An Input-Output Table of the Cluster of Provinces in the Mid-South of Thailand
ตารางปัจจัยการผลิตและผลผลิตสำหรับกลุ่มจังหวัดภาคใต้ตอนกลางของประเทศไทย

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บทคัดย่อ

งานวิจัยนี้ได้มีการจัดสร้างตาราง I/O ระดับจังหวัดและกลุ่มจังหวัดภาคใต้ตอนกลางขึ้น เพื่อวิเคราะห์เศรษฐกิจระดับพื้นที่ ประกอบไปด้วยตาราง 2 ลักษณะ คือ ตาราง I/O ขนาด 58 กิจกรรมการผลิตสำหรับระดับจังหวัดทั้ง 5 จังหวัด คือ สตูล พัทลุง ตรัง นครศรีธรรมราช และสงขลา และตาราง I/O ขนาด 16 กิจกรรมการผลิตสำหรับระดับกลุ่มจังหวัด ซึ่งตาราง I/O ทั้งสองขนาดนี้สามารถนำมาวิเคราะห์โครงสร้างการใช้ปัจจัยการผลิตภายในจังหวัด การนำเข้าปัจจัยการผลิต การกระจายผลผลิตไปยังจังหวัดต่างๆ รวมทั้งศักยภาพของอุตสาหกรรมของแต่ละจังหวัดได้ ผลการวิเคราะห์สภาวะของเศรษฐกิจการผลิตภายในจังหวัดและกลุ่มจังหวัดภาคใต้ตอนกลางสามารถสรุปศักยภาพภายในแต่ละจังหวัดทั้ง 5 ได้ ในด้านระดับการพึ่งพิงปัจจัยการผลิตภายในจังหวัดสำหรับกิจกรรมการผลิตสินค้าต่างๆ โดยพบว่าแต่ละจังหวัดจะมีกิจกรรมการผลิตที่มีการพึ่งพิงปัจจัยการผลิตภายในจังหวัดที่คล้ายคลึงกัน เนื่องจากทรัพยากรในพื้นที่ประกอบกับทำเลที่ตั้งมีความคล้ายกัน และเมื่อนำข้อสรุปมาพิจารณาร่วมกับมูลค่าผลผลิตที่แต่ละกิจกรรมผลิตได้ จึงทำให้ทราบว่าในแต่ละจังหวัดมีกิจกรรมการผลิตที่มีศักยภาพคล้ายกัน และมีกิจกรรมที่ควรสนับสนุน

คำสำคัญ: ตารางปัจจัยการผลิตและผลผลิตสำหรับกลุ่มจังหวัดภาคใต้ตอนกลาง

งานวิจัยชิ้นนี้ได้รับเงินทุนสนับสนุนจาก สำนักงานกองทุนสนับสนุนการวิจัย (สกว.) 2549 ผู้สนใจสามารถอ่านได้จากรายงานการศึกษาฉบับสมบูรณ์ได้ที่ศูนย์ศึกษาการค้าระหว่างประเทศ มหาวิทยาลัยหอการค้าไทย

Abstract

In this research, I/O tables for a cluster of provinces in Thailand's mid-south have been composed to analyze the economy for the five provinces of Satun, Phattalung, Trang, Nakornsrithamarat and Songkhla. The tables can be classified into two ways, namely an I/O table of 58 input activities for provinces, and of 16 input activities for the cluster of provinces. These tables can be used to analyze the structure of the input within these provinces, import items and distribution to other provinces, including the industrial potential of each province. The I/O tables show the structure of output uses that determines sources, value and flow of goods produced in one province that become an input and goods consumed in the other provinces. Ultimately, analysis can be made of the industrial potential in the cluster of provinces in Thailand's mid-south. Thus the tables can show the amount of output dependency and trade relationships between the provinces. From the research, it was concluded that the economic viability of the five clustered provinces would be enhanced if they co-operate more closely on becoming self-sufficient, and reduce their dependency on imports.

Keywords: Input-Output Table for the Cluster of Provinces in Thailand's Mid-South

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Introduction

A table for input and output, or an Input-Output Table, is one of the five main accounts in the Economic Accounting System of which the other four accounts are: National Accounts, Balance of Payment, Flow of Funds and National Balance Sheet or National Wealth. The Input-Output Table is compiled to measure and present national economic activities systematically by categorizing those activities into groups according to sectors or industries, such as agriculture, mining, industry, transportation, construction, service and others. If we assume that each sector has the same basic technological output, then this concept can be used to compose a table showing the relation between output and the distribution of goods and services in the national or provincial economic system for a particular period. We can even identify what sort of input each output sector may require to increase production of other goods, such

as raw material and labor. At the same time, each output sector produces goods and sells them to other sectors as an input and also sells to households, government, entrepreneurs, the export sector or stock surplus. Thus it can be said that an Input-Output Table shows the flow of goods and services between sectors during a particular period (usually a year). The columns of the tables show input structure and the rows show output distribution of each output sector. This is sometimes known as an "Inter-Industrial Relations Table". The general form of the I/O Table can be seen in Table 1.

Table 1 The General Format of Input-Output Table

		Producers					Final Demand (F_i)					Total
		X_1	X_2	X_3	.....	X_j	C	I	G	X	M	Output
Producers	X_1	X_{11}	X_{12}	X_{13}	.....	X_{1j}	C_1	I_1	G_1	X_1	M_1	X_1
	X_2	X_{21}	X_{22}	X_{23}	.....	X_{2j}	C_2	I_2	G_2	X_2	M_2	X_2
	...	.....					....	....	....	....	....	....
	...	.....					....	....	....	....	....	....
	X_i	X_{i1}	X_{i2}	X_{i3}	.....	X_{ij}	C_i	I_I	G_i	X_i	M_i	X_i
Value Added		V_1	V_2	V_3	.....	V_j						
Total Input		X_1	X_2	X_3	.....	X_j						

Sources: อัทธ์ พิศาลวานิช, 2549: 13-8.

From Table 1, the rows show output distribution of goods in each sector i.e. output is sold to other sectors or industries to meet intermediate demand and eventually to serve the final need (final demand), which consists of the consumption by households and government, and accumulated capital or increase in stock as well as exports. The columns show the structure of output for each industry that determines what input is needed, such as raw materials (which is a part of intermediate demand). Primary input consists of wages and salaries, operating surplus, which is the rent, interest, depreciation and indirect taxes, minus subsidies. The imported goods are accounted into the table. The Input-Output Table shows the status of demand and supply of goods in an economic system, which is the general equilibrium of goods and services in the open economy. Therefore, the table shows that the relation of input is always equal to output.

Business activities in the economy between inter-industrial transactions can be

learly explained in algebraic form as follows:

Each row shows the distribution of Industrial output by assuming there are n sectors of output, that is:

$$\sum_{j=1}^{n} X_{ij} + F_i = X_i \quad (i = 1, 2 \ldots\ldots\ldots\ldots n)$$

where X_{ij} = demand of industrial goods i for an output of industry j

X_i = the value of an output of industry i

F_i = final demand for industrial goods i

Similarly, each column shows a structure of the operating cost of output of industrial goods j, that is:

$$\sum_{j=1}^{n} X_{ij} + V_i = X_j \quad (j = 1, 2, \ldots, n)$$

where V_j = the added value of output sectors j

By assuming the use of input is in direct proportion to output value:

$$X_{ij} = a_{ij} X_j$$

$$\text{or} \quad a_{ij} = \frac{X_{ij}}{X_j}$$

As such a_{ij} is being called input or technical coefficients of each Input used in industrial output i

From the relation shown above, the matrix form can be explained as follows:

$$X = AX + F$$

$$\text{or} \quad X = (I - A)^{-1} F$$

$$\text{as} \quad X = \begin{pmatrix} X_1 \\ X_2 \\ : \\ X_n \end{pmatrix} \qquad F = \begin{pmatrix} F_1 \\ F_2 \\ : \\ F_n \end{pmatrix}$$

$$A = \begin{pmatrix} a_{11} & a_{12} & \ldots\ldots & a_{1n} \\ a_{21} & a_{22} & \ldots\ldots & a_{2n} \\ : & : & & : \\ a_{n1} & a_{n2} & \ldots\ldots & a_{nn} \end{pmatrix}$$

$(I - A)^{-1}$ is called the Leontief Inverse Matrix, or Inverse Matrix, named after Prof. Wassily W. Leontief, the founder of the theory of the input-output inverse matrix, which has become an important key in analyzing an economic system by I/O tables.

Objectives

1. To compose a table of input-output for the cluster of five provinces in Thailand's mid-south (clustering Input-Output Table for the mid-southern provinces), namely Satun, Phattalung, Trung, Nakornsrithamarat and Songkhla, using 16 output activities at the year 2004 prices.

2. To compose a table of input-output for the cluster provinces using 58 output activities at the year 2004 prices, for the purpose of studying the usage structure of input and sales of goods within provinces.

The Concept for an Analysis by Composing a Table for Input-Output in the Area

To compose a table for Input-Output or I/O Table in the provinces for 58 output activities, and 16 output activities for a cluster of provinces requires the following conceptual analysis (Figure 1).

1. Collect secondary data by gathering information from national offices, such as the Office of the National Economic Social Development Board, the Finance Ministry, the Commerce Ministry, the National Statistical Office, the Provincial Commerce Offices, the Department of Customs, and the Department of Revenue. The information gathered from the above offices can be classified into three main categories, namely an I/O Table of Thailand using 58 and 180 output activities in the year 2000, the gross national product and gross provincial product in the year 2004, and other provincial information in the year 2004.

2. Select and organize a cluster of output activities from the National I/O Table in the year 2000 using 180 output activities, which will be used to compose the National I/O Table using 58 output activities and calculate as follows: (Stone, 1960: 101-104 cited in Borwornsri Somboonpanya, 1980: 15-16):

1) $q^* = G\,q\,G$

$$= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \end{bmatrix} \begin{bmatrix} q_1 & 0 & 0 \\ 0 & q_2 & 0 \\ 0 & 0 & q_3 \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} q_1 & 0 \\ 0 & q_2 + q_3 \end{bmatrix}$$

where q^* is an output matrix of the cluster

q is an output matrix of three activities that need to include two final output activities

G is a matrix that shows clustering activities and is valued at 0 and 1

G is the transposition of matrix G

2) $Z^* = G\,Z\,G$

$$= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \end{bmatrix} \begin{bmatrix} Z_{11} & Z_{12} & Z_{13} \\ Z_{21} & Z_{22} & Z_{23} \\ Z_{31} & Z_{32} & Z_{33} \end{bmatrix} \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 0 & 1 \end{bmatrix}$$

$$= \begin{bmatrix} Z_{11} & Z_{12} + Z_{13} \\ Z_{21} + Z_{31} & Z_{22} + Z_{32} + Z_{23} + Z_{33} \end{bmatrix}$$

where Z^* is a matrix that shows a rotation of output which is already clustered

Z is a matrix that shows a rotation of input of three output activities that need

to include two final output activities

3) $B^* = Z^* q^{*-1}$

4) $\Gamma^* = q^{*-1} Z^*$

5) $$B^* = \begin{matrix} \frac{Z_{11}}{q_1} & \frac{Z_{12} + Z_{13}}{q_2 + q_3} \\ \frac{Z_{21} + Z_{31}}{q_1} & \frac{Z_{22} + Z_{32} + Z_{23} + Z_{33}}{q_2 + q_3} \end{matrix}$$

6) $$\Gamma^* = \begin{matrix} \frac{Z_{11}}{q_1} & \frac{Z_{12} + Z_{13}}{q_1} \\ \frac{Z_{21} + Z_{31}}{q_2 + q_3} & \frac{Z_{22} + Z_{32} + Z_{23} + Z_{33}}{q_2 + q_3} \end{matrix}$$

where B^* is an input coefficient matrix that is already clustered

Γ^* is an output coefficient matrix that is already clustered

From the above procedure, we can compose an I/O Table of Thailand in the year 2000 with 58 output activities for the purpose of study.

3. Adjust the National I/O Table in the year 2000 to represent the year 2004 by drawing the National I/O Table in the year 2000 to link with the gross national product in the year 2004 using Leontief Inverse Matrix and Allocational Inverse Matrix (Ramana, 1969: 1-3 cited in Borwornsri Somboonpanya, 1980: 21-22), which is the matrix that links the I/O Table and gross national product together:

Where Z is a matrix that shows a rotation of input

B is an input coefficient matrix

Γ is an output coefficient matrix

g is a row vector of added value

q is a column vector of output

q^1, q^2 is a column vector output of province 1 and province 2

d is a column vector of final demand

$\hat{}$ is a sign showing that the vector has been transformed into a diagonal matrix

1) $B = Z \hat{q}^{-1}$

2) $\Gamma = \hat{q}^{-1} Z$

This can be written in an alternative form as:

3) $B = \hat{q} \Gamma \hat{q}^{-1}$

4) $\Gamma = \hat{q}^{-1} B \hat{q}$

5) $(I - \Gamma)^{-1} = q^{-1} (I - B)^{-1} q$

As a model for input-output, value can be calculated by using the relation formulae as follows:

6) $q = (I-B)^{-1} d$

7) $q = g (I - \Gamma)^{-1}$

8) $q^1 + q^2 = (g^1) (I - \Gamma)^{-1} + (g^2) (I - \Gamma)^{-1}$

From the above formula $(I - B)^{-1}$ is called a Leontief Inverse Matrix, which estimates the vector of output in each level of final demand, and $(I - \Gamma)^{-1}$ is an Allocational Inverse

Matrix that is used to estimate the vector value of output in each value added level.

In order to adjust the I/O Table to agree with the gross national product, the National I/O Table of 58 output activities must first be calculated to obtain a Leontief Inverse Matrix. From this, an Allocational Inverse Matrix (formula 5) can be calculated. Then, by using the Allocational Inverse Matrix, which has been multiplied by gross national product of output activities, a vector output according to equation 7) and 8) can be derived. From there, taking the new vector output to calculate according to equation 1), the National I/O Table in the year 2004 can be derived by using a derived I/O Table as a control for calculating an I/O Table for the cluster of provinces.

4. Calculate the provincial I/O Table in the year 2004 with 58 output activities is done by using the National I/O Table in the year 2004 with gross national product, and investment and output activities data at the provincial level. In order to compose the provincial I/O Table, it is assumed that the provincial and national technology outputs are the same, but the difference lies the resources of each particular province. Therefore, each province has different output activities, causing the quantity of national output activities to differ from those of the provincial output activities. That means the provincial output activities are less in quantity, and the need of the provincial input also differs from the that of the national input.

Table 2 List of Output Activities for an I/O Table Using 16 Output Activities

Code	Activities	Code	Activities
001	Paddy	009	Rubber Products
002	Fruits	010	Saw Mills and Wood Products
003	Rubber (Latex)	011	Public Utilities
004	Oil Palm	012	Construction
005	Livestock	013	Trade
006	Fisheries	014	Transportation and Communication
007	Mining and Quarrying	015	Services
008	Food Manufacturing	016	Unclassified

Remark: The reader can obtain the 58 sectors in Appendix ก-2 to ก-8 from the final report of the study of Input and Output Structure for the Cluster of Provinces in Thailand's Mid-South for the Economic Evaluation, Center for International Trade Study (CITS), University of Thai Chamber of Commerce (2550).

Source: อัทธ์ พิศาลวานิช และคณะ, 2550: 3-6

5. Collect primary data by field survey of 1,000 samples to cover the total surveyed area of five provinces, then digest data to improve the provincial I/O Table using 58 output activities and, being more realistic, by bringing it into agreement with the actual provincial economic situation, thus spreading samples according to economic sizes and amounts of output activities as in Table 3.

Table 3 Spreading Samples of Output Activities of Each Province

unit: nos.

Province	Agriculture	Industry	Service	Questionnaire
Satun	48	18	34	100
Phattalung	44	18	38	100
Trang	68	24	44	136
Nakornsrithamarat	132	52	104	288
Songkhla	158	83	135	376
Total				1,000

Source: อัทธ์ พิศาลวานิช และคณะ, 2550: 3-13

Table 4 A Model Format for Input-Output for the Cluster of Five Provinces in the Mid-South and Other Provinces

From / To		I Satun 1……16	II Phattalung 1……16	III Trang 1……16	IV Nakornsrithamarat 1……16	V Songkhla 1……16	VI Others 1……16
I Satun	1	$r^{I,I}_{1,1}$ …… $r^{I,I}_{1,16}$	$m^{I,II}_{1,1}$ …… $m^{I,II}_{1,16}$	$m^{I,III}_{1,1}$ …… $m^{I,III}_{1,16}$	$m^{I,IV}_{1,1}$ …… $m^{I,IV}_{1,16}$	$m^{I,V}_{1,1}$ …… $m^{I,V}_{1,16}$	$m^{I,VI}_{1,1}$ …… $m^{I,VI}_{1,16}$
	16	$r^{I,I}_{16,1}$ …… $r^{I,I}_{16,16}$	$m^{I,II}_{16,1}$ …… $m^{I,II}_{16,16}$	$m^{I,III}_{16,1}$ …… $m^{I,III}_{16,16}$	$m^{I,IV}_{16,1}$ …… $m^{I,IV}_{16,16}$	$m^{I,V}_{16,1}$ …… $m^{I,V}_{16,16}$	$m^{I,VI}_{16,1}$ …… $m^{I,VI}_{16,16}$
II Phattalung	1	$m^{II,I}_{1,1}$ …… $m^{II,I}_{1,16}$	$r^{II,II}_{1,1}$ …… $r^{II,II}_{1,16}$	$m^{II,III}_{1,1}$ …… $m^{II,III}_{1,16}$	$m^{II,IV}_{1,1}$ …… $m^{II,IV}_{1,16}$	$m^{II,V}_{1,1}$ …… $m^{II,V}_{1,16}$	$m^{II,VI}_{1,1}$ …… $m^{II,VI}_{1,16}$
	16	$m^{II,I}_{16,1}$ …… $m^{II,I}_{16,16}$	$r^{II,II}_{16,1}$ …… $r^{II,II}_{16,16}$	$m^{II,III}_{16,1}$ …… $m^{II,III}_{16,16}$	$m^{II,IV}_{16,1}$ …… $m^{II,IV}_{16,16}$	$m^{II,V}_{16,1}$ …… $m^{II,V}_{16,16}$	$m^{II,VI}_{16,1}$ …… $m^{II,VI}_{16,16}$
III Trang	1	$m^{III,I}_{1,1}$ …… $m^{III,I}_{1,16}$	$m^{III,II}_{1,1}$ …… $m^{III,II}_{1,16}$	$r^{III,III}_{1,1}$ …… $r^{III,III}_{1,16}$	$m^{III,IV}_{1,1}$ …… $m^{III,IV}_{1,16}$	$m^{III,V}_{1,1}$ …… $m^{III,V}_{1,16}$	$m^{III,VI}_{1,1}$ …… $m^{III,VI}_{1,16}$
	16	$m^{III,I}_{16,1}$ …… $m^{III,I}_{16,16}$	$m^{III,II}_{16,1}$ …… $m^{III,II}_{16,16}$	$r^{III,III}_{16,1}$ …… $r^{III,III}_{16,16}$	$m^{III,IV}_{16,1}$ …… $m^{III,IV}_{16,16}$	$m^{III,V}_{16,1}$ …… $m^{III,V}_{16,16}$	$m^{III,VI}_{16,1}$ …… $m^{III,VI}_{16,16}$
IV Nakornsrithamarat	1	$m^{IV,I}_{1,1}$ …… $m^{IV,I}_{1,16}$	$m^{IV,II}_{1,1}$ …… $m^{IV,II}_{1,16}$	$m^{IV,III}_{1,1}$ …… $m^{IV,III}_{1,16}$	$r^{IV,IV}_{1,1}$ …… $r^{IV,IV}_{1,16}$	$m^{IV,V}_{1,1}$ …… $m^{IV,V}_{1,16}$	$m^{IV,VI}_{1,1}$ …… $m^{IV,VI}_{1,16}$
	16	$m^{IV,I}_{16,1}$ …… $m^{IV,I}_{16,16}$	$m^{IV,II}_{16,1}$ …… $m^{IV,II}_{16,16}$	$m^{IV,III}_{16,1}$ …… $m^{IV,III}_{16,16}$	$r^{IV,IV}_{16,1}$ …… $r^{IV,IV}_{16,16}$	$m^{IV,V}_{16,1}$ …… $m^{IV,V}_{16,16}$	$m^{IV,VI}_{16,1}$ …… $m^{IV,VI}_{16,16}$
V Songkhla	1	$m^{V,I}_{1,1}$ …… $m^{V,I}_{1,16}$	$m^{V,II}_{1,1}$ …… $m^{V,II}_{1,16}$	$m^{V,III}_{1,1}$ …… $m^{V,III}_{1,16}$	$m^{V,IV}_{1,1}$ …… $m^{V,IV}_{1,16}$	$r^{V,V}_{1,1}$ …… $r^{V,V}_{1,16}$	$m^{V,VI}_{1,1}$ …… $m^{V,VI}_{1,16}$
	16	$m^{V,I}_{16,1}$ …… $m^{V,I}_{16,16}$	$m^{V,II}_{16,1}$ …… $m^{V,II}_{16,16}$	$m^{V,III}_{16,1}$ …… $m^{V,III}_{16,16}$	$m^{V,IV}_{16,1}$ …… $m^{V,IV}_{16,16}$	$r^{V,V}_{16,1}$ …… $r^{V,V}_{16,16}$	$m^{V,VI}_{16,1}$ …… $m^{V,VI}_{16,16}$
VI Others	1	$m^{VI,I}_{1,1}$ …… $m^{VI,I}_{1,16}$	$m^{VI,II}_{1,1}$ …… $m^{VI,II}_{1,16}$	$m^{VI,III}_{1,1}$ …… $m^{VI,III}_{1,16}$	$m^{VI,IV}_{1,1}$ …… $m^{VI,IV}_{1,16}$	$m^{VI,V}_{1,1}$ …… $m^{VI,V}_{1,16}$	$r^{VI,VI}_{1,1}$ …… $r^{VI,VI}_{1,16}$
	16	$m^{VI,I}_{16,1}$ …… $m^{VI,I}_{16,16}$	$m^{VI,II}_{16,1}$ …… $m^{VI,II}_{16,16}$	$m^{VI,III}_{16,1}$ …… $m^{VI,III}_{16,16}$	$m^{VI,IV}_{16,1}$ …… $m^{VI,IV}_{16,16}$	$m^{VI,V}_{16,1}$ …… $m^{VI,V}_{16,16}$	$r^{VI,VI}_{16,1}$ …… $r^{VI,VI}_{16,16}$

Source: อัทธ์ พิศาลวานิช และคณะ, 2550: 3-7

The method of calculation assumes that:

1) $\beta_{ij}^{s} = r_{ij}^{S,S} + \sum_{\substack{t=1 \\ t \neq s}}^{4} m_{ij}^{t,S}$

where β_{ij}^{s} is the value of the provincial technical coefficient of zone s

$r_{ij}^{t,S}$ is the input coefficient of province s imported from province t

$m_{ij}^{t,S}$ is the input coefficient of province s imported from province t

2) $r_{ij}^{t,S} = \beta_{ij}^{s} \cdot CIQ_{ij}^{s}$

where CIQ_{ij}^{s} is the cross-industry quotient value of activities i and j in province s

3) $CIQ_{ii}^{s} = \dfrac{g_i^s / g^s}{g_i^n / g^n}$

4) $CIQ_{ij}^{s} = \dfrac{g_i^s / g_j^s}{g_i^n / g_j^n}$

where g_i^s is added value of activity I in province s

g^s is the value of gross provincial product of province s

g_i^n is added value of national activity i

g^n is the value of gross national product

Composing the I/O Table for the cluster of provinces starts by calculating $r_{ij}^{t,S}$ according to the above equation 2. If $CIQ_{ij}^{s} \geq 1$ then changes $CIQ_{ij}^{s} = 1$ which makes $r_{ij}^{t,S} = \beta_{ij}^{s}$ because output activity i is greater than output activity j, so it can be assumed that output activity i can respond to the need of all j activities and if $CIQ_{ij}^{s} < 1$ then $r_{ij}^{t,S} = \beta_{ij}^{s} \cdot CIQ_{ij}^{s}$

From there, the provincial technical coefficient of a province, which derives from province t or $m_{ij}^{t,S}$, has the following formula calculation:

5) $\sum_{\substack{t=1 \\ t \neq s}}^{4} m_{ij}^{t,S} = \beta_{ij}^{s} (1 - CIQ_{ij}^{s}) = M_{ij}^{S}$

From which can be further derived:

6) $m_{ij}^{t,S} = M_{ij}^{S} \; ACIQ_{ij}^{t,S}$

7) $ACIQ_{ij}^{t,S} = CIQ_{ij}^{t,S}$ which has been changed $\sum_{\substack{t=1 \\ t \neq s}}^{4} CIQ_{ij}^{t,S} = 1$

To find the value $CIQ_{ij}^{t,s}$ there are the following formulae:

8) $CIQ_{ij}^{t,S} = \dfrac{(g_i^t / g^t) - (g_i^s / g^s) \cdot \delta_{ij}^{t,S}}{e^{t,S}}$

9) $CIQ_{ij}^{t,S} = \dfrac{(g_i^t / g_j^t) - (g_i^s / g_j^s) \cdot \delta_{ij}^{t,S}}{e^{t,S}}$

Value $\delta_{ij}^{t,S}$ is equal to 0 or 1 depending on whether output activity i of province t has

been obtained from activity j of province s and is being used as input or not, that is:

If $(g_i^t / g^t) > (g_i^n / g^n) > (g_i^s / g^s)$ to obtain $\delta_{ij}^{t,S} = 1$ and conversely $\delta_{ij}^{t,S} = 0$

And if $(g_i^t / g_j^t) < (g_i^n / g_j^n) < (g_i^s / g_j^s)$ to obtain $\delta_{ij}^{t,S} = 1$ and conversely $\delta_{ij}^{t,S} = 0$

The variance $e^{t,S}$ is a varied distance which plays an important part in calculating goods rotation between provinces because the quantity of export from zone t to province s depends on the location of province t in which the seller i determines whether the transportation cost is more or less.

When the calculation is done according to the said equation, then the trade coefficient table between provinces would derive (Table 4, and if this is multiplied by the total value of all intermediate input of each province, then we obtain the value of trade between the provinces, activity i and activity j. The above-mentioned table is shown in double format for a provincial I/O Table that indicates the trade value of both provinces, whether being the distribution value of Intermediate Input and goods from the first province and consumed by the second province. It also indicates that the structure of uses of the second provincial input is being obtained from the first province, and if all tables from the five clustered provinces, namely Satun, Phattalung, Trang, Nakornsrithamarat, Songkhla, and the other 71 provinces of Thailand are drawn together we derive the Thailand I/O Table for the year 2004 at the output price.

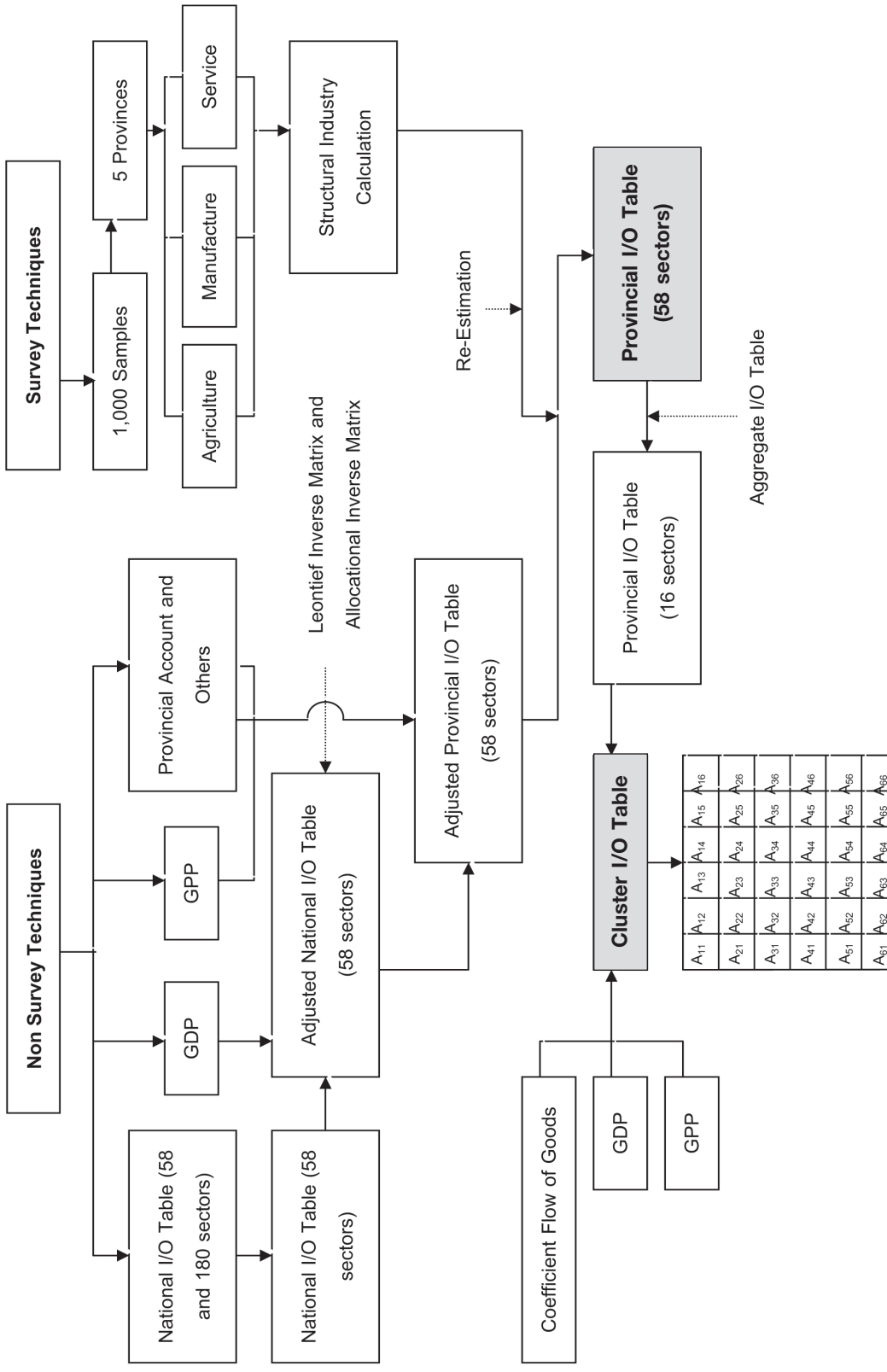

Figure 1 The Format to Compose an I/O Table of the Cluster of Provinces in the Mid-South

The Value of Provincial I/O Table and the Cluster of Provinces in the Middle South

The provincial I/O Table for the year 2004 consisting of 16 and 58 output activities and the cluster of provinces table for the year 2004 of 16 output activities which have been composed, can explain the economic value of each province in three dimensions as follows:

Total Supply

The value of total supply of goods and services is the value of the saleable output within the province to be used as intermediate input and are the goods for final consumers. Total supply within the provinces is derived from two sources. These are goods produced within the area or provinces, and goods imported from foreign countries or other provinces in response to the need within the provinces. From the provincial I/O Table of the five provinces in the mid-south for the year 2004, there is a total supply value worth 816,273 million baht, of which Songkhla has the highest value at 47,426 million baht. Nakornsrithamarat, Trang, Phattalung, and Satun have values of 246,374, 114,813, 55,060 and 52,600 million baht respectively. If total supply is broken down into total output within the area of export, it can be found that the five provinces in the mid- south obtained a total value within the area greater than what was imported from outside at an average rate of 75 and 25 percent respectively (Table 5).

Table 5 The Value and Percentage of Total Supply of Internal Output and Imported Goods for the Year 2004

value: million baht

Province	Total Supply					
	Value	%[1/]	Internal Output		Imported Goods	
			Value	%[2/]	Value	%[2/]
Satun	52,600	0.27	38,827	73.82	13,773	26.18
Phattalung	55,060	0.28	41,554	75.47	13,506	24.53
Trang	114,813	0.59	87,262	76.00	27,551	24.00
Nakornsrithamarat	246,374	1.27	189,442	76.89	56,932	23.11
Songkhla	347,426	1.78	258,885	74.52	88,541	25.48
Total (5)	816,273	4.19	615,969	75.46	200,303	24.54
Others (71)	18,657,510	95.81	14,564,499	78.06	4,093,011	21.94
TOTAL	19,473,783	100.00	15,180,469	77.95	4,293,314	22.05

Remarks: [1/] a percentage of total supply in each province is being compared to the national total supply.

[2/] a percentage of domestic output and import goods is being compared to each provincial total supply.

Source: อัทธ์ พิศาลวานิช และคณะ, 2550: 4-2

1) Provincial Product

The value of the products of the five provinces in the mid-south from the provincial I/O Table for the year 2004 is 615,969 million baht, which was 4.06 percent of the total domestic product. The value of provincial products consisted of intermediate expense, which was the expense of buying an input for each goods amounting to 303,296 million baht and also added value of output from goods produced amounting to 312,942 million baht, which was 49.24 percent and 50.76 percent, respectively. It can be seen that Songkhla was the most productive province and had the best economic results with 126,942 million baht, followed by Nakornsrithamarat, Trang, Phattalung and Satun, respectively.

Table 6 The Value of Domestic Product, Intermediate Expense and Added Value by Area for the Year 2004

value: million baht

Items	Output within Province					
	Value	%[3/]	Intermediate expense [1/]		Added Value [2/]	
			Value	%[4/]	Value	%[4/]
Satun	38,827	0.26	18,566	47.82	20,260	52.18
Phattalung	41,554	0.27	18,609	44.78	22,945	55.22
Trang	87,262	0.57	43,235	49.55	44,026	50.45
Nakornsrithamarat	189,442	1.25	90,943	48.01	98,499	51.99
Songkhla	258,885	1.71	131,942	50.97	126,942	49.03
Total (5)	615,969	4.06	303,296	49.24	312,673	50.76
Others (71)	14,564,499	95.94	8,373,684	57.49	6,190,815	42.51
TOTAL	15,180,469	100.00	8,676,981	57.16	6,503,488	42.84

Remarks: [1/] is total intermediate expense.

[2/] is added value consisting of 1) salary, wage 2) returns from production 3) depreciation and 4) net indirect tax.

[3/] a percentage of total output in each province is being compared to total domestic output within each province.

[4/] a percentage of intermediate expense and added value of each province is being compared to total output within each province.

Source: อัทธ์ พิศาลวานิช และคณะ, 2550: 4-7

2) Total Imports

The value of imported goods of the five provinces in the provincial I/O Table for the year 2004 is the value of the sum of goods imported from abroad and other provinces, which amounted to 200,303 million baht (Table 7). From the table, it can be seen that most imported goods were industrial and service goods because of output restraint. As for agricultural goods, there were some but not many, as most were species of imported plants rarely grown or scarce in the area.

Table 7 The Value and Percentage of Imported Goods in the Cluster Provinces in the Mid-South

unit: million baht

Product	Satun		Phattalung		Trang		Nakornsrithamarat		Songkhla	
	Value	%	Value	%	Value	%	Value	%	Value	%
Paddy	20	0.15	0	0.00	0	0.00	0	0.00	3	0.00
Fruits	0	0.00	0	0.00	1	0.00	8	0.01	291	0.33
Rubber (Latex)	0	0.00	0	0.00	0	0.00	1	0.00	3	0.00
Oil Palm	3	0.02	28	0.20	4	0.01	59	0.10	863	0.97
Livestock	0	0.00	0	0.00	8	0.03	17	0.03	85	0.10
Fisheries	0	0.00	101	0.75	0	0.00	7	0.01	38	0.04
Mining and Quarrying	375	2.72	211	1.56	258	0.93	3,682	6.47	1,362	1.54
Food Manufacturing	1,285	9.33	1,020	7.55	1,608	5.84	2,372	4.17	10,038	11.34
Rubber Products	1	0.01	1	0.00	4	0.01	71	0.12	386	0.44
Saw Mills and Wood Products	372	2.70	181	1.34	342	1.24	1,331	2.34	596	0.67
Public Utilities	721	5.24	809	5.99	931	3.38	266	0.47	514	0.58
Construction	0	0.00	-	-	-	-	0	0.00	-	-
Trade	-	-	-	-	-	-	-	-	-	-
Transportation and Communication	3	0.02	3	0.02	53	0.19	970	1.70	761	0.86
Services	298	2.16	122	0.90	593	2.15	3,317	5.83	6,024	6.80
Unclassified	10,693	77.64	11,030	81.67	23,751	86.21	44,833	78.75	67,577	76.32

Source: อัทธ์ พิศาลวานิช และคณะ, 2550: 4-34

Final Demand

The value of final demand from the provincial I/O Table for the year 2004 amounted to 512,976 million baht, which was the value of goods exported to other provinces and abroad at 323,677 million baht, or 63.10 percent. Consumption within the area was 113,121 million baht, savings or investments 66,921 million baht, government expenses 9,214 million baht and the remaining goods in process or Stock was 44 million baht, respectively (Table 8).

Table 8 The Value and Percentage of Final Demand for the Cluster Provinces in the Mid-South for the Year 2004

unit: million baht

Province	Final Demand					
	Total	Household Exp.	Government Exp.	Capital	Stock	Export
Satun	34,033	11,434	534	3,906	-16	18,176
	(100.00)	(33.60)	(1.57)	(11.48)	(- 0.05)	(53.41)
Phattalung	36,451	11,540	628	4,944	-2	19,341
	(100.00)	(31.66)	(1.72)	(13.56)	(- 0.01)	(53.06)
Trang	71,578	18,254	1,694	9,726	19	41,884
	(100.00)	(25.50)	(2.37)	(13.59)	(0.03)	(58.52)
Nakornsrithamarat	155,431	31,451	2,877	20,100	14	100,988
	(100.00)	(20.23)	(1.85)	(12.93)	(0.01)	(64.97)
Songkhla	215,483	40,442	3,481	28,245	29	143,288
	(100.00)	(18.77)	(1.62)	(13.11)	(0.01)	(66.50)
Total (5)	512,976	113,121	9,214	66,921	44	323,677
	(100.00)	(22.05)	(1.80)	(13.05)	(0.01)	(63.10)
Nation	10,796,802	3,835,921	800,202	1,421,056	89,700	4,649,923
	(100.00)	(35.53)	(7.41)	(13.16)	(0.83)	(43.07)

Remark: ( ) is the percentage of final demand of each category to total final demand.

Source: อัทธ์ พิศาลวานิช และคณะ, 2550: 4-43

Trade Margin and Transport Cost*

To compose the provincial I/O table for the five provinces in the mid-south can be done in two formats. These are I/O tables at producers' price ** and at consumers' price.*** The tables are different because of the value of the two items as below:

1) Trade Margin is the expense that occurs while selling goods from one place to another with the I/O Table showing two kinds of Trade Margin, these being the process of selling goods from the factory to retailers or other places, and the process of retailing goods to consumers, namely to households and the general public.

2) Transport cost is the cost that occurs while transporting goods from the output source to be sold to consumers. This cost may be included in the price that consumers must pay when buying goods, or may be included in output cost.

The value of both items will be borne by producers and consumers, although the proportional burden will vary depending on whether producers are able to set the price by covering those expenses or not. If the price being set is not too high, then producers may have to bear this particular cost and vice versa. Apart from that, the supply of raw material, the transforming activities and the distribution of finished goods to consumers creates a link between several businesses and becomes a supply chain.

Conclusions and Suggestions

Based on the valuation of domestic products, exports and inputs used in provinces, it can be found that food manufacturing is a potential activity of all five provinces because it has high output value and also uses high proportional input within the provinces. Most inputs are goods that derive from fisheries, for which all the provinces have potential, except Phattalung which has low value fishery output. One of the important factors in fisheries that may create an output problem is petrol, which is imported from other regions. Therefore, the provinces must together find substantial support in this area. Apart from that, rubber products are another activity that nearly all

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* Trade margin of Wholesale and Retail are shown in Codes 501 and 502 and the of the cost of transport is shown in Code 503 on the I/O Table at consumers' price only because those expenses occur while selling goods to consumers.

** The value at the price to producers.

*** The value of the payment to consumers.

provinces have the potential for because there is the use of input within the province and also high proportional export value. As for rubber plantation activity, although there is a low dependent input within the province there is a high output value and the product can be exported as well as sold to important rubber products factories (Table 9).

Table 9 A Summary of the Potential Output Activity of the Cluster Provinces in the Mid-South that Needs to be Supported

Province	Production Activity	
	Potential	Need support
Satun	Food Manufacturing, Fishery	Rubber
Phattalung	Food Manufacturing, Rubber Products	Rubber, Livestock, Paddy
Trang	Food Manufacturing, Rubber Products, Fishery	Rubber and Saw Mills and Wood Products
Nakornsrithamarat	Food Manufacturing, Rubber Products, Fishery	Rubber, Mining and Quarrying, Saw Mills and Wood Products, Livestock, Paddy, Fruits
Songkhla	Food Manufacturing, Rubber Products, Fishery	Rubber, Saw Mills and Wood Products, Livestock, Fruits

Source: อัทธ์ พิศาลวานิช และคณะ, 2550: 5-67

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