

# Chapter 1

## Introduction

### 1.1 Background

China has sustained high economic growth rate on for around 30 years, the overall economic and social situation has been much developed. But economic growth has been accompanied by many social and environmental problems such as high environmental pollution, an increasing gap between rich and poor, and over-consumption of energy. Indeed, China is known in development circles for the tremendous increase in industrial and urban pollution that and has given China the vast majority (17 out of 22) of the most polluted cities in the world and threatened to postpone the Beijing Olympics in 2008. China is also known for the widening gap in incomes between the rich and the poor, and especially between the prospering eastern coast and the stagnating rural hinterland. Like any country, the level and volatility of energy prices has led to the search for alternative biological and solar sources of energy.

The Chinese government at both national and provincial levels has realized that a balanced and sustainable development strategy must replace the uni-dimensional emphasis on GDP growth in order to lead the nation to a brighter future and resolve the current conflict between economic growth and social development. It also knows, that despite its discontents, globalization and trade expansion is the most promising engine of that development. Any development plan that will create enough social capital to solve the non-growth objectives of development must therefore make

full use of the profound investment in infrastructure that has resulted from the Asian Development Bank's initiative to link Kunming, the capital of Yunnan province, with Eastern China and the remaining Greater Mekong Subregion (GMS).

## 1.2 Importance, relevance, and usefulness

Yunnan lags slightly behind the eastern provinces in relation to economic and social development. Nowadays, the province's pillar industries are tobacco, development of bio-resources, mining, tourism and hydra electric industry. The Yunnan government announced and has carried out so-called The Plan for the 11th Five-Year Period (2006-2010) to target on eight priorities as following:

- rural development
- upgrading industrial structure and changing the way of economic growth
- optimizing the spatial plan for the economy and promoting co-ordinated regional development
- developing science & technology, education and social sectors
- enhancing infrastructure construction and development of basic industries
- expanding domestic demand and improving people's living standard
- further reform and opening up
- construction of democracy and rule of law

This research thesis intends to explore “walking on two legs”<sup>1</sup> of integrated

<sup>1</sup> This phrase was used during the Mao Zedong period, 1949-1976, to refer to subperiods where both economic incentives and socioeconomic ideology were set as twin targets.

sustainable development objectives in terms of not only traditional GDP but also the environmental and social objectives like employment creation, poverty alleviation, energy dependence, environmental degradation, and full use of the transportation network. These six aspects are commonly considered as the core part of a sustainable development economy which fulfills the principle of sustainability of a maximum growth target without deteriorating the welfare of the next generation. Toward this end, this thesis will combine the results from multiplier analyses and linear programming optimizations to identify the complementarities and possible trade-offs between narrow improvements in income and broader socioeconomic and environmental objectives.

The overall aim of the thesis is to give separate and interrelated accounts of the sustainable development goals of the Yunnan Economy in terms of growth of GDP, energy dependency, transport dependency, environmental degradation, poverty alleviation, and employment creation. This will be achieved by applying both macroeconomic and mesoeconomic methods of Social Accounting Matrix (SAM) for Yunnan province. Once constructed at both levels, the SAMs will be employed to conduct a systematic analysis for the economy of Yunnan in 2002 through a macroeconomic and mesoeconomic perspective. In addition, the total provincial value added of the mesoeconomic SAM will be optimized using linear programming techniques, subject to the other socioeconomic and environmental objectives that constitute the second “leg” of Chinese development.

A Social Accounting Matrix is a comprehensive, economy-wide data framework presented in the form of a square matrix. A main part of this thesis is devoted to firstly build the Social Accounting Matrix by organizing information about the economic and social structure of the economy of Yunnan province in 2002; and,

secondly, to build a SAM to be used for accounting multiplier model and the “optimal” social planning gives attractive sets of development priority. The SAM will describe the economic situation of Yunnan economy by revealing the relations between five types of accounts in terms of commodities-activities, factors, capital, institutional and the rest of world. The purpose to build a SAM is mainly to show and explain how the economic flow of goods and services transfer among different accounts for Yunnan province in 2002.

It is the purpose of this thesis to bring about applicable policy recommendations for the policy maker of the Yunnan provincial government. It should be noted at the outset that the data for social accounting matrices and their underlying Leontieff input-output tables for the economy take many years to collect and compile. Most SAM analyses in the literature, as will be shown in Chapter 2, are therefore at least 5 years out of date. In many underdeveloped economies, this is not a serious issue; however, the fact that China has maintained average growth rates of national GDP surpassing 10%/annum since 2002 means that the structure of the Yunnan economy may have evolved structurally over the past 7 years. This structural change may have evolved both technical changes within economic branches that favour the substitution of capital for labour; the introduction of new forms of energy and transportation modes; and a shift in the relative importance and comparative advantages of agriculture versus industry and the service sector. To the extent that comparative advantage and the percentage values-added of various branches have remained proportional; the results of this thesis may be used to point the way to how the Yunnan government and private sectors can invest to take sustainable advantage of globalization. To the remaining extent that comparative advantage, technology, and even the set of economic branches has shifted, this study will still fill the more modest

goal of showing how future studies for Yunnan and the rest of China can combine Social Accounting and optimization techniques to generate complementary information for national and provincial planning.

Based then, on the assumptions that the 2002 data are still proportional and pertinent, and that the Yunnan provincial government might intend to form its policy towards such a target, an accounting multiplier matrix and the corresponding linear programming optimization will be built to isolate the subset of economic sectors that will bring the highest return according to the objectives of a sustainable development. According to the principles discussed above, chapter 2 will lay out the conceptual framework for the study and cite major previous research in China and elsewhere that has used Social Accounting and or linear programming approaches. Chapter 3 will discuss the whole process for building the Macro SAM by the method called the top-down approach. Every detail for constructing the Macro SAM and the method to balance the Macro SAM will be precisely explained.

In chapter 4, a mesoeconomic SAM will be set up on the level of industrial sectors, which includes all the transfers with other accounts. It is continually and technically disaggregated based on and dominated by the Macro SAM. The thesis will present the whole process how the Meso SAM has been built. A complete Meso SAM can be used to conduct other researches according to different topics; however, the multiplier analysis used in this research is only one of those.

Based on a complete Meso SAM, chapter 5 puts emphasis on building an accounting multiplier matrix. The exogenous variable multiplier matrix will be built to calculate the ranks of the accounting multipliers. The accounting multiplier analysis will give the best choice for persuading six different economical, environmental, and social objectives. Then, the six objectives will be weighted to construct an integrated



sustainable development multiplier by two methods, the inverse multiplier method and the negative multiplier method. The maximum output under the sustainability constraints will be calculated by putting in the fixed amount of injections in terms of government consumption, investment, or trade with ROMC and ROW into different industries. Finally, 17 sectors will be recommended to be the top choice for a sustainable development objective, and, optimizations using linear programming techniques show that a maximum GPP will be achieved by reallocating all the input under the certain constraint of the factors input. It can give a policy recommendation for adjustment of input on different industries.

### 1.3 Research objectives:

- To construct a Macro Social Accounting Matrix (Macro SAM) for Yunnan economy as well as a consistent Meso Social Accounting Matrix (Micro SAM). These two SAMs could help to paint the whole picture of Yunnan economy in both the macro and branch-by-branch levels.
- To analyze the impacts of exogenous variable changes on Gross Provincial Product, employment creation, poverty alleviation, energy dependency, environmental degradation, and full use of the transportation network.
- To evaluate which sectors/industries should be supported with the intention of increasing total value-added and satisfying the sustainable development in Yunnan province.
- To show how optimal resource allocation could be directed to maximize overall value-added/welfare in Yunnan province.
- To propose, on the assumption that the 2002 data are still proportionally valid, policy implementation guidelines for the relevant organization

and government in order to develop Yunnan economy.

#### 1.4 Research Questions

Based on the multiplier analysis and linear programming with 2002 Social Accounting Matrix for Yunnan, the thesis will answer the following research questions:

- Which sectors of the Yunnan should be targeted for exogenous investments (by government, banks, the rest of China, and the foreign sector) in order to maximize GPP as measured by value added (VA)?
- Which sectors of the Yunnan economy should be targeted for exogenous investments in order to minimize environmental degradation?
- Which sectors of the Yunnan should be targeted for exogenous investments in order to minimize energy dependency?
- Which sectors of the Yunnan should be targeted for exogenous investments in order to make the fullest use of the net transportation infrastructure?
- Which sectors of the Yunnan economy have the greatest potential for increasing employment?
- Which sectors of the Yunnan economy have the greatest potential for alleviating poverty?
- Which among land, labour, and capital is the most binding constraint to future increases in the VA?
- Do the same sectors of the economy occupy the top rank across all types of multiplier (value added, employment creation, environmental degradation, energy dependency, poverty alleviation, full use of transportation)?

- Do linear programming and the integrated multiplier analysis lead to the same ranking of priority sectors for balanced growth?
- Which government policies would be most favourable to the reorientation of the economy in the way dictated by the balanced linear programming scenario?

### 1.5 Scope of the Study

A SAM is an effective quantitative economic method which is used to analyze the overall economy of a country or a region. In China, the relative research have launched for about over 10 years and the 1997 SAM for Yunnan has been built in 2003 with limited experiences. The essential condition to build a SAM is accessibility of valid data with a newest updated Yunnan IO table (2002) has been issued in 2007. It is the essence for this research using the up to bottom method to build a SAM with accessible and better data.

For the data entries of the research, the major data sources come from the official statistics issued data in term of 2002 Yunnan IO table, Yunnan statistics yearbook and Yunnan economy yearbook etc. Top to bottom is the basic principle for building SAM which means using macro economy information to control the frame of SAM and then in detail to build Micro SAM. The related indicator will be directly used in the SAM to form the basic structure of Macro SAM. For disaggregating the farming sectors into specific farming crops which are not included in the original IO table, a survey results which carried out by ICRAF Yunnan with 1500 samples will be referred to build the Micro SAM. However, secondary and published data are the most important data sources and dependence for building the SAM for Yunnan 2002.

Yunnan Province has been chosen as the target region of this research. Firstly,



Yunnan, as the poorest and minorities place of china, it has abundant of natural resource and biodiversity. Secondly, Yunnan province is the only province of China which is located along with the Great Mekong River Region (GMS) so that such a research result will be useful for comparative analysis with other GMS countries. Thirdly, Yunnan has different area with vary elevation and economy situation which is quite representative.

### 1.6 Definitions

*Social Accounting Matrix:* A social accounting matrix (SAM) constitutes a “circular flow of income around the familiar macro-economic loop of demands on activities, leading to the demands for factors, hence to the incomes of institutions and form there back to demands on activities”

*SAM Accounting Multipliers:* SAM accounting multipliers, or income multipliers, are elements in a SAM multiplier matrix. Each element reflects the global effects of the exogenous injection on each endogenous account.

*LP:* linear programming (LP) is a method in the thesis for optimization of GPP, subject to constraints of factors input in terms of land, labor, and capital.

*GPP (Value added):* GPP is the gross provincial product or value added. It describes the newly created goods and services by using total products reducing the intermediate input. In the thesis, GPP is the summation of the total factor income in terms of the value added of agricultural labor, other rural labor, urban labor and capital based on an accounting multiplier matrix.

*Energy Dependency:* Energy dependency describes the dependence of economy on energy consumption and production. In the thesis, it is the summation of all the energy industries based on a accounting multiplier matrix.

*Employment Creation:* Employment creation is an important social indicator to observe the employment situation. In this thesis, an employment creation multipliers are represented as the summation of all sectors of value added labor and a ratio that the summation over value added capital based on a accounting multiplier matrix.

*Poverty Alleviation:* Poverty alleviation is represented as the summation of the all types of the rural household based on the accounting multiplier matrix.

*Full Transportation Use:* On the one hand, rapid economy growth brings a high demand on roads, bridges, airports for satisfying the increasing demand from the expanding economic activities. In the thesis a transportation dependency multiplier is represent as the transportation industries based on the accounting multipliers matrix. On the other, new roads that have been built to connect Kunming with Eastern China and Southeast Asia (Hanoi, Bangkok, etc) as part of the Asian Development Bank's Economic Growth Corridor Initiative, should be fully utilized. The analysis will evaluate which branches of the economy could make the fullest economic use of the burgeoning transportation network.

*Environmental Degradation:* Economic growth has been usually brings the more pollution. In the thesis, the environmental degradation is represented as the summation of the polluting industries based on the accounting multipliers.

*Sustainable Development:* Sustainable development in the thesis can be represented as a summation of economic growth objective and social objectives by weighting those objectives based on the accounting multiplier matrix.

*Rural-urban Scissors Ratio:* The rural-urban scissors ratio is a socialist term used to describe the income gap between rural household and urban household. A "scissors" ratio of rural to urban incomes in the thesis represents the ratio that the total

average income of rural households over urban households. This figure hovered around 0.68 during the Mao Zedong period. Other things equal, the higher the scissors ratio, the better.



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