWEC for the Savannakhet economy.

❖ Integrated policy recommendations for government

The most important recommendation that flows from this research is that government must attempt to construct and optimize a model of the economy under the constraints of philosophical principles in order to develop an integrated and correct plan consistent with the King of Thailand's stance on "balance" or "sufficiency." The results from several simulations also point to a strong recommendation that government should focus on promoting education, one of the two essential pre-conditions of applying that philosophy. Education should thus constitute a key priority in the promoting of economic growth and socio-economic well-being in Savannakhet households.

The transportation sector, employment, the capital and financial sectors, and road-related activities (including tourism) have clearly been increased by the construction of the East West highway. Continued public and private investment in these sectors can clearly stimulate the trade sector for both domestic and border trade (Thai, Laos and Vietnam), including international trade. Moreover, road-related activity, notably construction, can attract substantial investment capital. This will lead other sectors related to the construction sector –finance, personal service, business service, wholesale and retail trade, and public utilities -- to share in that growth. This growth will

in turn affect the movement of products and other services along the border through the East-West highway.

Furthermore, government should promote and encourage the investment on the service sector coupled with the industry sector such as hotel and restaurant because the service sector is likely to grow steadily in this province. For agriculture sector, government should support investment in agricultural product innovation. These may help to solve problems in the agricultural production process and could create new opportunities to invest in this agriculture market. Moreover, government should pay more attention to accelerate the development of infrastructure along the border to get ready for the growth of trade and investment in the future.

❖ **Implications for guiding investments by the private and foreign sectors**

The transportation sector, employment, the capital and financial sectors, and road-related activities (including tourism) have clearly been increased by the construction of the East West highway. Continued public and private investment in these sectors can clearly stimulate the trade sector for both domestic and border trade (Thai, Laos and Vietnam), including international trade. Moreover, road-related activity, notably construction, can attract substantial investment capital. This will lead other sectors related to the construction sector –finance, personal service, business service, wholesale and retail trade, and public utilities -- to share in that growth. This growth will in turn affect the movement of products and other services along the border through the East-West highway.

This research leads to four policy-oriented conclusions. First, policies must urgently address income inequality, especially in the urban areas. Due to the over-competitive labor market and population density in this principal economic sector, any policy that would diversify a household's income fully or partially away from farming should be seriously considered. Such policies could involve either creating opportunities to migrate to semi-urban or urban jobs, or creating rural-based industrial and service sector employment.

Secondly, family planning remains an important policy imperative. Our results have demonstrated that reducing the number of family members could substantially relieve poverty and increase the welfare of households.

Third, we recommend promoting awareness of and equal opportunity in the education sector and employment. Women empowerment on education and employment is one key priority to solving socio-economic problem and poverty alleviation in Savannakhet province. A higher level of household education decreases the probability of being poor. This is because opportunities for a better education can create better job skills, lower unemployment, and less poverty.

Finally, extension of the secondary and tertiary links to the EWEC, as well as the general improvement of the infrastructure in rural areas, should be a key priority in poverty reduction. These areas are still lacking in such basic infrastructure as clean water, gas stations, and shops, which limits the benefits from the road infrastructure.

3. Policy implications for Hat Yai

Apparently, this academic work evoked a few important issues for the development of policy implications in Songkhla. These are as follows.

❖ **High income gap among the households**

Although, poverty has fallen down and quality of life improved as a result of economic growth and expansion in Thailand over the years, there are still millions of Thai people below the poverty line and still at risk of poverty. The impact of higher inequality on the incomes of those at the bottom of the distribution raises obvious questions about the connection between inequality and poverty. The survey clearly depicts that mean income of the households between urban and semi-urban areas is significantly different and the income gap is highest in urban areas (44%). Policy literatures argued that poverty reduction is generally associated with both (i) reduction in the incidence and depth of poverty, and (ii) the initial level of inequality and changes in the level of inequality. Thus, economic growth and equity both have a role to play in poverty alleviation. Therefore, the policy needs to address the issue of income inequality in the province.

❖ **Negative shock in international arrivals by land transport**

Undeniably, tourism is a potential strategic sector for socioeconomic progress in Songkhla. Thus, number of tourist arrivals is the key success factor for tourism business. Empirically, short run negative shock or volatility is observed in the international arrivals by land transport. Volatility can be inferred as risk and envisage uncertainty of the arrivals in the Songkhla. Therefore, administrator, policy makers and hotel-owners have to realize this fact to stabilize negative shocks in tourism demand through (a) targeted advertising campaigns in various countries, (b) subsidy offers to certain subgroups of tourism or special tourism packages, (c) provision of publicly available up-to-date tourism information, (d) capacity enhancement of the tourism personnel for providing high quality services, and (e) harmonizing in between private - public sectors to remove the bottlenecks of the industry and attract private investment for tourism infrastructure development. The tourism industry is the one of the fastest growing sectors in Thailand and has contributed considerably to the national economy. The majority of the

international tourist arrivals into the Songkhla province by land transport are from neighboring countries, with more than 80% of total arrivals from Malaysia.

The economy of Songkhla province is influenced by the tourism business, including its impacts upon plantation crops and fisheries. The province is endowed with diverse tourist attractions with convenient transportation routes, accommodations, communication facilities and other tourist amenities. Ancient monuments and places, traditional culture, natural beauty, and interesting local products are the main tourism assets. The diverse cultural inheritance passed down from generation to generation is further enriched by a melting pot of Thais, Chinese and Malays that made the province more attractive.

In this connection, the tourism sector can be considered a vital strategic sector for Songkhla's economic development. There is potential room to harvest contributions of tourism in terms of foreign receipts in hard currencies or exports, and poverty reduction through the creation of local demand for goods and services and employment opportunities in the province. Despite this great potential, the possible negative impacts of international tourism need to be investigated in order to manage and stabilize future tourism demand for both public-sector policy improvement and enhanced private-sector management of the tourism sector. Therefore, it is necessary to rigorously and carefully investigate tourist arrival growth and volatility over time. Such has been the goal of this paper.

The conditional mean and conditional volatility models of the ARCH family were employed to model international tourist arrivals by land transport using daily data from January 1, 2007 to September 30, 2010. The empirical results showed that the transformed (logarithm and logarithm differenced) variables of daily international arrivals by land transport in Songkhla are stationary. In other words there is no significant trend in arrivals over the 3.75 year series. This suggests that no further expansion of tourist facilities by the private sector will be necessary over the near future on average.

However, the short run risk or volatility in daily international tourist arrivals is quite persistent. In accordance with modeled symmetric and asymmetric conditional volatility models (GARCH, GJR and EGARCH) with exogenous ARMA (1, 1) terms, the short run negative shock is also observed and estimated coefficients are statistically significant. The regularity condition for GARCH (1, 1) and GJR (1, 1) and $|\beta| < 1$ in case of EGARCH (1, 1) are satisfied for asymptotic normality of QMLE. Therefore, the volatility can be inferred as risk associated with daily international tourist arrivals in the provincial tourism industry of Songkhla by land transport. The negative asymmetric behavior is also observed in the daily international arrivals. Thus, this empirical study envisages sufficient room for intervening or amending the provincial tourism policy to trap the essence of tourism benefit and imposition of effective policy measures to promote tourism locally as a business.

The further research on tourism demand incorporating other modes of transport and behavior of domestic arrivals by land transport considering peripheral destinations in other province in the south could be an important attempt for policy implications and its real meaning. The refinement of our model for seasonal and other effects is also an important subject for future research.

❖ **Price volatility of latex type RSS 3 is persistence:**

Empirical analysis clearly illustrated that there is log run persistence of shock or volatility in daily bid prices of natural rubber latex type RSS3 over time at Central Rubber market Hat Yai, Songkhla. It envisaged uncertainty of the price for the latex. As we know, Songkhla is an international hub for natural rubber trade, and rubber export contributed Thai Baht 487.22 billion in 2013. NR plantation is the source of income and livelihood for millions of smallholding producers and tappers. Thus, volatile rubber price in the CRMH could have implications for both economic and environmental policies such as price stabilization through market intervention and other effective measures. NR industry has always been susceptible to crisis induced by fluctuating prices, and manufacturers are most vulnerable to raw materials, production and export of rubber based articles. Perhaps, economic shocks to the rubber marketing channel have always had major impact upon not only the economy but also the social and political stability of the region.

4. Policy implications for Mawlamyine

This report employed a new household-level dataset on Mawlamyine Township to fill a major knowledge gap as to the level, causes and consequences of poverty in one of the most promising areas for economic development in Myanmar. Of particular concern are how poverty may reduce the ability of the population to meet their food and non-food basic needs.

Using multiple regression and correlation matrices, we have rejected hypotheses 1, 3, and 4 while failing to reject hypotheses 2, and 5. Taken together, the results affirm that the problems of poverty and inequality are acute in the Mawlamyine area, that absolute poverty is worst in semi-urban areas, while relative inequality is most acute in urban areas. The intensity of poverty may be most effectively reduced by education, remittances from migration, motorcycle ownership, business/sales/ transportation/services occupations, and self-consumption.

Since these results are all amenable to policy intervention we recommend that:

- Government should invest both monetary capital and management supervision to increase the road infrastructure, educational institutions, and Nargis clean-up as fast as possible.

- The semi-urban areas with the highest incidence of poverty should be given priority targeting for anti-poverty programs. In the meantime, in-kind aid such as a special food scheme policy should be seriously considered for poor families with a high severity of poverty. Adequate calorie sources should be given first, and then, if necessary, small protein supplements.
- Special relief programs should also be visibly aimed at the urban poor to reduce the income gap and social unrest in metropolitan areas.
- Transportation and mobility-related job creation should form the nucleus of the anti-poverty thrust in Mawlamyine. If people living in rural and semi-urban areas can be partially subsidized to afford motorcycles, they can undertake jobs in the business, sales, transportation and other services sectors. Otherwise, the entire positional advantage of Mawlamyine as a major transit and border trade city at the terminus of the EWEC will remain unrealized.
- Adult education will also be necessary. This is particularly true in the case of females, who must be equipped with knowledge to seek higher paying jobs outside the household, notably in the transportation, business and service jobs. A combination of wage-rate subsidies and low-interest loans may be envisaged to promote investment and job-seeking in these areas.
- Consistent with the writings of Todaro and Smith (2003), rural-based employment and welfare improvement programs should precede any effort to promote rural-urban migration. Families should be encouraged to remain in rural areas and to unite larger family units under a single roof.
- Public health care institutions and personnel should be upgraded. Based on our survey experience, most of the younger generations from rural areas are paying inadequate attention to education and healthcare.
- Within non-food necessities, health care plans for dependents should be checked. The factor that a high dependency ratio induces families to spend more on education, health and clothing is especially serious because, as we have seen, health institutions and personnel are already lacking in the public institutions to which the poor would normally go. Investments in the public health sector would therefore be a “pro-poor” policy.

5. Scope and limitations of the research and suggestions for future research

Principal component analysis currently being used by researchers to measure poverty in Thailand could be extended to each of the datasets of this study to determine which clusters of variables, including transportation, may explain the level of poverty. An environmental social accounting matrix (ESAM) could be constructed using the data from household categories, data

from firms, schools, banks, government institutions and engineering data on the pollution and deforestation effects of each type of enterprise -- to calculate impact multipliers and optimal development strategies for taking full advantage of the EWEC.

Finally, focus groups with provincial leaders could be conducted to receive feedback on the results to date and instructions as to the priority research hypotheses to be tested in the future that are consistent with Da Nang's overall development goals.

Limits and weaknesses of the present research

This research has focused on four single, although representative provinces. Parallel studies should therefore be applied to other provinces and of course the national economies of all Southeast Asian nations in order to critically evaluate the setting and realization of the objectives of successive 5-year plans. Moreover, we recommend that a fuller version of SAM scenario 7 – technically termed a sufficiency economy matrix (SEM) -- be employed for future research in Thailand's neighboring country Laos. Contrastive evaluations between the SAM and SEM results could help policy makers to realistically weigh the impacts of alternative policies.

The data used to construct the SAM used in this research were mostly derived from an original 2010-2011 survey data of both households and firms in the informal sector. Private enterprises and the business sector were, however, reluctant to give us the necessary data. We therefore had to rely on household purchases and household income sources to reflect a mirror-image the sales and payments of private sector firms. This process may have limited the accuracy of our portrayal of the links among the various sectors or the economy.

The southern coverage of this research study was limited only in the segment of the Asian Highway, Hat Yai in Songkhla, which is part of the Thai-Sino strategy, and this connects the GMS Corridor and IMT-GT growth triangle. The socio-economic impact study of the Highway may cover a multi-dimensional approach. However, we intend to concentrate on the price behavior of the rubber, tourism industry and poverty dynamics of the household survey accordance with data, time and fund availability constraints.

The matrix of accounts consisting of various sectors of Songkhla's economy was constructed by using household survey in 2010. Though the matrix is balanced, it needs to be updated for further analysis. During the fieldwork, a set of data about the tourism sector was lost due to the heavy flood in Songkhla and rescheduling for data collection was not accomplished because of resources and time constraint. Therefore, interested graduate students and other researchers on Social Accounting Matrix will be highly welcomed to update and use the data set.

Further research on tourism demand incorporating other models of transport and behavior of domestic arrivals by land transport considering peripheral destinations in other province in the south could be an important attempt for policy implications and its real meaning. The refinement of our model for seasonal and other effects is also an important subject for future research.

Moreover, sustainability of the natural rubber industry is crucial for the Songkhla's economy to overcome rural poverty by generating jobs at the local level and foreign receipts earnings from the natural rubber trade. Thus, volatile rubber price in the CRMH may have implications for both economic and environmental policies. Future policies could address the uncertainties behind the small holding rubber growers' level of income transmitted due to the volatile price international market. Rubber price stabilization in the local market as well as in the international market could be an option to harness the huge export potential of natural rubber and rubber articles. This baseline study has modeled volatility for the recent historical period (2004-2011). Future research on volatility, as well as the extension price of modeling for co-integration of price considering spatial destination, could further explore the long-run relationships among the underlying variables to help refine the policy solutions.