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THE ROLE OF SUSTAINABILITY IN DEVELOPMENT ANALYSIS: A

CASE STUDY OF LAOS

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ABSTRACT

The main purpose of this thesis is to identify the role of sustainable development in Laos, based on the integration of three factors, economic growth, social development, and the environmental dimension. Annual time series data are used for the period 1980-2010. In order to generate the most appropriate regression, relevant theoretical and empirical studies are reviewed. This thesis contributes to the on-going research issue about key determinants influencing sustainable development in developing countries.

Firstly, this study uses the first different of logarithm form to identify the determinants of economic growth, the impacts of growth on poverty and environmental conditions in Laos. However, using the multiple regressions, serious problems of multicollinearity were encountered and those results became less reliable. Principal components analysis (PCA) is a technique to handle the problem of multicollinearity and produce stable and meaningful estimates for regression coefficients.

This thesis concludes that there are several variables, both internal and external factors, which have influenced the current economic growth of Laos. Particularly the internal factors (domestic investment, government expenditure, and industry) show their strong correlation with economic growth, while the external factor (participation in ASEAN) also plays an important role in economic growth. On the other hand, the other external factors (FDI, AID and OPEN) show a weaker link to domestic growth of Laos. In the long run, to ensure the effectiveness of external factors on domestic growth, this research suggests exploiting more effectively the opportunities provided by foreign direct investment, through the openness of the system to globalization and international trade, together with better management of aid allocation.

The impacts of economic growth on poverty and environmental conditions are then considered, questioning whether economic growth leads to the reduction of poverty and whether it produces a pressure on environmental conditions. This study found that those determinants not only have been dominant in economic growth, but they do indeed correlate with a reduction in the level of poverty. On the other hand, the increase in economic activities leads to increased environmental damage.

This research supports continuing the adjustment of domestic activity investment, government expenditure, improving trade openness system, foreign direct investment, aid allocation, ASEAN, and so on. These factors can help the country to grow and poverty to diminish but we have also to pay attention to their impacts on the environment. Sustainable development would achieve its goal only if these internal and external factors contribute to economic growth, where this growth is distributed across the entire population, together with environmental protection conditions.

In order to attain the goal of sustainable development, strong environmental and natural resource protection policies are suggested. To maintain a high rate of economic growth, this study suggests considering the natural resources and the areas with the greatest potential to be utilized for growth; such as tourism sustainability, human resource improvement and trade policy improvement. To improve social development, reduce the development gap and eradicate extreme poverty, it is suggested that community participation development, gender promotion, and investment in social services be increased especially in rural areas.

Keywords*: Economic growth, Poverty, Income inequality, Environmental degradation, Trade openness, Sustainable development.*

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Certification of authorship of Dissertation Work

THE ROLE OF SUSTAINABILITY IN DEVELOPMENT ANALYSIS: A

CASE STUDY OF THE LAO PDR

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Abbreviations

ADB	Asian Development Bank
AEC	ASEAN Economic Community
AFTA	ASEAN Free Trade Areas
ASEAN	Association South-East Asian Nations
CIA	Central Intelligence Agency
CLV	Cambodia, Laos, and Vietnam (Indochina countries)
CPI	Committee for Planning and Investment
DI	Domestic Investment
FAO	Food and Agriculture Organization
FDI	Foreign Direct Investment
FTA	Free Trade Areas
GATT	General Agreement on Tariffs and Trade
GDP	Gross Domestic Product
GNP	Gross National Product
GOL	Government of Laos
HDI	Human Development Index
IDA	International Development Association
IGA	Income Generation Activities
IMF	International Monetary Fund
Lao PDR	Lao People Democratic Republic
LDCs	Least Developed Countries
LECS	Lao Expenditure and Consumption Survey
MDGs	Millennium Development Goals
NZODA	New Zealand Official Development Assistance
NEMs	New Economic Mechanisms
NSC	National Statistics Centre
ODA	Official Development Agency
OLS	Ordinary Least Squares
PCA	Principal Components Analysis
PEI	Poverty and Environmental Institution
PM	Prime Minister
PRF	Poverty Reduction Fund Project
PWT	Penn World Table
SIDA	Swedish International Development Authority
USD	United States Dollar
UN	United Nation
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
VIF	Variance Inflation Factor
WDI	World Development Indicator

CHAPTER 1: INTRODUCTION

1.1. Sustainable Development Background

The concept of sustainable development, which is proposed to reconcile economic, social, and ecological dynamics, was initiated during 1980s. Today, the economic development through sustainable concept has become an important issue to ensure the effectiveness of long term perspective. It is discussed among the leaders of many counties. The development concept has gone through various phases according to development research literature in numerous countries. The concept of Sustainable development has become a global issue and this concept is the source of strongly diverging interpretations in the field of economic analysis.

Sustainable development (SD) is development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland Commission, 1987). The definition also includes two facets: one is about the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; the second one is the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.

Initially, SD was emphasized only the environmental issues; however, the reality of development, this concept should also encompass the social development perspectives and other key indicators such as natural, cultural and economic issues. At the 1992 'Rio Earth symposium' in Brazil, sustainable development issue was the main topic of discussion. Rio Earth Summit in Brazil was attended   by 152 world leaders from around the world. The symposium's main focus was to highlight the importance of sustainability, included in agenda 21, a plan of action, and a recommendation that all countries should produce national sustainable development strategy.

In addition, SD is a politically and scientifically contested concept and it is needed to identify clearly about the major indicators influencing the SD purpose. This is partly due to its definition, which contains ambiguous, normative and subjective elements. In addition, sustainable development is a complex concept describing developments at different time-scales, geographical scales and across domains (Munasinghe, 2001). The concept of sustainable development has become a global issue. Therefore, in order to achieve the goal we need the cooperation of relevant organization, particularly from government to frame the most appropriate strategy to achieve its goals.

1.2. The problems

Once poor countries are on a sustained growth path, they will be able to address a wide range of needs, including environmental protection and the eradication of poverty (Korten, 2005). In Laos, although the country has performed persistent sustained economic growth since the introduction of open door policy in 1986, particularly after holding a full membership of ASEAN in 1997, it is questionable whether economic growth is of benefit to the reduction of either poverty or social inequality, or whether the economic growth produces negative impacts on environmental condition. The interaction of these determinants is considered to be a primary concept of sustainable development, which remains a major challenge for current and future development of Laos.

Poverty eradication has become the objective of the government's economic and social policy in many developing countries (Bruce, 2006; Robert and Dasguta, 2007; Rupasingha and Stefan, 2007). In Laos, although the Government has reported that the average proportion of poverty has decreased significantly, this issue remains very important, particularly, in rural areas. In addition, the inequality level of income distribution is increasing, since the value of the Gini

index increased from 30.4 percent in 1990 to 36.2 percent in 2010; hence, it is questionable whether economic growth is distributed throughout the population or not, and an increase in the level of inequality is assumed to reduce the level of sustainable development. Moreover, an increase in the amount of industrial and manufacturing factories increases in the volume of pollution and produces negative impacts on environmental systems. Therefore, the environmental issue has become an important topic among the policy makers in Laos.

Three major issues will be discussed in this research. The first one is to identify the determinants influencing economic growth, the second one is to examine the impacts of economic growth on poverty and income distribution, and the last one is to investigate the impacts of economic growth on environmental conditions. These three issues are identified in order to find reasonable evidences to provide some suggestions for sustainable development for current and long run development for Laos.

1.3. The purposes

The strong commitment of the Government of Laos is to achieve the Millennium Development Goals (MDGs), while exiting the ranks of the Least Developed Countries (LDCs) by the year 2020. With this specific target to achieve, a high rate of economic growth is considered as a necessary condition for economic development but it is not a panacea for socio-economic development. One has also to consider the impact of economic growth with respect to other factors such as the impact of growth on social development, particularly, poverty and income distribution which remains a challenge for economic development of Laos. The other one is the impact of economic growth on the environmental factors such as deforestation and environmental degradation, due to the fact that the major products in Laos depend on natural

resources, including woods, and mineral resources, while the hydro power electricity causes a serious impact on natural resources system such flora and fauna.

Economic growth is considered as a key factor to achieve the national development goal of Laos; however, if the government's policies are focused only on economic growth as to reach a minimum income to graduate from LDCs[1], without considering their impacts on the other aspects, such as social, cultural, and natural sustainability, this could mean that the envisaged development mechanisms and processes would prove inadequate for country's long term development perspective. For this reason, to achieve successfully the goals of the various economic development plans, the government needs to consider both the development potential to increase the wealth of people in the country and also to preserve the sustainability of development that would ensure lasting benefits for the country's future generations.

1.4. Innovative aspects

In brief, through the achievement of sustainable and equitable development, it is very important that the country's socio-economic development policies, strategies and investment are sustainable. Consequently, analyzing the sustainability of development undertaking should almost by definition become the main criteria to achieve the national development goal. This thesis attempts to determine the importance of sustainable development and aims to present some indicators and tools that would be used to facilitate a transition towards sustainability. It is assumed that sustainable development is a function of three factors, economic growth, social development and environmental conditions.

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[1] A country is classified as a Least Developed Country if it meets three criteria:
- Poverty changeable criterion: three-year average GNI per capita of less than US$992 which must exceed $1,190 to leave the list as of 2012,
- Human resource weakness (based on indicators of nutrition, health, education and adult literacy) and
- Economic vulnerability (based on instability of agricultural production, instability of exports of goods and services, economic importance of non-traditional activities, merchandise export concentration, handicap of economic smallness, and the percentage of population displaced by natural disasters)

Firstly, it is to identify the key determinants which dominate in economic growth, in particular, after becoming a member of ASEAN in 1997. Then it is opened to question whether economic growth is of benefit to the reduction poverty or income inequality, and also its impacts on environmental conditions. Secondly, this paper identifies the impacts of economic growth on poverty and income distribution, which is the priority of economic development goal. Lastly, this paper analyzes the impact of economic growth on environment; carbon dioxide emissions per capita are used to be a proxy for environmental degradation. The results are then combined with certain principles of sustainability, to develop a roadmap for sustainable development in Laos. The sustained economic growth is a promising prospect for the country to disembark from list of LDCs in terms of income per capita; however, it may have a negative impact on the natural resource of the country. The thesis investigates the following questions:

1. Does trade openness foster economic growth in Laos? Or there are other factors (such as foreign aid, foreign direct investment, domestic investment, government expenditure, etc.) dominate in economic growth?

2. Does economic growth influence social development (poverty and income inequality)?

3. Does the economic growth have a negative impact on environmental conditions? Is there any correlation between the economic growth and environmental conditions?

The expected outcomes of this thesis are to identify the key factors dominate in economic growth, based on the concept and theory of economic growth and its influence on social and environmental aspects. We expect that the employment of many relevant indicators will offer a clear explanation, and also will identify a very good strategy contributing to a sustainable development of Laos; in particular:

1. To classify the condition of the socio-economic development of Laos as to achieve the maximum benefit from sustainable development;

2. The impacts of each component on a sustainable development path, elaborating criteria and indicators that allow for project preparation, implementation and evaluation,

3. To provide some recommendations for policy makers in order to achieve the national development and its long term development goal.

This thesis contributes to the on-going research issue about key determinants influenced in sustainable development in developing countries.

1.5. Structure of the thesis

This thesis consists of six chapters including the introductory one. Chapter 2 presents the theory and the analysis framework. Chapter 3 introduces the basic economic conditions in Laos; including the aspects of social development and environmental issues. Chapter 4 details the proposed methodological approach and econometric models, the data that will be used, and discusses results from empirical studies. Chapter 5 discusses about sustainable development through the integration of the three factors (Economic growth, poverty, and environment), to consider the possibility to achieve the goal of sustainable development. Last chapter concludes and provides some suggestions for future development of Laos.

CHAPTER 2: STATE OF THE ART

2.1. Theoretical framework

Sustainable development (SD) refers to a mode of human development whereby resources use aims to meet human needs while ensuring the sustainability of natural systems and the environmental conditions (Smith et al., 1998). The concept of SD is related to different issues of socio-economic development, which aims to determine the needs for societies to be sustained. The term SD is largely used; the Brundtland Commission introduced the idea that the next generation should access to have the same degree well-being opportunities as the current generation. In other words, sustainable development is described as "non-decline" in time of human welfare, which can be estimated, based on the type of analysis, through the level of human utility, earnings, and consumption (United Nations, 1987).

In general, SD is about achieving and maintaining economic growth that relates to other factors of socio-economic development. It aims to meet the maximum expectation of human needs and improve the living conditions, in parallel with financial resources that make environmental conservation possible (United Nations, 2000). The vision of sustainable development encompasses a broad meaning and numerous assumptions in different countries. Economists, researchers, governments, and agencies (including the World Bank, the IMF, and the WTO) in these last decades characterized the strategy for sustainable development, taking into account living conditions of people and environmental aspects (David, 1996).

According to the work of Disano (2001), the underlying theme of SD is the integration of economic, social, and environmental issues in decision and policy making at all levels of development dimensions. This helps the understanding of the various dimensions of sustainable development and their complex interactions and the facilitation of policy decisions aimed at

achieving sustainable development goals. The integration implies the involvement of virtually all traditional sectors of economic and government activity, such as economic planning, agriculture, health, energy, water, natural resources, industry, education, and the environment.

Several studies show that the wealthy benefit from growth and the remainder of the population is affected by the costs of resource depletion, social stress, environmental degradation, and other problems (Bo Gao, 2001; Greiner, 2010; Limskul et al., 2013). Referring to the World Commission on Environment and Development (2011), sustainable development contains two key concepts: (1) the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and (2) the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet the present and future needs.

Sustainable development involves more than economic growth; it requires a change in the content of growth, to make it less material and energy-intensive and more equitable in its impact. These changes are required in all countries as part of a package of measures to maintain the stock of ecological capital, to improve the distribution of income, and to reduce the degree of vulnerability to economic crises (United Nations, 2000).

David (1996) states that SD is about achieving the economic growth needed to meet human needs, improve living standards, and provide the financial resources that make environmental protection possible. There are two major aims of SD, including a sustainable economy that equitably meets human needs without extracting resource inputs or expelling waste in excess of the environment's renewing capacity and sustainable human institutions that assure both security and the opportunity for social interaction and spiritual growth.

The most critical task facing humanity today is the creation of a shared vision of a sustainable and desirable society; one of the most important issues is to contribute permanent prosperity within the biophysical limitations of the world in a way that is fair and equitable to all of humanity, from this generation to future generations (Herman, 1992; Costanza, 2003). Environmental sustainability is the maintenance of the factors and practices that contribute to the quality of the environment on a long-term basis. The measurement of this factor emphasizes the overall viability and health of living systems in their different and comprehensive dimensions (Costanza, 2000).

2.2. Conceptual framework

This paper is built upon the following three main factors of analysis, which includes economic growth, social development, and environmental protection. The key concept of sustainable development requires balanced and integrated analysis from the three main perspectives (Diagram1) of economic growth, social development and environmental conditions.

This conceptual framework is used to examine the interaction of those key factors, which aims to provide a good definition for sustainability and its impacts in Laos. Considering the perspective of economic growth, this factor aims towards improving the living condition of the population, from basic needs provision through increases in the consumption of goods and services.

Diagram 1: Conceptual Framework of analysis

The interaction of these domains is very important to ensure the outcome of sustainability in development, it is required a good policy and regulation

Considering the determinants influence economic growth. **Variables:** GDP growth, GDP per capita (GDPP), trade, foreign aid, investment, government expenditure, etc.

Economic growth

SUSTAINABILTY

Environmental Sustainability: Based on the protection of the integrity and resilience of ecological system and protection pollution.
Variables: CO_2 emissions

Sustainability of Social development and living condition improvement

Variables: Poverty (POV) and income inequality.

Social Development

Environmental protection

The key concept of this thesis is to identify the key determinants nominate in economic growth, followed by examining the impacts of economic growth on poverty and income distribution, and the impacts of growth on environmental conditions. The integration of these factors is a key concept of this research (chapter 5).

GDP is used to be a standard measure of economic growth, while environmental issue, it emphasizes on protection of environmental and ecological system, mainly based on the changing of air pollution, the Carbone dioxide emissions (CO_2) is used to be a proxy for environmental conditions. Poverty and income inequality are used as a proxy for social dimensions in Laos, despite persistent economic growth for more than a decade (since 2000), the proportion of poverty decreased from 45 per cent in 1992 to 26 per cent in 2010, which is considered to be a high level, and the poverty issue remains widespread in rural areas (Bertelsmann Stiftung,

2012)[2], while the income inequality level increased from 30.43 per cent to 36.74 per cent in 1992 and 2008, respectively (WDI[3], 2013).

It is questionable whether economic growth increases inequality in society. Therefore, an analysis of the impacts of economic growth on poverty and income distribution is included in this thesis. Economic growth is good for sustainable development only when it is distributed to social improvement through poverty reduction and minimization of the level of income inequality.

The impacts of economic growth on social aspects relates to job creation, skill enhancement, local economic impacts, and social investment. Several studies express that economic growth and social development are highly interdependent. One good example is the study by Stinivasan (1997), which states that the opinions regarding both economic growth and basic need development are interwoven. He suggests that great emphasis on basic needs would, at least in the short run, harm economic growth, which in turn would damage future improvement in the basic needs programme.

By definition, social development refers to the adjustment of the social order within a society. It may also refer to the notion of social progress. A change in economic performance leads to a change in social development. One of the most important factors for assessing sustainable social development is social equity, which is one of the principal values underlying sustainable development, with people and their quality of life being recognized as a central issue. In brief, equality involves the degree of fairness and inclusiveness by which resources are distributed, opportunities afforded, and decisions made (Disano, 2001).

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[2]Information from: http://www.bti-project.org/countryreports/aso/lao/
[3] The World Development Indicators (WDI) is the primary World Bank collection of development indicators, compiled from officially-recognized international sources

To identify the impacts of economic growth on environmental conditions, it has also become an important issue to measure the degree of sustainable development of a country. A high rate of economic growth is considered to be a key factor of economic development for many countries, including Laos. However, there are many challenges involved in resuming economic growth and strengthening the country's share in the global economy, while reducing social inequality and protecting the environment.

In brief, this conceptual framework aims to highlight that to achieve the final outcome of this research. To realize the final aim of sustainable development in Laos, it is necessary for the socio-economic development of the country to be well-adjusted among economic growth, social development, and environmental protection, which are three main issues discussed in this thesis. In addition, the socio-economic development must be harmoniously distributed between sectors, regional development, and urban and rural development, in order to utilize human and maintain natural resources fully and efficiently (GOL, 2003).

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CHAPTER 3: ECONOMIC CONTEXT OF LAOS

3.1. Overview of country

Laos is one of the world's few remaining communist states and it is one of East Asia's poorest countries. This is a small landlocked country located in the centre of South-East Asia, which occupies an area of 236,800 square kilometres of the northwest portion of the Indochinese peninsula. This country is surrounded by China, Vietnam, Cambodia, Thailand, and Myanmar. It is a mountainous country, especially in the north, where peaks rise above 2,800 metres and dense forests cover the northern and eastern areas. Laos became independent in 1975, and the country chose a socialist system under that the centrally planned system, where the government decided what to produce, how to produce it, and who received the final product.

In the early 1980s, this system did not satisfy the goal; however, as economic performance was unable to reach the expected goals, the population became poorer and the economic system weakened. These issues confirmed that the centrally planned system alone was not the most appropriate for Laos, leading to economic reform. Basically, the centrally planned system is opposite to a market economy, in which individuals own property that they are free to trade and gain from and where prices for goods are decided in a free market system where demand dictates what is made.

In 1986, a reform named the new economic mechanisms (NEMs[4]) opened the door to new economic policies, aimed at transforming the nation from a closed and centrally planned economy to a market-oriented one. The two basic political goals including: 1) Open market

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[4] "Drastic changes from the socialist revolution to the market economy in Laos"
http://www.esri.go.jp/jp/archive/bun/bun137/bun137d.pdf#page=2 , accessed May 2013

policy and 2) Introduction of market economic principles. Some divestment[5] of the state enterprise and development of legal institutional framework for private economic and commercial activities were involved in the transition of the reforms. Following the introduction of NEMs, the government of Laos announced the development of the private sector, leading to deregulated price and production controls, and granted managerial and financial autonomy to state-owned enterprises. Under the NEMs, there have been discussions on market integration, for example:

- Price liberalisation – complete liberalisation except for some key utility prices;
- Agricultural reform – liberalisation of agricultural prices, including the abolition of the state monopoly into the price market;
- Public enterprise reform – increased autonomy for public enterprises and the privatisation of selected public enterprises;
- Trade reform – liberalisation of trade through a simplification of tariff codes and elimination of most quantitative restrictions;
- Exchange rate reform – created a single official exchange rate that was nearer to the market exchange rate, and did it earlier than Vietnam or the other socialist countries. The existing seven exchange rates were unified into single official rate, and
- Foreign investment policy reform – attracting foreign direct investment and cooperation. The Foreign Investment Law was enacted in 1988 to encourage foreign investment, and promote capital inflow and external economic activity.

These reforms were necessary for the regional and economic cooperation of Laos, following ASEAN's regulations and preparing for WTO membership. Further, they created a less complicated environment for export and import activities and persuaded Laos to become an active participant in the world market. However, to achieve higher benefits, the reforms also aimed to achieve stronger integration with the international economy (Hodgson, 1998 and Xue, 2005). Laos has achieved remarkable economic growth, privatization of former state-owned

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[5] Divestment is the reduction of some kind of asset for financial, ethical, or political objectives or sale of an existing business by a firm.

enterprises, and macroeconomic stability. In addition, it has witnessed a significant rise in public and private investment and improvement of economic activities both regional and global economic cooperation and development (World Bank, 2010).

The introduction of NEMs leads to increase in the international cooperation and attractive foreign direct investment (FDI). Laos has successfully developed amicable relations with regional states, being a members of many international organization, particularly, the country joined the Association of Southeast Asian Nations (ASEAN); this made necessary for Laos to respect in its economic progress both regional and global procedure (Phimphanthavong, 2012).

3.2. The role of ASEAN in Laos

Laos was recognized to be an ASEAN member on July 23rd, 1997. It could be assumed that entering in ASEAN has been a significant occasion for Laos, which could promote this country to set up both economic and political cooperation with member countries rather than its previous socialist states. This is a good opportunity for Laos to access new markets with both regional and international cooperation. The high rate of economic growth may be influenced by the good economic performance of Laos within the ASEAN member countries, through trade cooperation, investment, and economic policy improvement; thus, this determinant (ASEAN) is included in this analysis.

ASEAN does not only increase the cooperation and relation within member countries, but it also expands its cooperation with other regions in order to facilitate wider cooperation among different nations outside its regions; thereby, the ASEAN's committees were established in order to create dialogue with its partner countries to handle its external relations (Khamphan, 2007). This organization derived three main objectives:

1) To act as a forum for the resolution of intra-regional differences;

2) To secure the political and economic constancy of the region and exert an influence on competition; and

3) To enhance the economic, social, and cultural expansion of the region through cooperative programmes.

In order to obtain greater achievement from membership of ASEAN, it is necessary for the commitments of both trade liberalization and cooperation policies to involve education development, in particular emphasizing more development of human resources and building of capacity. The Government of Laos has itself attempted to accelerate the economic development in order to eradicate poverty and increase the living conditions of the population. Furthermore, the cooperation among ASEAN member countries is assumed to gain more positive advantages in terms of human development, economic growth, and trade cooperation.

3.3. Economic performance

Laos has emerged into international trade with very deprived social and economic growth conditions in 1986. Since then, Laos has pursued significant economic and institutional reforms aimed to improve the living condition of the population through the implementation of a market-oriented economy and. In 1997, beyond ASEAN, member countries differ in their levels of development, political systems, investment environments and economic structures; therefore, narrowing social disparities and economic development gaps between countries are key challenges facing ASEAN (Southeast Asian Economic Outlook 2013)[6]. Many member countries of ASEAN have more potential both human resource and know how technology. However, it is important for Laos to access a good atmosphere to boost both regional and global affaires to ensure the economic progress of Laos.

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[6] http://www.oecd-ilibrary.org/development/southeast-asian-economic-outlook-2013

In order to encourage and maintain high economic growth, several policies were adapted since beginning of year 2004 and in late of the same year, Laos aimed at Normal Trade Relations status with the US, allowing Laos-based producers to benefit from lower tariffs on exports. This means that Laos has a good opportunity to take the steps to join the World Trade Organization (WTO). This would assume that the introduction of trade policy reforms and joining ASEAN would improve the business environment in Laos.

3.3.1. GDP shares by sector

Laos has achieved long-term economic growth since the introduction NEMs; however, the economic growth of this country is still highly dependent on natural resources. Although both industrial and service sectors have experienced a high rate of growth in recent years, while the agricultural share of the GDP has become smaller, agriculture still accounts for the largest share of the GDP; it accounted for more than 50 per cent of the GDP in 2000. This indicates that the agricultural sector exerted a strong, positive, and significant influence on economic growth in Laos during the early stage, whereas over the extended period, the industrial sector and the service sector tend to be more dominant in the growth.

Considering the share on GDP of agriculture and industry, the figure (1) shows a minor decrease during 1999 and 2000, which was due to the fiscal deficits and monetary expansion leading to rapid inflation and exchange rate depreciation; in mid-1999, the Government took decisive steps to reduce its fiscal deficit and contain monetary expansion in order to restore macroeconomic stability, which decreased the industrial and agricultural development (Arnold et al., 2003). After a certain period, value added of these two factors increased, while the annual growth rate of industry remained higher than that of agriculture.

Between 1999 and 2000, the share on GDP of services increased enormously because it was the first in which international tourism and the first world heritage city in Laos were announced, by increasing the promotion and advertisement in different medias for domestic, regional, and international tourists. These special occasions led to an increase in the number of tourists and income in the service sector. Improvements in the service system (transportation, communication and telecommunication, information network, tourism promotion, and public administration) led to increased income from the service sector and an increasing GDP share.

Figure 1: GDP shares by sector (1984 -2011)
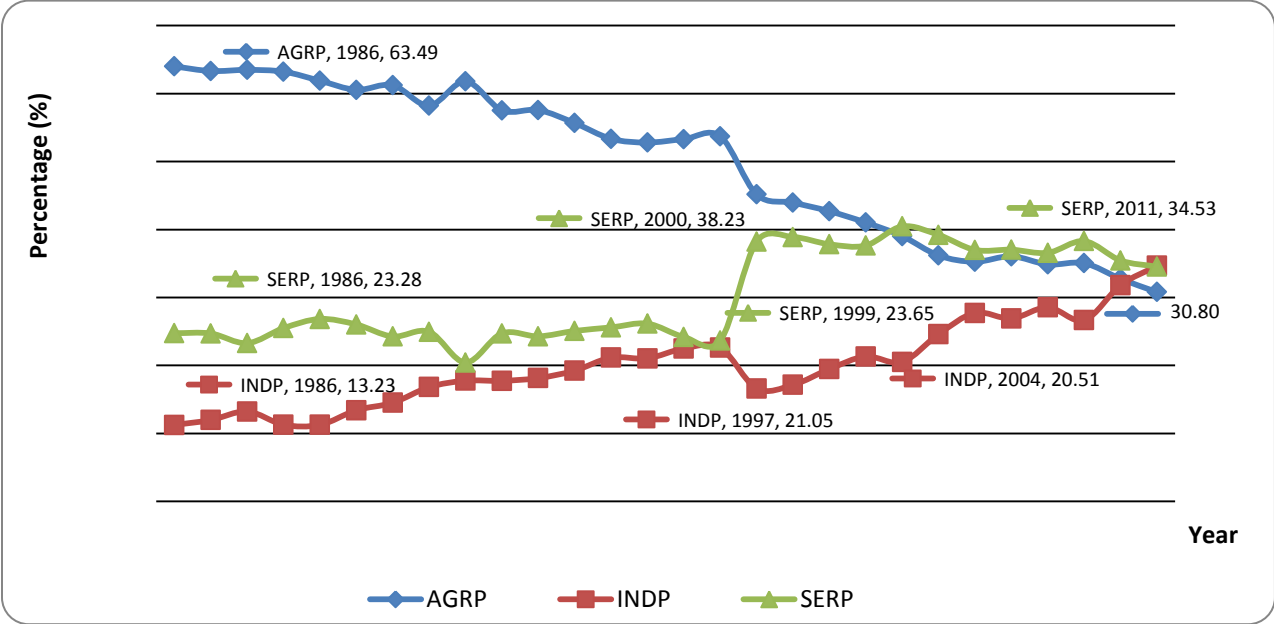
Source: World Indicator Database or WDI (2013)

Where: AGRP is the percentage of agricultural value-added; INDP is the percentage of industrial value-added; and SERP is the percentage of service value-added on GDP.

Figure 1 shows that the share of agriculture with respect to other economic activities has declined substantially from more than 63.49 percent in 1986 to 30.80 percent in 2011, while the share of industry and services in the GDP has remarkable increased from 13.23 percent in 1986

to 33.64 percent in 2011 and from 23.28 percent in 1986 to 34.53 percent in 2011, respectively. Before joining the ASEAN (1984-1997), the average growth rate of IND, SER, and AGR was 10.85 percent, 5.02 percent, and 4.62 percent, respectively. After joining ASEAN (1998-2011), the average growth rate of IND and SER increased to 12.38 percent and 6.87 percent, while AGR smaller increased, only 3.74 percent. Therefore, the average growth rate of IND was higher than that of SER and AGR, especially after 2004, when the Government of Laos took another step in amending the business and investment policy.

In comparison with neighboring countries at the share on GDP, Cambodia, Laos, and Vietnam (CLV) share some similarities in term of economic structure, where agriculture remain key factor contributing to 27.6 percent of the GDP and employing about 60 percent of the total labour forces. It is recognized that Vietnam is more economically advanced than Cambodia and Laos, but it's struggling towards realizing its ambition to become an industrialized and modernized nation by 2020.

Table 1: Economic structure of Cambodia, Laos and Vietnam in 2011 (% of GDP)

	Cambodia	Laos	Vietnam
Agriculture	30%	30.80%	22%
Industry	30%	34.67%	43.3%
Service	40%	34.53%	37.7%

Source: CIA Facebook and WDI (2012)

3.3.2. GDP growth, trade openness, and foreign aid

Trade openness is considered to be one of the factors encouraging the economic growth of Laos; in particular, since becoming a full membership of ASEAN, the Government of Laos has been committed through various policies and strategies to achieving a robust growth rate of 7-8

percent per annum on average and aims to emerge from the LDCs status by 2020. The trade policy promotion has been improved, especially the extension of exports, which is considered to have played a critical role in economic growth during these two decades (1990-2010). Numerous export products have become more diversified and embodied more value added since 1990; the majority of those products are wood products, garments, coffee, electricity, timber, and mining products (gold and copper).

Laos has achieved a good performance for its economic development and growth. It is assumed that the introduction of NEMs produced a significant increase in public and private investment, which contributed to an average economic growth rate of over 5 per cent from 1990 to 1999, more than 6 per cent from 2000 to 2005, and more than 7 per cent from 2006 to 2011. Some factors are assumed to dominate the economic growth, such as the open-door policy and international cooperation, which is related to the degree of trade openness. An increase of one unit of this determinant is associated with an increase in the level of GDP.

It seems that international trade has contributed significantly to the economic growth of the country; an increase in trade is expected to increase the overall economic growth, thereby producing the resources required for environmental conservation because economic efficiency means better use of natural resources (David, 1996). After the introduction of the NEMs in 1986 and joining ASEAN in 1997, the Government of Laos liberalized its trade in order to integrate into the regional and world economy.

To enhance trade liberalization and the integration of the country with the regional and global economy, and in the context of ASEAN and dialogue partners, together with the other ASEAN member countries, Laos is actively participating in FTA[7] negotiations with China, the

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[7] Free Trade Area

Republic of Korea, Japan, India, and the EU. It has also applied for WTO membership since 1998 as part of an economic strategy to increase export revenues and attract foreign investment.

Figure 2: Trade openness degree (1980-2010)
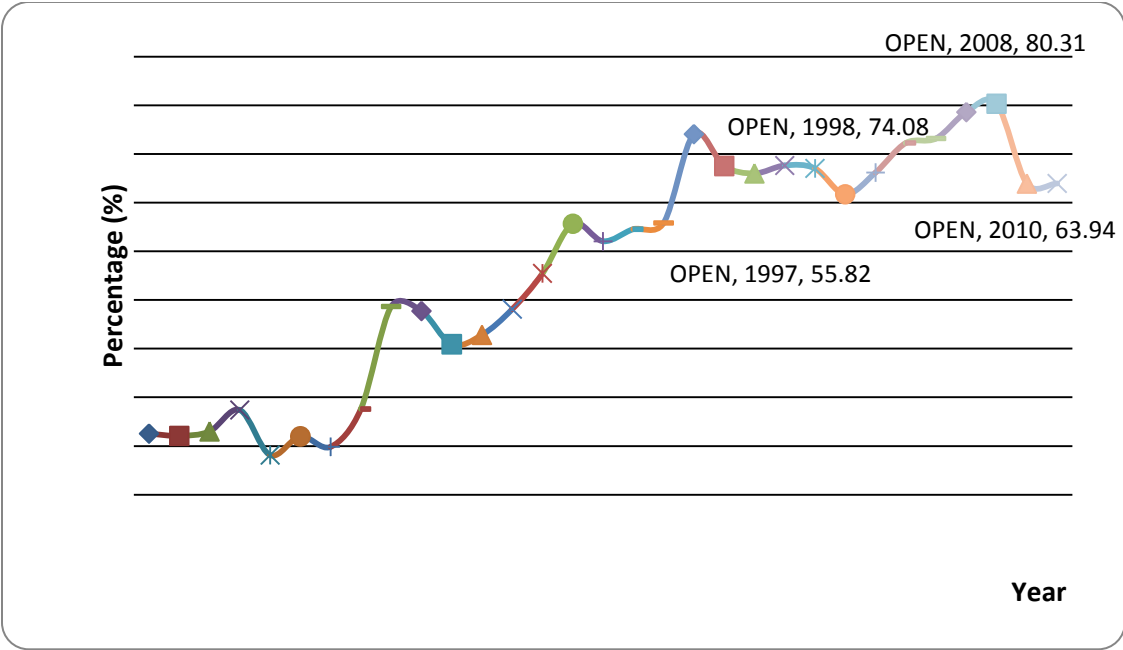
Source: Penn World Table 7.1 (released on November 30, 2012)

Figure 2 shows that the degree of trade openness (OPEN= (Import + Export)/GDP) increased remarkably from 1986 to 2010. For example, it rose from about 10 per cent in 1986 to over 50 per cent during 1997 and 2000; in particular, it reached 74.08 per cent in 1998, which was one year after becoming a member of ASEAN, and showed a minor decrease after the ASEAN financial crisis. After a certain period, the openness degree reached its peak point of 80.31 per cent in 2008, the preparation year for the first occasion of the SEA Game[8] organized in Laos in 2009, leading to an increase in the cooperation and trade volume with other ASEAN countries as well as other regions.

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[8] The Southeast Asian Games (also known as the SEA Games), is a biennial multi-sport event involving participants from the current 11 countries of Southeast Asia.

The impact of foreign aid on the economic growth process of developing countries has been a topic of intense debate. The impact of foreign aid on economic growth is supported by several studies, such as Gomanee et al. (2003), Dalgaard et al. (2004), and Karras (2006). However, there are two major contrasting views in this debate. One argues that aid has a positive effect on economic growth, with an even greater impact in countries with sound economic and trade policies. The other contends that foreign aid causes corruption, encourages rent-seeking behaviour, and erodes bureaucratic institutions (Dollar and Burnside, 2000; Anup Shah, 2012).

In general, foreign aid is classified into two types such as grants aid and loan aid. Both grant and loan aid can be divided into two categories (Appendix 2), including (1) Bilateral aid administered by agencies of each donor government, such the New Zealand Official Development Assistance (NZODA), and Swedish International Development Authority (SIDA); and (2) Multilateral aid funded by contributions from developed country governments and administered by international institution, for example: World Bank, ADB, UN, FAO, UNCTAD, etc. In addition, foreign aid plays a significant role in stimulating economic growth by transferring capital (money), ideas, and technology from donors to the recipient countries.

Figure 3: GDP growth and foreign aid per GDP in percentage (1980-2010)
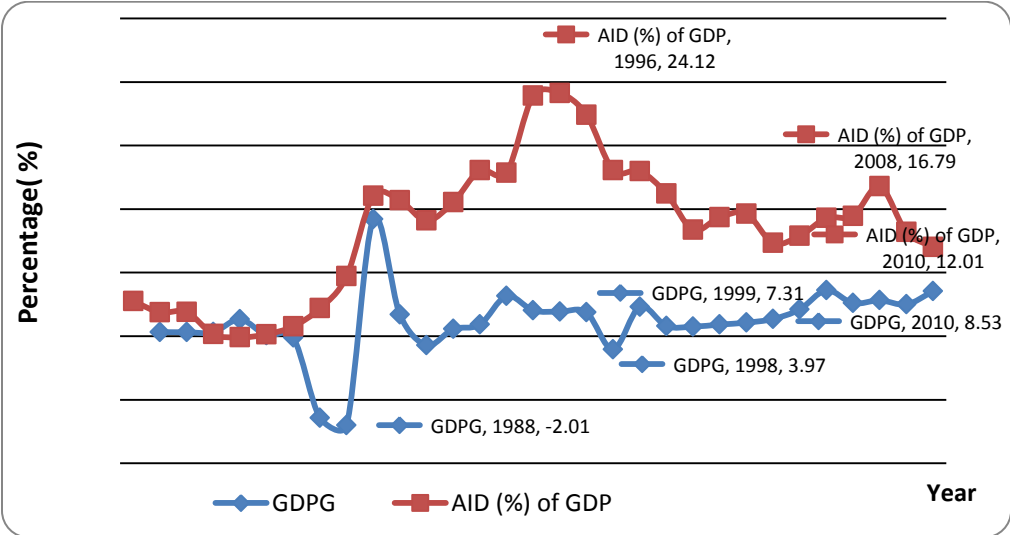
The adoption of new market oriented economic policies was the turning point of the donor policies towards Laos in the late 1980s. In addition, in order to achieve the economic development goal by 2020, the Government of Laos sought more international assistance from many countries and organizations. Figure (3) shows that Laos received a great deal of support from international organizations and agencies in terms of foreign aid. In 1986, it amounted to only 5.57 per cent of the GDP, while in 1989, 1997, and 2010 the figures were 16.08 per cent, 22.41 per cent, and 12.01 per cent of the total GDP, respectively. It amounted to 15 per cent of the GDP, on average, between 1997 and 2010. During the 1990s, the remaining sectors are considered as having received aid for promoting economic growth, directly targeting the poor, and the social safety net of 74.12 per cent, 15.68 per cent, and 10.20 per cent, respectively (UNDP, 2001).

Foreign aid constitutes the major part of Laos's public investment programme (PIP), through which the Government plans and invests capital investment. It allocates about 60-80 per cent to the PIP and it mainly distributes it to finance public capital outlays, such as infrastructure construction, including roads, bridges, irrigation, electricity networks, and other factors related to education and health care improvement. In addition, many aid agencies have engaged in humanitarian, social, and environmental aspects, such as food security, poverty eradication, and natural resource protection (GOL, 2006).

The annual average of Laos's economic growth was about 6 per cent from 1980 to 2010, with a minimum of -2.01 per cent in 1988 and a maximum of 14.19 per cent in 1989. The negative growth in the drought years of 1987 and 1988, it was the period that the Laos economy

experienced recessions which exports of hydroelectricity were substantially lowered[9], and also so the border-war between Laos and Thailand (1987-1988). It notices that the virtual end of the command economy fueled the 1989 industrial boom after the first investment law was issued and dominated in high rate of growth in following years. Principal activities in the industrial sector include manufacturing, construction, mining, processing agricultural and forestry goods, and producing hydroelectricity.

The decrease of economic growth of Laos in 1998, it was because of the impact of the Asian financial crisis in 1997, and then Laos achieved high rate of growth again in 1999 , which was the first year in which international tourism and the first world heritage city (Luanphrabang[10]) in Laos were announced. Following years, Laos could maintain a high rate of economic growth over 5 per cent, particularly, during 2005-2010, Laos sustained a high rate of economic growth of 7-8 per cent (Laos: Economy Indicators,[11] 2012). This high rate of economic growth is because of the economic policy improvement and international cooperation with ASEAN and other regions; for example, Laos gained normal trade relations status with the US in 2004 and was admitted to the WTO in 2012. In addition, the Government simplified investment procedures and expanded bank credits for farmers and small entrepreneurs, which encouraged the economic growth prospects of Laos.

In comparison the economic growth with CLV (2012), these countries gained independence from colonialism in the early 1950s, and had gone through prolonged war, regime changes, instability and political upheavals, which caused them to remain far behind the other Southeast Asian countries in terms of economic development, industrialization and modernization (Chheang et al, 2012). During 1990s and 2000s, these countries have experienced

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[9]Source: http://countrystudies.us/laos/76.htm
[10] http://www.azuretours.com/laos_luangphrabang.htm
[11] http://www.theglobaleconomy.com/Laos/indicator-NY.GDP.MKTP.KD.ZG/

relatively good economic performance with annual GDP growth about 7 to 8 percent. Economic growth rates of CLV remain promising. In 2012, Laos had the highest growth in ASEAN with 8.4 percent, followed by Cambodia with 6.2 percent, and Vietnam with 5.8 percent. In terms of per capita income, CLV's remain low, as compared with other countries in the region, while Vietnam was US$ 1100, followed by Laos with US$ 1010 and Cambodia was only US$ 760.

Table 2 : Income per capita and economic growth for CLV in 2012

Countries	Cambodia	Laos	Vietnam
GDP growth rate	6.2%	8.4%	5.8%
Per capita income (US$)	760	1010	1100

Source: International Monetary Fund and World Bank Doing Business Report 2012

3.3.3. Foreign direct investment inflow

A key factor which is expected to have a positive impact in economic growth is FDI. This factor is assumed to produce a significant role on economic growth through providing the job opportunity to the host country, which is related with the increase in national income (Johnson, 2005). We can consider in two sides: From the domestic one, the program is considered to boost domestic production and develop domestic market, while on the international side, it aims to extend international trade and to avoid the external trade deficit by improving the quality of export goods, and improving foreign investment security.

To reach its economic development goal by 2020, FDI is needed and it is expected to play an important role on economic growth, because FDI is assumed to contribute in job creation, economic growth, capital inflow, and wealth in the host country (Sun, 2002). After economic reform, the government has paid more attention on improving its business environment to attract more investor-friendly. Its laws and regulations have been revised a few

times, such as the Enterprise Law, the Law on Commercial Banks, and the Law on Foreign Investment Promotion.

The introduction of NEMs, particularly during the planned economy period (1986-1988), investment from socialist countries flowed into Laos. However, data on the FDI during that period were not available. In order to promote FDI in Laos, the first investment law was made in 1988; the first revision of the law was conducted in 1994, the second revision in 2004, and the third revision in 2009.

Figure 4: Total FDI inflows in million US$ (1988-2010)
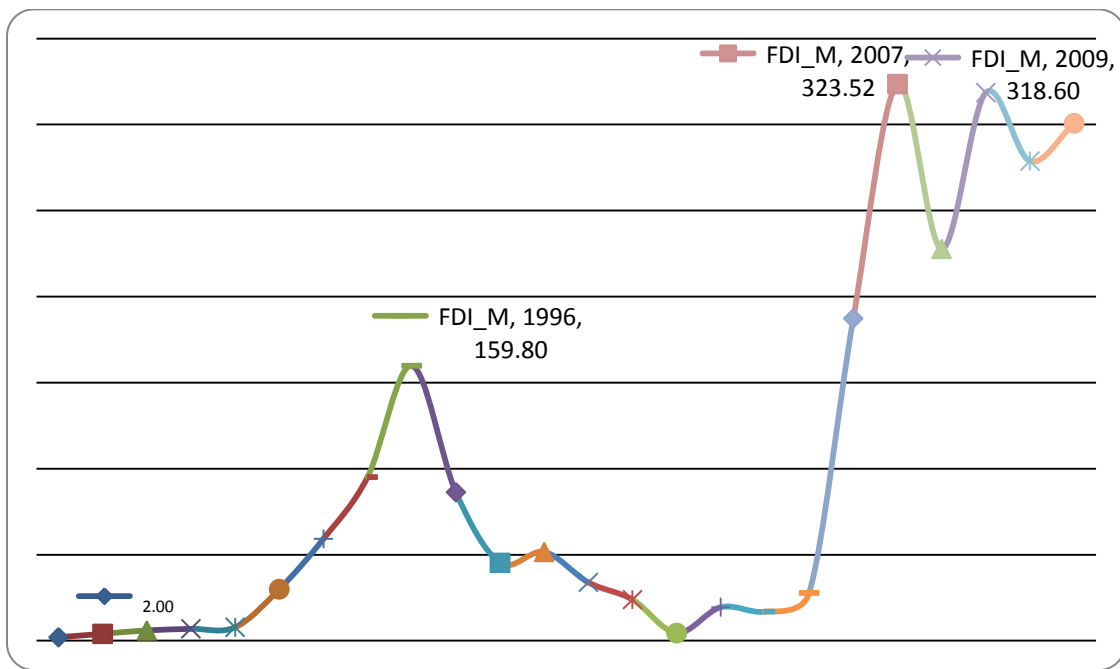
Source: World Bank Indicators[12] (2012)

Figure 4 shows the movement of the FDI inflow into Laos from 1988 to 2010. From 1989 to 1996, it shows that the FDI increased slightly in 1992 to its maximum point in 1996, after the Laos Government revised its investment promotion law in 1994 and also gained full membership of ASEAN, which would increase the number of regional and foreign investors. However, the

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[12] http://www.tradingeconomics.com/laos/foreign-direct-investment-net-bop-us-dollar-wb-data.html

Asian financial crisis in mid-1997 caused a substantial decrease in FDI inflows to Laos in the following years until 2002. Then, the Government took another step in amending the FDI promotion law in 2004, leading to an increase in the amount of FDI inflows; in particular, it increased from 2005 to the maximum point again in 2007.

The minor decrease in FDI inflows in 2008 was due to the impacts of the world economic crisis, and then in 2009, it increased again when the condition of the world economy was improving. In addition, the Government of Laos took another step in improving the FDI promotion law in 2009, which merged the law on domestic and foreign investors, by promoting investment in all economic sectors, both domestic and foreign, by formulating policies to create a favourable investment climate, including providing clear guidelines for all investors. The Government promoted investment in all sectors, except for areas and business operations that are considered harmful to national security, the natural environment, at present and in the long term, public health, and national culture (ASEAN, 2009).

For the whole capital inflow of FDI, most ratio of such inflow has gone to be invested mainly in mining and hydropower. For the regional investors have been expressed interest investing in agriculture, agro-processing, and other manufacturing. In agriculture and agro-processing, land-leases have been signed recently for producing pulp from eucalyptus, rubber, sugar and palm oil. Of the 43 countries which invested in Laos from 1988 to 2010, the majority are ASEAN members. There are some East Asia and some European countries; Thai, Chinese, and Vietnamese investors are among the biggest foreign investors in Laos.

When looking at FDI activity in the Indochina sub-region (Cambodia, Laos, and Vietnam or CLV), where FDI inflows are considered as one method of boosting economic development and growth, and assisting in the transition process consisting of both economic reforms and

business liberalization measures. As part of the economic transition process that the three countries have undergone since the late 1980s. Since foreign private capital was generally not permitted into these countries in the years preceding their 'opening up', the governments of the three countries have been on a steep learning curve; learning how to attract, retain, sustain, manage, harness, monitor and then attract more FDI inflows (Nick, 2002).

Table 3: FDI, net inflows in Cambodia, Laos, and Vietnam (1993-2011)

		FDI, net inflows (million US$)		FDI, net inflows (% of GDP)		
	Cambodia	Laos	Vietnam	Cambodia	Laos	Vietnam
1993	54.1	29.9	926.3	2.14	2.25	7.03
1994	68.9	59.2	1944.5	2.47	3.84	11.94
1995	150.8	95.1	1780.4	4.38	5.39	8.59
1996	293.6	159.8	2395.0	8.37	8.53	9.71
1997	203.7	86.3	2220.0	5.92	4.94	8.27
1998	242.8	45.3	1671.0	7.78	3.54	6.14
1999	232.2	51.6	1412.0	6.60	3.55	4.92
2000	148.5	33.9	1298.0	4.06	1.96	3.86
2001	149.4	23.9	1300.0	3.75	1.35	3.68
2002	145.1	4.5	1400.0	3.39	0.25	3.69
2003	84.0	19.5	1450.0	1.80	0.96	3.39
2004	131.4	16.9	1610.0	2.46	0.71	3.26
2005	379.2	27.7	1954.0	6.03	1.01	3.39
2006	483.2	187.3	2400.0	6.64	5.42	3.62
2007	867.3	323.5	6700.0	10.04	7.66	8.65
2008	815.2	227.8	9579.0	7.87	4.18	9.66
2009	539.1	318.6	7600.0	5.18	5.46	7.17
2010	782.6	278.8	8000.0	6.96	3.88	6.90
2011	901.7	300.7	7430.0	7.03	3.64	5.48
2012	1557.1	294.4	8368.0	11.09	3.13	5.37
Average	411	129	3572	**5.70**	**3.58**	**6.24**

Source: World Development Indicator 2012

The above table (3) indicates that the flow of FDI has been stable with some certain increasing trend over the years due to political stability, relatively low labor cost, investment promotion policy, institutional environment, global and regional economic integration and openness and the improvement of infrastructure. It is noticeable that Vietnam has received more

than eight times the amount of FDI that flows into Laos and Cambodia and more than 25 times that flows in Laos, and also the average net inflow as percent of GDP of Vietnam (6.24 percent), which was higher than of Cambodia and Laos which was 5.70 and 3.58 percent, respectively. Due to the face that Laos is small land-locked country with small market, and few numbers of population and labour force compared with Vietnam as well as Cambodia. It reflects the attractiveness and economic centrality of Vietnam in CLV, where there is abundant natural resource and cheap labour cost compared with Laos and Cambodia.

3.4. Poverty and income distribution

3.4.1. Poverty incidence and definition

Poverty can be defined in many different ways depends on the characteristics of each country. By basic definition, poverty is described as a lack of essential human needs, such as food, clothing, and shelter needed for proper living. The basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education, and information. Based on these components, when people are unable to get sufficient food to eat, unable to go to school or any access to health care, then those people can be considered to be in poverty, regardless of their income.

Poverty has frequently been discussed in terms of income and the poverty line, measured by the percentage of the population living below PPP[13] US$1.25 per day and multidimensional deprivation. In Laos, poverty is defined as the lack of basic requirements for daily livelihood, such as the lack of food (less than 2,100 kilocalories per person per day), clothing, and permanent shelter, the inability to afford necessary medical treatment, the inability to afford one's own education and the education of other members of the family, and the lack of easy

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[13] PPP stands for purchasing power parity.

access to primary education. To deal with this situation, the Government of Laos has issued different strategies and methods for poverty eradication as well as rural development.

Based on the Laos economic profile report 2013,[14] the economic growth of Laos exceeded 7 percent per year during 2008-2012. Despite this high economic growth rate, this country remains a country with an underdeveloped infrastructure, particularly in rural areas. There is a basic, but improving, road system, and limited external and internal landline telecommunications. In addition, Laos's economy still continues to rely on subsistence agriculture, and is dominated by rice cultivation in lowland areas, which accounted for about 30 percent of the GDP and 75 percent of the total employment in 2010.

The high rate of economic growth was officially considered to diminish the poverty index from 45 percent in 1992 to 26 percent in 2010. In comparison with neighboring countries **(Table 4)**, the poverty index of Laos is higher than of Cambodia, Vietnam and Thailand, which are 22.1 percent, 20.7 percent and 13.6 percent, respectively. This would prove that the economic dimension of Laos is remaining behind those bordering countries. In this case, poverty is considered to be a key challenge for the national development of Laos, because the poverty proportion remains widespread in remote areas, where people rely on natural resources for their survival. It is suggested that the Government considers the most appropriate policy to minimize the development gap between urban and rural areas, as well as a good strategy for poverty reduction.

Figure 5: The proportion of poverty incidence (Headcount ratio, 1980-2010)

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[14] Laos economic profile 2013 at http://www.indexmundi.com/laos/economy_profile.html
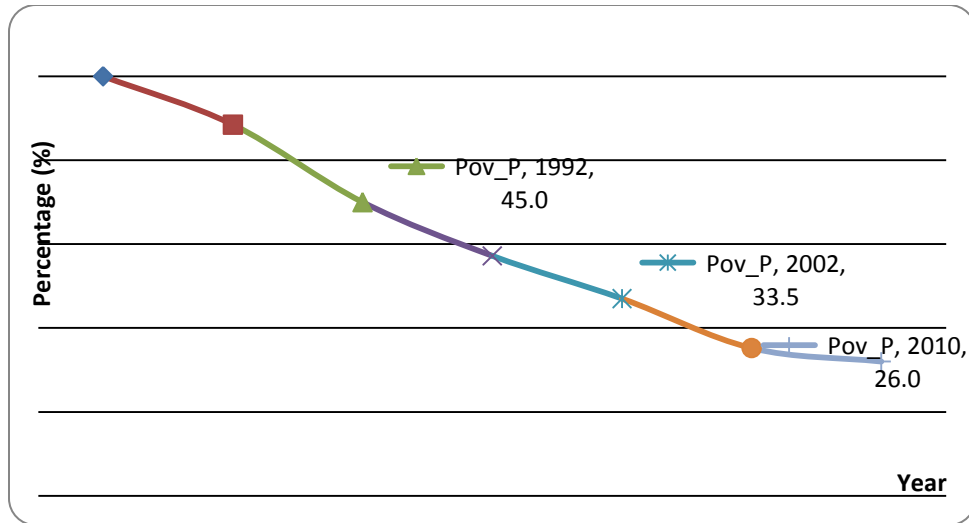
Source: LECS[15], Government Report & World Development Indicator 2012

Figure 5 shows a noticeable decrease in the poverty index from 1980 to 2010, which is considered as the result of economic growth from the end of the 1990s, particularly during 2000-2010. However, to prove this correlation, we also have to consider other factors, such as income distribution or the Gini coefficient, to identify whether growth is distributed to the total population.

3.4.2. Income distribution

Income equity is one of the principal values underlying sustainable development, with people and their quality of life being recognized as a central issue. By basic definition, equity involves the degree of fairness and inclusiveness with which resources are distributed, opportunities afforded, and decisions made. Income distribution is the only one key factor to prove that economic growth is good for economic development and how it is distributed to the entire population.

In economic terms, the income distribution describes how a country's total income is distributed amongst its population. In order to assess the level of income inequality of a country,

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[15] Lao Economic Consumption Survey

the Gini coefficient is widely used by several organizations, such as the United Nations (UN) and the US Central Intelligence Agency (CIA). These organizations have measured and used this index to clarify the degree of inequality in the distribution of family income in a country.

Figure 6: The Gini index of Laos (1990-2010)
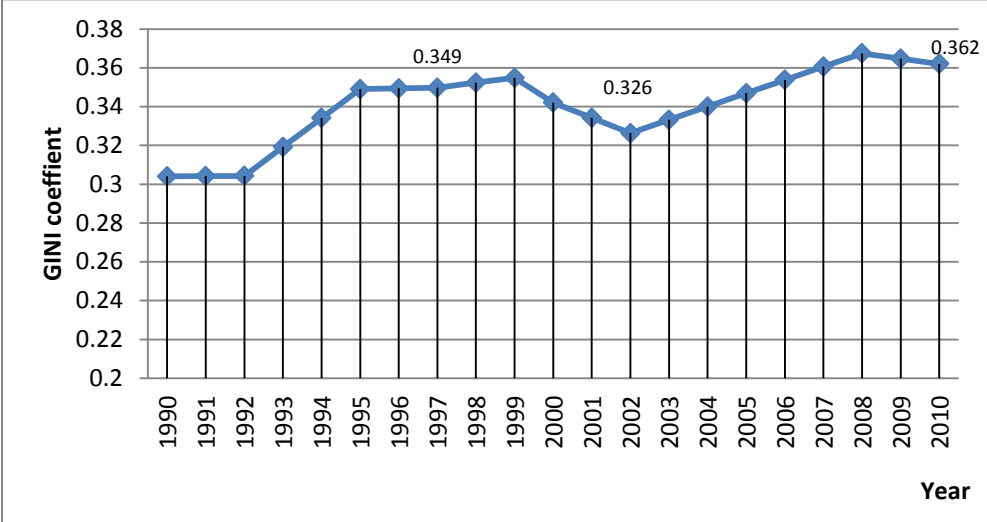
Source: Author analysis based on WDI and IMF report (2012)

The above figure shows that the average value of the Gini index remains high at 33.8 percent, on average, between 1990 and 2010. The changes of this index might be influenced by the change in government policy in each period. It is noticeable that this index increased from 30.40 percent in 1990 to 35.4 percent in 1999; in parallel with the high rate of growth during this period, the inequality value also increased, especially, the introduction of international tourism year in Laos in 1999, the rich people benefited more than the poor.

During 2001-2003, the Gini index decreased, as during the period that the introduction rural development project through community driven development (CDD) which encourage the community (villagers, women and ethnic minority) involvement in development process. However, it increased again from 2004 when the Government took another step in amending the

FDI promotion law, the Gini index was high between 2008 and 2010, which was 36.73 percent and 36.20 percent, respectively.

In comparison the Gini index with other neighboring countries **(Table 4),** in 2010, Laos has a smaller value than of Cambodia, Vietnam, and Thailand, which are 36.9 percent; 37.60 percent; and 39.37 percent, respectively. The high value of the Gini index implies that the high rate of growth caused the high level of inequality and caused the development gap in society, such as the development gap between rich and poor, urban and rural areas, the lack of opportunity for most of the population to participate in the development process, and decision making. It is important for policy makers to develop the most appropriate policy to guarantee sustainable development as well as to reduce the development gap in society.

Figure 7: Life expectancy (years), literacy rate, and HDI (1980-2012)
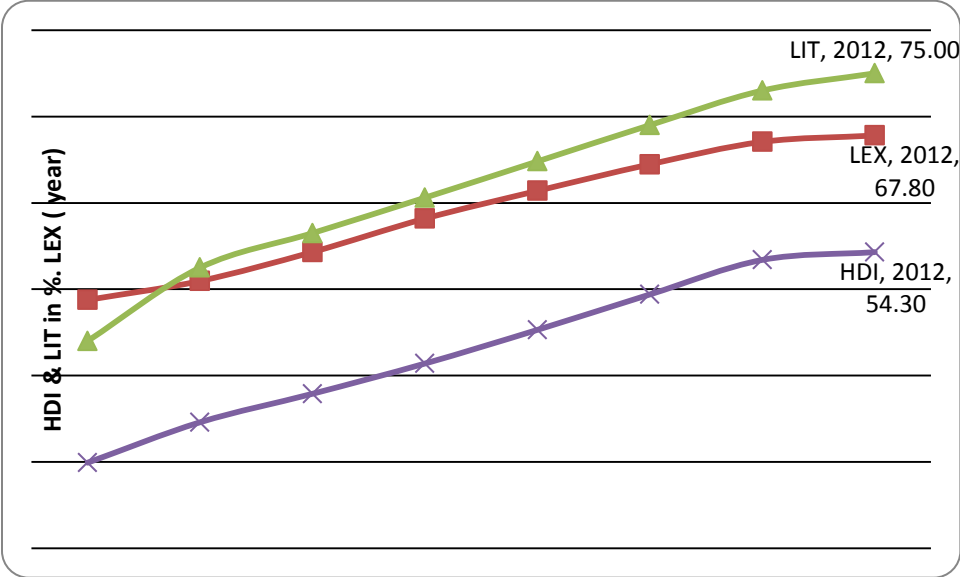
Source: Author analysis based on Human Development Report 2013 of Laos

Figure 7 indicates the other determinants of the development performance of Laos between 1980 and 2012, relating to the performance of human development. Each determinant indicates that it

has increased considerably; for example, the HDI[16] index increased from 0.346 to 0.543 with an average annual increase of about 1.7 percent between 1980 and 2012. At the same time, the life expectancy at birth also increased by 19 years between 1980 and 2012, from 48.8 years to 68.8 years, as well as, the slightly increase the adult literacy rate by 31 percent, from 44 percent to 75 percent, respectively.

The significant increase in each determinant (figure 7) is correlated with the increase national income between 1990s and 2012. The higher national income is assumed to increase the government expenditure on social service and improve living conditions of population (Bhargava et al., 2001). Therefore, high rate of economic growth is considered to be a necessary condition for human development.

Table 4: Laos's HDI for 2012 relative to selected countries and regions

	HDI	HDI rank	Life expectancy at birth	Expected years of schooling	Mean years of schooling	GNI per capita (PPP US$)	Gini index (2010)	Poverty index (2010)
Laos	0.543	138	67.8	10.1	4.6	2,435	36.20	26
Cambodia	0.543	138	63.6	10.5	5.8	2,095	36.9	22.1
Vietnam	0.617	127	75.4	11.9	5.5	2,970	37.60	20.7
Thailand	0.690	103	74.3	12.3	6.6	7,722	39.37	13.6
East Asia and the Pacific	0.683	-	72.7	11.8	7.3	6,874	-	-
Medium HDI	0.64	-	69.9	11.4	6.3	5,428	-	-

Source: Human Development Report of Laos 2013

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[16] The HDI is an average measure of basic human development achievement in a country, based on three basic dimensions of human development: 1) a long and healthy life, 2) access to knowledge, and 3) a decent standard of living.

In 2012, Laos's HDI value is 0.543 in the medium human development category positioning the country at 138 out of 187 countries and territories and it is shared the rank with Cambodia. It is below the average of 0.64 for countries in the medium human development group and below the average of 0.683 for countries in East Asia and the Pacific. In comparison with some neighbouring countries, such as Cambodia, Vietnam, and Thailand, Laos has an equivalence HDI with Cambodia (HDI of 0.543) which has ranked 138, compared with Vietnam and Thailand which have a higher HDI at 0.617 and 0.690, and are ranked 127 and 103, out of 187 countries (Human Development Report, 2013).

Gender inequality is a challenge for the development of Laos. Based on the UNDP report in 2013 about Laos, the Gender Inequality Index (GII) reflects gender-based inequalities in three dimensions reproductive health, empowerment, and economic activity. Reproductive health is measured by maternal mortality and adolescent fertility rates; empowerment is measured by the share of parliamentary seats held by each gender and attainment at secondary and higher education by each gender; and economic activity is measured by the labour market participation rate for each gender.

Table 5: Laos's GII for 2012 relative to selected countries and groups

	GII Value	GII Rank	Maternal mortality ratio	Adolescent fertility rate	Female seats in parliament (%)	Population with at least secondary education (%)		Labour force participation (%)	
						Women	Men	Women	Men
Laos	0.483	100	470	30.1	25	22.9	36.8	76.5	79.5
Cambodia	0.473	96	250	62	18.1	11.6	20.6	79.2	86.7
Vietnam	0.299	48	59	22.7	24.4	24.7	28	73.2	81.2
Thailand	0.36	66	48	37	15.7	29	35.6	63.8	80
East Asia and the pacific	0.333	-	73	18.5	17.7	49.6	63	65.2	80.6
Medium	0.457	-	121	44.7	18.2	42.1	58.8	50.5	79.9

HDI								

The GII replaced the previous Gender-related Development Index and Gender Empowerment Index. The GII shows the loss in human development due to inequality between female and male achievements in the three GII dimensions. Laos has a GII value of 0.483, ranking it 100 out of 148 countries in the 2012 index. Laos has 25 percent of parliamentary seats are held by women, and 22.9 percent of adult women have reached a secondary or higher level of education compared to 36.8 percent of their male counterparts. For every 100,000 live births, 470 women die from pregnancy related causes; and the adolescent fertility rate is 30.1 births per 1000 live births. Female participation in the labour market is 76.5 percent compared to 79.5 for men. In comparison with Cambodia, Vietnam, and Thailand are ranked at 96, 48 and 66 respectively on this index. This indicates that the degree of gender inequality in Laos is retaining higher than other neighboring countries.

3.5. Environmental conditions in Laos

Managing natural resources is essential, especially if the government of Laos wants to maintain high rate of economic growth in long term. The increase in economic activities is related to the allocation of natural resource of the country, which assumes to increase the environmental degradation. In this case, the environmental management and natural resource protection have become an important issue to reach the development perspective in 2020.

Laos is highly dependent on natural resources for socio-economic development and growth; approximately 70 per cent of the total population lives in rural areas and relies totally on natural resources for daily consumption, such as food, firewood and charcoal, traditional medical usages, and family income, for example, people's access to forests to find non-timber products to

sell in local markets. Almost 60% of FDI is related to the country's environmental and natural resources (PEI[17], 2011).

Given the limited diversification of the Lao economy, natural resource especially forest, being a critical element of the ecosystem, remaining an important source of living condition of population. Currently, Laos suffers several numbers of environmental problems, the key issue of which are related to deforestation. To obtain high rate of economic growth, it is necessary to extend commercial exploitation of the forests, plans, for additional hydro-electric facilities, foreign demand for wild animals, and non-wood forest products for food and traditional medicines, and growing population put pressure on the forests. The high rate of deforestation not only destroyed at least 150,000 to 160,000 hectares of valuable forest annually in the 1980s, but this also caused erosion, which leads to the siltation of reservoirs, navigation channels and irrigation systems downstream and reduce groundwater level. Moreover, the widespread soil erosion, leading to the decrease of agricultural productivity and having a harmful effect on Laos' wildlife habitat (MDGs, 2008).

Even though the environmental issue of Laos is only a minor contributor to climate change at global and regional levels, the change in environment may have a significant impact on the long-term development of the country and region. The major cause of greenhouse gas emissions of Laos were mainly related to widespread consumption of fuel wood and slash and burn farming. Therefore, the conservation and sustainable management of agricultural biodiversity would play an important role in adapting to the climate change scenarios and their impact on the living condition of Lao people should be taken into consideration.

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[17] The Poverty-Environment Initiative (PEI) of the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP)   http://www.unpei.org/

The introduction of NEMs and the membership of ASEAN encouraged the economic activities and economic growth in Laos. However, to maintain a high rate of economic growth, a high level of investment and natural resource allocation is required. These activities lead to an increase in the level of environmental pressure, including deforestation and carbon dioxide emissions. By definition, carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide emissions produced during the consumption of solid, liquid, and gas fuels and gas flaring.

Figure 8: Carbon dioxide emissions in metric tons per capita (1980-2010)
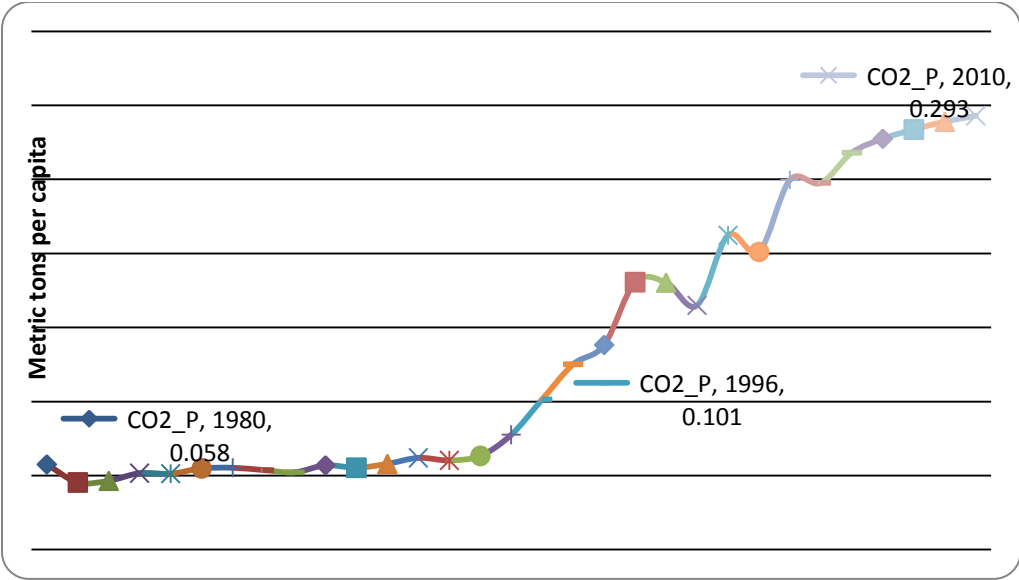
Source: World Development Indicator and IMF Report (2012)

Figure 8 indicates the movement of carbon dioxide emissions per capita, which increased considerably from 1980 to 2010; the average during that period was 0.1327 metric tons per capita, with a minimum of 0.0453 metric tons in 1981 and a maximum of 0.2929 metric tons in 2010. The increase in carbon dioxide emissions per capita was very high between 1997 and 2010, after participating in ASEAN, with figures of 0.1251 and 0.2929 metric tons per capita, respectively. The increase in carbon dioxide emissions per capita was mainly due to the

continued a high economic growth rate, with the related increase in fossil fuel consumption (coal, petroleum, and natural gas), the obvious deforestation and destruction of rainforests, the increase in the amount of building construction and expansion of infrastructure, the increase in the number of electricity establishments, and the rapid increase in the number of vehicles.

It is questionable whether the Government of Laos will reach its development goal by 2020, in order to emerge from the list of LCDs, how much the environmental conditions will be destroyed, and what the best strategies are to deal with this constraint. In order to maintain the condition of natural resources, which is a part of sustainable development, the Government has developed a wide array of legislation, regulations, and action plans for environmental conservation and protection, including other factors such as health. The forestry law was amended in 2007 to strengthen the sustainable management of forests, and the wildlife law was also enacted to contribute a stronger legal framework for biodiversity conservation because this issue is directly linked to sustainable development.

Table 6: CO2 emissions of Cambodia, Laos and Vietnam (metric tons per capita)

Year	1980	1985	1990	1995	2000	2005	2010
Laos	0.058	0.055	0.055	0.078	0.180	0.248	0.293
Cambodia	0.043	0.054	0.050	0.144	0.162	0.208	0.291
Vietnam	0.313	0.360	0.324	0.404	0.691	1.189	1.728

Source: World Development Indicator 2012

Comparing the CO_2 emissions per capita, the above table shows that Laos and Cambodia have lower CO_2 emissions per capita than Vietnam. Vietnam's rapidly growing economy and energy consumption are creating serious environmental problems at both local and global levels. The rapidly growing industrial sector in Vietnam, in terms of its impact on GDP, is greater than that

of the service and agriculture sectors. This would imply that higher industrial development is associated with an increase in carbon dioxide emissions. As Vietnam continues to rapidly develop industrially, there is a need to further implement and extend policies for environmental protection that will help Vietnam avoid high CO_2 emissions and further environmental degradation.

3.6. Opportunities and challenges of Laos

In order to achieve a high rate of economic growth, there are numerous factors influenced, some of those factors may provide a good opportunity to support the economic growth, while the other factors would become a major challenge that the government has to find the most appropriate solution. The major opportunities and Challenges for future development of Laos can be briefly detailed below:

3.6.1. Opportunities of growth

The sustainability of political and social stability since the introduction of economic reform shows the positive side of the development of production and industrial activities. The stable political situation is recognized as a safe destination for domestic and international development as well as tourism promotion. Being full membership in regional and global political, economic and monetary organization contributes the dynamism of the economy and accelerates the development of Laos. Particularly, becoming a membership of ASEAN in1997 is a very good opportunity that Laos could benefit from the opening up of integration with the ASEAN market, and play an important role in international community.

Laos has a large area compared with the total population which is only 27 people per square kilometer (2010). This country contains the abundant natural resources, such as forest and mineral resources, including many discovered and unexploited mineral resources

endowments including the potential resource for hydropower construction. These things would be allocated in socio-economic development such as hydro-power, bio-energy production, forestry, organic agriculture, and mining. Moreover, this country is also rich of cultural heritage with a good maintaining the traditional custom and life style which would be a potential resource nominating in tourism business (Appendix 6).

The advantageous geographical location, which is connecting the most dynamic South-east Asian markets with the huge Chinese market, even though Laos is a small land-locked, it is now becoming a land-linked country, known as land-bridge among GMS[18] countries. Laos has become an important trade link in Mekong region and South-East-Asia, Chinese and East Asia Economy. This country is finally obtaining the international attention that deserves, it is assumed as the "Jewel of the Mekong or the Battery of Asia".

Laos is able to continuously provide more opportunities for trade and investment. In particular, expansion of mineral and hydro-electricity investment and exports are highly possible. Other potentially areas for expansion of trade and investments are agro-business, tourism and other services industries. Overall, the number of investment wills likely increase due to the attractive incentives packages provided by the new Law on Investment Promotion and the politic situation of the country.

Foreign agricultural investors are not only attracted by low land prices and rents, but also lower tariffs and duties on Lao exports under the principle of being membership of ASEAN, given the country`s status as a least developed country. In recent years, with the Greater Mekong Sub-region programme boosting infrastructure development, in particular roads and railways, investors in Laos could also reap the benefits from better transport services, more integrated markets, and the free flow of goods and labour within the sub-region

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[18] GMS: Greater Mekong Sub-region Countries

3.6.2. Key challenges

A country with experienced transition, although succeeding in numerous aspects of socio-economic performance, would unavoidably still present challenges for future development perspective, including international cooperation and trade. Among the most-often cited constraints are skills shortage, inadequate and high-cost basic infrastructure services, low technology, and the absence of the sea ports due to being a land-locked country.

The main challenges for the government of Laos are how to sustain current growth in manufacturing and services sectors, especially to ensure that mining and hydropower development can be realized in a sustainable prospective for the future. Another challenge is to ensure that the rules of laws and related trade and investment regulations are respected and implemented as envisioned.

One issue is about the development goal, which cannot be achieved or sustained when a high proportion of the population is affected by poor health and inadequate access to health care facilities, particularly in remote areas. Poverty eradication and inequality are other two challenges for current and future development of Laos. Although the country achieved high rate of economic growth last two decades, the poverty rate still extends in remote areas, and also the income inequality is also increased. The equitable growth is one concept to reach extreme development; in this case, the income growth should be distributed to the total population both in urban and rural areas, may be through community participation development method as author's suggestion.

A new challenge of economic development of Laos is involving in the ASEAN Economic Community (AEC), which is considered to be the goal of regional economic integration by 2015. AEC envisages the following key characteristics: (a) a single market and production base, (b) a

highly competitive economic region, (c) a region of equitable economic development, and (d) a region fully integrated into the global economy. It is questionable about the impacts of AEC on the economy of Laos. Since this country is one of the poorest economic performances, small market in the large areas, and low human development resource (skills shortage) compared with other ASEAN nations.

Recently, the world leaders have been expressing their willingness to contribute to the issues of environment and climate change initiatives. To align with this issue, the government of Laos has highlighted its commitment to environmental issues as well as international participation in the fight against climate. This discussed issue is strong expressed for policy makers as to frame the most appropriate policies and documents, with a directive to achieve the equitable growth and sustainability (MDGs, 2010).

CHAPTER 4: THE PROPOSED APPROACH

This chapter presents the analysis of three factors for sustainable development in Laos. Firstly, it identifies the determinants of economic growth, followed by analyzing the impacts of economic growth on poverty and income distribution, and last one, analyzing the impacts of economic growth on environmental conditions.

4. 1. Introduction

4.1.1. Economic growth in Laos

Laos pursued significant economic reform under the new economic mechanisms (NEMs) in 1986, which aims to improve the economic development system based on a market-oriented economy, with the intention of transforming the nation from a closed and centrally planned economy to a market-oriented one. Laos made great efforts to reform state-owned enterprise and promote private enterprise and foreign investment, in parallel with strengthening the banking system and implementing trade liberalization. From the early 1990s, this country has paid attention to improving its business environment to make the country more investor-friendly, together with trade promotion and international cooperation.

Economic growth is considered to be a key factor for current and future development, particularly to achieve the development goals for 2020, which is to emerge from the list of LDCs; in addition, the country expects to achieve at least the middle-income country status.

Economists have long been interested in the factors that cause different countries to grow at different rates and one of such factors is economic reform. Laos had a high rate of economic growth from 1990 to 2010, particularly after the introduction of NEMs in 1986, which is basically a policy that opened economy to international transaction and integration. The perspective economic growth of Laos under NEMs and holding a full membership of ASEAN

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depends on the perspective of trade with other nations. Following the open-door policies and being a membership of ASEAN, Laos accepted several offers of support from governments and international organizations around the world. These factors are assumed to produce a positive impact on its economic development.

Moreover, in the past foreign aid has been considered to be one important factor for growth, since this country depends heavily on foreign aid for the promotion of higher economic growth and poverty reduction. Foreign aid plays a crucial role in overcoming problems in poor countries. Laos received a great deal of support from international organizations and agencies in terms of foreign aid, amounting to 16 percent of the GDP, on average, between 1989 and 2010. This aid was allocated to social economic development, particularly rural development and poverty alleviation.

Regarding other factors, such as investment, both foreign and domestic investments, they increased significantly, particularly after gaining full membership of ASEAN in 1997.

This thesis attempts to examine the impacts of these key determinants, such as trade openness, foreign aid, government expenditure and investment, on economic growth in Laos. In order to provide a better explanation of the determinants which influenced in economic growth, additional variables such as industrial extension, and ASEAN membership, may also be included. The expected outcomes will provide good suggestions for the future development of Laos.

4.1.2. Economic growth and poverty reduction

Laos became independent in 1975, and decided to adopt socialist system, where the government decides what to produce, how to produce, and who receives the final product. This is opposite to a market economy, in which individuals own the greater part of property rights on

both consumption and capital goods, are free to trade and where prices for goods are decided in a free market system. In the early 1980s, the system's economic performance was unable to reach the expected goals, the population became poorer and the economic system weakened. These issues confirmed that the centrally planned system alone was not the most appropriate for Laos, leading to economic reform (Phimphanthavong, 2012).

Most programs of economic reform now underway in the developing world and in the post-communist world have as their strategic aim the integration of the national economy with the world economy (Sachs & Warner, 1995). Considering the case of Laos, the introduction of the NEMs (1986) has produced remarkable economic development, which has shown that Laos has achieved remarkable economic growth, privatised former state-owned enterprises, and generated macroeconomic stability (detailed in Chapter 3.1).

In addition, the NEMs and holding a membership of ASEAN encouraged a significant growth in public and private investment, which contributed to average real GDP growth rates of over 5 percent per annum from 1990 to 1999, more than 6 percent from 2000 to 2005, and beyond 7 percent from 2005 to 2010. According to the Human Development Report of UNDP (2011), the country is one of the 10 "top movers" in the world in terms of progress on human development (2010) over the past 20 years.

Given that one of the major goals of economic development is to emerge from the list of LCDs by 2020, one of the major challenges for economic development is poverty eradication. It is questionable whether the introduction of new economic policy had a positive impact on economic development in Laos in terms of economic growth and poverty alleviation. The benefits of economic growth are considered to be a key agenda of development of many countries including Laos.

The development agenda of the government is now to alleviate poverty and maintain macroeconomic stability. From the point of view of social dimensions of development, results are contrasting.

Despite its impressive economic growth, Laos is still considered by the international community to be a least developed country, at rank 122 out of 169 countries. Further, its human development index is a mere 0.497, which is lower than the average for developing countries of 0.592 (UNDP, 2011); Its economy is dependent on natural resources. Despite this, Laos has experienced a high rate of growth since 1990s, which has helped reduce poverty from 45 percent in 1992/93 to 26 percent in 2009/2010. However, it still relies heavily on foreign aid and supports for economic development and poverty reduction. The population living under the poverty line still continues to be widespread throughout the country, particularly in rural areas.

There are now a large number of studies of the determinants of economic growth and its impacts on socioeconomic development. Programs for poverty reduction that have been launched by many developing countries seek to evaluate such factors, since it is important to recognise their impacts to identify the exact relationship between economic development and poverty. In the case of Laos, few studies have analysed the impacts of economic growth on social development. Therefore, this study examines the relationship between economic growth and poverty reduction and how growth benefits are distributed across the total population.

This analysis aims to demonstrate that macroeconomic policies and openness to the world economy are important factors in reducing poverty. Since these new policies have influenced economic growth and such growth is assumed to alleviate poverty, the expected outcome of this analysis is important for several reasons. Nobody is denying the policy significance of understanding the determinants of economic growth and its relationship with poverty. For that

reason, this section would be useful to provide recommendations to streamline current socio-economic development in the country.

4.1.3. Economic growth and environmental conditions

To ensure the benefit of growth in the long run, it is necessary to consider the impacts of growth on other dimensions of development; therefore, the impacts analysis of economic growth on environmental conditions is also included in this thesis.

The impact of economic growth on the environment has been widely discussed in the economic literature.

A high rate of economic growth has been a primary and permanent goal of government and society, particularly in developing countries. The increase in economic growth is related to an increase in the production and consumption of goods and services; consequently, this may lead to an increase in the quantities of goods for people, income per capita and consumption. To encourage a high rate of economic growth, different economies' mechanisms have involved development based on each individual country's characteristics and the potential natural resources that are available.

Growth may produce negative impacts on the environment through many aspects, such as environmental degradation (pollution), overexploitation of natural resources, degradation and loss of wildlife habitat, and climate change. These are the key issues that many countries have been facing; in particular, the decline in environmental quality is considered to be a serious issue for the living condition of the population from the current as well as the long-term perspective. In general, technological development is considered as having the potential to diminish or exacerbate the effects of economic growth on environment.

As a consequence, development should not be measured by the GDP growth alone. Instead, the sustainability of natural resources and environmental condition must be considered to be one key factor that can be used to prove that the benefits of growth are sustainable for the population and hence development is occurring. If national development goal is focused only on income growth and fails to consider its impacts on the natural resources and environmental condition, this would confirm that the envisaged development guidelines and processes are inadequate for the long-term development perspective of the country. For this reason, to achieve successfully the goals of the various economic development plans, a country's government needs to consider both the development potential to increase the living condition of the population and the sustainability that would ensure lasting benefits for the country's future generations.

The key indicators used to capture the changes in environmental conditions have been developed and used in many countries. Considering the environmental condition it seems that there are many aspects which must be included such as water pollution, Carbone Dioxide emissions (CO_2 emissions), soil erosion, solid waste, and deforestation. However, since we have limited data available of other aspects, this study considers only the CO_2 emissions to be a proxy for environmental degradation.

In general, the increase of the CO_2 emissions is mainly caused by burning oil, coal, and natural gas for energy use. Furthermore, CO_2 emissions also enters the atmosphere from burning wood and waste material land from some industrial process such as cement production, garment manufacturing, alcohol factories, Tobacco companies, etc. In Laos, the calculation of CO_2 is mainly based on the consumption of liquid fuel, gaseous fuel, solid fuel, transportation, electricity and heat production. The increase in number of economic activities is assumed to

increase the proportion of environmental damage. This study would discuss some hints about how to balance growth and good conditions of environment.

As already mentioned in relation to the environmental issue of Laos, which is only a minor contributor to climate change at global and regional levels, the degradation in the environmental system, particularly the rapid decline of natural resources caused by factors such as deforestation, may cause a negative impact on the living condition of the population from the current and the long-term perspective. This is due to the economic growth in Laos is still greatly dependent on natural resources.

The high rate of economic growth is a promising prospect for the country to disembark from the list of LDCs but we have to question whether the high rate of economic growth during the last two decades, especially after joining ASEAN in 1997, has produced negative impacts on the natural resources and environmental conditions of the country. The expected outcome of this study may provide a good suggestion for policy makers to consider the most appropriate method to achieve a high level of growth and simultaneously to maintain the sustainability of the natural system and a good environmental condition.

4.2. Literature review

4.2.1. The determinants of economic growth

Economic growth means an increase in the average rate of output produced per person, usually measured on a per annum basis. This section reviews the theoretical and empirical studies related to economic growth, particularly the relationship between economic growth and its explanatory variables, such as factor endowment, investment and some other characteristics like trade openness, aid and Government expenditure.

Growth theory has mainly developed from the neoclassical model, such as by Solow (1956), Cass (1965), and Koopmans (1965). The neoclassical model has an aggregate approach.

Solow's model[19] of economic growth allows the determinants of economic growth to be separated out into increases in inputs (labour and capital) and technical progress. Economic growth studies begin with the neoclassical production function which has the form:

$$Y = AK^{\alpha}L^{1-\alpha} \qquad (1)$$

where Y represents the total production in an economy, A denotes total factor productivity which is usually known as technology level (and its change in time), K is capital, and L is labour and α is elasticity of output to capital. Please note that the technology in the general Solow Growth Model is contained in the residual term A, and is meant to represent societal factors that are not taken into account in Capital (K) or Labour (L)

The theory of Solow (1956) essentially argues that when production takes place under neoclassical conditions and constant returns to scale, there will no opposition between natural and unwarranted rates of growth. The system is self-adjusting to any given rate of growth in the labour force and eventually approaches a state of steady proportional expansion. The main innovation introduced by Solow is the ability to allow for factor sustainability, so that stable equilibrium growth could be attained.

One characteristic of this model is the convergence property. Many studies remark that a country that begins with a lower level of GDP per capita is expected to achieve a higher growth rate in the long term. This could imply the assumption that if all economies were basically the same, except for their initial capital intensities, poor economies would grow faster than rich ones.

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[19] The General Solow Model, can be described as the interaction of seven basic macroeconomic equations: Macro-production function; GDP equation; Savings function; Change in capital, Change in Human Capital; Change in workforce and Change in 'technology'

However, this theory has not been completely proved by the empirical analysis, since the economic systems of different countries differ in various features, including the government policy, access to work, international cooperation, willingness to work, and access to technology.

The widespread use of the neoclassical model focuses on the roles played in coordinating and integrating various factors in macroeconomics, public finance, and international economics. Due to the dependence of growth on exogenous technical progress in the neoclassical growth model and the evident inconsistency of the "unconditional convergence", the hypothesis led to a renewed search for alternative models that can generate economic growth endogenously. According to the endogenous growth theory, economic growth is primarily the result of endogenous and not external forces. This theory maintains that investment in human capital, innovation, and knowledge is a significant contribution to economic growth; therefore, the endogenous theory emphasizes education, on-the-job training, and the development of new technologies, accounting for their increasing relevance (Lucas 1988).

Several studies have followed the endogenous theory, such as the study by Romer (1990), who identifies four basic preconditions for growth: (1) capital-measured in units of consumption goods; (2) labour skills available from a healthy human body; (3) human capital-activities such as formal education and on-the-job training, which is person-specific; and (4) an index of the level of technology. However, this model specification is less clear about the technical progress and the factors influencing growth are hard to measure. In an open economy, the economic growth theory usually suggests more additive determinants, such as degree of trade openness, foreign aid and other factors, which are assumed to influence growth. Those factors may have a positive impact on economic growth, the production growth function usually simplifies as follow:

$$Y_t = A_t f(K_t, L_t, X_t) \quad (2)$$

where: Y_t denotes the output,

A_t is the technical change,

f (…) is the production function

K_t is the capital stock; and

L_t is the labour

X_t is a vector of other variables such as trade openness degree, foreign aid, FDI, government expenditure, domestic investment, etc.). Subscript t denotes the time (year)

Trade and growth

Openness to trade is one significant determinant of economic growth performance. There are sound theoretical grounds for arguing that there is a strong and positive link between openness and economic growth. Openness enables the exploitation of comparative advantage, technology transfer and diffusion of knowledge, increasing scale economies and exposure to competition (Arvanitidis et al, 2009).

Economists generally agree that openness to international trade facilitates development. Several studies confirm that the openness achieved through trade cooperation and reduced trade obstruction is related to greater growth. This is confirmed by the study of Harrison (1995), who examined the relationship between openness and the rate of GDP growth, using the results from cross-sectional and panel data estimates while controlling for country effects. This study shows that the openness measures seem to have a positive correlation with GDP growth, meaning that the more open the economy, the higher the growth rate, while the more protected the local economy, the slower the growth in income.

Hassan (2011) remarks that trade openness is believed to lead to the improved allocation of all types of resources thanks to economies of scale, improvements in knowledge production techniques, multilateral international arrangements for the transfer of technology, accumulation and formation of capital, and raising the level of employment by job creation and thus economic growth and development. He points out that the idea of trade openness is derived from the classical school of economics and from the theory of Adam Smith and David Ricardo. It is believed that economic gains of specialization, discernible in enhanced exports, entail higher levels of GDP, thus exports contribute directly to growth of the national income.

On the other hand, Jeffrey and Romer (1999), examining the correlation between trade and income, state that the direction of causation. Between those two factors cannot be identified. In addition, countries' geographic characteristics; however, have important effects on trade, and are plausibly uncorrelated with other determinants of income. Therefore, they use geographic components of countries' trade to obtain instrumental variables estimates of the effects of trade on income. The results provide no evidence that OLS estimates overstate the effects of trade. They suggest that trade has a quantitatively large and robust, though only moderately statistically significant, positive effect on income.

The impact of trade on growth is confirmed by a number of empirical studies. Dollar and Kraay (2001), using cross-country data on 100 countries, confirm that changes in the growth rate are associated with changes in trade volumes. Particularly, the change in trade policy is one of the key factors that causes an increase in trade volume and leads to rapid growth. Furthermore, Dollar and Kraay (2002) state that countries with better institutions are also countries with better trade. The change in decadal growth rates measured through instrumented changes in trade and changes in institutional quality provides evidence of a significant effect of trade on growth, with

smaller role for improvement institutions. Fosu (1990) and Sachs and Warner (1997) conducted studies on several African countries, and agreed that more trade restrictions have a negative impact on growth. However, those studies based on cross-country data may suffer from biased estimation, since the different characteristics of each individual country lead to differences in data measurement and collection.

Many of the recent studies, using time series analysis to examine the impacts of trade on economic growth, confirm that there is a strong correlation between export performance and economic growth (Greenaway et al., 2002; Shahbaz, 2012). Medina-Smith (2001) look at the relationship between trade and growth is envisaged through an export-led growth strategy, which follows the theory that sustained trade is the main engine of economic growth. This idea is confirmed by Obadan et al. (2011), who examined the impacts of trade on economic growth and development in Nigeria using time-series data. The study was developed from the studies of Edwards (1998) and Obandan (2008) with some modifications to the model. GDP growth is function of the degree of openness, exchange rate, foreign direct investment, domestic investment, and political stability. The study confirms that trade openness produced a positive impact on Nigeria's economic growth. Moreover, it states that political instability has a strong negative impact on growth and development.

Foreign aid and growth

However, the economic growth may be influenced by other determinants, which depend on the characteristics of the individual countries, particularly developing countries. Foreign aid is an additional determinant assumed to play a critical role in economic growth; therefore, other studies have explored the impact of foreign aid on economic development. For example, Indonesia in the 1970s, and Bolivia in the late 1980s, moved from a slow path of economic

growth to rapid development through aid; in fact, foreign aid plays a significant role in stimulating growth by transferring money, ideas, and technology from donor countries to developing countries (Burnside & Dollar, 2000). Moreover, the positive impacts of aid on promoting economic growth are confirmed by Mosley et al. (1987), Arvin and Barillas (2002), Hudson (2004), and McGillivray et al. (2006).

As said, taking into account the difference in the characteristics of the countries, foreign aid may play a very important role (direct or indirect correlation) in the economic growth of many countries, particularly the countries on the list of LDCs, because of their lack of savings and capital stock.

On the other hand, some studies are critical of the impacts of foreign aid on economic growth. For example, Boone (1996) disagrees with the positive aid-growth relationship, stating that aid has no effect on either investment or income growth in LDCs. Gupta (1975) and Gupta and Islam (1983) discovered that the negative effect of foreign aid can be reversed if indirect effects are incorporated. Mosley (1980) also found a negative (but not significant) correlation in aid and economic growth used a simultaneous equation model; in contrast, he found a positive correlation in the case of LDCs in his sample but in total concludes that his analysis is incomplete.

Recently, the relationship between foreign aid and economic growth has attracted great attention and there is now a large amount of literature on the correlation between foreign aid and economic growth. The study carried out by McGillivray (2005) identified the impact of foreign aid on growth in African countries, using time series from 1968 to 1999; the result of this study demonstrates that aid not only has a positive impact on growth, but also reduces poverty in Africa.

The study by Gomanee et al. (2005) directly addressed the mechanism through which aid impacts on growth, based on data on 25 sub-Saharan African countries over the period from 1970 to 1997; this study indicates that there is a positive correlation between aid and growth. It proves that foreign aid has a significant positive effect on economic growth. Moreover, this study also finds that investment is also one of the most significant transmission mechanisms for growth.

Karras (2006) investigated the relationship between foreign aid and growth per capita using annual data on 71 aid-receiving developing countries, for the period 1960 to 1997. The result of this study shows that the impact of foreign aid on economic growth is positive, permanent, and statistically significant. A permanent increase in foreign aid by US$20 per person results in a permanent increase in the growth rate of real GDP per capita by 0.16 percent; however, this result is obtained without considering the effects of policies.

Easterly (2001) says that the multiple factors that affect growth cause the relationship between growth and investment to be loose and unstable. Growth fluctuates around an average for each country, while investment rates drift all over the place. About the aid, he states what income a country would have achieved if the predictions of the financing gap approach were correct and then compare the prediction to the actual outcome. The financing gap model predicts that aid goes into investment one to one, or more. Investment to GDP will increase over the initial year by the amount that aid to GDP increases over the initial year and then this investment will increase growth in the next period, but the results he finds are not positive.

Foreign Direct investment and growth

Clift and Diehl (2007) state that capital should flow from richer to poorer countries, from countries that have more physical capital per worker and hence where the returns to capital are

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lower to those that have relatively less capital and hence greater unexploited investment opportunities. In principle, this movement of capital should make poorer countries better off by giving them access to more financial resources that they can then invest in physical capital, such as equipment, machinery, and infrastructure. Such investment should improve their levels of employment and income. Capital flows to and from developing economies include official flows, such as inflows of foreign aid and outflows in the form of accumulated international reserves. These flows may be driven by factors other than the basic rate-of-return considerations discussed earlier.

Borensztein et al (1988) examined the impact of foreign direct investment (FDI) on economic growth in a cross-country regression framework, utilizing data on FDI flows from industrial countries to 69 developing countries over the last two decades. The results of their study suggest that FDI is an important vehicle for the transfer of technology, contributing relatively more to growth than domestic investment. However, the higher productivity of FDI holds only when the host country has a minimum threshold stock of human capital. Thus, FDI contributes to economic growth only when a sufficient absorptive capability of the advanced technologies is available in the host economy.

Kottaridi and Stengos (2010) examined the relationship between FDI and economic growth by contrasting past empirical evidence and conventional wisdom and arriving at some interesting new results. Applying non-parametric methods, and taking into account non-linear effects of initial income and human capital on economic growth, they explored the FDI effect on growth in much greater detail than previous studies. Their findings not only confirm the non-linear effect of human capital in the presence of FDI inflows but also suggest that FDI inflows are growth

enhancing in the middle-income countries while there is a 'two-regime' FDI effect for high-income countries.

Chansomphou and Ichihashi (2011) examined the impact of foreign aid and foreign direct investment on the long-run and short-run per capita income growth of Laos. Using time-series data for the period 1970-2008 and modified Solow's growth model, they find that foreign aid has a strong positive impact and it is considered to be a main contributor to income growth in Laos, while FDI has a negative impact on income per capita. They concluded that the negative impact of FDI might be due to its concentration in few economic sectors and its extreme rises and falls in some periods.

From the above review of the empirical literature, we assume that trade openness has a positive impact on economic growth; an increase in the openness degree is associated with an increase in the level of income per capita, meaning that the trade openness is a driving force of economic growth. Next, we consider, as Karras (2006) and Chansomphou and Ichihashi (2011), that foreign aid and FDI have a positive impact on economic growth, since the impact of foreign aid and FDI on growth, particularly in developing countries, is confirmed by numerous studies, such as Hansen & Tarp, (2000); Brautigan & Knack, (2004); and Dalgaard et al., (2004). The main role of these factors in stimulating economic growth is to supplement domestic sources of finance, such as savings, thus increasing the amount of investment and capital stock.

4.2.2. The impacts of economic growth on poverty reduction

The relationship between economic growth and poverty reduction has been analysed by the development research literature in many countries (Roemer and Gugerty, 1997; Deaton and Dreze, 2001; Bhagwati, 2001; and Dollar and Kraay, 2002). According this literature, a high rate of economic growth is considered to be a necessary condition for fighting poverty. However, it

has also been claimed that to assess the link between economic growth and poverty other external factors associated with the real enhancement in people's quality of life should be taken into consideration. Analysing the direct correlation between these two variables is not enough; we also have to consider other factors at the same time such as foreign aid, international cooperation, FDI, and population growth.

Easterly (2001) states that countries with positive income growth had a decline in the proportion of people below the poverty line, and the fastest average growth was associated with the fastest poverty reductions. In Indonesia, for example, which had average income growth of 76 percent from 1984 to 1996, the proportion of Indonesians beneath the poverty line in 1993 was one-quarter of what it was in 1984, (a bad reversal came with Indonesia's crisis over 1997-1999, with average income falling by 12 percent and the poverty rate shooting up to 65 percent, again confirming that income and poverty move together.

Dollar and Kraay (2001) explored this question by studying the experiences of a group of developing countries that have significantly opened up to international trade during the past two decades. They provide evidence that, contrary to popular beliefs increased trade has strongly encouraged growth and poverty reduction and has contributed to narrowing the gaps between rich and poor worldwide.

The persistent problem of poverty in the developing world has led to frequent questions about the effectiveness of economic growth in influencing poverty reduction. The persistence of poverty may also lead to pessimism about the impacts of market-oriented policies and outward-looking development strategies. However, the programs launched by many developing countries for the reduction of poverty seek to evaluate the factors that are important to identify the exact

relationship between economic growth and poverty. Therefore, a large body of scientific literature on this topic has empirically examined the important independent variables.

Kuznets (1955) analysed the relationship between economic growth and income inequality using the "inverted U" hypothesis. He suggested that in the early stages of economic growth, income distribution tends to worsen, while in the next stage it improves as a wider segment of the population participate in the rising national income. This implies that the positive effect of this linkage depends on the level of economic development.

Following Kuznets (1955), many empirical studies have emphasised the role of economic growth to deal with poverty. In general, they have found that economic growth plays a significant role in poverty reduction. This has been supported by the work of the World Bank (1990), Lipton and Ravallion (1995), Goudie and Ladd (1999), Kakwani (1993), and Osmani (2002). The increase in per capita GDP is directly related to an increase in average income of the poor, so and economic growth is positively associated with reductions in poverty (Roemer & Gugerty, 1997). Indeed, 10 percent of GDP growth per year is associated with income growth of 10 percent for the poor, which covers 40 percent of the total population. These results provide strong support for the proposition that growth in GDPP is a powerful force in reducing poverty.

Over the past 20 years, the share of extremely poor people in the world (those living on less than two dollars a day) has fallen sharply, from 38 percent in 1978 to 19 percent in 1998. This decline is almost entirely attributable to growth itself, not to changes in income distribution. The irrelevance of changes in income distribution in explaining changes in overall poverty over the past 20 years is not a coincidence. In general, income distribution is associated to poverty reduction only when growth is sufficiently high, as said by Kuznets. So, the first effect on poverty is of growth, not of a change in income distribution.

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Thirtle et al. (2003) exploited the causal chain model to analyse the relationship between economic growth and poverty reduction. In their paper, the poverty index was explained by the Gini coefficient, GDPP, export or trade, government expenditure, gross fixed investment, and rural population. The result shows that the Gini coefficient and rural population are poverty related and that GDPP, exports, government expenditure and gross fixed investment are poverty reducing. Gross fixed investment has a large impact because it includes land improvements and road building, which are labour intensive activities that provide jobs at the bottom end of the labour market, especially in rural areas.

Islam (2004), using cross-country data, demonstrated the relationship between economic growth, employment and poverty. The author stresses that growth is important; however, it is not sufficient condition for poverty reduction. Therefore, the pattern and sources of economic growth as well as the manner in which its benefits are distributed (an even grouth) are more important to achieve the goal of poverty reduction. The result of this study argues that there is no invariant relationship between economic growth and poverty reduction. It has been demonstrated that similar growth rates can be associated with different outcomes on poverty reduction. Patterns of growth, especially in terms of developments in employment and labour markets that take place as a result of economic growth, play an important role in producing such varying results regarding poverty reduction.

Adams (2004) used data collected in 126 countries including 60 developing countries to analyse the elasticity of poverty. He found that economic growth reduces the proportion of poverty; however, the measurement of the relationship between growth and poverty based on cross-country data is often questionable. Ravallion (1995) stated that the characteristics of each country could lead to biased measurements of the impact of growth on poverty using cross-

country data. This is due to the differences in household surveys, including differences in the living standards indicator used and real values of poverty lines.

Recent studies have employed time series data to analyse the relationship between economic growth and poverty reduction. Many of those have confirmed that economic growth is essential for poverty reduction, especially when it leads to an increase in employment and an improvement in opportunities for productive activities among the poor. For example the study of Tsai and Huang (2007), using time series data from 1964 to 2003, analysed the relationship between growth and poverty in Taiwan. They confirmed that economic growth is a major driving force for poverty reduction in Taiwan and that openness to foreign trade helps the poor through a direct distribution effect as well as an indirect growth effect, in both the long-term and the short-term

Ijaiya et al. (2011) examined the impact of growth on poverty by employing time series data (1980-2008) in Nigeria. This study indicated that a positive change in economic growth is disposed to poverty reduction. Therefore, to sustain high rate of economic growth in Nigeria from which poverty could be reduced, measured such as stable macroeconomic policies, huge investment in agriculture, infrastructural development and good governance are suggested.

Mulok et al. (2012) determined the empirical relationship and importance of growth for poverty reduction in Malaysia. The results showed that growth explains much, but not all, about the evolution of poverty. They stated that economic growth is necessary but not sufficient for poverty reduction, especially if the objective is a rapid and sustained poverty reduction. If a policy objective is focused on poverty alleviation, it is necessary to consider additional variables such as income distribution.

Economic strategies and policies through economic reform are expected to enhance the impacts of growth on poverty. Poverty reduction is an issue of raising the income levels of the poor on a sustainable basics, and there are many ways of obtaining this goal. Reducing poverty can occur through redistributions among households at an existing level of average income, growth in average incomes, or a combination of the two (McKay, 1997).

Following the studies of Ijaiya et al. (2011) and Mulok et al. (2012), this analysis tries to assess if a relationship between economic growth and poverty reduction exists and how much a change in economic growth affects a change in poverty reduction. To prove that growth reduces poverty, this study also examines the relationship between growth and income distribution based on Kuznets' hypothesis. In addition, we will check if the introduction of new economic policies, the membership of ASEAN, and openness to the world economy, reduces poverty through its effects on growth (Thirtle et al., 2003).

4.2.3. The impacts of economic growth on environmental conditions

Sustainability can be identified in terms of the maximization of well-being of a population over time, while the economy is considered to be a major source of the improvement in the living condition of a country and its population (Lawrence, 2011). Therefore, the governments of many countries have emphasized the achievement of economic growth. From this point of view, the progress of growth occurs through the growing consumption of natural resources. Thus the measurement of the growth of sustainable development has been considered as a major objective of development dimensions.

Grossman and Krueger (1991) state that the impact of economic growth on environmental quality is categorized through three different channels: (1) the scale effect, (2) the composition effect, and (3) the technique effect. By definition, the scale effect happens as pollution increases

with the size of the economy, the explanation being that if the structure of the economy and technology does not change, it is assumed that an increase in the scale of economic activity leads to an increase in pollution and environmental degradation. The composition effect refers to the change in production structure of an economy from agriculture-based to industry and service. In the first stage of the development process, pollution increases as the economic structure changes from agriculture to resource-intensive heavy industries. The last effect is the technique effect, which captures improvements in the technique of production and adaption of cleaner technologies and hence a reduction in pollution.

Several studies have considered the impact of growth on environmental conditions. One of the most effective studies is that of Smyth et al.(2008), who conducted an analysis of the relationship between growth and environmental issues in China, finding that together with the high rate of economic growth, it also produces a high rate of pollution. Many cities in China are now suffering from a high level of pollution and natural disasters, as well as a traffic congestion problem. Those problems are becoming a major challenge for the future development of China.

Some studies have confirmed that the pursuit of higher growth dominates the environmental aspects. In this condition, the worsening of the environment eventually leads to a decline in the welfare of the population (Day and Grafton, 2001). Moreover, environmental and social harm can limit long-run growth; therefore, the key factors of social, economic and environmental systems are codetermined. Thus, in order to obtain the objective of sustainable development, an expansion of the scope of analysis is required to encompass wider system dynamics (Munasinghe, 2001).

The relationship between economic growth and environmental degradation has been recognized and approved by numerous studies (for instance Opschoor, 2001), who examined the

relationship between economic growth and environmental sustainability, while proposing institutional and moral reforms to promote sustainable development. The study by Norgaard (2001) indicates some basic limitations of rapid sustained growth, discusses some mythologies concerning economic growth, and finally outlines an agenda based on ecological economics to move beyond growth and globalization.

Other studies have demonstrated a negative relation between the abundant endowment of natural resources and economic growth: countries that have abundant natural resources tend to have lower economic growth than others (Ascher, 1999; Birdsall et al., 2001; Gylfason, 2001; Sachs and Warner, 1995). However, these studies employed cross-sectional data, and it is hard to classify the impact on economic growth of different processes of natural resources' scarcity.

The growth of economic activities, in terms of production and consumption, requires larger inputs of energy and material that generate a greater quantity of waste by-products (Georgescu-Roegen, 1986). This is confirmed by Grossman and Krueger (1995), who states that to achieve a high level of growth a country needs more inputs to enlarge its outputs, leading to an increase in the waste and emissions generated through the production of economic activities. The increased use of natural resources, accumulation of waste, and concentration of pollutants directly impacts on the degradation of environmental quality, leading to a decrease in the human living quality, despite the rising income (Daly, 1991). In addition, Daly argues that the cause of resource degradation may eventually put economic activity itself at risk; therefore, to maintain the environment and even economic activity itself, the growth must cease and the world must establish a transition to a steady-state economy.

Panayotou (1993) points out that when the production of an economy shifts from agriculture to industry, the pollution intensity increases, and then at higher levels of

development, structural change towards information-intensive industries and services, coupled with increased environmental awareness, enforcement of environmental regulations, better technology and higher environmental expenditures would ultimately lead to a leveling off and gradual decline in environmental degradation. Beckerman (1992) stresses a strong relationship between income growth and the adoption of environmental protection measures, which indicates in the long term that the improvement of the environmental quality of a country can only occur when it has become rich.

Since the beginning of the 1990s, several empirical studies have examined the relationship between economic growth and environmental degradation, by using the environmental Kuznets curve (EKC). The studies by Grossman and Krueger (1995), Selden and Song (1994), and Shafik and Bandyopadhyay (1992) hypothesize that the relationship between economic growth and environment quality, whether positive or negative, is not fixed along a country's development path; certainly, the correlation would change the direction from positive to negative when a country reaches a level of income at which people require and are able to afford more efficient construction and tools for a cleaner environment.

Stern (2004) states that the environmental Kuznets curve is a hypothesized relationship among various indicators of environmental degradation[20] and income per capita; during the early stages of economic growth, degradation and pollution increase, but beyond some level of income per capita the trend reverses, so a high income level of economic growth leads to environmental improvement.

The EKC hypothesis is fundamentally a within-country story; however, cross-country study assumes that all cross-section countries react identically, regardless of their differences in

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[20] Environmental degradation includes water pollution, Carbone dioxide emission, soil erosion, solid waste, and deforestation

income, geographical condition, culture, and history (Dijkgraaf and Vollebergh, 1998). Recently, some studies have started to analyze single country to examine the EKC hypothesis: for example, the studies of Cole (2003), Lekakis (2000), and Stern and Common (2001). In fact, the environmental degradation factor is not only explained by the level of growth; it is also affected by other factors of economic development (Akpan et al., 2011).

Considering the case of Laos, it seems that there are few studies made with the use of the Environmental Kuznets Curve (EKC). The previous study conducted by Kyophilavong (2011) used a Computable General Equilibrium (CGE) method to analyze the impact of trade liberalization on CO_2 emissions and a micro-simulation to assess the impacts of trade liberalization. His study proves that trade liberalization provides positive impact on growth, and it also decreases CO_2 emissions but it increases the proportion of resource depletion because the demand for products increases.

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Another study conducted by Dasgupta et al. (2005) examined the regional poverty-environment nexus in Cambodia, Laos, and Vietnam. This study focuses on spatial relations between poor populations and environmental problems at provincial and district level. The results of this study show that the pattern of regional settlement by poor households is strongly

associated with five environmental problems: deforestation, fragile soils, indoor air pollution, contaminated water, and outdoor pollution.

This study is different from the previous studies of Laos, because it intends to put several factors together, using time series data analysis to test whether an EKC exists. The paper systematically examines the relationship between economic growth and environmental quality. The variables such as population density, trade openness, and other independent variables, are considered in the measurement of the relation between environment and growth.

4.3. Research methodology

4.3.1. Data and description

This thesis aims to identify the role of sustainability in development, by considering three factors of analysis: 1) the identification of determinants of economic growth; 2) The examination of the impacts of economic growth on poverty and income distribution, and 3) The investigation of the impacts of economic growth on environmental conditions.

We will use time series data for the period 1980-2010 taken from different sources, both international and national. Mostly, the data are from the World Development Indicators, World Economic Outlook database of IMF, Penn World Table (PWT 7.1)[21], Asian Development Bank, UNDP, Laos Economic and Consumption Survey (LECS), and relevant Ministries in Laos. Additionally, data were collected from surveys and case studies carried out by local and international organizations including Annual reports of Laos, Economic monitoring reports by the World Bank, etc. (See Appendix 2 for a detail).

In table 7 the main variables are defined.

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[21] PWT is the **Penn World Table** provides purchasing power parity and national income accounts converted to international prices for 189 countries/territories for some or all of the years 1950-2010.

Table 7: Variable and definition

Variable	
GDPP	GDPP per capita in US$
OPEN	Trade openness degree =(import + export)/GDP in percent
AID	Foreign aid inflows in Laos in US$
FDI	Total foreign direct investment in US$
DI	Total domestic investment in US$
GoEx	Total government expenditure in US$
IND	Value added of industrial sector in US$
POPD	Population density
POV	Poverty headcount ration (lower poverty line)
ED	Environmental degradation based on Carbon dioxide emission in kg/person
Additional variables| ASEAN, Gini, etc. Al time series variables have been transformed in logarithms, in order to better describe the evolution over time.	

The trade openness level (OPEN) is based on the proportion of exports and imports per GDP or OPEN = (export + import)/GDP from PWT 7.1. The data on foreign aid and FDI and GDPP are from the World Development Indicators and IMF (2012), while the data on domestic investment and government expenditure are from PWT 7.1 and PWT 6.3. The data of poverty and income inequality are taken from LECS, Ministries and annual report in Laos, while the data of environmental degradation are based on Carbone dioxide emissions per capita which measure environmental degradation (ED) and industrial value added (IND) are taken from WDI. Because we are more interested to growth processes we transformed all variable in logarithm form.

The descriptive statistics (Table 8) is divided into two periods of analysis: one before 1997 when Laos did not hold a full membership to ASEAN, and the second one after 1997, when the country obtained a full membership of ASEAN. This organization, known as the Association of Southeast Asian Nations comprises ten member countries in Southeast Asia: of Singapore, Thailand, Malaysia, Indonesia, Philippine,(founder countries), Brunei, Laos, Vietnam,

Cambodia, and Myanmar. Its aims include the acceleration of economic growth, social progress, cultural development among its members, and the promotion of regional peace.

Table 8: Descriptive statistics of variables

Before being a member of ASEAN (1980-1997)					
Variable |	Obs	Mean	Std. Dev.	Min	Max
LnGDPP |	18	5.65839	.350953	5.050753	6.271707
LnOPEN |	18	3.297633	.7671062	2.086914	4.176846
LnAID |	18	18.34323	.8830883	17.2043	19.61766
LnFDI |	18	9.309856	8.642088	0	18.88943
LnDI |	18	18.75591	.4964343	17.98641	19.50707
LnGoEx |	18	18.6844	.3722834	18.06341	19.24891
LnIND |	18	2.622508	.2848037	2.181547	3.05164
LnPOPD |	18	2.832204	.1429355	2.614472	3.053057
LnPOV |	18	3.901302	.1357917	3.653252	4.094345
LnED |	18	4.112504	.2613218	3.81993	4.845682
After becoming a member of ASEAN (1998-2010)					
Variable |	Obs	Mean	Std. Dev.	Min	Max
LnGDPP |	13	6.126295	.4811368	5.525572	6.839691
LnOPEN |	13	4.308469	.1185067	4.135487	4.461415
LnAID |	13	19.60672	.2215071	19.31612	20.02128
LnFDI |	13	18.03452	1.194614	16.64282	19.67344
LnDI |	13	20.84995	.4539215	20.21366	21.44913
LnGoEx |	13	19.41638	.4797973	18.74234	20.16648
LnIND |	13	3.142119	.1992859	2.810005	3.459466
LnPOPD |	13	3.17353	.0613054	3.074081	3.265378
LnPOV |	13	3.446547	.1210143	3.258096	3.626472
LnED |	13	5.421519	.2459606	4.944168	5.691632

Source: Author analysis

By comparing the two periods it can be seen that, the mean values of the economic indicators indicate improvement; for example GDP per capita (LnGDPP) increases from 5.7 to 6.1, while the share of poor (LnPOV) declines from 3.9 to 3.4, and environmental degradation (LnED) growths from 4.1 and 5.4, respectively. This would assume that being a membership of ASEAN yields a positively impact on the economic performance in terms of economic growth, and reduces poverty, but with an associated negative impact on environmental conditions.

4.3.2. Specification of the model

1. Determinants of economic growth

We start examining the determinants of economic growth in Laos, particularly, the impacts of trade openness and foreign aid on economic growth and development in Laos.

The model derives from the study by Obadan and Elizabeth (2011), though with some modifications. The proposed economic growth model can be specified as below:

$$LnGDPP_t = \alpha_0 + \alpha_1 LnOPEN_t + \alpha_2 LnAID_t + \alpha_3 LnFDI_t + \alpha_4 LnGoExp_t + \alpha_5 LnDI_t + \alpha_6 ASEAN_t + \varepsilon_t \quad (3)$$

where: GDPP denotes the GDP per capita at time (t=1980, 1981, 1982,…)

OPEN is the degree of trade openness

AID is the foreign aid inflow

FDI is foreign direct investment

GoEx is government expenditure

DI is domestic investment

ASEAN membership is used as a dummy variable

ε_t represents the error term at time t

Subscript "t" represents time.

ASEAN is a dummy variable: ASEAN=0 before becoming a member of ASEAN, otherwise ASEAN=1. This variable is used to examine the impacts of ASEAN on the economic growth of Laos.

OPEN variable is measured as exports plus imports divided by GDP, this variable is used as a proxy for the level of trade openness between the country's economy and the rest of the

world. It is expected to have a positive impact on economic growth as drawn from various studies reviewed earlier (Mosley et al., 1987; Fosu, 1990; Sachs & Warner, 1997; Arvin & Barillas, 2002; Hudson, 2004; and McGillivray et al., 2006).

Foreign aid (AID) is considered to contribute in the capital stock of the economy, under the hypothesis that foreign aid plays a critical role in boosting economic growth and development of Laos (Chansomphou and Ichihashi, 2011); therefore, this variable is also included in our analysis.

As additional determinants, we consider also the foreign direct investment (FDI) and domestic investment (DI) which are expected to have a direct or positive impact on economic growth (Lucas, 1988; Barro, 1991; and Romer, 1993). Foreign direct investment (FDI) represents any contribution of foreign capital liable to monetary evaluation. It constitutes foreign investors' own capital under their own risk, which originates from abroad and is aimed to be an investment in the host country.

Domestic investment (DI) refers to any contribution of national capital liable to monetary evaluation that constitutes national investors' own capital under their risk aimed to be an investment in their own country.

Government expenditure (GoEx) is used as government spending on public sectors, such as education, health, sanitation, water supply and infrastructure.

In an extension of the model we may introduce also population density (POPD) as a further possible determinant of economic growth.

2. The economic growth and poverty reduction

Countries such as Laos that follow a high economic growth strategy believe that growth has trickle down effects on poverty (Duraisamy & Mahal, 2010). Based on this impression, we

can say that poverty reduction depends on the rate of economic growth. In line with the study of Ijaiya et al. (2011) and Mulok et al. (2012), the model is based on whether the nation's economic growth has a significant influence on poverty reduction. This section aims to examine the relationship between economic growth and poverty reduction, the next equation is formulated as:

$$LnPOV_t = \beta_0 + \beta_1 LnGDPP_t + \beta_2 ASEAN_t + \varepsilon_t \qquad (4)$$

Equation (4) describes that the changes in poverty index (LnPOV$_t$) are linked to changes in GDPP (LnGDPP$_t$) at time t (t=1980, 1981, 1982,...). ASEAN is the already described dummy variable, ε is the error term.

A different approach which will be considered is to explain change in poverty indirectly, that is using as explanatory variables the determinants of economic growth that we have presented in previous point 1. Thirtle et al. (2003) confirms that GDPP, exports, government expenditure and gross fixed investment are the key determinants of poverty reduction. Based on this study, we assume that poverty reduction is explained by the change in GDPP, OPEN, AID, FDI, DI, and GoEx.

3. The impacts of economic growth on environmental conditions

The approach consists of estimating reduced-form models of the relationship between environmental degradation and per capita income. Different indicators have been employed in empirical literature on EKC, as a measure of environmental degradation and natural resource damage (CO_2, SO_2, deforestation, etc.). Since we lack data for other indicators, therefore, CO_2 is used as proxy environmental conditions (ED); it is measured by the proportion between annual carbon dioxide emissions and population. The GDP per capita is used to be an explanatory variable, and is assumed to increase the environmental conditions based on the volume of carbon

dioxide emissions per capita. This choice is also due to the fact that the EKC shows some weaknesses (Kaikas and Zervas, 2013).

This is why we will try to measure the relation between ED and the other growth-related variables already used for the analysis of poverty.

4.4. The statistical approach

There are two reasons for which it would be wrong to use a classical OLS approach. The first is the strong non stationarity of several of the variables we have discussed. Time series variables are often non-stationary at levels and an econometrics analysis with these variables results in spurious correlations. To avoid spurious relations among economic variables, time series analysis should base not on the original series but it should be transformed to avoid non-stationarity. It can be possible to eliminate non stationarity by calculating difference variables. A variable is said to be integrated of order d, (I(d)), if it can be transformed to a stationary stochastic process by differencing d times. But also having calculated difference variables which are stationary, their use in the regressions is very difficult to interpretate.

Additionally, The use of ordinary least squares (OLS) to estimate the parameters of the response function results in instability and variability of the regression coefficients (Cook and Jacoby 1977). The estimation of the coefficients using OLS may result in regression coefficients much larger than the physical or practical situation would deem reasonable (Draper and Smith 1981). The coefficients wildly fluctuate in sign and magnitude due to small changes in the dependent or independent variables; and coefficients with inflated standard errors that are consequently non-significant.

The second reason is the strong correlation between many of the explanatory variables. As it can be seen in Table 9, the values of the correlation coefficients are very high, so to use directly these variables imply a strong problem of multicollinearity.

Table 9: Correlation Matrix between explanatory variables

	LnDI	LnGoEx	LnAID	LnOPEN	LnFDI	LnIND	LnPOPD	ASEAN
LnDI	1	0.896	0.875	0.834	0.776	0.904	0.969	0.897
LnGoEx	0.896	1	0.871	0.787	0.800	0.919	0.909	0.675
LnAID	0.875	0.871	1	0.952	0.954	0.935	0.952	0.729
LnOPEN	0.834	0.787	0.952	1	0.960	0.856	0.899	0.690
LnFDI	0.776	0.800	0.954	0.960	1	0.851	0.869	0.595
LnIND	0.904	0.919	0.935	0.856	0.851	1	0.954	0.755
LnPOPD	0.969	0.909	0.952	0.899	0.869	0.954	1	0.849
ASEAN	0.897	0.675	0.729	0.690	0.595	0.755	0.849	1

VIF measures the extent that a regression coefficient's variance is inflated due to correlations among the set of predictors. VIFs can be obtained as the diagonal elements of reverse correlation matrix (See appendix 4). If the of VIF is higher than 10 (VIFs>10) are often considered to be problematic.

Table 10: VIF values for the different variables

VIF Values							
LnDI	LnGoEx	LnAID	LnOPEN	LnFDI	LnIND	LnPOPD	ASEAN
51.94	14.43	47.11	22.45	25.72	17.02	80.62	10.61

Table 10 shows the VIF values for the different explanatory variables used. All the VIF values show high problems of multicollinearity.

This is why a Principal Components Analysis approach is used in this research, as it is shown in the next section.

4.5. Principal components analysis

4.5.1. Principal components analysis method

Why use PCA?

Several studies include the collection and use of data to examine the correlation between a respond variable and a set of independent variables. For instance, if the independent variables are related to one another, a situation denoted to multicollinearity results and those results become less reliable. Principal components analysis (PCA) is a technique to handle the problem of multicollinearity and produce stable and meaningful estimates for regression coefficients. Fritts et al. (1971) was the first to introduce the method of PCA for estimating response functions in dendroecology. The estimators of the parameters in the response function, obtained after performing PCA, are referred to as principal component estimators (Gunst and Mason 1980).

There are two main objectives of using PCA model: one is to find a small set of linear combinations of the covariates which are uncorrelated with each other. This will avoid the multicollinearity problem. The second one is to ensure that the linear combinations chosen have maximal variance. A good regression design chooses values of the covariates which are spread out.

Calculating new variables for principal components

Suppose that the original variables X_1, X_2,..., X_k have been standardized to avoid troubles related to their different magnitude or different dispersion before performing the Principal Components Analysis (PCA).

Use **A** for the (k x k) eigenvectors matrix and **Λ** for the (k x k) eigenvalues (diagonal) matrix of the correlation matrix **R;** hence, the j-th Principle Components can be written:

$$F_j = \boldsymbol{a}_j'\boldsymbol{Z} = \sum_{i=1}^{k} \boldsymbol{a}_{ij}\boldsymbol{Z}_i \qquad \text{j=1, 2,....,k} \qquad (1)$$

Where $\boldsymbol{a}_j$ denotes the j-th column of the eigenvector matrix $\mathbf{A}$ (or the (k x 1) j-th vector) and $\mathbf{Z}$ denotes the (k x 1) vector of the standardized original (and correlated) variables.

The eigenvalues $\lambda_1, \lambda_2, \ldots, \lambda_j, \ldots, \lambda_k$ of the correlation matrix $\mathbf{R}$ represent the variances of the k Principal Components; that is:

$$Var\ (F_j) = Var\big(\boldsymbol{a}_j'\boldsymbol{Z}\big) = \lambda_j\ , \quad \text{j=1, 2,...,k} \qquad (2)$$

and the number of PC's which must be taken into account depends on the amount of the total variance "reproduced" by them. In our analysis, we use only the first two PC's because they are able to reproduce an important portion of the total variance given by the sum of the k eigenvalues; more formally, we have

$$\text{Total Variance} = \text{tr}(\mathbf{R}) = \sum_{j=1}^{k} \lambda_j \qquad (3)$$

where tr(.) denotes the trace operator or, in our case, the result of the sum of the diagonal elements of the correlation matrix. For the considered models we have

$$\frac{(\lambda_1+\lambda_2)}{\sum_{j=1}^{k} \lambda_j} > 0.9 \quad (4)$$

and formula (4) is known as "Variance explained criteria". Hence, the first two Principal Components are able to reproduce the almost totality of the Total Variance and to synthesize a relevant part of the total information contained in the data; consequently, we decide to choose only the first two principle components ($\mathbf{F_1}$ and $\mathbf{F_2}$).

4.5.2. Results and discussion of using PCA

The PCA technique is used to generate a set of independent and uncorrelated variables in the regressions able to explain economic growth, poverty reduction and environmental change. The variables used in the PCA are detailed in table below:

Table 11: Variables in logarithm form for PCA

LnGDP	GDP
LnGDPP	GDP per capita
LnDI	Domestic investment
LnGoEx	Government expenditure
LnAID	International aid
LnOPEN	Degree of openness
LnFDI1	Foreign direct investments
ASEAN	Dummy ASEAN
LnPOV	Poverty headcount ratio
LnED	Environmental degradation (Carbone dioxide per capita)
LnIND	Share of Industry on GDP
LnPOPD	Population Density

By using the PCA method, four main equations have been employed for the analysis, two equations are for economic growth analysis, and the last two equations are the impact of economic growth on poverty and environmental degradation, as detailed below in table 12

Table 12: PCA models with 2 components retained

Dependent Variables	Independent variables								
LnGDPP	LnDI	LnGoEx	LnAID	LnOPEN	LnFDI				**GDPP model 1**
LnGDPP	LnDI	LnGoEx	LnAID	LnOPEN	LnFDI	lnIND	ASEAN		**GDPP model 2**
LnPOV	LnDI	LnGoEx	LnAID	LnOPEN	LnFDI	lnIND	LnPOPD	ASEAN	**POV Model 3**
LnED	LnDI	LnGoEx	LnAID	LnOPEN	LnFDI	lnIND	LnPOPD	ASEAN	**ED Model 4**

The first model is used to identify the determinants of economic growth. LnGDPP is the function of LnDI, LnGoEx, LnAID, LnOPEN, and LnFDI.

The second model is the extension of the first one, by adding two more additional variables LnIND and ASEAN, so as to identify the impacts of these determinants on economic growth of Laos.

The third model is used to consider the impacts of economic growth on poverty, by employing the key determinants of economic growth in second model with an additional variable LnPOPD. This aims to identify the impacts of those determinants on poverty situation of Laos, where LnPOV is the function of LnDI, LnGoEx, LnAID, LnOPEN, LnFDI, LnIND, LnPOPD, and ASEAN.

The fourth model is used to identify the impacts of economic growth on environmental conditions, i.e. degradation (see 4.3.2). This aims to identify the impacts of those determinants on economic growth of Laos, even though they play a significant role in economic growth and may diminish poverty, but they may also produce negative impacts on environmental conditions. For this model, LnED is the function of LnDI, LnGoEx, LnAID, LnOPEN, LnFDI, LnIND, LnPOPD, and ASEAN.

4.5.2.1. Results and discussion of GDPP model 1

Table 13: Mean and standard deviation of the basic variables

	Mean	Standard deviation
LnDI	19.634	1.133
LnGoEx	18.991	0.544
LnAID	18.873	0.914
LnOPEN	3.722	0.760
LnFDI	12.969	7.749

It can be seen from the statistical mean of the basic variables that the standard error is sufficiently low if compared with the mean value. Only foreign direct investment has a high SE,

given the fact that the variables change from a zero value between 1980 and 1987 to a higher one in the following years.

Table 14: Correlations Matrix of Predictors for model 1

		Correlation matrix			
R	LnDI	LnGoEx	LnAID	LnOPEN	LnFDI
LnDI	1	**0.8955**	**0.8752**	**0.8338**	**0.7762**
lnGoEx	**0.8955**	1	**0.8715**	**0.7874**	**0.8002**
LnAID	**0.8752**	**0.8715**	1	**0.9516**	**0.9539**
LnOPEN	**0.8338**	**0.7874**	**0.9516**	1	**0.9601**
LnFDI	**0.7762**	**0.8002**	**0.9539**	**0.9601**	1

Notice: In bold, significant values (except diagonal) at the level of significance alpha=0,050 (two-tailed test)

Table (14) above shows that the correlation matrix of these explanatory variables is strongly correlated with other (between 70 and 100 percent) and these data show the problems of multicollinearity. Therefore, we cannot measure directly their impacts on economic growth. This suggests to use the principal component analysis (PCA) to generate new explanatory variables. The results of PCA are detailed in table 5 below:

Table 15: Eigenvalues and Eigenvectors for model 1

Eigenvalues:					
	F_1	F_2	F_3	F_4	F_5
Eigenvalue	**4.485**	**0.340**	0.120	0.034	0.022
% variance	89.697	6.790	2.403	0.676	0.433
Cumulative %	89.697	**96.487**	98.891	99.567	100.000
Eigenvectors:					
	F_1	F_2	F_3	F_4	F_5
LnDI	0.436	**0.524**	0.651	0.024	0.333
LnGoEx	0.434	**0.556**	-0.640	-0.250	-0.173
LnAID	0.464	-0.156	-0.049	0.808	-0.324

LnOPEN	0.453	**-0.402**	0.302	-0.527	-0.515
LnFDI	0.449	**-0.480**	-0.268	-0.086	0.699

Source: Author analysis

The first and second components can explain more than 96% of the total variance of the basic variables, so only the first two components are retained in the analysis.

The 1st Principal component (PC) is an average of all economic drivers, where both internal (such as domestic investment and government expenditure) and external (openness of the economy, international aid, foreign direct investment) factors are positive. All weights are positive and of almost the same magnitude (0.4/0.5). This implies that the first 1st PC strongly explains the positive role on growth of the original variables; growth increases with AID, OPEN, FDI, DI and GoEx, respectively.

The 2nd Principal Component is an average of the basic drivers where the internal ones have positive coefficients (Domestic investment and Government expenditure) while the external ones have negative coefficients. The 2nd PC increases with increasing of GoEx and DI because they are strong correlated with other, 0.556 and 0.524, followed by the decreasing of FDI and openness of the economy, respectively.

Table 16: Summary the dependent and independent variables for model 1

Variable	Total no. of values	No. of values used	No. of values ignored	Sum of weights	Mean	Standard deviation
LnGDPP	31	31	0	31	5.855	0.466

Summary for the quantitative variables:		
Variable	Mean	Standard Deviation Variance
F_1	0.000	4.485
F_2	0.000	0.340

Given the relation between principal components F_1 and F_2 and the basic variables, the PC series have been calculated for both F_1 and F_2 using, as weights, the eigenvector values which

multiply the standardized values of the base variables. Synthetic results are reported in table 16. We have then regressed the variable LnGDPP against the comprised scores of the two components retained. Results are summarized in table 17.

Table 17: Result of model 1

Goodness of fit coefficients:	
R (coefficient of correlation)	0.839
R² (coefficient of determination)	**0.704**
R²adj. (adjusted coefficient of determination)	0.683
SSR	1.928

Evaluating the information brought by the variables (H0 = Y=Moy(Y)):					
Source	DF	Sum of squares	Mean square	Fisher's F	Pr > F
Model	2	4.596	2.298	33.367	< 0,0001
Residuals	28	1.928	**0.069**		
Total	30	6.524			

Model parameters:						
Parameter	Value	Standard deviation	Student's t	Pr > t	Lower bound 95 %	Upper bound 95 %
Intercept	5.855	0.047	124.212	< 0.0001	5.758	5.951
F_1	**0.053**	0.011	5.000	< 0.0001	0.031	0.074
F_2	**0.897**	0.139	6.460	< 0.0001	0.612	1.181

The result of the above table shows that the coefficient value of both F_1 and F_2 are positive and statistically significant, the P-values are smaller than 5 percent, which are good regression results. So the estimation of the model is the following:

$$LnGDPP = 5.855 + 0.053*F_1 + 0.897*F_2$$

In economic terms, this would imply that the recent economic growth for Laos has been favored by internal and external factors. However, the possible contribution of external factors seems not have been fully exploited: the weights (eigenvector coefficient) of 2nd Principal Component for these variables are negative.

The effectiveness of AID, which is considered to be an important determinant supporting economic growth of Laos, depends on how the aid is allocated, if a good system for monitoring and evaluation exist, and also in which sector is mostly aid allocated. To ensure that aid is effectively allocated with accountability and transparency, the Government and donors should develop a clear methodology and policy for aid allocation, which involves a good monitoring and evaluation system. This is important to avoid issues of uselessness and corruption.

From the early 1990s, the Government of Laos has paid more attention to improving its business environment to make the country more investor-friendly. An investment law policy and regulations have been adopted and developed. The first investment law policy was introduced in 1988. The first revision of this law was made in 1994, followed by the second revision in 2004 and another in 2009.

The increase in the FDI inflow has been widely considered to be a potential contributor to growth and economic development. FDI, which is an external factor, also promotes economic growth. However, it can be a somewhat detached from the national growth if the foreign investment is mainly related to the availability of natural resources, such as minerals, hydropower, and timber. These may produce a positive impact on average growth but only a few people benefit from those investments compared with total population.

OPEN is considered, in the literature, a strong booster of the possibilities of growth. In Laos this opportunity is not perhaps fully exploited, because Laos is a very small market with small population compared with ASEAN members and other countries. It would be better if the Government could reconsider allocating the potential resources of the country for economic development in a sustainable way.

On the other side, the two internal factors DI and GoEx contribute positively in both Principle Components (F_1 and F_2). This implies that their contribution has been very important in the first regime change, but perhaps could be stopped in the long run by a growing public expenditure and its possible consequences. The positive and statistically significant weight of domestic investment in both components confirms a positive correlation between domestic investment and economic growth.

The domestic investment involves public (excluding aid) but in particular private investment, which progressed greatly after the introduction of the new investment policy and joining the ASEAN. The government expenditure includes spending on the national infrastructure (roads, bridges, electricity, information networks, etc.) and social services (education, health, water supply, etc.). These factors are considered to be important demand factors and efficiency boosters that foster economic growth of Laos.

4.5.2.2. Results and discussion of GDPP model 2

The second model is the extension of the first one, by adding two more additional variables LnIND and ASEAN (table 18). The standard error is still sufficiently low if compared with the mean value, except the value of ASEAN and LnFDI.

Table 18: Mean and standard deviation of the basic variables model 2

	Mean	Standard deviation
LnDI	19.634	1.133
LnGoEx	18.991	0.544
LnAID	18.873	0.914
LnOPEN	3.722	0.760
LnFDI	12.969	7.749
LnIND	2.840	0.354
ASEAN	0.452	0.498

Table 19: Correlation matrix model 2

	LnDI	LnGoEx	LnAID	LnOPEN	LnFDI	**LnIND**	**ASEAN**
LnDI	1	**0.896**	**0.875**	**0.834**	**0.776**	**0.904**	**0.897**
LnGoEx	**0.896**	1	**0.871**	**0.787**	**0.800**	**0.919**	**0.675**
LnAID	**0.875**	**0.871**	1	**0.952**	**0.954**	**0.935**	**0.729**
LnOPEN	**0.834**	**0.787**	**0.952**	1	**0.960**	**0.856**	**0.690**
LnFDI	**0.776**	**0.800**	**0.954**	**0.960**	1	**0.851**	**0.595**
LnIND	**0.904**	**0.919**	**0.935**	**0.856**	**0.851**	1	**0.755**
ASEAN	**0.897**	**0.675**	**0.729**	**0.690**	**0.595**	**0.755**	1

In bold, significant values (except diagonal) at the level of significance alpha=0,050 (two-tailed test)

The above table (19) has the same problem as mentioned in model 1. The correlation matrix shows that these explanatory variables are strongly correlated and show the same problems of multicollinearity as model 1. To handle this problem, the approach of principal components analysis is used.

Table 20: Eigenvalues and Eigenvectors model 2

Eigenvalues:							
	F_1	F_2	F_3	F_4	F_5	F_6	F_7
Eigenvalue	**6.019**	**0.549**	0.280	0.079	0.035	0.019	0.018
% variance	85.984	7.844	4.006	1.135	0.501	0.278	0.251
Cumulative %	85.984	**93.828**	97.834	98.969	99.471	99.749	100.000

The above result shows that 93.828 percent of the variation is explained by the first two eigenvalues together.

Eigenvectors:							
	F_1	F_2	F_3	F_4	F_5	F_6	F_7
LnDI	**0.388**	0.355	0.079	-0.385	0.342	0.264	0.618
LnGoEx	0.375	0.009	0.704	-0.382	-0.229	-0.188	-0.360
LnAID	**0.398**	-0.213	-0.093	0.254	-0.329	-0.614	0.487
LnOPEN	0.383	-0.306	-0.407	-0.245	0.571	-0.279	-0.362
LnFDI	0.374	-0.480	-0.233	-0.101	-0.429	0.617	-0.019
LnIND	**0.391**	0.010	0.314	0.751	0.336	0.242	-0.114
ASEAN	0.333	**0.710**	-0.413	0.088	-0.315	-0.021	-0.326

Table 20 indicates that the 1st Principal component is again an average of all economic drivers, where both internal (such as domestic investment, government expenditure and industry) and external (openness of the economy, international aid, foreign direct investment, and ASEAN) factors are positive and of almost the same magnitude (0.333/0.398), but smaller than those in model 1.

On the other hand, the 2nd Principal Component is an average of the basic drivers where the internal ones have positive coefficients (Domestic investment, Government expenditure, and industry) while the external ones (excepted ASEAN) have negative coefficients as in the previous model. ASEAN is strongly and positively correlated also to this second component.

Using the same method as before, we calculated the series of the two components (table 20), which have been used as repressor for the variable LnGDPP. Table 21 reports the results of the regression.

Table 21: Summary the dependent and independent variables for model 2

Summary for the dependent variable:						
Variable	Total no. of values	No. of values used	No. of values ignored	Sum of weights	Mean	Standard deviation
LnGDPP	31	31	0	31	5.855	0.466

Summary for the quantitative variables:		
Variable	Mean	Standard Deviation Variance
F_1	0.000	6.019
F_2	0.000	0.549

The value of R^2 is in this second specification of the model lower than before (0.424) but both coefficients maintain a sufficiently high t-student statistic.

Table 22: Result of model 2

Goodness of fit coefficients:	
R (coefficient of correlation)	0.651

R² (coefficient of determination)	**0.424**
R²adj. (adjusted coefficient of determination)	0.383
SSR	0.383

It is noticeable that the value of R² (0.424) of model 2 is smaller than of model 1 (0.704), this would imply that model 1 shows a stronger coefficient of determination.

Evaluating the information brought by the variables (H0 = Y=Moy(Y)):

Source	DF	Sum of squares	Mean square	Fisher's F	Pr > F
Model	2	2.767	1.384	10.313	0.000
Residuals	28	3.757	**0.134**		
Total	30	6.524			

Model parameters:

Parameter	Value	Standard deviation	Student's t	Pr > t	Lower bound 95 %	Upper bound 95 %
Intercept	5.855	0.066	88.990	< 0,0001	5.720	5.989
F_1	**0.043**	0.011	3.892	0.001	0.020	0.065
F_2	**0.280**	0.120	2.340	0.027	0.035	0.526

In synthesis the estimation of the model is now:

$$LnGDPP = 5.855 + 0.04254*F_1 + 0.280*F_2$$

By adding two more additional variables (LnIND and ASEAN) in PCA, the results also shows that the coefficient value of both F_1 and F_2 are positive and statistically significant at 5 percent. In economic terms, by following the same interpretation as in previous specification, the recent economic growth for Laos has been favored by internal and external factors. The new internal variable, industrial extension (LnIND), is considered to be a key factor fostering economic growth of Laos. The impact of the industrial component on GDP is related to the development and extension of factories, manufacturing plants and industries. It is assumed that

these generate job opportunities for Laos's population and increase the national productivity, leading to stronger economic growth.

Also ASEAN partnership contributes positively to both Principal Components (F_1 and F_2), and this implies that its contribution has been very important in the economic growth of Laos. This is one of the most important events that plays a critical role in economic growth and it is a good opportunity to promote the position of Laos in the international community.

By combining the results of model 1 and model 2, this analysis concludes that the current economic growth for Laos has been favored by both internal (domestic investment, government expenditure, and industrial extension) and external (openness of the economy, international aid, foreign direct investment, and participating ASEAN) factors because their contributions are positive on the first principal component (F_1). While the negative weight of FDI, AID, and OPEN contribute to the second principal component (F_2), permits to affirm that these drivers must be better used and made more effective through appropriate policies, because – as in literature is reported – in the long run their contribution is fundamental. In the long-run, the Government cannot focus on only the optimistic outcomes of domestic investment, government expenditure, and industrial extension policy. So, if Laos wants to grow more strongly, Laos has to exploit more effectively the opportunities provided by foreign direct investment, by the openness of the system to the globalization and international trade. In addition, the allocation of aid needs to be better managed in the different sectors of development.

4.5.2.3. Results and discussion of POV model 3

The relationship between growth and poverty reduction has been recognized by the development research literature in many countries. However, analyzing the direct correlation between these two variables is not enough. Model 3 aims to examine the impacts of economic

growth on poverty, by employing the key determinants of economic growth in model 2 with an additional variable LnPOPD that is the population density (in log).

Table 23: Mean standard deviation of the basic variables of model 3

	Mean	Standard deviation
LnDI	19.634	1.133
LnGoEx	18.991	0.544
LnAID	18.873	0.914
LnOPEN	3.722	0.760
LnFDI	12.969	7.749
LnIND	2.840	0.354
LnPOPD	2.975	0.203
ASEAN	0.452	0.498

Table 24: Correlation matrix for model 3

Correlation matrix:								
	LnDI	LnGoEx	LnAID	LnOPEN	LnFDI	LnIND	LnPOPD	ASEAN
LnDI	1	**0.896**	**0.875**	**0.834**	**0.776**	**0.904**	**0.969**	**0.897**
LnGoEx	**0.896**	1	**0.871**	**0.787**	**0.800**	**0.919**	**0.909**	**0.675**
LnAID	**0.875**	**0.871**	1	**0.952**	**0.954**	**0.935**	**0.952**	**0.729**
LnOPEN	**0.834**	**0.787**	**0.952**	1	**0.960**	**0.856**	**0.899**	**0.690**
LnFDI	**0.776**	**0.800**	**0.954**	**0.960**	1	**0.851**	**0.869**	**0.595**
LnIND	**0.904**	**0.919**	**0.935**	**0.856**	**0.851**	1	**0.954**	**0.755**
LnPOPD	**0.969**	**0.909**	**0.952**	**0.899**	**0.869**	**0.954**	1	**0.849**
ASEAN	**0.897**	**0.675**	**0.729**	**0.690**	**0.595**	**0.755**	**0.849**	1

In bold, significant values (except diagonal) at the level of significance alpha=0,050 (two-tailed test)

By adding LnPOPD in model 3, the strong correlation among independent variables confirms that those variables have huge problems of multicollinearity.

The results of the model are not very different from the result of model 1 and model 2, where the statistical mean of the basic regressions, the standard error is sufficiently low if compared with the mean value. Only ASEAN and FDI are higher than other.

Table 25: Eigenvalue and Eigenvectors for model 3

Eigenvalues:								
	F_1	F_2	F_3	F_4	F_5	F_6	F_7	F_8
Eigenvalue	**6.996**	**0.557**	0.281	0.080	0.035	0.024	0.019	0.008
% variance	87.455	6.960	3.510	0.996	0.442	0.297	0.243	0.096
Cumulative %	87.455	**94.415**	97.925	98.921	99.363	99.661	99.904	100.000

The above result shows that 94.415 percent of the variation is explained by the first two eigenvalues together. So, we retain only F_1 and F_2 as model 1 and model 2.

Eigenvectors:								
	F_1	F_2	F_3	F_4	F_5	F_6	F_7	F_8
LnDI	0.361	**0.335**	0.071	-0.390	0.354	0.342	-0.257	-0.540
LnGoEx	0.347	-0.008	0.698	-0.395	-0.265	-0.339	0.183	0.129
LnAID	0.368	-0.230	-0.096	0.249	-0.316	0.332	0.620	-0.382
LnOPEN	0.353	**-0.325**	-0.409	-0.251	0.535	-0.402	0.274	0.128
LnFDI	0.345	**-0.496**	-0.234	-0.106	-0.434	0.006	-0.617	-0.017
LnIND	0.363	-0.007	0.309	0.740	0.297	-0.257	-0.245	-0.106
LnPOPD	0.374	0.110	0.031	0.055	0.119	0.562	0.003	0.717
ASEAN	0.312	**0.687**	-0.423	0.072	-0.358	-0.338	0.017	0.069

The 1st Principal component shows that both internal (domestic investment, government expenditure, industry, and population density) and external (openness of the economy, international aid, foreign direct investment, and ASEAN) factors are positive. All weights are positive and of almost the same magnitude (0.312/0.374).

On the other hand, the values of the eigenvector for the second components, as in the other models presented show contrasting values.

As usual external drivers show a negative value (AID, OPEN, FDI), but also government expenditure (albeit very weakly the share of industry in economic activities (IND) have a positive value.

Table 26: Summary the dependent and independent variables for model 3

Summary for the dependent variable:						
Variable	Total no. of values	No. of values used	No. of values ignored	Sum of weights	Mean	Standard deviation
LnPOV	31	31	0	31	3.711	0.261

Summary for the quantitative variables:		
Variable	Mean	Standard Deviation Variance
F_1	0.000	6.996
F_2	0.000	0.557

Table 27: Result and discussion for model 3

Goodness of fit coefficients:	
R (coefficient of correlation)	0.991
R² (coefficient of determination)	**0.982**
R²adj. (adjusted coefficient of determination)	0.981
SSR	0.036

Evaluating the information brought by the variables (H0 = Y=Moy(Y)):					
Source	DF	Sum of squares	Mean square	Fisher's F	Pr > F
Model	2	2.014	1.007	782.800	< 0,0001
Residuals	28	0.036	**0.001**		
Total	30	2.050			

Model parameters:						
Parameter	Value	Standard deviation	Student's t	Pr > t	Lower bound 95 %	Upper bound 95 %
Intercept	3.711	0.006	575.989	< 0,0001	3.697	3.724
F_1	**-0.036**	0.001	-38.691	< 0,0001	-0.038	-0.034
F_2	**-0.096**	0.012	-8.284	< 0,0001	-0.120	-0.072

The estimation of the model is:

$$\text{LnPOV} = 3.711 - 0.036 * F_1 - 0.096 * F_2$$

The above result shows that the coefficient of determination, R^2, is high (98.2 percent) that it can be explained by model 3. A high rate of economic growth is one of the major goals of economic dimensions of Laos. It is questionable whether the growth is distributed throughout the entire population, particularly, the poor population who have limited opportunity to participate in any activities of economic activities of the country. The result of model 3 shows that the coefficients of both principal components (F_1 and F_2) are negative and statistically significant. Therefore, poverty has been reduced by all of these determinants of internal and external factors. In particular, internal domestic investment has helped to reduce poverty in Laos.

An increase in domestic investment is also associated with an opportunity for local people to run businesses in Laos that create employment opportunities for the population in the country. While an increase in government expenditure on social and rural development would increase the opportunity of poor to access social services such education, health, and other benefits. Most poor people in rural areas need to achieve at least a basic level of subsistence to survive. The negative coefficient of government expenditure in F_2 is very small (-0.008) compared with that of F_1 (0.347). In total, government expenditure plays a positive role in diminishing poverty, but it is a small contribution compared with domestic investment. Perhaps, this government expenditure might encompass some activities having less impact on poverty. It is suggested that government expenditure be more focussed on activities which stimulate activities that directly involve poor populations.

In considering the impact of industry on poverty, the coefficient value of industry is positive in the first principal component and becomes negative in second one. This would imply that its contribution has been important but could have been imitated by the fact that industrial

expansion is concentrated only in urban areas, with the advanced industrial technology where the poor and unskilled workers are unable to work.

The pattern of industrialization, however, impacts remarkably on how the poor benefit from growth (Veloso et al, 2001). In addition, the location of industrial facilities has an impact on overall poverty reduction and inequality. As industrial extension is often concentrated in urban areas because of ready access to skilled labour force, better infrastructure, larger markets and technological spillovers (Lanjouw and Lanjouw, 2001), it is possible that industrialization may increase inequality between urban and rural areas, and it may benefit skilled people only.

In considering the relationship between population density growth and poverty reduction, it is hard to conclude that the increase in population density is good for economic growth or it reduces poverty, because of its positive coefficient value in principal components. It is more likely that population density growth is caused by economic growth (and its determinants, note that the circulation value between LnPOPD and the other variables is extremely high).

The positive coefficients of ASEAN in both PCs would confirm that being a member of ASEAN has a positive impact on economic growth and benefit to the poor. In other words, membership of ASEAN offers an opportunity for Laos to access new regional and international markets, leading to a high economic growth and poverty reduction. In addition, poverty reduction is a priority of ASEAN; therefore, members have invested more funds into poverty eradication, which has led to dramatic decreases in the proportion of poor people in many countries in ASEAN including Laos.

When considering the impacts of external factors on poverty, AID has been considered to play a vital role in economic dimensions of Laos, particularly for socio-economic development, rural development, and poverty alleviation. To ensure that AID is distributed to the poor, the

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Government and donors should target the poor communities in rural areas, particularly ethnic minority tribes, poor women, and other underprivileged groups, through the community participation concept, for example, in the implementation of PRF (see appendix 7). In the longer term, instead of only relying on foreign aid, the government has to consider the potential for internal growth in Laos, since this country has a variety of natural resources and historical aspects that could assist economic performance process.

Another external factor, FDI, is also considered to play a crucial role in economic growth and hence poverty reduction. However, the previous foreign investment in Laos have been mostly concentrated on big projects related to the mining and hydropower sectors. This might have created fewer spillover effects to all the poor across the country and may not be able to prove that it diminishes poverty in Laos. With respect to OPEN, it is still not clear whether an increase in OPEN degree leads to a reduction in poverty in Laos. It depends on the open door policy of the government that encourages and provides opportunities to the poor to become involved and benefit from the activities linked to international trade.

The external factors in the period of consideration produce impacts on economic growth and reduction of poverty which could be lower than expected, as showed by negative coefficient values in F_2. As previously explained (model 1 and model 2), the Government of Laos has to develop better policy for foreign investment, international trade as well as aid allocation in order to encourages economic growth and reduction of poverty.

In conclusion, to prove that economic growth is good for poverty reduction, we should consider income inequality, by using Gini index. If this index increases it would imply that the rich and powerful people get more advantage than the poor because those people have more opportunity to be involved in economic activities and running some businesses, particularly in

the big cities, while the poor people in rural areas have a very limited opportunity to do so. This is considered to be a main cause of income inequality in Laos. There are two ways the poor could become better off. Income could be redistributed from the rich to the poor, and the income of both the poor and the rich could rise with overall economic growth (Easterly, 2001).

4.5.2.4. Results and discussion of ED model 4

Model 4 shares the same independent variable as model 3, therefore, the interpretation for statistical description and matrix correlation are the same with model 3, as already detailed in previous section.

Table 28: Summary for the dependent and independent variables for model 4

Summary for the dependent variable:						
Variable	Total no. of values	No. of values used	No. of values ignored	Sum of weights	Mean	Standard deviation
LnED	31	31	0	31	4.661	0.703
Summary for the quantitative variables:						
Variable		Mean		Standard Deviation Variance		
F1		0.000		6.996		
F2		0.000		0.557		

Table 29: Result of model 4

Goodness of fit coefficients:	
R (coefficient of correlation)	0.988
R² (coefficient of determination)	**0.976**
R²adj. (adjusted coefficient of determination)	0.974
SSR	0.359

Evaluating the information brought by the variables (H0 = Y=Moy(Y)):					
				Fisher's	
Source	DF	Sum of squares	Mean square	F	Pr > F
Model	2	14.462	7.231	563.815	< 0,0001
Residuals	28	0.359	**0.013**		

		Standard	Student's		Lower	Upper
Total	30	14.821				

Model parameters:						
Parameter	Value	Standard deviation	Student's t	Pr > t	Lower bound 95 %	Upper bound 95 %
Intercept	4.661	0.020	229.176	< 0,0001	4.620	4.703
F₁	**0.0896**	0.003	30.811	< 0,0001	0.084	0.096
F₂	**0.488**	0.037	13.354	< 0,0001	0.413	0.563

The estimation of the model can be written as:

$$LnED = 4.661 + 0.0896*F_1 + 0.4878*F_2$$

Model 4 is used to examine the impacts of economic growth on environmental conditions, which is an important factor of sustainable development. Reaching a high rate of economic growth is assumed to damage environmental conditions, in sustainable development terms, the development of these two factors should be moved in the same direction both retaining economic growth and protection of environmental conditions.

The value of R^2 (97.6 percent) is high. The result shows the positive correlation of both principal components (F_1 and F_2), and those are statistically significant. It implies that the increase in economic activities leads to increase environmental damage. This is true for external factors such FDI, because many big projects of foreign investment are related to natural resources which lead to damage to the atmosphere and generate more air pollution in Laos.

Also the internal factor of domestic investment is assumed to produce a negative impact on environmental conditions of the country, particularly, by increasing the number of industrial investments (garment, brewery, cement …), and vehicle businesses which lead to a massive increase in the consumption of gasoline. These factors lead to an increase in the dusty atmosphere and air pollution. In brief, industrialization may dominate economic growth in earlier

stages of development and it may produce a negative impact on environmental conditions if it ignores the strong environmental protection law policy.

In terms of population density, the increase in population density correlates with the use of natural resources and waste production and is associated with environmental stresses like loss of biodiversity, air and water pollution and increased pressure on arable land. However, this result is not sufficient to prove that population density growth contributes to environmental degradation. Its effects may be determined by other factors of economic growth and development activities.

In terms of trade openness (OPEN), it is not clear whether OPEN causes environmental degradation. However, a higher degree of OPEN is related to a higher degree of trade competition in region, which leads to increase in the volume of productivity in the country, and this may produce negative impacts on environmental conditions. Trade openness is associated with export promotion, which leads to an increase in productivity in order to obtain a high level of growth and also increases the level of air pollution and the environmental in general.

Becoming ASEAN member is considered to be a key factor in fostering economic growth (since the coefficient values of ASEAN are positive in both F_1 and F_2). On the other hand, the high level of economic competition among ASEAN members encourages Laos to improve its economic performance, including increasing investment, trade cooperation, and improving productivity. These factors are related to the environmental quality and natural resource circumstances; for example, the huge investments in this country are mainly related to hydropower generation and particularly mineral exploration. It can be assumed that they produce a very strong impact on the environmental system. Furthermore, it is questionable whether mineral exploration can be sustained in the future.

In conclusion from the above analysis the (4 Models), this research confirms the negative correlation between the determinants of economic growth and poverty and the positive correlation with a variable of environmental degradation. This research supports continuing the adjustment of domestic activity investment, government expenditure, improving trade openness system, foreign direct investment, aid allocation, ASEAN, and so on. These factors can help the country to grow and poverty to diminish but we have also to pay attention to their impacts on the environment. Sustainable development would achieve its goal only if these internal and external factors contribute to economic growth, where this growth is distributed across the entire population, together with environmental protection conditions.

CHAPTER 5: THE INTEGRATION OF KEY FACTORS

Sustainable development is a concept which needs the creation of a working definition for specific discussions on its implementation. The integration of the economic drivers, social development, and environmental components suggests the involvement of virtually all the traditional sectors of the economy and government activity. This chapter presents a predictable road map of sustainable development of Laos, and it also proposes the definition of sustainable development and its determinants.

5.1. Road map of sustainable development

The development and implementation of sustainable development concepts need to take into account temporal, governance and feedback mechanisms (Cheigh et al, 2004). Sustainable development requires the construction of interdisciplinary models for evaluating and quantifying the effects of ongoing economic policies on the delicate interplay between living populations, natural resources, environment, and economic development (Nihoul, 1998). Therefore, it is important to integrate and reconcile the economic, social and environmental factors within a holistic and balanced sustainable development framework.

This integration implies the involvement of virtually all the traditional sectors of the economy and government activity. To ensure that these indicators have been developed and sustained consistently, the relevant institutions or organizations, particularly from government sectors, should take up the mechanisms for national strategies to achieve sustainable development. The fundamental approach to sustainable development should be kept in mind in developing, examining and using indicators.

This thesis verifies that sustainable development is the strategy to achieve high economic growth, under the condition that growth is distributed to all the population, through poverty reduction, minimizing inequality in society, and maintaining a good condition of the environmental conditions and natural resources. The road map for sustainable development of Laos is proposed in Diagram 2 below:

Diagram 2: Road map for sustainable development in Laos
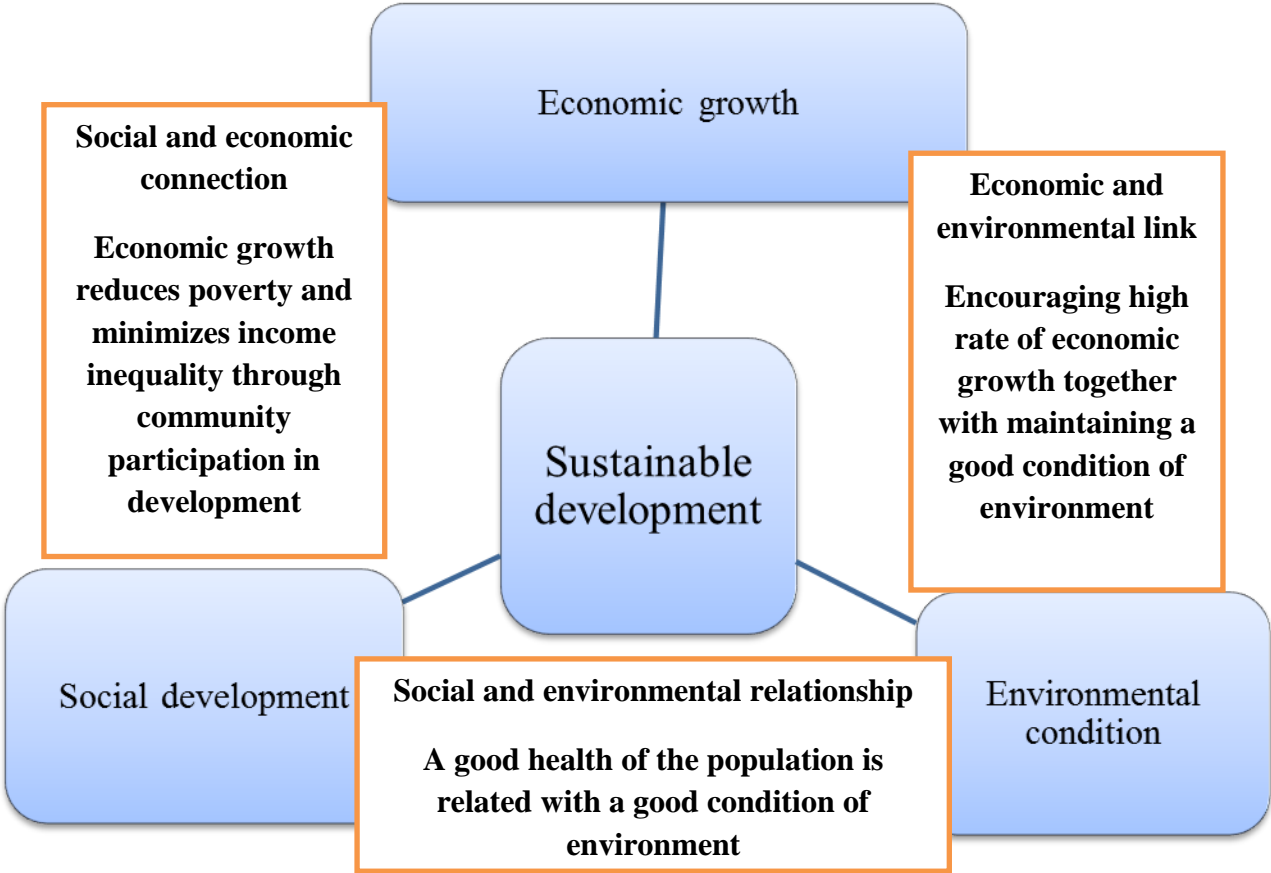
Successful implementation of sustainable development planning requires consensus and the ability to provide a compelling argument to change traditional development methods for more sustainably focused change (Beatley and Manning 1997; McDonough and Braungart 1998). Diagram 2 details and specifies three key factors of sustainable development in Laos:

economic, social, and environmental factors. The integration of these three factors is identified as the key to reach the sustainable development perspectives. The basic definition of these three factors can be explained below:

- The economic factor relates with two key elements including the capital efficiency and growth enhancement.

- Social factor includes different dimensions, for example: human rights, community development, poverty eradication, inequality minimization, gender promotion, etc.

- Environmental factor regards the environmental and natural resource protection, such as clear air, clean water, reforestation, and emissions abatement. It is important to analyze sustainable development in an innovative way, because this implies how society should be organized, not simply how environmental protection should be adapted or how well it can be improved.

5.2. The integration between economic growth and social development

The integration of social development and economic growth is related to many factors of economic and social development. The main issues are related to the achievement of social equity and welfare of population, including poverty eradication, income distribution, gender promotion, ethnic minority, health, literacy, and intergenerational opportunity (Hediger, 1999). This study highlights the integration of economic growth and poverty reduction, as well as the impact of growth on income distribution.

Economic growth itself is dominated by several determinants, such as an open-door policy leading to an increase in the trade volume, receiving several kinds of support from other countries in terms of foreign aid and assistance, an increase in the flows of foreign direct investments as well as domestic investments, while becoming a full member of ASEAN is important for Laos in respect of its economic progress in both regional and global procedures.

This analysis proves that these factors produce positive impacts on economic growth (Chapter 4). The result also confirms that economic growth benefits the poor, implying that a high rate of growth correlates with a higher rate of poverty reduction. On the other hand, economic growth increases inequality in early stage and then it decreases when a certain average income is reached. Our data confirm the inverted-U relationship of Kuznets' hypothesis between these two variables. As present, economic growth increases income inequality in Laos, meaning that even the growth reduces poverty, the rich people who benefit from economic growth more than the poor.

The final goal of national development of Laos is to succeed in poverty eradication and to minimize the level of income inequality. The positive impact of economic growth on social factors occurs only when the growth is distributed throughout the population, by minimizing the development gap between urban and rural areas and also between rich and poor. The integration of economic growth and poverty is considered to be a positive correlation only when the growth can reduce poverty and reduce inequality among the population.

One concept of social sustainable development is community participation. Active participation is a key to building an empowered community; it is a necessary factor of capacity building, which is the development of self-confidence, pride, initiative, creative, responsibility, and cooperation (Burkey, 1993 and Wattam, 1998). Particularly, for poverty reduction and rural development, the concept of participation in development has become an effective method for the economic development. Any efforts towards sustainable development must begin with local people knowledging, understanding, and participating in the creating of sustainable development goals (Manteaw, 2012). Under the implementation of PRF (appendix 7), sustainable development is related to the long-term effectiveness of sub-project operation. This largely

depends on the capacity of the local community to be aware of the operation and the maintenance of rural infrastructures following the completion of PRF. The implementation assessment of PRF confirms that community participation is directly related to capacity building for local people as regards strengthening the skills, competencies, abilities of people, and gender equality in targeted areas so they can overcome the causes of their exclusion and suffering (Phimphanthavong, 2012).

5.3. The integration between economic growth and environmental conditions

To encourage a high rate of economic growth in Laos, the Government has encouraged greater productivity and allocated a number of resources by shifting from an agricultural economy to an industrial and service economy, particularly since the year 2000; therefore, industrial extension is related to the increase in the proportion of air pollution, which is expected to become a serious issue for the living condition of the population. To ensure the long-term development perspective, the integration of growth and environment has to be categorized into its key components of development.

The integration between economic and environmental conditions is discussed in previous section (4.5), which confirms that at the present early stage, economic growth increases environmental degradation, but perhaps environmental degradation will decrease after reaching a certain level of average income per capita: Grossman and Krueger (1995) find no evidence that economic growth does unavoidable damage to the natural conditions. This relationship between economic growth and environmental quality, which resembles an inverted-U, has been found for many other environmental indices such as water quality and waste disposal. In brief, the integration of these factors is considered as a good situation only when economic growth

produces less impact on environmental conditions, particularly, resources are used to both maximize their productive value and environmental protection.

5.4. The integration of social and environmental factors

Their integration of social and environmental dimensions has become an important issue for national and also global development, this integration concerns the safety and health of population which is related with a good condition of environment; therefore, it is necessary to develop clear environmental regulations, together with environmental justice, which are essential to prevent global climate change, as well as to maintain the access to drinkable water and long-term natural resources.

Laos has maintained a high rate of economic growth after becoming a member of ASEAN, including the benefits of trade openness, investment, foreign support, investment, etc. Those factors of economic activities are directly related to natural resources, particularly the hydropower generation potential that is considered to play a crucial role in the socio-economic development of the country. On the other hand, Laos is still considered to be one of the least developed countries with a still high level of poverty[22]. More than 70 per cent of the total population live in rural areas and rely on natural resources for their survival.

The construction of many hydropower systems would produce negative impacts that could be substantial, including displacement of people, flooding of natural habitats, damage to fisheries, changes in the quantity, quality, and timing of water flows, as well as changes in the quantity and quality of sediment transported by the river. The people who rely on natural resources would directly receive negative impacts on their living conditions (UNDP, 2006). As a result, the poor may lose their chance to access those resources again and they would eventually

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[22] Source: http://www.cia.gov/cia/publications/factbook/

become poorer, leading to increase the development gap between rich and poor. It is important to consider the most appropriate policy to distribute the growth that would benefit the entire population. The rural or urban development concept must be based on the characteristics of each region, and emphasize development through community participation and building capacity of local people.

5.5. Sustainable development discussion

Opschoor and Reijnders (1991) propose a simple structure for the development of physical indicators of sustainable development. This model begins with the development of two types of environmental indicators: one describing the pressure being placed on the environment, and one describing the effects of this pressure. In reality, sustainable development has a core premise of satisfying basic human needs and can be viewed as a continuing dynamic and evolving process between people and ecosystems that can foster adaptive capabilities and enhance opportunities (Holden and Linnerud, 2007; Newman, 2007).

David (1996) states that sustainable development concept consists of two major aims: 1) the sustained economic growth that equitably meet human needs without extracting resource inputs or expelling wastes in excess of the environment's renew capacity and 2) the sustained human institutions that assure both security and opportunity for social, interaction and spiritual growth life.

This thesis suggests that SD helps to ensure social equity and economic progress while protecting natural resources and ecosystems. In brief, it draws together with the capacity carrying of natural systems with the social challenges faced by humanity. We assume that sustainable development is the function of economic, social, and environmental dimensions.

The integration of these three factors is important because all the activities aim at obtaining a balance of the economic growth process. Based on the theoretical description of each factor, we highlight their advantages and drawbacks, underlining the fact that no indicator is perfect and no one can give a comprehensive view of sustainable development; therefore, the analysis of various indicators is necessary to evaluate sustainable development with accuracy (Nourry, 2008).

➢ Economic dimension (ECD) relates with the measurement of economic sustainability, which occurs if the economic system can maintain stability and support the economic activities and needs of current and future generations in addition to withstanding the pressures and shocks emanating from other determinants (Clarke et al., 2002). Economic sustainability is used to identify several strategies which allocate available resources for the best advantage. Moreover, this idea also promotes the use of those resources in a way that are both efficient and responsible, and likely to provide long-term benefits. In most scenarios, the measurement of economic sustainability is shown in monetary terms; however, it is not always easy to identify the amount of return generated by the efficient use of those resources.

➢ Social dimension (SOD) relates with the measurement of social sustainability, which is concerned with maintaining social and human relationships in the face of external pressures; it is referred to socio-cultural sustainability as a concept which seeks to maintain the stability of social and cultural systems, including the reduction of destructive conflict (Munasinghe, 1993). Social sustainability is one of the aspects of sustainable development. This factor is used to determine the living conditions of people in society, including human rights, labor rights, and equality. Social sustainability includes several social resources that the future generations should have, at the same or greater access as the current generation. Social

resources include ideas as broad as other cultures and basic human rights. One important factor of social development is sustainable human development; this would include a poverty reduction program, gender balance promotion, community participation in development including ethnic minority involvement, and education accessibility for the whole population, while these factors are basic elements of social development in Laos.

➢ Environmental dimension (END) relates with the measurement of environmental sustainability, which is concerned with maintaining an ecological system that can support feasible communities. Environmental sustainability is one of the most important factors of sustainable development. The global environmental issues on climate change and the wider scope of sustainability had a growing impact over the last few decades on the social demand and the international political agenda (Kim and Brodhag, 2010). This factor contains the process of making decisions and implementing actions that should be involved with the method of protecting natural resources by emphasizing the preservation of the capacity of the environment to support human life at the current economic growth rate for future generations.

Environmental sustainability is the concept of making reliable decisions on economic activities that produce a lower impact on the environment. This concerns not only reducing the amount of waste or using less energy, but also developing processes to create sustained economic growth that benefits the population. Several economic activities, aimed at achieving a high level of growth, can potentially cause damage to all areas of the environment. In the case of Laos, some of the common environmental degradation concerns mainly include:

✓ Damaging rainforest and woodlands through logging and agricultural clearing;

- ✓ Polluting the atmosphere through fossil fuels, manufactures running, and big industrial construction; and

- ✓ Damaging agricultural and cultivated land through the use of unsustainable farming practices.

Based on the above definition, to achieve the goal of sustainable development in Laos, this thesis combines the results detailed in chapter 4, and then summaries the correlation of those factors below:

Table 30: The determinants of sustainable development

SD	ECD	SOD		END
		POV	GINI	
GDPP		-	+	-
OPEN	+/-	-/+		-/+
AID	+/-	-/+		-/+
FDI	+/-	+/-		-/+
DI	+	-		+/-
GoEx	+	-		+/-
ASEAN	+	-	+/-	-/+
IND	+/-	-/+		-
POPD	-/+	-/+		-

Notice: The symbol plus "+" or minus "-"represents the positive or negative correlation of key determinants and three key factors, economic, social, and environmental factors.

Table 30 presents the combination of three development functions, ECD, SOD, and END based on the model specifications and the empirical results detailed in chapter 4. Economic growth is function of trade openness, foreign aid, foreign direct investment, domestic investment, government expenditure, and the benefit from holding full membership of the ASEAN. To prove that those variables produce positive impacts on sustainable development, we have to consider their impacts on social aspects and environmental conditions.

Regarding social improvement, based on the poverty alleviation progress and income distribution, these determinants are used as a proxy for social improvement. The final aim of poverty reduction is to lower the proportion of the population living under the poverty line, together with minimizing the degree of income inequality in society. In brief, a higher level of poverty and inequality is considered to have a negative impact on sustainable development, which relates to the national expenditure known as social cost to eradicate or decrease those matters.

This study indicates that the recent economic growth of Laos reduces poverty; on the other hand, it increases the level of income inequality among individuals and groups within a society. This implies that gap between the rich and the poor is wider where the rich may achieve more opportunity than the poor, particularly the opportunities to obtain education, and also to access information, while many poor people are unable to do so. In brief, the income inequality varies between societies, historical periods, economic structures and systems (for example, socialism), and between individuals' abilities to create wealth (Kopczuk et al., 2010).

The environmental aspect considers both the air pollution condition as well as the natural condition (deforestation), to demonstrate that growth is worthy of sustainable development only when it produces fewer impacts on air pollution and natural resources. Meanwhile, the economic development of Laos is highly dependent on natural resources. It is questionable how those natural resources can be sustained for the next generation. Environmental degradation is explained by the increase in the proportion of air pollution, based on carbon dioxide emissions as well as deforestation. This is related to the national expenditure known as the environmental cost to resolve these problems, which has a negative impact on sustainable development.

Succeeding in achieving future economic growth and maintaining the health of the sustainable condition would not occur unless there are specific and deliberate policy interventions in all areas of economic development policies, environmental policies, macroeconomic policies, sectoral policies, legislative policies, trade policies, and international policies (Islam and Jolley, 1996).

This analysis supports the agreement that high growth does threaten the level of sustainability concerning both social and environmental factors. An additional solution to reduce the negative impact of growth on the environmental condition of Laos is to consider the potential resources that would be allocated to the economic development of Laos, since each part of this country (south, middle, and north) contains a variety of wonderful natural characteristics, such as waterfalls, islands, caves, green forestry, rivers, and lifestyles of people from different ethnic minorities; these factors would be able to be allocated to social economic development and ensure the effectiveness of sustainable development.

Based on the country's geography and those potential natural resources, sustainable tourism is one option that could play an important role in sustainable development. This tourism concept attempts to produce a low impact on the environment and local culture, while assisting in creating job opportunities for current and future local people. The final aim of sustainable tourism is to ensure that development carries a positive experience for local people (villagers or communities), tourism companies, and tourists themselves. This would benefit not only local people or companies, but also the entire population by increasing the national income.

CHAPTER 6: CONCLUSIONS AND POLICY IMPLICATIONS

6.1. Conclusions

The main purpose of this thesis is to identify the role of sustainable development, based on the integration of three factors, economic growth, social development, and environmental dimension. In reality, we cannot focus only one of those; therefore, it is important to integrate and reconcile the aspects of these factors within a holistic and equity sustainable development concept. The analysis attempts to determine the importance of sustainable development and aims to present some indicators and tools that would be used to facilitate a transition towards sustainability. Both the empirical and the theoretical description of each factor highlighted its advantages and drawbacks, underlining the fact that no indicator is absolutely perfect and no one can give a comprehensive view of sustainable development.

This thesis contributes to the on-going research issue about key determinants influencing sustainable development in developing countries. Firstly, it uses the first different of logarithm form to identify the determinants of economic growth, the impacts of growth on poverty and environmental conditions in Laos. However, using the multiple regressions, serious problems of multicollinearity were encountered and those results became less reliable. To handle the problem of multicollinearity and produce stable and meaningful estimates for regression coefficients, the Principal Components Analysis (PCA) is used for this research. Four main equations have been employed for the analysis. The first two equations are for economic growth analysis, and last two equations relate to the impact of economic growth (by employing the key determinants of economic growth) on poverty and environmental degradation.

The results show that the recent economic growth for Laos has been favored by internal (such as domestic investment, government expenditure and industry) and external (openness of

the economy, international aid, foreign direct investment, and ASEAN) factors. However, the possible contribution of external factors seem not have been fully exploited because the coefficient values of the second Principal Component are negative.

Trade openness is considered to be a key variable for economic growth in Laos. The changing of the economic system encouraged a high level of progress of economic performance in terms of international trade and cooperation. Moreover, becoming a member of the ASEAN enabled significant performance of progress in both foreign trade and economic growth. Foreign aid is considered to play an important role in the economic performance of Laos, since this country has faced difficulties with its trade deficit; therefore, foreign aid is considered to be an essential factor for the accomplishment of the Government's investment program in terms of infrastructure improvement and rural development.

FDI inflow has been widely considered to be a potential contributor to economic growth and economic development. However, it can be a somewhat detached from the national growth if the foreign investment is mainly related to the availability of natural resources, such as minerals, hydropower, and timber. These may produce a positive impact on average growth but only a few people benefit from those investments compared with total population.

The other internal factors, such as DI, GoEx and industry, show their positive impacts on economic performance and they are considered to improve the progress of economic activities and generate job opportunities for Laos's population and increase the overall national productivity, leading to a high rate of sustained growth.

Participating in ASEAN has proved to contribute positively to the economic growth of Laos. This is one of the most important events that has played a critical role in economic growth

and it is a good opportunity to promote the position of Laos in the international community; in this case, there will be a long-term effect on the direction of Laos's economic development

This thesis concludes that there are several variables, both internal and external factors, which have influenced current economic growth of Laos. In particular, the internal ones (domestic investment, government expenditure, and industry) show a strong correlation with economic growth, while participation in ASEAN also plays an important role in economic growth. The other external factors (FDI, AID and OPEN) show a weaker link to domestic growth of Laos (based on regression result). In the long run, to ensure the effectiveness of external factors on domestic growth, this research suggests exploiting more effectively the opportunities provided by foreign direct investment, through the openness of the system to the globalization and international trade, together with better management of aid allocation.

To examine the impacts of economic growth on poverty reduction, this research employs the key determinants of economic growth (GDPP Model 2) with an additional variable LnPOPD, The result confirms that those determinants not only encourage economic growth, but also diminish poverty, because the coefficients of both principal components (F1 and F2) are negative and statistically significant. The key determinants of economic growth include trade openness, foreign aid, foreign direct investment, domestic investment, government expenditure, and participation in ASEAN. These variables have been influencing economic growth and that has benefited the poor. However, to prove that economic growth is good for social development, it is necessary to consider income distribution. This is concerned with the provision of job opportunities for all and providing a framework for the population to be involved in socio-economic development, including the right to talk about these issues.

In brief, we can say that social equity is considered to be one of the principal values underlying sustainable development, with people and their quality of life as a central issue, because equity involves the degree of fairness and inclusiveness with which resources are distributed, opportunities afforded, and decisions made. It includes the provision of comparable opportunities for employment and social services, including education, health, and justice. Moreover, equity would be strengthened by enhancing pluralism and community participation, as well as by empowering disadvantaged groups defined by income, gender, ethnicity, and religion.

Lastly, we examined the relationship between economic growth and environmental conditions. Sustained growth is considered to be a key factor in achieving Laos's economic growth; however, it is important to identify the impacts of growth on environmental conditions, which is one factor to achieve the sustainable development goal. Using the same determinants of economic growth as well as poverty reduction, this research found that the increase in economic activities leads to increase environmental damage. Particularly, industrialization may dominate economic growth in earlier stages of development and it may produce a negative impact on environmental conditions if it ignores the strong environmental protection law policy.

The increase in population density correlates with the use of natural resources and waste production and is associated with environmental stresses such as loss of biodiversity, air and water pollution and increased pressure on arable land. However, this result is not sufficient to prove that population density growth contributes to environmental degradation or whether it increases poverty. Its effects may be determined by other factors of economic growth and development activities.

In order to reach the sustainable development goal, strong environmental and natural resource protection policies are suggested for the current and future development of Laos. Therefore, the policy makers of Laos should consider different approaches and strategies to find the resources with the most potential to be allocated to economic development, instead of carrying out unsustainable patterns of consumption and production, which are the major cause of the continued depletion of natural resources and deterioration of the environmental conditions.

Furthermore, we discussed environmental sustainability by considering the equity in the environmental sense, which has received more attention recently. There has been an increase in the proportion of environmental damage suffered by disadvantaged groups, particularly in rural areas, where most of the population relies on natural resources for survival. Therefore, poverty eradication efforts are being broadened to address the degraded environmental and social conditions facing the poor. In this case, the poor who rely on natural resources are often good environmental managers; so community participation in development is related to the capacity of local people to manage and allocate natural resources in sustained patterns.

In conclusion, based on the analysis of economic growth, poverty reduction, and environmental degradation, this thesis confirms the negative correlation between the determinants of economic growth and anti-poverty variables and environment dimensions. This research supports continuing the adjustment of domestic activity investment, government expenditure, improving trade openness system, foreign direct investment, aid allocation, ASEAN, and so on. These factors can help the country to grow and poverty to diminish but we have also to pay attention to their impacts on the environment. Sustainable development would achieve its goal only if these internal and external factors contribute to economic growth, where

this growth is distributed across the entire population, together with environmental protection conditions.

On the other hand, sustainable conditions would not be achieved unless there are specific and deliberate policy interventions in all areas of socio-economic development policies as well as the environmental protection policies. It concerns the involvement of virtually all traditional sectors, including economic planning, education and health improvement, sanitation system extension, poverty reduction strategies, social equality promotion (including gender and ethnic minority), and the environmental and natural resource protection. Sustainable development is in fact based on the integration of these factors in decision and policy making at all levels.

6.2. Policy implications

The current economic growth of Laos has been influenced by both internal and external factors, such as foreign aid, foreign direct investment, trade openness system, domestic investment, government expenditure, industrial extension, participating ASEAN and so on. However, the high rate of economic growth is related to a high rate of natural resources consumption and increased environmental degradation. Moreover, it also increases the level of social inequality, while poverty remains high compared with other neighboring countries. Based on these problems, this research provides some reasonable suggestions for policy makers to guarantee the effectiveness of sustainable development.

One suggestion for the trade openness and trade cooperation is to improve the international trade policies with trade partners. Trade performance can be improved by means of a comprehensive development of the regional transportation system, especially with China, Thailand and Vietnam and other countries.

For FDI, it suggests the promotion of diversity of investment in other sectors that would provide job opportunities to the whole population in urban and rural areas through the spillover effects and less on activities that are natural resources based, such as manufacturing, handicraft, waving, agricultural production, etc. Moreover, the Government still continues to develop and improve policies that attract more stable inflows of FDI, together with promotion of private domestic investment.

To avoid risky aid distribution and corruption in foreign aid allocation, aid donors should develop good strategies and principles for aid allocation, which involve a good monitoring and evaluation system that could be used to evaluate the effectiveness of aid allocation. Although foreign aid plays an important role for social development, in the long term, instead of relying on foreign aid the Government should consider the potential of natural resources (of the country) and improved agricultural techniques that would allow for economic development under sustainable condition.

The rapid increase in the number of factories/industries and vehicles has led to a massive increase in the consumption of gasoline, which is causing an increase in air pollution. These factors are considered to be a serious problem for future development and also sustainable development concept. It suggests developing a strong environmental protection policy for industrialization, together with issuing a strict policy for vehicle use (personal cars and other vehicles), by encouraging people to use public transportation and vehicles that do not rely on gasoline. In this case, this thesis suggests developing and improving a good system for public transportation in the big cities with special track for pedestrians and cyclists. In the long term, planning for the use of light rail and electric trains should be undertaken.

Regarding the suggestion for natural resource protection, which is a main resource for the current economic development of Laos, it will be necessary to have a good policy for natural and environmental protection. Large projects for hydropower construction and mineral projects should have acceptable environmental impact studies from environmental specialists to confirm that those projects will benefit the entire population and produce few negative impacts on the environmental and natural conditions in both current and long terms.

Participation in ASEAN has the potential for significant growth. ASEAN has signed a declaration to integrate national economies and construct an economic and political union modeled on that of the European Union, by 2015. This suggests that the Government of Laos has to pay attention to human capital promotion and investment. To avoid the development gap among member states, it is necessary to have qualified staff who can work both at national and international integration. Therefore, the quality of human capital is a significant factor in determining whether Laos will achieve current and long term of sustainable development goals.

Natural resource scarcity and environmental degradation are major concerns for the whole ASEAN region; therefore, the environmental and natural protection should be a priority for all members. This suggests developing a concrete policy for environment protection based on the real characteristic of each member.

Additional suggestions for sustainable development

One of the most important strategies is to consider the geography of the country. Laos is a small land-locked country that comprises a variety of characteristics, ethnic minority groups and languages, traditional beliefs, cultures, and natural resources in each part of the country (southern, central, and northern parts). There are many factors of social characteristics and natural resources that could be allocated to economic development. Laos is considered to be a

land of discovery, which contains many historical sites (ancient temples, Buddhist history, old historical buildings, etc.), wonderful views of natural resources (caves, waterfalls, islands, plain of jars[23], etc.), traditional cultures, and lifestyles (clothing, traditional festivals and beliefs, people are gentle polite nature with their charming hospitality, etc.), and Laos still retains several biological features that include the genus and species of plant and animal life, their preferred growing or breeding habits, and their connection to one another in the environment. These potential resources remain in good condition in many parts of Laos.

This would suggest that sustainable tourism development must be considered as an extremely appropriate strategy for the current economic development of Laos. This concept should attempt to have as low an impact on the environment and local culture as possible (maintaining a good traditional lifestyle, clothing, and a good condition of historical aspects), while helping to generate job opportunities for local people. This is expected to bring a positive experience for local people, tourism companies, and the tourists themselves.

To encourage strong development in the tourism sector, this work suggests improving the information system, through different media, including newspapers, magazines, and the internet, and translating information into different languages, such as Lao, Thai, English, French, Chinese, Vietnamese, and Japanese. Moreover, human resource development for the tourism sector is very important. In particular, the information providers and tourism service sector should obtain specific knowledge on how to provide the best service to tourists and understand different languages. The last suggestion for tourism promotion concerns the tourist protection law. It is essential to protect and provide a highly satisfactory service to all tourists, both domestic and foreign.

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[23] Detail of plain of Jars in Laos:
https://www.google.it/search?q=Plain+of+Jars+in+Laos&tbm=isch&tbo=u&source=univ&sa=X&ei=X9t8Ur3RCMuv4QTFkoDAAg&ved=0CDMQsAQ&biw=1366&bih=577

An important issue regards the "slash and burn" shifting cultivation, which remains widespread in remote areas of Laos. This has bad environmental consequences. The suggestion is to put in place a policy to resettle residents in locations where agriculture is sustainable with good conditions for the agricultural production of those poor people. An additional suggestion for rural development and poverty alleviation strategies is to promote community participation in the development process through preparation and implementation.

The final aim of community participation is to provide equal opportunities among the population (gender and ethnic minorities) to share their ideas and needs in social development, leading to increased capacity and awareness of local people that can be utilized for the future development of their communities. In reality, Lao women have always received less opportunity than men in terms of working and achieving a high level of education. Therefore, the Government should develop a good strategy to encourage women to participate in economic activities and social development, instead of only working at home and taking care of their children, particularly in rural areas.

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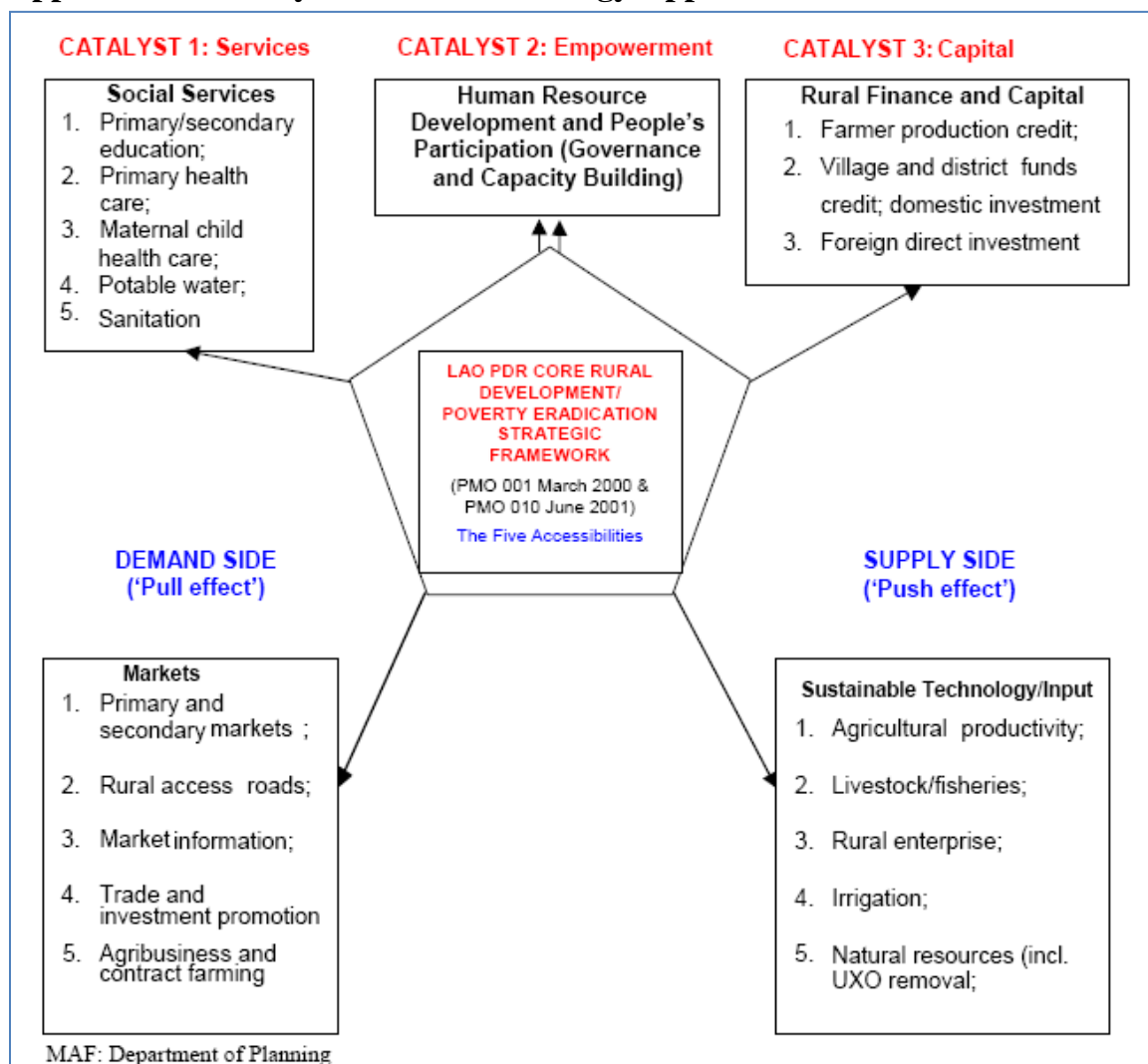
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Appendix 1: Poverty Eradication-Strategy Approach

CATALYST 1: Services	CATALYST 2: Empowerment	CATALYST 3: Capital
Social Services	**Human Resource Development and People's Participation (Governance and Capacity Building)**	**Rural Finance and Capital**
1. Primary/secondary education; 2. Primary health care; 3. Maternal child health care; 4. Potable water; 5. Sanitation		1. Farmer production credit; 2. Village and district funds credit; domestic investment 3. Foreign direct investment

LAO PDR CORE RURAL DEVELOPMENT/ POVERTY ERADICATION STRATEGIC FRAMEWORK

(PMO 001 March 2000 & PMO 010 June 2001)

The Five Accessibilities

DEMAND SIDE ('Pull effect')

SUPPLY SIDE ('Push effect')

Markets
1. Primary and secondary markets ;
2. Rural access roads;
3. Market information;
4. Trade and investment promotion
5. Agribusiness and contract farming

Sustainable Technology/Input
1. Agricultural productivity;
2. Livestock/fisheries;
3. Rural enterprise;
4. Irrigation;
5. Natural resources (incl. UXO removal;

MAF: Department of Planning

This analysis is based on some factors of government development strategy, such as economic development, rural development, and environmental protection. It aims to provide some suggestions for future development planning and achieving sustainable development goal.

Appendix 2: Sources and definition of all variables

No.	Variables and definition	Computations
1	GDP: Gross Domestic Product is one of the primary indicators used to measure the health of a country's economy.	GDP is a measure of all the goods and services produced domestically in Laos in US$. It represents the total dollar value of all goods and services produced over a specific time period.
2	GDPP: Gross Domestic Product per capita, based on the IMF and government report.	A measurement of the total output of a country that takes the gross domestic product (GDP) and divides it by the number of the total population in Laos in US$ GDPP = GDP/POP
3	OPEN: Trade openness degree refers to the degrees to which countries or economies permit or have trade with other countries. In brief, openness enables the exploitation of comparative advantage, technology transfer and diffusion of knowledge, increasing scale economies and exposure to competition.	The degree of trade openness or OPEN = (Import + Export)/GDP In percentage (%)
4	AID: Foreign aid is the capital assistance, grant and soft loan; it is defined as official development assistance (ODA). This capital assistance can be divided into bilateral and multilateral components	Total ODA inflows (US$) to the Laos
5	Foreign direct investment (FDI), it refers to the investment of foreign assets into	Total actual foreign direct investment in Laos in the period of study (US$)

	domestic goods and services.	
6	DI: Domestic investment is the investment of the companies and products of the own country, rather than in those of foreign countries	Total domestic investment in US$, based on the gross capital formation (IKON) from the Penn World Table 7.1 at the constant prices in 2000,
7	Government expenditure (GoEx), it is sum of government collective consumption expenditure and government individual consumption expenditure, plus health and education services of Government consumed by households.	It is the total of government expenditure in the period of study in US$, based on the GCUR at the Penn World Table 7.1 at the constant prices in 2000.
8	Poverty incidence (POV): Poverty incidence is the number of households having an income below the Poverty threshold, in brief, poverty threshold is the income needed to sustain food and non-food needs of the household.	Total population under poverty line divided by total population, in percentage (%)
9	Income inequality (Gini), the concept of inequality is distinct from that of poverty and fairness. The Gini coefficient is often used as an indicator of the income distribution in a given country.	We used the Gini coefficient to be a proxy for the inequality of income distribution, a value of 0 expressing total equality and a value of 1 maximal inequality. The Gini coefficient is commonly used as a measure of inequality of income or wealth.
10	CO_2 Emissions, it is the primary greenhouse gas emitted through human activities.	Total carbon dioxide emission in metric tons, Notice: The main human activity that emits CO_2 is the combustion of fossil fuels (coal, natural gas, and oil) for energy and transportation, although certain industrial processes and land-use changes also produce CO_2

11	Environmental degradation (ED) Measured in metric tons per capita	$ED = CO_2/population$ In analysis, we converted from metric tons in kg tons before transforming in logarithm form.
12	Industrial extension (IND) denotes the income or GDP share by industrial sector, which is used a proxy for industrial enlargement and development.	Total industrial value added in the share of GDP in US\$. It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas.
13	Population density(POD)	POD = population divided by total land area (person per square km)
14	ASEAN is used as dummy variable. The dummy variable is used to examine the impact of membership of the ASEAN on the economic development of Laos.	Becoming a full member of the ASEAN in 1997 serves as a dummy variable: ASEAN = 0 before becoming a member of the ASEAN, while ASEAN = 1 after joining the ASEAN in 1997.

BILATERAL VS MULTILATERAL FUNDING DIFFERENT ATTRIBUTES

BILATERAL	MULTILATERAL
Donors focus their assistance on specific countries and regions, whether because of economic and political interests, perceived need, historical ties, or geographic proximity.

Developed country governments often have well-established relationships with particular developing countries that provide a solid basis for dialogue and co-operation. As donor country agencies build knowledge and experience about local conditions, the result can be more effective development assistance programs targeting specific sectors or projects.

Bilateral assistance tends to be somewhat less bureaucratic and more efficient than multilateral support. One reason is that | Resources are spread across a broad geographic scale. While distributions from country to country or continent to continent may vary somewhat, multilateral donors strive for a wider geographic spread than their bilateral counterparts.

Assistance generally flows in relatively large blocks. GEF projects and World Bank loans can run into the tens of millions of dollars, though there are programs that manage to release funding in smaller increments.

Multilateral funding priorities by definition reflect the consensus of multiple nations working together. The biodiversity priorities of the GEF, for example, are largely set through |

bilateral strategies are based on the priorities of two nations working in co-operation rather than a whole host of countries trying to reconcile differing agendas. Bilateral assistance is generally subject to fewer restrictions than those imposed by larger funding institutions.	the Convention on Biological Diversity. Multilateral funding can be inflexible and difficult to obtain. Also, in large part due to safeguards such as rigid auditing and reporting requirements, approved grant funds may flow in an inefficient manner, hampering project effectiveness.

Source: http://conservationfinance.org/guide/guide/index19f.htm

Appendix 3: Data use for CPA

In regression analysis both the dependent variable and independent variable(s) are log-transformed variables, one unit change (or one percent change) in the independent variable results in the respective coefficient change in the expected value of the dependent variable.

Table 31: Data use for PCA

Year	LnGDP	LnGDPP	LnPOV	LnED	LnDI	LnGoEx	LnAID	LnOPEN	LnFDI1	LnIND	LnPOPD	ASEAN
1980	20.19833	5.834226	4.094345	4.0573	17.98641	18.06341	17.52542	2.486572	0	2.181547	2.614472	0
1981	20.25014	5.181109	4.074142	3.81993	18.11776	18.21889	17.36742	2.476538	0	2.241773	2.633327	0
1982	20.30196	5.15894	4.05387	3.84505	18.22626	18.2684	17.45965	2.576422	0	2.300583	2.656055	0
1983	20.35378	5.737636	4.03371	3.950551	18.37005	18.35168	17.2043	2.88759	0	2.360854	2.681021	0
1984	20.41515	6.06979	4.013496	3.944258	18.08242	18.13371	17.34128	2.209373	0	2.420368	2.707383	0
1985	20.46461	6.271707	3.993419	4.012592	18.3005	18.51562	17.4172	2.086914	0	2.482404	2.734367	0
1986	20.5123	5.886159	3.983413	4.021057	18.33196	18.5534	17.62417	2.422144	0	2.582487	2.761907	0
1987	20.49794	5.507646	3.962716	3.993419	18.70645	18.50119	17.82084	2.965788	0	2.423031	2.789323	0
1988	20.47763	5.050753	3.916015	3.965488	18.96935	18.75171	18.11034	3.734808	14.50866	2.421257	2.817204	0
1989	20.61033	5.233726	3.895894	4.053193	18.88875	18.80137	18.76491	3.779177	15.20181	2.587012	2.84549	0
1990	20.67523	5.356586	3.8795	4.024977	18.98192	18.81043	18.8132	3.598134	15.60727	2.674838	2.873565	0
1991	20.71729	5.518537	3.864931	4.071997	19.02639	18.86485	18.75537	3.618189	15.74703	2.822569	2.901971	0
1992	20.7714	5.62816	3.828641	4.140671	19.04084	18.89983	18.90705	3.786233	15.86963	2.876949	2.930126	0
1993	20.82885	5.720312	3.795938	4.113395	19.13522	18.97716	19.11398	4.122608	17.21337	2.875822	2.957511	0
1994	20.90728	5.844182	3.76213	4.163233	19.23653	19.0829	19.18242	4.17146	17.89643	2.898119	2.983154	0
1995	20.97523	5.968324	3.727138	4.366507	19.29538	19.14444	19.54206	4.103469	18.37044	2.956991	3.008155	0
1996	21.04222	5.983079	3.690877	4.635767	19.40312	19.24891	19.61766	4.155126	18.88943	3.05164	3.031582	0
1997	21.10868	5.900144	3.653252	4.845682	19.50707	19.13124	19.61081	4.176846	18.27334	3.046901	3.053057	1
1998	21.14759	5.525572	3.626472	4.944168	20.21366	18.95565	19.43384	4.434026	17.62217	3.113515	3.074081	1
1999	21.21811	5.593335	3.598955	5.211222	20.28532	18.74234	19.50031	4.382776	17.75919	3.119277	3.093313	1
2000	21.27436	5.715382	3.570659	5.208185	20.25216	19.03119	19.45258	4.30474	17.33863	2.810005	3.111291	1
2001	21.33043	5.716699	3.541539	5.116658	20.5704	19.04635	19.31612	4.185555	16.98939	2.841998	3.128513	1
2002	21.38789	5.749393	3.511545	5.366667	20.60765	19.08096	19.44486	4.154027	17.03439	2.969388	3.144583	1
2003	21.44724	5.874088	3.481855	5.30992	20.69174	19.11808	19.52282	4.135487	16.7849	3.059646	3.159975	1
2004	21.50927	6.01835	3.450939	5.525708	20.86338	19.19976	19.41356	4.292239	16.64282	3.020913	3.175133	1
2005	21.57786	6.138806	3.419365	5.5183	20.96692	19.46945	19.52574	4.405499	17.13694	3.203153	3.190476	1
2006	21.65987	6.389737	3.38676	5.600483	21.03752	19.70529	19.71187	4.443004	19.04876	3.322515	3.205588	1
2007	21.73259	6.541895	3.352707	5.639415	21.44913	19.89634	19.79723	4.461415	19.59471	3.292498	3.220874	1
2008	21.80446	6.752504	3.317816	5.667271	21.42429	19.98504	20.02128	4.345103	19.24398	3.352007	3.235929	1
2009	21.87732	6.786378	3.288402	5.691632	21.29703	20.16648	19.85572	4.148043	19.57945	3.283164	3.250762	1
2010	21.96757	6.839691	3.258096	5.680115	21.39015	20.01595	19.89141	4.318187	19.67344	3.459466	3.265378	1

Source: Author analysis

Appendix 4: Correlations Matrix of Predictors and Inverse

Correlation matrix is used to measure the strength and direction of the linear relationship between the two and more variables. In practical method, the correlation coefficient can range from -1 to +1, with -1 indicating a perfect negative correlation, while +1 indicating a perfect positive correlation, and 0 indicating no correlation at all.

Table 32: Correlation Matrix of predictors and Inverse

Correlation matrix								
R	LnDI	LnGoEx	LnAID	LnOPEN	LnFDI1	LnIND	LnPOPD	ASEAN
LnDI	1	**0.896**	**0.875**	**0.834**	**0.776**	**0.904**	**0.969**	**0.897**
LnGoEx	**0.896**	1	**0.871**	**0.787**	**0.800**	**0.919**	**0.909**	**0.675**
LnAID	**0.875**	**0.871**	1	**0.952**	**0.954**	**0.935**	**0.952**	**0.729**
LnOPEN	**0.834**	**0.787**	**0.952**	1	**0.960**	**0.856**	**0.899**	**0.690**
LnFDI	**0.776**	**0.800**	**0.954**	**0.960**	1	**0.851**	**0.869**	**0.595**
LnIND	**0.904**	**0.919**	**0.935**	**0.856**	**0.851**	1	**0.954**	**0.755**
LnPOPD	**0.969**	**0.909**	**0.952**	**0.899**	**0.869**	**0.954**	1	**0.849**
ASEAN	**0.897**	**0.675**	**0.729**	**0.690**	**0.595**	**0.755**	**0.849**	1
Inverse of Correlation matrix								
R^(-1)	LnDI	LnGoEx	LnAID	LnOPEN	LnFDI	LnIND	LnPOPD	ASEAN
LnDI	**51.94**	-16.91	18.87	-12.07	5.26	6.44	-41.27	-13.55
LnGoEx	-16.91	**14.43**	-4.40	6.70	-2.96	-5.53	2.99	7.41
LnAID	18.87	-4.40	**47.11**	-8.50	-14.91	-6.52	-28.63	-4.31
LnOPEN	-12.07	6.70	-8.50	**22.45**	-14.63	0.86	3.98	1.70
LnFDI	5.26	-2.96	-14.91	-14.63	**25.72**	3.06	-3.12	3.27
LnIND	6.44	-5.53	-6.52	0.86	3.06	**17.02**	-14.43	-0.31
LnPOPD	-41.27	2.99	-28.63	3.98	-3.12	-14.43	**80.62**	-2.59
ASEAN	-13.55	7.41	-4.31	1.70	3.27	-0.31	-2.59	**10.61**

Source: Author analysis

VIFs can be obtained as the diagonal elements of R^(-1). All the VIF values show high problems of multicollinearity. VIF measures the extent that a regression coefficient's variance is inflated due to correlations among the set of predictors. If the of VIF is higher than 10 (VIFs>10) are often considered to be problematic.

Appendix 5: Sample of lliterature survey of previous empirical studies

"Determinants of economic growth"			
The widespread use of the neoclassical model focuses on the roles played in coordinating and integrating various factors in macroeconomics, public finance, and international economics. This model usually finds wide usage in aggregate economic analysis. Solow's model of economic growth allows the determinants of economic growth to be separated out into increases in inputs (labour and capital) and technical progress. The theory of Solow (1956) essentially argues that when production takes place under usually neoclassical conditions and constant returns to scale, there wills no opposition between natural and unwarranted rates of growth. The system is self-adjusting to any given rate of growth in the labour force and eventually approaches a state of steady proportional expansion. The main innovation introduced by Solow is the ability to allow for factor sustainability so that stable equilibrium growth could be attained.			
Author	**Period**	**Countries covered**	**Main Features and Policy Recommendations**
Hassan Mobeen	Time Series: 1971-2007	Pakistan Interdisciplinary Journal of Contemporary Research in Business, Vol. 2, No. 12, pp. 329-338 (2011)	Topic: "An Econometric Analysis of Export-Led Growth Hypothesis: Reflections from Pakistan" This study used twenty seven years (1971-2007) quarterly time series data from Pakistan. To investigate the efficacy of export-led growth hypothesis we used the quarterly time series data running from 1971 to 2007 for Pakistan. This study has applied the co-integration technique and error correction model to investigate the relationship among the export import and GDP growth. Using the unit root test (ADF) for checking the stationarity of the variables and the variables were stationary at first difference which enable author to use co-integration technique. He should conclude and recommend policy implication through this estimation in short run and long run perspective. The research will be

			useful for policymakers in Pakistan as it gives important suggestions to step up the measures for boosting experts and make arrangements to the diversification of exportable goods production. Of course the earnings of service sector to other countries like tourism, health & education etc. is not preview of this study. However that constitutes a significant part of balance of payment. So this area should be given the due attention. The multiple linear regression model: Economic growth (GDP) = f(Exports, imports)
Mike, I. Obadan and Okojie, I. Elizabeth	Time series data 1980-2007	Nigeria	Topic:" An empirical analysis of the impact of trade on economic growth in Nigeria" This study aims to examine the effect of trade on economic growth and development in Nigeria. It states that many economists mostly agree that openness trade accelerates development. The relationship between trade and growth is envisaged through an export led growth strategy following the theory that sustained trade is the main engine of economic growth. Using time series data in Nigeria case during 1980-2007. The results showed that trade openness positively impacted on Nigeria s economic growth. Political instability had a strong negative impact on growth which reaffirms the very nature of their shaky nascent democracy. It is recommended that Nigeria should diversify her export base to include agricultural exports and solid minerals instead of depending solely on petroleum.

			The model specification is:
			GDPGR=f(OPEN, EXRT, FDI, DINV, POST)
			GDPGR-Growth rate of gross domestic, OPEN-the degree of openness (OPEN = (export + import)/GDP), EXRT-exchange rate, FDI-foreign direct investment, DINV-domestic investment, POST-politic stability.
Vatthanamixay Chansomphou and Masaru Ichihashi	Time series data from 1970-2008	Laos	Topic: " Foreign aid, foreign direct investment and economic growth of Lao PDR"
			This paper investigates the impact of foreign aid and foreign direct investment on the long-run income per capita and short-run income growth of Lao PDR. They formulate a modification of Solow model; employing a co-integration technique to carry out the long-run relationship, and employ an error correction model to estimate the short-run growth effects. The results show that foreign aid has a strong positive impact and is the main contributor on income level and income growth of Laos in the long run. Surprisingly, FDI has significant negative impact on long-run income per capita and small positive impact on income growth in the short run. They conclude that the long-run negative impact of FDI might be due to its surge and concentration on few economic sectors and due to its extreme rises and falls in some period. Therefore, the policies to promote FDI in many sectors and the policies that attract stable FDI inflows should be promulgated. Model specification:
			$\log YPC = C + \theta \log(AID) + \beta \log(FDI) +$

			$\gamma \log(\mathrm{DI}) + \mathrm{T}$
			YPC is income per capita, AID is foreign aid per capita, FDI is foreign direct investment per capita, DI is domestic investment per capita, and T represents time trend.
Shahbaz, M; Leitão, N. C., and Malik, S.,(2011)	Time series data, 1975-2008	Portugal	Topic: "Foreign Direct Investment-Economic Growth Nexus: The Role of Domestic Financial Development in Portugal"
			This paper investigates the role of financial development on FDI-Growth nexus, which aims to provide new guidelines for policy making authorities for Portuguese's economy. Stationarity issue is investigated by Ng-Perron unit root test with other techniques, in doing, log-linear specification has been applied. The results show that financial development stimulates economic growth for the case of Portugal. Foreign direct investment also good promoter of economic growth while investment in public capital stock is contributing more as compared to financial development and foreign direct investment. Inflation declines economic growth. Model specification:
			$\log\mathrm{GDP}_t = \alpha_1 + \alpha_2\log\mathrm{PCS}_t + \alpha_3\log\mathrm{FD}_t + \alpha_4\log\mathrm{FDI}_t + \propto_5 \log\mathrm{FD}_t * \log\mathrm{FDI}_t + \propto_6 \ln\mathrm{INF}_t + \mu_t$
			Where GDP is GDP per capita, PCS is public capital stocks proxies by gross fixed capital formation, FD is financial, and FDI stands for foreign direct investment or foreign inflows. FD*FDI shows the interaction between financial

			development and foreign direct investment whose expected signs are ambiguous, and INF denotes inflation
E. M. Ekanayake and Dasha Chatrna	Time series (1980-2007)	Data of 85 developing countries covering Asia, Africa, and Latin America and the Caribbean	Topic: "The Effect of Foreign Aid on Economic Growth in Developing Countries" This study identifies the effects of foreign aid on the economic growth of developing countries. They explore the hypothesis that foreign aid can promote growth in developing countries. They test this hypothesis using panel data series for foreign aid, while accounting for regional differences in Asian, African, Latin American, and the Caribbean countries as well as the differences in income levels. While the findings of previous studies are generally mixed, the results also indicate that foreign aid has mixed effects on economic growth in developing countries. The model is developed from a production function in which foreign aid is introduced as an input in addition to labor and domestic capital. Based on the simple production function can be written as follows: $$Y = (L, K, A)$$ Where Y is gross domestic product (GDP) in real terms, L is labor input, K is domestic capital stock, and A is stock of foreign aid. The model can modify in this special equation: $$GGDP_{it} = \beta_0 + \beta_1 GPOP_{it} + \beta_2 (\frac{INV}{GDP})_{it}$$ $$+ \beta_3 (\frac{AID}{GDP})_3 + \beta_4 (\frac{AID}{GDP})_{it}^2$$ $$+ \beta_5 \ln(GDP)_{i0} + \beta_6 INF_{it} + e_{it}$$

			GGDP is the growth rate of real GDP per capita, GPOP is the growth rate of population, INV is the investment, AID is the foreign aid, i0 is the initial level of GDP of country i, and INF is the inflation rate of country i in year t.

"The impacts of growth on poverty reduction"

The relationship between economic growth and poverty is one of the major themes in current development literature and thinking. While it is widely acknowledged that overall economic growth reduces overall poverty, there are two main reasons why more detailed results are of utmost importance. Firstly, policymakers need more detailed guidance to make decisions about the allocation of public resources and sources of funds to finance public expenditures (Sarris, 2001). Secondly, theoretically it is indeed the case that growth of different economic sectors has a heterogeneous effect on poverty. Representing many other studies with similar arguments, Ravallion and Datt (1996) state that although the direct impact of a sector's growth on poverty is likely to be small as it depends very much on the sector's population share, its indirect effect is much larger because of labor mobility and the linkages between that sector's growth with growth of the other sectors. Hence, differences that exist between the sectors in these three factors may cause economic sectors to have different effects on poverty. Therefore, to achieve the largest poverty reduction effect from economic growth, it is important to identify the sectors that have the strongest effect on poverty reduction.

Author	Period	Countries covered	Main Features and Policy Recommendations
PAN-LONG TSAI and CHAO-HSI HUANG	Time Series: 1964-2003	Taiwan World Development Vol. 35, No. 11, pp. 1858–1871, 2007	Topic: "Openness, Growth and Poverty: The Case of Taiwan". Sustained economic growth is found to be the major driving force for poverty reduction in Taiwan, and openness to foreign trade helps the poor through a direct distribution effect as well as indirect growth effect, in both the long term and short term. While inward FDI has no significant

			impact on the mean income of the poor, outward FDI from Taiwan in the past two decades seems to have had an adverse effect on the poorest 20% of the population.
Asep Suryahadi , Daniel Suryadarma, Sudarno Sumarto	A panel data. Consumption Module of Susana's (1984-2002)	Indonesia	Topic: "The effects of location and sectoral components of economic growth on poverty: Evidence from Indonesia". In this paper, they investigate the relationship between economic growth and poverty reduction by differentiating growth and poverty into their sectoral composition and urban–rural location using data from Indonesia. They find that rural services growth reduces poverty in all sectors and locations. However, urban services growth has the largest effect on poverty in most sectors. Finally, they also find that rural agriculture growth strongly reduces poverty in rural areas, the largest contributor to poverty in Indonesia. This implies that while agriculture growth in rural areas still plays a major role in reducing poverty, policies that enable strong growth in the services sector in both urban and rural areas would expedite poverty reduction. Basic Model: $dP = \alpha - \beta y - e$ where P refers to the level of poverty rate and dP refers to the change in poverty rate, $\dot{y}$ represents the rate of economic growth, ε is the error term, while α and β are the parameters to be estimated..
Ijaiya, G, T., Ijaiya, M,A., Bello, R,A., &	Time series data from 1980 -2008	Nigeria	Topic: "Economic Growth and Poverty Reduction in Nigeria" Studies on economic growth indicates that economic growth is essential for poverty

Ajayi, M,A., (2011)			reduction, especially when it leads to increase in employment and improvement in opportunities for productive activities among the people that are poor. Using multiple regression analysis this paper therefore examine the impact of economic growth on poverty reduction in Nigeria by taking into consideration a time subscript and a difference–in-difference estimator that describes poverty reduction as a function of changes in economic growth. This study indicates that the initial level of economic growth is not prone to poverty reduction, while a positive change in economic growth is prone to poverty reduction. To therefore improve and sustain the rate of economic growth in Nigeria from which poverty could be reduced measured, such as, stable macroeconomic policies, huge investment in agriculture, infrastructural development and good governance are suggested. $Ln\Delta POVt = f(Ln\Delta EGt, Ln\Delta EGt\text{-}1)$
Rizwanul Islam (2004)	1970-2002	Cross countries data	Topic: The Nexus of Economic Growth, Employment and Poverty Reduction: An Empirical Analysis Using cross-country data, the paper empirically demonstrates the link between poverty reduction and employment intensity of growth. Cross-country analysis is also employed to examine the impact of employment and labour market related variables on poverty reduction. Developments that are found to make a positive contribution to poverty include structural transformation of

			employment towards manufacturing and other non-farm sectors, education, and lowering of the dependency burden (i.e., increase in labour force participation). The equation is: POV = f (EAG, EMA, EDU, DEP) POV = headcount measure of poverty EAG = percentage of workforce employed in agriculture EMA = percentage of workforce employed in manufacturing EDU = adult literacy rate (in percentage) DEP = dependency ratio
Colin Thirtle, Lin Lin, and Jenifer Piesse, 2003	Pooled data from Africa, Asia, and America	Cross continents data	Topic: "The impact of research-led agricultural productivity growth on poverty reduction in Africa, Asia and Latin America" Using the causal chain model to analyze the relationship between economic growth and poverty reduction. In this paper, the poverty index is explained by the Gini, GDP per capita, export or trade, government expenditure, gross fixed investment and rural population. This study shows that the Gini and rural population are poverty increasing , while GDP per capita, exports, government expenditure and gross fixed investment are all poverty reducing. These results are general agreement with the literature and they quantify the effects. Gross fixed investments has a large impact because it includes land improvements and road building, which are labor-intensive activities that provide jobs at bottom end of the labor market, especially in rural areas. $LnPov_t = \alpha_0 + \alpha_1 LnGDP_{t-1} + \alpha_3 LnExport_t + \alpha_4 Ln\,Trade_t + \alpha_5 LnGov\_exp_t +$

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			$\alpha_6 Gov\_exp_t^2 + \alpha_7 LnFix\ Investment_t +$ $\alpha_8 LnFix\ Invesment_t^2 + \alpha_9 LnRural\ popt$
Dullah Mulok, Mori Kogid	Time Series Data 1970 - 2009	Malaysia	Topic: "Is economic Growth Sufficient for Poverty Alleviation? Empirical Evidence from Malaysia". This study attempts to determine the empirical relationship and important of growth for poverty reduction in Malaysia. The results show that growth explains much, but not all, about the evaluation of poverty. It states that growth is necessary but not sufficient for poverty reduction, especially if the objective is rapid and sustained poverty reduction. This study proposes that if a policy's objective is focused on poverty alleviation, reduction as well as economic growth should be simultaneously taken into account as the final target. Model used in this study: $LnPOV_t = \beta_0 + \beta_1 lnGDPP_t + \epsilon_t$

"The impacts of growth on environmental conditions"

The impact of economic growth on the environment has been widely discussed in the economic literature. Several studies have investigated the relationship between environmental pollution and per capita income, mostly by using the framework of Kuznets curve, which was introduced by Kuznets (1955), known as the inverted-U-shaped curve. This hypothesis, which suggests a U-shaped or inverted U-shaped relationship between two variables, implies a non-linear relationship that is applicable in many countries. The key indicators used to capture the changes in environmental conditions have been developed and used in many countries. A high rate of economic growth has been a primary and permanent goal of government and society, particularly in developing countries. The increase in economic growth is related to an increase in the production and consumption of goods and services; consequently, this may lead to an increase in the multiplied goods of the people and income

per capita consumption. Technological development has been considered as having the potential to diminish or exacerbate the effects of economic growth; however, this depends on the net result regarding increased or decreased per capita natural resource consumption.

Author	Period	Countries covered	Main Features and Policy Recommendations
Eunho Choi, Almas Heshamati, and Yongsung Cho	Time Series: 1971-2006	China, Korea, and Japan	Topic: "An empirical study of the relationships between CO_2 emissions, economic growth and openness" The paper investigates the environmental Kuznets curve for carbon dioxide (CO_2) emissions, and its causal relationships with economic growth (GDP) and openness (OPEN). The results determine that depending on the national characteristics, the estimates EKC show different temporal patterns. China shows an N-shaped curve while Japan has U-shaped curve. Such dissimilarities are also found in the relationship between CO_2 and openness, Japan and Korea present an inverted U-shaped curve, while China shows a U-shaped curve. The specification model is specified as the following multiple regressions for each country: $$LogCO_2 = \alpha_0 + \alpha_1 lnGDP_t + \alpha_2 (lgGDPt)_t^2 + \alpha_3 OPEN_t \\ + \alpha_4 OPEN_t^2 + \alpha_5 lnRE_t + \alpha_6 Trend_t \\ + \alpha_7 lnFOP_t + \varepsilon_t$$ FOP is fossil consumption/capita*100, RE contribution of renewable energies (%).
Selden and Song, 1994	Pooled time series and cross-sectional data	30 countries in the sample, 22 were categorized as high income, six as middle income, and	Topic:" "Environmental Quality and Development: Is there a Kuznets Curve for Air Pollution Emissions?" This study estimated EKCs for four airborne emissions: SO2, NOx, SPM, and CO_2. The emissions are measured in term of kilogram per capita on a national basis. This concentrate on the results they present for a fixed effects model including a population density variable. The fitted

			equations were of the form:
	two as low income		$$m_{it} = \alpha_0 + \alpha_1 y_{it} + \alpha_2 y_{it}^2 + \alpha_3 d_{it} + c_i + v_t$$ m is per capita emissions, y is real GDP per capita, i indexes location, and t indexes time. c_i are country specific effects, and v_t are time period specific effects, and d is population density. This study suggests that the countries with low population density are less pressure to adopt stringent environmental standards and emissions due to transportation will be higher.
David I. Stern*, Tony Auld, Michael S. Common, Kali K. Sanyal	Cross countries data 1960-1990	Cross countries	Topic: "Is there an environmental Kuznets curve for sulfur?" The environmental Kuznets curve (EKC) hypothesis proposes that there is an inverted U-shape relation between environmental degradation and income per capita. Various explanations for this phenomenon have been put forward and some authors argue that important explanatory variables are omitted from conventional EKC estimates. This study estimates a logarithmic quadratic EKC for World, OECD, and non-OECD samples. Both fixed effects and random effects models are used with both country and time effects. Both dependent (emissions per capita) and independent (PPP GDP per capita) variables are in natural logarithms. The model is given by: $$\ln(\frac{S}{P})_{it} = \alpha_0 + Y_t + \alpha_1 \ln(\frac{GDP}{P})_{it} + \alpha_2 \ln(\frac{GDP}{P})_{it}^2 + \varepsilon_{it}$$ Where S is sulfur emission in tons of sulfur, P is population, ε_{it} is a random error term, i is country specific and Y_t are time specific intercepts, in time periods by t.
Akpan, Usenobong	Time series data,	Nigeria	Topic: "Economic Growth and Environmental Degradation in Nigeria: Beyond the Environmental

F. and Chuku, Agbai	1960-2008		Kuznets Curve" Using CO_2 emissions per capita to proxy environmental degradation, the findings do not support the existence of the EKC hypothesis. Rather our results show that Nigeria's situation when confronted with data is exemplified by an N-shaped relationship with a turning point at \$77.27 that lies below the data set used for the study. Based on these findings, the paper posits that the hypothesized EKC serves as a dangerous policy guide to solving environmental problems in Nigeria. The conclusion is that to ensure sustainability, there exist an urgent need to look beyond the EKC by adopting courageous policy measures of environmental preservation in Nigeria irrespective of the country's level of income. In its general format, the standard EKC hypothesis can be given as follows: $$C_t = \propto_0 + \beta_1 y_t + \beta_2 y_t^2 + \beta_3 y_t^3 + \tau Z_t + \varepsilon_t$$ Where C_t is per capita CO2 (used as a proxy for environmental degradation), y_t is real per capita GDP, and Z_t is a vector of other explanatory variables that may influence environmental degradation.
Kleemann and Abdulai	Cross countries data (1990-2003)	From 90 developed and developing countries	None of the various hypotheses that concern the link between trade and environmental degradation (ED) can be entirely confirmed. There is modest support for the pollution haven hypothesis. In addition, trade liberalization (TRADE) might be beneficial to sustainable development for rich countries but harmful to poor ones. $$ED_{it} = \beta_1 TRADE_{it} + \beta_2 GDP_{it} + \beta_3 GDPPSQ_{it} + \beta_4 LNPOPD_{it} + \varepsilon_{it}$$ Where: Subscript "it" denotes country and year

Appendix 6: The geography and potential resources of Laos

Laos has a large area compared with total population, while the density is only 27 people per square km (2010). The country is divided in three main parts, including southern part, middle, and northern part. Each part of this country contains a variety of wonderful characteristics which

remains in a good condition, including culture and life style, a long and fascinating history of royalty, occupation and struggle for independence, awe inspiring 'Vats or Buddhist temples', a unique mix of French colonial (Vientiane capital), traditional architecture, and life styles of people from different ethnic minorities. In terms of natural resources, this factor includes several indicators, including, waterfalls, variety of rivers, islands, caves, green forests, fruits and

vegetables, etc. These mentioned factors would be able to be allocated to social economic development and ensure the effectiveness of sustainable development.

The main cities in Laos, including Vientiane, Luangprabang, Chmapasck, and Savannakhet, are all located along the mighty Mekong River. The main occupation of people living along this river is fishing and agricultural production. Fishing is therefore a very important activity for many Laotians and provides a vital source of protein for local people. In additional, the hydropower, mining and timber are the main industries, and more recently the tourism industry has started to become significant. With this recent development the environment has not been forgotten and it is become a risky issue for sustainable development.

In brief, about tourism perspective, Laos is still developing and it is relatively new to the travel prospect, comparing with some of more developed neighbors like Thailand and Vietnam. It is suggested to improve the service and information system about tourism (as well as other sectors) at international standard level, since this country has something more to offer from local people such as a hospitality and warmth that more then make compensations. In additional, together with tourism promotion and service improvement, one thing is maintaining the life style, culture, and the unique of Laos. The sustainable tourism concept attempt to produce as low an impact on the environment and local culture as possible, while assisting in creating employment opportunities for future and current local people, the final aim is to benefit not only local people or tourism companies, but also the entire population by increasing the national income.

Appendix 7: Executive Summary of PRF's implementation

1.   Background of PRF

The poverty reduction is considered to be a central goal of the final achievement of socio-economic development of Laos. In the actual situation of economic development, to achieve the development goals, specifically, to achieve the poverty eradication strategy, the government has emphasized three areas of development, more specifically (1) rural development, (2) human resource development, and (3) public participation. Most of poverty is due to rural conditions, reflected in part by a low productivity of the agriculture; thus, the most important way to improve real income for poor people through the upgrading of rural productivity complements smoothly economic growth by improving agricultural productivity, together with creating a local market, and favoring the emergence and development of non-farm activities target areas.

One of the new strategies which has been currently implemented for poverty alleviation is the community participation. The idea is to encourage the villagers to get involved in the development process; it is commonly understood as the involvement of locals in assessing their needs and developing strategies to achieve those needs (Zakus and Lysack, 1998). This strategy has emerged as one of the fastest-growing mechanism for assistance amongst aid agencies since the mid-1990s. Many developing countries in South-East Asia, including Laos, have currently implemented through the community participation development. Considering the case of Laos, here the development based on community participation has become a new method for rural development and poverty alleviation, this strategy aims to increase the capacity of communities for self-development and strengthen local institutions. One of the most effective projects in Laos is the Poverty Reduction Fund Project (PRF).

Poverty situation is considered as the core problem and challenge for global, regional as well as national development. It is directly related to the national development and poverty eradication which is stated in the current economic development plan. Consequently, developing the most appropriate methods and principles has been discussed among policy makers and project planners. One method known as "community participation" is considered as an important method for socio-economic development, particularly in the rural development and poverty alleviation program. This development method has been improved through the implementation of the project PRF since 2003. In 2009, the PRF was considered to be a model for Community Driven Development method or development through community participation.

The Poverty Reduction Fund Project was legally established by Decree from the Prime Minister of Laos (No. 073/PM) on 31 May 2002, initially supported by the World Bank in the form of a low-interest credit, repayable over a forty-year term. The consented credit amounts to approximately 19.5 million US$. The Prime Ministerial Decree allows the PRF to receive and use funds from other sources too.

2. Objectives of PRF

The principle objectives of the PRF are to support the government in its efforts to reduce poverty through expanding community opportunities to identify local development needs and manage small scale development through financing sub-projects for the rehabilitation and reconstruction of social and economic infrastructure, and other socially productive activities, including the creation of income, generating opportunities by training and other support. Key emphases of the PRF include participation of the communities by encouraging ethnic minority and women to get involved in planning and implementation processes, transparency and sustainability of the sub-project outputs (PRF, 2003).

Specifically the project objectives are:

(i) to assist villagers to develop community public infrastructure and gain improved access to services;

(ii) to build capacity and empower villages in poor districts to manage their own public investment planning and subproject implementation in a decentralized and transparent manner; and

(iii) to strengthen local institutions to support participatory decision-making and conflict resolution processes at the village, koumban and district levels, involving a broad range of villagers, including women and the poor.

A network of volunteers (village and koumban[24] representatives) was set up. Through their elected representatives, villagers decide on how resources are allocated, manage funds, and implement subprojects. Extensive facilitation and training is provided to ensure that poor villagers, including women and people from smaller ethnic groups, participate in the decision-making process and benefit from Program inputs. The Program builds community capacity by providing technical support for villagers.

3. Community participation method of PRF

Community participation is one of the seven principles[25] under the PRF's activities. This idea is used to encourage villagers to participate in all the processes of the project preparation and also implementation, specifically, in the process of decision-making, they must involve more people than just party representatives or elite, they must involve the whole community. The selection of subprojects is based on the list of eligible and not eligible subprojects (Annex 1),

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[24] Koumban is the group of villages or sub-district
[25] Seven principles: Simplicity, Menu of Options, Participation , Ownership, Transparency and Accountability, Wise Investment (sustainable, replicable, complementary), and Empathy ("Siding With The Poor")

villagers decide about what subprojects are prioritized in their community and what benefit for all the population in their areas. The subproject list that PRF has supported includes several sectors:

1. Education Sector includes school construction and equipment, and teacher stipends

2. Public Work and Transportation (PWT) includes bridge construction and improvement, footpaths, tracks, culverts, ramps, piers, road repairs and upgrading, and main electricity line access

3. Health Sector includes water supply (drug well, drilled well, community water supply), sanitation, dispensary construction, medicine box, nurse's stipends, and health services.

4. Agricultural Sector includes irrigation, weir, water tank, cables for water pipes and veterinary training including the agriculture and handicraft markets.

5. ITE/CB sector includes animal raising and cropping training, village saving group, IGA training, and capacity building training for local authority of PRF.

The selection process of subproject starts from village needs priority assessment (VNPA), which is organized at village level, the next step is prioritized again at Koumban level, and the last step is at district level, this step is called *district decision meeting*. After the district decision meeting, the representatives of the villagers have to participate in the sub-project implementation, monitoring, and maintenance as to ensure the sustainability of those supported subprojects.

The final aim of community participation is to increase capacity building and awareness raising for local people and poor villagers. In long term, they are expected to organize and operate themselves for their community development after the completion of the PRF project in their communities.

Numerous studies examined about the impact of community participation, such the study of Narayan (1995), argued that villagers' involvement could contribute to the achievement of five main objectives of water supply subprojects, including: effectiveness, efficiency, empowerment, equality, and coverage. However, that is not the final result to demonstrate those achievements; growing critiques of participation in development suggest that the adverse outcome that would negate on those benefits, such the argument of Oakley (1991) stated that participation places unfair burdens on the shoulders of rural people, who are forced to participate against their will. Then, participation can be a sham where local people have no real ability to influence the direction of a project (Cooke & Kothari, 2001).

To align with those arguments, there are some suggestions that would ensure the final outcome of participation, for the participation lead to the expected sustainable outcomes, people need to be involved in the higher levels of decision making, not only just in manual work (Schouten & Moriarty, 2003). From this suggestion, we assume that community participation in all the processes of project implementation is associated with the sustained outcome of subprojects supported by PRF and this leads to improve the welfare of population and contribute in rural development and poverty alleviation (Phimphanthavong, 2010).

4. The Impacts of PRF

4.1. The impacts on rural development

Overall goal of PRF is to create stronger links between the local government and the aspirations of villagers with a Program staff at a district, province and national level that coordinates and builds linkages. A forum was created at district level where villagers and district authorities meet regularly to discuss together the priorities and the plans and also to reach a compromise that will satisfy each party.

The achievement of this project, in the first phase of implementation, is considered as one of the most significant supporting the national five-year Socio-economic Development Plan (2001-2005) and the Interim Poverty Reduction Strategy Plan in which the poverty incidence is reduced by half by 2015. PRF was promoted national programme under the agreement No.01/PM[26] in 2010 (PRF Report, 2010). The impact of the PRF's activities may have influence on the national development programme; especially, the national poverty reduction, which is 33.5 percent in 2002 and only 26 percent in 2010.

PRF has completed the first phase of five-year implementation period (2003 to 2008). The overall outcome of this project is to contribute to the social development, specifically in the areas of rural development and poverty alleviation which is a priority of the government for national growth and poverty eradication strategy. Moreover, the PRF demonstrates to its commitment to support the government to achieve its goals on socio-economic development in regard to reduce poverty and increase welfare of the population. It is engaged in assisting poor community to develop small scale community–based infrastructure and other activities, such as water supply, transportation, education, health service, agriculture and other sectors, aiming to reduce poverty in poor rural villages. Grants are made for communities to develop infrastructure and others priorities following a menu of options. The villages make the key decision on the type of sub-projects for which they will use the budget allocated.

For the first five years, 2,067 sub-projects have implemented with a total investment of US$16,616,000, out of total 1,699 subprojects are related the basic infrastructure (education, health sector, public work and transportation, agriculture) and the other subprojects are about income generation activities (cropping, animal raising, waving, occupational training, environmental protection training, etc). This confirms the achievement of the first objective to

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[26] PM stands for Prime Minister

improve the basic infrastructures and to assess the service of targeted areas. The sub-project identification and prioritization process entails the selection of sub-projects that are, in general, responding to the real needs of the communities.

The PRF's sub-projects benefit people living in most of the areas where there is a lack of rural infrastructures. The benefit from the installation of rural infrastructures is immediate and remarkable, especially in remote areas. We can conclude that the purposes of the PRF project are to support the Lao PDR government in its efforts to reduce poverty, through empowering local communities and participatory approach development. With PRF support, they identify local development needs; they manage small-scale development projects for the rehabilitation or construction of social and economic infrastructure; and they also support other socio-productive activities, including income-generating activities.

In the first five years, the PRF activities had covered nearly 2,000 villages, covering 21 districts in five targeted provinces with total population of 744,140 people and more than1000 villages are direct beneficiaries and more than half of those beneficiaries are poor villages. Looking at the number of districts, in 2003, as the first cycle of implementation, PRF had worked only in 10 targeted districts; due to positive impacts it extended its activities to 21 districts in 2008.

The impact of PRF on living condition of poor community, particularly the impact on rural development, through the PRF's sub-projects produced benefit for all communities in the most areas where there is a lack of rural infrastructures. The benefit from the installation of rural infrastructures is immediate and remarkable, especially in remote areas. Benefits from social support in terms of primary education and primary health care follow the installation of rural infrastructures.

For example, the supply of drinkable water has drastically reduced (in most cases eliminated) cases of intestinal diseases, increased food security with the supply of permanent irrigation facilities for paddy cultivation, increased income generation levels in communities with the construction of access roads, and also with the consequence of more time for women/children (no longer fetching water from a distance) to develop their productive activities. Lastly, the benefit from income generating activities, training and environment activities are uncountable but noticeable because the poor villagers who received training can contribute to activities (handicraft, cropping and animal raising training, environmental protection) that create income for their families and ensure long term of natural resource.

Based on the numerous positive impacts and beneficiaries as mentioned above, the donors are satisfied with the results of the first phase, the Lao government and donors decided to extend PRF program with a 3-year additional phase or transition period (2008-2011) which started in October 2008 with grants from the World Bank (US$ 15 million) and from the Swiss Agency for Development and Cooperation (US$ 5 million) to implement 1,266 subprojects associated with 4 main sectors: health, education, public work and transportation, and agriculture. Moreover, the PRF's Phase II was approved by the government of Laos and corporate donors with 5-year implementation, from 2012 to 2016, aims to support long term of national development.

Figure 9: The proportion of poor village benefiting (2003-2010)
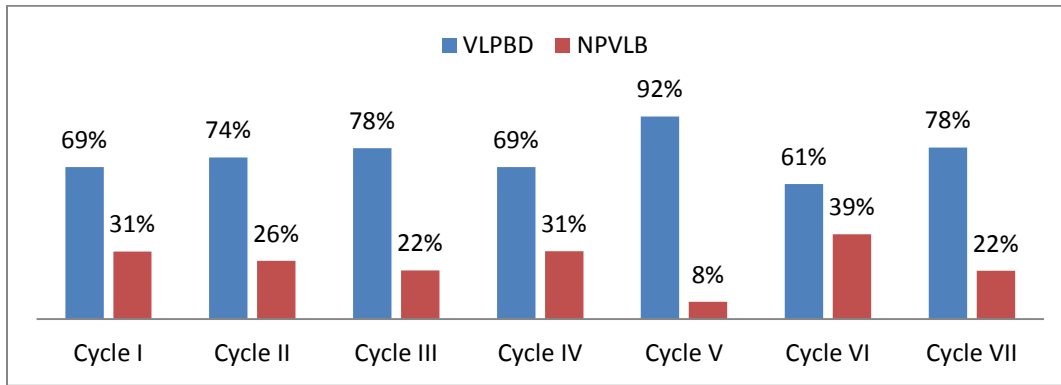
	Using t-Test: Paired Two Sample for Means				
	VLPBD	*NPVLB*	t -Stat	t- Critical	P(T<=t)
Mean	0.745	0.255	6.67	2.45	0.0005

Source: Author Analysis based on data from PRF office (2003-2010)

Notice: VLPBD denotes the poor village's direct benefit. NPVLB denotes the number of non-poor villages' direct benefit from the PRF's activities in the period of consideration.

One method to prove the positive impacts of PRF on rural development, especially considering the impact on poor community is the principle of empathy "siding with the poor"; therefore between all processes and procedures, preference is given to the poorest people in the community and also prioritized to the poorest villages based on championship of the rural poverty. The above figure indicates that more than 60 percent of total direct benefit goes to villages that are considered as poor, while the rest are better condition villages. To prove the null hypothesis that there is no significant difference between villages' benefiting is a poor or better condition ($H_0: \mu_{VLPBD} = \mu_{NPVBD}$), we use the t-Test: Paired Two Sample for Means, at 5 percent of significant level, the result shows that there is a statistically significant difference between two types of villages that benefit from the subprojects that PRF has supported from Cycle I to Cycle VII. The poor village tends to benefit more than better condition ones, the mean value of VLPBD is greater than of NPVLB, which is 0.745 and 0.255, respectively.

4.2. The impacts on capacity building of local people

The other key objectives of PRF are related to the local capacity building and strengthen local institution as detailed in second and third objectives. Using the community participation method, PRF has encouraged local people to participate the implementation process and training provided by PRF. The PRF has supported many training for local community which aims to enhance their understanding of the bottom up participatory approach in local development as well as to strengthen their supports to the PRF's participatory process. This process contributes to increase capacity of local people on managing their community development and also to the decision-making process, which has involved more people, not only government representative in targeted districts and RRF staff but the whole communities also involved in these processes.

Furthermore, PRF has also provided the training for small local entrepreneur or constructors and villagers in localities to involve in civil works, leads to utilize on their own community development. This is achieved through reorganization of the community at Koumban level, through the process of learning by doing. The PRF allows villagers' decision maker and encourage women to participate in the implementation process with widest representation the choice over what project types are selected and proposed. Moreover, the PRF also allows them to choose whether they will implement the project themselves or they can choose contractors, and lastly, hand over the financial control of the execution of the chosen activities, which is unusual in government financed programs. All of these approaches can demonstrate the achievement of community participation developed under the PRF's activities.

**Figure 10: Subprojects proposed by gender (2003-2010)**
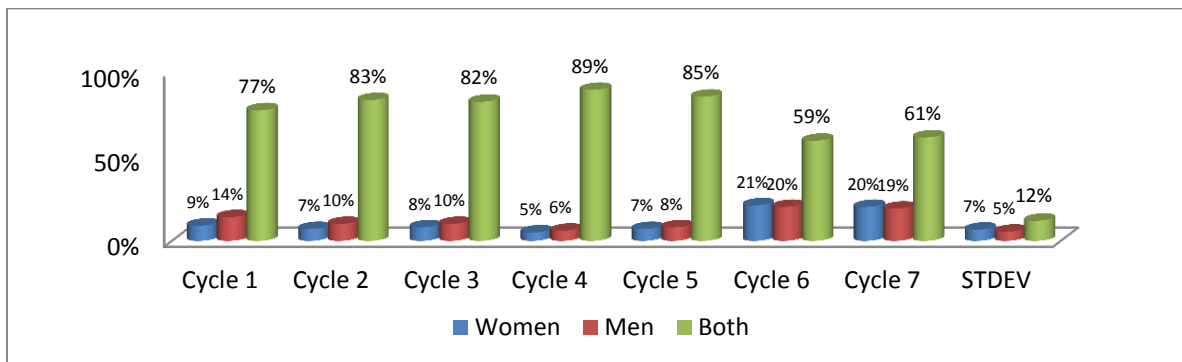
	Gender		Using t-Test: Paired Two Sample for Means		
	women	men	T-stat	t- Critical	P(T<=t)
Mean	0.11	0.12	- 0.51	1.761	0.309

Source: Author Analysis based on Data from PRF Office

The above figure indicates that the implementation under PRF activities succeeded in its purpose, specifically to promote gender balance. It proves that men and women have to same opportunity to share their ideas on their community development. Based on the proportion of subprojects proposed by men and women in each cycle, it shows that more than 60 percent of subprojects are requested by both groups. To prove whether men and women have the same power on subproject decision-making, we used the t-Test: Paired Two Sample for Means, based on the null hypothesis that the number of subprojects proposed by women and men has no significant difference condition ($H_0: \mu_{men} = \mu_{women}$). The mean different test confirms that at 5 percent of significance level we cannot reject the null hypothesis and hence we conclude that the participation from both women and men has been equal. By this result, we can guarantee that the number of women participating on social economic development would increase, and also that to avoid the traditional believes of local communities that women can work only on family services and have no ability to serve on social economic development as men.

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Then, we have analyzed the role of community participation on subproject implementation. This method is very important to sustain the number of subprojects supported by PRF. The community participation, in the case of PRF, includes the participation during the project preparing and implementation, and last one the community contribution. The community contribution is directly linked with the principle of PRF "Ownership". In this concept the villagers should be willing to contribute to subprojects to show their supports and ownership of the activities. The local contribution can be in cash, in kind, and/or labour. For every other aspect of the subprojects, villagers themselves make the main decisions. Encouraging high levels of ownership is critical if activities are to be sustained in long term.

Figure 11: Community contribution
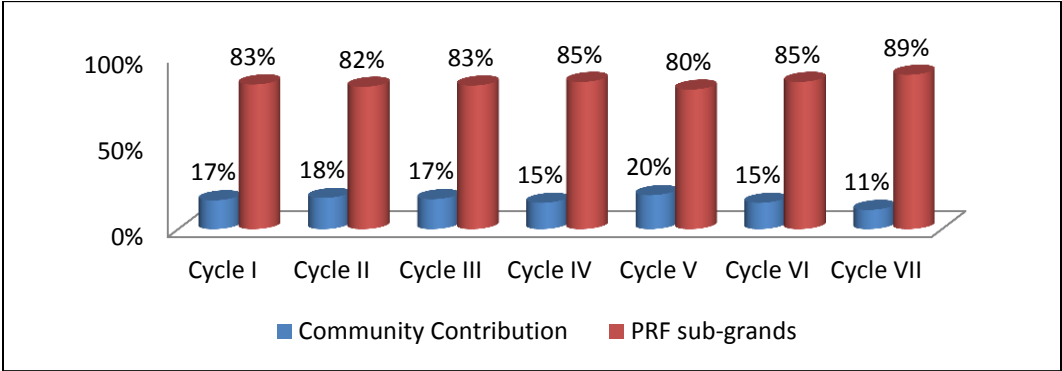
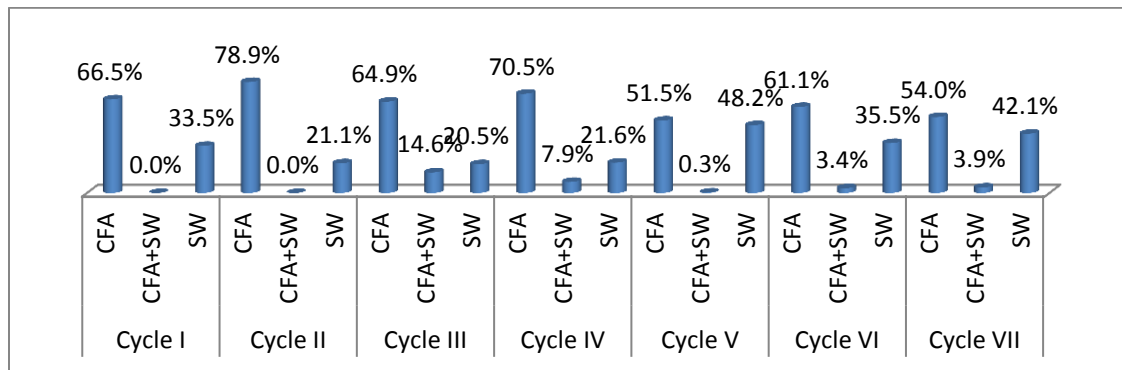Source: Author Analysis based on Data from PRF Office

The above figure indicates the proportion of community contribution on subproject implementation. It shows that the average of community contribution is about 11% to 20% of total grant used for subproject implementation. The sense of ownership is related to the sustainability of using subprojects, based on the subprojects' assessment of sustainability in 2010, conducted by the Monitoring and Evaluation Staff at the PRF office. The total of 1,051 subprojects had been used for this assessment, the result shows that the 91% of subprojects

assessed are considered in very good condition and are well maintained. This result confirms that those subprojects will be able to be used in long period of time. One of the most important factors nominated in the good quality and sustainability of subprojects is the responsiveness of the operation and maintenance committee that was set up after the subprojects were completed and many of those committee play very important role in the operation and maintenance activities.

The community contribution is also related to the lower cost for subproject implementation. By comparing the cost of sub-project construction between the PRF and other projects in Laos, it shows that the PRF cost is remarkably lower (Annex 2). The approach of the program is to use labor-based methods and community force account operations, rather than machines or contractors. For example, in the construction of a dispensary, the building materials such as cement, steel bars, corrugated roofing, and nails are supported by the PRF. The community contributed providing sand, aggregate, wood and labor. The supervisors and technicians are also from the local community. To evaluate that the efficiency of the PRF is highly positive, we can take a look at the outputs of projects made with lower (more than half) costs compared with similar projects, and we can conclude that the implementation of PRF activities has reached the plan in a way that met the expectation of the World Bank and the donors.

Considering that in this case the subproject implementation, more than half of those sub-projects were implemented by communities, which aim to improve the capacity building of the local community with the "participatory development and ownership concept", we can confirm that the second objective was obtained.

Figure 12: Implementation type of subprojects 2003-2010

Source: Author Analysis based on Data from PRF Office

The data in Figure 12 shows that the average of implementation types, which is more than 65 percent of all sub-projects, had been implemented by local communities (CFA), while about 30 percent and 5 percent had been implemented by fully contracting work (SW) and mixed implementation, respectively. From this result, we can confirm that the implementation of PRF reach its development goals for local capacity building through the community participation method.

5. Suggestion for future development

To harmonize the development plan between PRF and the national development, both government and donors have to outline the most appropriate strategies, based on teaching and experiences from previous projects. In order to effectively reduce poverty and to reach the objectives of the PRF, this project must cater to the specific requirements of the beneficiaries. The successful sustainability of many sub-projects depends on raising the awareness, a good design and implementation, and a high level of participation to develop a sense of ownership. By launching the second phase, the PRF has to continue to improve tools and methodologies which will be used to support and ensure success in the following cycles for the next phase of PRF.

Annex. 1 (7): Items Eligible and Not Eligible subprojects

Subproject Type	Items <u>Eligible</u>	Item <u>Not Eligible</u>
Access	Small bridges, footpaths, tracks, culverts, ramps, piers, road repairs and upgrading.	New roads and road surfacing/sealing
Community electrical supply	Mini-hydro generator, wiring, line extension	Gasoline or diesel generators
Primary health care facilities	Health centers (building, furniture, latrine, supplies and medicines, temporary allowance for contracted nurses/midwives[27] in cash or kind; village medicine kits; training; scholarships; medical equipment)	Generators
Domestic Water systems	Wells, gravity water supply, latrines, *etc.*	Piped household water hookups
Education	Schools & nurseries (buildings, latrine, temporary allowance for contracted teachers[6], supplies, equipment, furniture, training, scholarship, textbooks, musical instruments).	Any supplies provided by the government
Agricultural Infrastructures	Weirs, ponds, canals, bunds, gates, spillways, and other structures[28]	Electrical pumps
Markets, community halls	Buildings, drainage, wells, and furnishings.	Generators

Source: PRF Manual of Operation, 26 August 2008

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[27] PRF may fund special recurrent costs on a temporary basis, like small temporary allowances for non-civil servants (nurses, teachers); such costs would need to be clearly justified and must comply with the limitations of the negative list. Temporary allowances should not be paid for more than 1 year unless under exceptional circumstances which need to be properly justified and validated by PRF Executive Director.

[28] Agriculture infrastructures shall be eligible investment only when they are public goods, benefiting to 75% or more of the village population.

Annex. 2 (7): Cost comparison between PRF and other projects

Subproject Types	Unit	Organization	Budget (US$)
Rural Road	per Km	PRF	1,714- 2,500
	Per Km	ADB	4,591- 7,518
	Per Km	SIDA	7,000
	Per Km	SRNP	10,000
Pipe Convert (80mm)	Cell	PRF	50
	Cell	CRWRC	112
	Cell	SIDA	90
School Construction	per m2	PRF	65
	per m2	ADB(GEP)	96
	per m2	World Bank	62
	per m2	ADB(IP)	115
Irrigation	per m3	PRF	494
	per m3	ADB	1889

Source: Community Driven Approaches in Laos, World Bank 2008

Appendix 8: Presence of women in public administration and political positions in Laos, 2009

As many countries, regardless of their level of development, women are underrepresented in Laos' political sphere.

Position	Total	Women		Men	
		Number	Percent (%)	Number	Percent (%)
Ministers and vice ministers	64	6	9.4	58	90.6
Provincial governors	17	0	0	17	100
Vice provincial governor	34	1	2.9	33	97.1
District governors Vice-district governors	143	2	1.4	141	98.6
Village head	8726	148	1.7	8578	98.3
Vice-village head	17128	863	5.0	16565	95.0

Source: Statistics on Local Administration 2010

Lao women always had fewer opportunities than men in terms of achieving a high level of education and, as a consequence, in the quality of jobs and public positions.

In the recent years, women are considered as important drivers of sustainable development, and their involvement is increasingly included among the objectives of development projects, programs, and policies.