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FOREWORD

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Abstract

This paper introduced an approach in analyzing the impact of east-west corridor along Savannakhet route no. 9 to its neighboring countries. The significance of this economic measurement tackles broad issues on export-import expansion, interdependence of industrial structure from Rest of Savannakhet (intra and interregional analysis), evaluating impacts or changes in final demand (production, income, and employment), and short term projections and forecast of the domestic economy. The case of Savannakhet examines the use of mixed or hybrid technique that practically avoids budget constraints by simply maximizing administrative resources and minimizing survey costs.

1. INTRODUCTION

The methodological approach of compiling regional and interregional input-output has been expanding since its first introduction by Leontief in 1919[1]. Since then, the system in describing the interrelationship among industries has been constructed for more than 90 countries (UN, 2000) and is now being introduced to Lao PDR as another analytical tool. To serve the objective of investigating the inter-linkages of products[2], the accounting framework of the traditional single area I-O model is tested to Savannakhet, the second largest province of Lao along East-West Trading-Corridor. Thus, by factoring in the effects of cross border trade issues, the analytical framework is expanded to distinguish and quantify outflows (exports) and inflows (imports) between Savannakhet and the rest of the areas outside of Savannakhet, i.e., intra-regional linkages between Savannakhet and Rest of Lao (ROL) and inter-regional linkages between Savannakhet and Rest of the World (ROW).

LAO PDR has been producing its national Gross Domestic Product (GDP) Accounts annually. It has also made an initial attempt to compile the 1997 national I-O Table. However, due to its reliability, the National Statistics Center (NSC) withheld the publication of its results. Meanwhile, at the sub-national level, no such Production Accounts exist officially nor an Input-Output Table, although some provinces have been compiling the Gross Provincial Product for their own internal use. In support of this pioneering effort, a survey of establishments[3] was conducted to meet the rigid data demands of the I-O accounting. Moreover, secondary data collection and processing have been fully tapped from all possible data sources to complement the survey[4] results. The complementing method (also known as hybrid or mixed approach of generating symmetric I-O tables) is herein adopted to simplify the development of the I-O for Savannakhet.

The report is organized as follows. Section 2 presents some related studies concerning the usefulness of the tool to regional integration while section 3 provides the analytical framework used for the inter-intra industrial linkages model. Step by step compilation of the system is presented in section 4. This section also enumerated the conceptual framework of MAKE and USE matrix and the identification of possible data sources. The empirical findings of this report are highlighted in section 5. The section provides the analysis of its structural performance, analysis of supply and demand, input and output structures by establishing the product-by-product relationship, In addition, an analysis of external trade flows, inter-industrial dependencies and backward and forward linkages are highlighted in this section. Furthermore, impact analysis is conducted to measure and examine the total (direct and indirect) effects of final demands on production, income, employment, and import requirements. Finally, section 6 ends with the limitation and future research of this study.

2. LITERATURE REVIEW

The consequence in joining the ASEAN is basically in the context of regional and global integration that create significant strides in economic growth and the reduction of poverty of its member countries. Lao PDR, in particular Savannakhet, that houses the national highway route number 9 (NH9) is considered as the Asia's strategic highway connecting the East with the

[1] Although Francois Quesnay;s Tableu Economique conceptualize circular flows between industries and general equilibrium in 1798 followed by Leon Walras in his theory of general equilibrium that examines the independence of goods and/or services within production process.

[2] Development under ADB TA 4264-Lao: Investment Climate and Productivity Study

[3] A establishment is defined as "an economic unit, generally at a single location, where business is conducted or where services or industrial operations are preformed and has one administrative accounting system.

[4] The survey captured 100 establishments representing agriculture, industry and services sectors.

West of the region. Thus, the infrastructure is expecting to accelerate industrial linkages to its neighboring countries in parallel to ASEAN advocacy.

Vast researchers in Asia have attempted to analyze fundamental structure of international flows of goods and services with interest in a short-cut or hybrid methods. Korea and Japan, for instance, evaluated the dependency of Japan to Korean via a non-survey technique (H. Lee, 2002; Sano, 1996; Jung and Bang, 2001 and Kim, 1989). However, the hybrid method is considered to be most cost-effective procedure in estimating the inter-regional flows with acceptable accuracy (Lahr, 1993; Van del Westhuizen, 1992; West, 1990; Imansyah, 2000; West, 1990).

3. ANALYTICAL FRAMEWORK: SVK I-O MODEL

In order to fully attain the objectives of this I-O study, an accounting framework for a non-competitive-import type of I-O table is developed for Savannakhet's economy. This non-competitive-import type of I-O table explicitly distinguishes inter-sectoral (monetary) transactions of locally produced from the imported products. Shown in Appendix 1 is the actual lay-out of the IO Table (or also called the USE Table) of the noncompetitive-import type.

The following are the salient features of the SVK I-O Table:

- transactions are confined within the territorial limits of Savannakhet Province;
- a static, open type of I-O model and final demand is treated as exogenous in the system;
- a symmetric, product-by-product table in which referred to as Quadrant I);
- a non-competitive-imports type; and
- transactions are valued in current producers' prices

4. COMPILATION METHODOLOGY

The method used in this study is a hybrid or a mixed approach of generating symmetric I-O tables. Basically, the hybrid approach is recommended practical to take into account the optimum use of currently available data obtained from regular data sources, to be complemented, if needed, by an ad hoc small sample I-O survey of establishments. Such data sources as (1) regional census/survey of establishments, (2) household surveys, and (3) existing statistical reports from administrative/regulatory agencies of government could provide the take-off points in developing the I-O database. The overall compilation methodology is done in eight (8) sequential work phases, as follows:

Phase I	Estimation of Control Totals
Phase II	Building the MAKE matrix (at Producer's Price)
Phase III	Constructing the USE Table (at Purchaser's Price), Competitive Type
Phase IV	Revaluing the USE table from Purchaser's to Producer's price
Phase V	Balancing/Reconciling Phase IV output
Phase VI	Deriving Symmetric USE Table at Producer's Price, Competitive Type
Phase VII	Building Satellite Tables on Import Flows
Phase VIII	Deriving Symmetric USE Table at Producer's Price, Non-competitive Type

For better understanding and appreciation of the overall compilation methodology, a work flowchart is appended in Appendix 3.

4.1 Phase I. Estimating the Control Totals

Initial estimates on gross output and value added relied mostly on raw data from the SVK I-O survey. Data for final demand and other sectors not covered in the survey were

collected, processed and revalidated from various source agencies. Relevant data retrieved from the 2003/2004 Enterprise Surveys of the National Statistics Center (NSC) are supplemented to validate the results.

4.2 Phase II. Building the Make Matrix

The MAKE matrix describes the production pattern of industries, recording the distribution of distinctly classified products produced during the period under study (Table 1). The diagonal elements correspond to the industry's characteristic or principal produce, while the off-diagonal elements account for the non-characteristic or secondary products. A product is said a primary produce when it accounts for the largest value of the industry's total gross output. The structure of the Make matrix is defined as:

$$x_{ij} = s_{ij} X_{i.} \tag{4}$$

where x_{ij} is estimated value of product j produced by industry i, $X_{i.}$ is total gross output of industry i, and s_{ij} is the estimated proportion of product j to total output of industry i.

Table 1. Layout of Make Matrix

From \ To	Product 1	2	…	j	…	n	Total Industry Output
Industry 1	x_{11}	x_{12}	…	x_{1j}	…	x_{1n}	$X_{1.}$
2	x_{21}	x_{22}	…	x_{2j}	…	x_{2n}	$X_{2.}$
:	:	:		:		:	:
i	x_{i1}	x_{i2}	…	x_{ij}	…	x_{in}	$X_{i.}$
:	:	:		:		:	:
n	x_{n1}	x_{n2}	…	x_{nj}	…	x_{nn}	$X_{n.}$
Total Product Output	$X_{.1}$	$X_{.2}$	…	$X_{.j}$	…	$X_{.n}$	$\sum_{i=j=1}^{20} x_{ij}$

4.3 Phase III. Constructing the Product-By-Industry Use Table

The objective of compiling a product-by-industry USE table is to provide the database, along with the MAKE matrix, in deriving the desired product-by-product type of I-O matrix through mechanical means, for the simple reason that, as stated earlier, existing cost of production data are available only by industry, not by product. A product-by-industry USE matrix is one type of IO accounts that traces the (money) flows of products to consuming industries as well as to final demand, valued in purchasers' prices.

One advantage of a product-by-industry USE table is that it can be compiled directly from readily available data sources and in a relatively shorter period of time given the regular economic census/survey results and other statistical reports from administrative agencies and regulatory bodies, complemented by a less complicated type of ad hoc IO survey. However, its usefulness is limited in the sense that it does not satisfy the material balance criterion because, unlike in a product-by-product table, there is no one-to-one correspondence between the row

and column sectors. The row sectors are products while the column sectors are industries; hence $X_i \neq X_j$.

Table 2. Layout of Product x Industry USE Table

From \ To			Intermediate Demand: Industry 1	2	…	j	…	n	Final Demand: Sector 1	2	…	k	…	m	TGO
			QUADRANT I						**QUADRANT II**						
Intermediate Inputs Used	Product	1	x_{11}	x_{12}	…	x_{1j}	…	x_{1n}	y_{11}	y_{12}	…	y_{1k}	…	y_{1m}	$X_{1.}$
		2	x_{21}	x_{22}	…	x_{2j}	…	x_{2n}	y_{21}	y_{22}	…	y_{2k}	…	y_{2m}	$X_{2.}$
		:	:	:		:		:	:	:		:		:	
		i	x_{i1}	x_{i2}	…	x_{ij}	…	x_{in}	y_{i1}	y_{i2}	…	y_{ik}	…	y_{im}	$X_{i.}$
		:	:	:		:		:	:	:		:		:	
		n	x_{n1}	x_{n2}	…	x_{nj}	…	x_{nn}	y_{n1}	y_{n2}	…	y_{nk}	…	y_{nm}	$X_{n.}$
			QUADRANT III						**QUADRANT IV**						
Value Added		1	v_{11}	v_{12}	…	v_{1j}	…	v_{1n}							$V_{1.}$
		:	:	:		:		:							:
		l	v_{l1}	v_{l2}	…	v_{lj}	…	v_{ln}			0				$V_{l.}$
		:	:	:		:		:							:
		p	v_{p1}	v_{p2}	…	v_{pj}	…	v_{pn}							$V_{p.}$
TGI			$X_{.1}$	$X_{.2}$	…	$X_{.i}$	…	$X_{.n}$	$Y_{.1}$	$Y_{.2}$	…	$Y_{.k}$	…	$Y_{.m}$	

The construction of the product-by-industry USE table involves two activities that need to be carried out, but not necessarily in their order, as follows:

4.3.1 Building the Input or Absorption Matrix

The input or ABSORPTION matrix represents the input or cost of production structure of industries. In Table 2, it is quadrant I (I-O matrix) plus quadrant III (GVA matrix). Read vertically, the input structure of industry j is consisting of the products absorbed or used as intermediate inputs plus its primary input payments to the factors of production. As earlier stated, the sum of intermediate and primary inputs of industry j equals its gross output i. Primary inputs shows: (1) compensation of employees as payment to labor, (2) indirect taxes net of subsidies as payments to government, (3) depreciation as allowance for wear and tear of capital and (4) operating surplus as returns to capital.

The method of building the input matrix is as follows: Given gross output of industry j, X_j, as recorded in the MAKE matrix, its intermediate and primary input levels are calculated by multiplying X_j by its corresponding vector of input coefficients that describes, in ratio form, the cost of production of industry j. In matrix form, the input matrix, IM, is computed as:

$$IM = B * \hat{X} \tag{5}$$

where: B is derived input coefficient matrix; and $\hat{X}$ is the diagonal matrix of industry gross outputs, Xj. The calculated absorption matrixes, IM, valued in purchasers' prices, thus fill in quadrants I and III.

4.3.2 Building the Final Demand Matrix

The other half of the USE table is the final demand matrix, shown in Table 2 as Quadrant II. The SVK USE table categorized final demand quadrant II into eight (8) exogenous sectors to include, among others, the domestic outflows (exports) and inflows (imports) with imports recorded as negative entries. The data sources are given in Table 4.

Table 3. Possible Data Sources for Final Demand

Final Demand Sector	Data Needs	Possible Data Sources
1. PCE: Private Consumption Expenditures	Household expenditures Imputed output of Ownership of dwellings NPISH* data (Non-Profit Institutions Serving Households (NGOs)	LECS results (unpublished) To be estimated from LECS Results (published & unpublished) To be checked if existing
2. GCE: General Government Consumption Expenditures	1. Government expenditures (This vector relates to govt. administrative services sector)	1. SVK Local Government 2. Min. of Finance
3. GFCF: Gross Fixed Capital Formation	1. Durable equipment by commodity 2. Construction 3. Breeding stocks & orchard development	1. SVK survey (capital expenditures) 2. SVK /NSC 3. SVK/NSC/Min. of Agric.
4. CI: Change in Inventories	1. Inventory levels by commodity	1. SVK survey/NSC
5. Exports a) Foreign, E^F b) Domestic, E^D c) Tourism	1. Commodity exports by commodity 2. Commodity exports by commodity 3. Tourist Expenditures by sector	1. SVK survey/Customs 2. SVK survey/Customs 3. Local govt/DGP local office
6. Imports a) Foreign, M^F b) Domestic, M^D	1. Commodity imports by commodity 2. Commodity imports by commodity	1. SVK survey/Customs 2. SVK survey/Customs

The output of Phase III is a USE matrix, combining the input matrix (quadrants I & III) and the final demand matrix (quadrants II & IV). The resulting USE matrix, as shown in Table 5, is a product-by-industry matrix for inter-sectoral transactions valued at purchasers' prices, with its row and column totals valued at producers' prices. At purchasers' price, every cell entry in the matrix is consist of the (a) producers' price of the product plus (b) the trade mark-up on the product that passes through trade channels and (c) the corresponding transport or delivery cost from producer to the buyer or purchaser.

Table 5. Layout of Product x Industry USE Table at Purchasers' Prices

FROM		TO	INTERMEDIATE DEMAND INDUSTRY 1 2 ……**Td Tn** ……19 20	FINAL DEMAND SECTORS HCE GCE FCF CI E M	**TGO At Prod Prices**
I N T E R M E D	I N P U T S	P R O D U C T S : 1 2 : **Td** **Tn** : 19 20	**QUADRANT I** I-O MATRIX at **PURCHASERS' PRICES** **0 0 ……0 0 ……. 0 0** **0 0 ……0 0 ……. 0 0**	**QUADRANT II** FINAL DEMAND MATRIX at **PURCHASERS' PRICES** **0 0 0 0 0 0** **e* 0 0 0 0 0**	X_1 X_2 : X_{Td} X_{Tn} : X_{19} X_{20}
P R I M A R Y	I N P U T S	1 2 3 4	**QUADRANT III** VALUE ADDED MATRIX at **Purchasers' = Producers' Prices**	**QUADRANT IV** **0**	**GDP**
TGI			**X_j at Producers' Prices**	**Y_k at Producers' Prices**	

NOTES:
Td: Trade sector - Entries along this sector are all zero, except its total output, X_{Td}.
Tn: Transport sector – Entries along this sector are zero, except at intersection of H vector (passenger fare expenditures)
e* suggesting there is an entry

In view of the different valuation between inputs and outputs, the table is thus not balanced along the rows, although it is balanced column-wise. There is the need therefore to revalue the cell elements from purchasers' to producers' prices before the balancing process is undertaken.

4.4 Phase IV: Revaluation from Purchaser's to Producer's Price

The process of revaluing the USE table from purchasers' to producers' prices involves the construction of separate tables on trade (TdM) and transport margins (TnM). These satellite tables are then subtracted from Table 5 to obtain Table 6, which is now a USE table being revalued at producers' prices, but is still unbalanced.

The compilation of the trade and transport tables is based on trade and transport mark-up ratios that could be derived from enterprise surveys. Where data are not locally available, national indicators on trade and transport margins could be utilized as proxies. The calculation of trade and transport margins is done row-wise by multiplying trade and transport mark-up rates to corresponding row entries in Table 5. In equation form, the trade margins are calculated as:

$$TdM_{ii} = TdMR_i \; x \; X_{ij} \qquad (6)$$

where: TdM_{ij} is trade margin of product i consumed by column sector j;
$TdMR_i$ is trade margin ratio for product i; and
X_{ij} is value of product i consumed by column sector j.

The transport margins are estimated as follows:

$$T_nM_{ij} = T_nMR_i \; x \; X_{ij} \qquad (7)$$

where: TnM_{ij} is the estimated value of freight charge in the delivery of commodity i to using sector j; and $TnMR_i$ is the transport margin ratio for commodity i.

The producers' price table can now be generated by subtracting the sum of Eq.6 and Eq.7 from Table 5 to obtain Table 6 as illustrated below:

TABLE 5 USE TABLE at PURCHASER'S PRICE	-	(Eq.6) TRADE MARGINS TABLE	-	(Eq.7) TRANSPORT MARGINS TABLE	=	**TABLE 6** USE TABLE at PRODUCER'S PRICE
		Totals = **TdM_j**		Totals = **TnM_j**		

TABLE 6. Balancing and Reconciliation of Input and Output

	TO	INTERMEDIATE DEMAND	FINAL DEMAND	
		INDUSTRY	SECTORS	
FROM		1 2 …….…….. 19 20	H G FCF CI E^F E^D M^F M^D	**GO**
INTERMEDIATE INPUTS	COMMODITY 1 2 : :	Quadrant I	Quadrant II	X_i at Prod Prices
	Td	**TdM_j**		**X_{Td}**
	Tn		**TnM_j**	**X_{Tn}**
	: 20			
TII				
PRIMARY INPUT	1 : p : 4	Quadrant III VALUE ADDED $V_{p\,i}$ Purch price = Prod price	Quadrant IV VALUE ADDED	
TPI				**PGDP**
GI		X_j at PRODUCERS' PRICES	F_k at PRODUCERS' PRICES	

It can be observed that the column totals of trade margins, TdM_j and transport margins, TnM_j, now overlay the zero entries in Table 5 to complete the configuration of Table 6 as shown above. The sum of column entries of Table 6 balances with respective column totals, but sum of row entries does not necessarily balance with its corresponding row totals. Thus, the next phase is to balance Table 6.

4.5 Phase V: Balancing/Reconciling Table 6

The penultimate step is balancing the resulting product-by-industry USE account which is now fully valued at producers' prices (Table 6). As stated earlier, the sum of column entries balances with column totals of the table, while the sum of the row entries do not necessarily balance with corresponding control row totals. This is so because, as stated in previous sections of this Report, the method used in building the tables is the input method, that is, by filling-in the table column-wise.

The initial step in balancing Table 6 is to observe the sectors where big differences between the derived row totals and their corresponding control totals occur; check and revalidate the row entries that are perceived to be either overstated or understated based on

some interrelated information; and revised the row entries such that derived row totals equal the row constraints.

However, revising the entries to balance the row results in unbalanced columns, thus the need to balance again the columns but will again results in unbalanced rows. A manual iterative procedure of entry adjustments is thus followed until the differences are observed to be relatively small; in which case, the mechanical bi-proportional RAS[5] adjustment method is applied until the derived and control totals converge.

4.6 Phase VI: Deriving the Symmetric Use Matrix, Competitive Type

The final stage is to transform Table 6, which is the balanced product-by-industry USE matrix, into a symmetric product-by-product USE matrix. This essentially involves the mechanical transfer of outputs and inputs between sectors based on two restrictive technology assumptions: (a) industry technology assumption, and (b) product technology assumption.

4.6.1 Symmetric I-O Table by the Industry Technology Assumption

The industry technology assumption states that a product exhibits the same input structure as its producing industry. Using this assumption needs information on market shares of product outputs produced by industries to serve as weights in the reallocation of outputs and inputs between sectors. From the MAKE matrix, the market-share coefficients are computed by dividing each element down the column by its corresponding column total, which is the total product output. The desired matrix of product-by-product input coefficients can be calculated as:

$$ {}^{I}A_{PP} = B_{CI} D_{IC} \tag{8} $$

where: ${}^{I}A_{PP}$ is the product-by-product matrix of input coefficients based on industry technology assumption;
B_{PI} is the input coefficient matrix derived from the balanced product-by-industry USE table (Table 6); and
D_{IP} is the market-share coefficient matrix derived from the MAKE matrix (Table 1).

4.6.2 Symmetric I-O Table by the Product Technology Assumption

The product technology assumption states that a product possesses the same input structure wherever it is produced. Using this assumption requires indicators on the mix of products that industries produce. These product-mix coefficients are calculated from the MAKE matrix by dividing each element along the row by its corresponding row total, which is the total industry output. The desired matrix of product-by-product input coefficients can be calculated as:

$$ {}^{P}A_{PP} = B_{PI} C_{IP}^{-1} \tag{9} $$

where: ${}^{P}A_{PP}$ is the product-by-product matrix of input coefficients based on product technology assumption;
B_{CI} is the input coefficient matrix derived from the balanced product-by- industry USE table (Table 7); and

[5] The basic objective of the method is to distribute the differences between known product outputs and the sums of the rows of the present intermediate matrix proportionally along the rows and then to distribute the differences between industry outputs and the sums of the columns proportionally along the columns. The process is carried out continuously until all discrepancies are reduced to an acceptable minimum.

C_{IP}^{-1} is the inverse of product-mix coefficients, C, where $c_{ij} = x_{ij} / x_i$.

Empirical studies show that both assumptions have advantages and disadvantages. A_{PP} coefficients derived using the industry technology assumption result in positive numbers. Its disadvantage is that the assumption itself is believed to be non-sensible from the economic point of view. The product technology assumption, on the other hand, appears to be plausible in the economic sense. However, calculated A_{PP} coefficients yield some unacceptable negative numbers, albeit relatively insignificant. As to what assumption to adopt would be a judgmental choice on the part of the I-O specialist.

The product-by-product input matrix, expressed in monetary terms, is derived by multiplying the given vector of product outputs by the calculated matrix of product-by-product input coefficients, A_{PP}. That is,

$$\hat{X}_{PP} = A_{PP} X_p \tag{10}$$

where: X_{PP} is the estimated input matrix
X_P is the diagonal matrix of vector of commodity outputs, X_P.

Merging the input or absorption matrix, X_{PP}, with the final demand matrix in Table 7, generates the symmetric product-by-product I-O USE table valued at producers' prices and of the competitive type.

4.7 Phase VII: Building Satellite Tables on Import Flows

The objective of compiling a non-competitive type of I-O table is to maximize the capability of the I-O model in unraveling the interwoven interrelationships between sectors in the economy and its interdependencies with ROW, whether domestic or international. With a non-competitive I-O table such as this, direct and indirect backward-forward linkage effects among sectors in the local economy can be measured accurately because, unlike in the competitive type of I-O table, inter-sectoral flows relate only to local produce, with imports treated as exogenous of the I-O system.

Moreover, it serves as an appropriate analytical tool in assessing the direct and indirect impact of changing final demand for products. Since local and imported products are explicitly distinguished in a non-competitive table, it is thus possible to quantify how much imported inputs are needed in increasing production to sustain the increase in final demand.

Satellite tables on import transactions are calculated by the hybrid method or the mixed approach. From the SVK I-O survey of enterprises, derived indicators on material import consumption are referred to. These derived ratios are further revalidated by using the indirect method of estimating the import flows by consuming sector. Separate import tables are generated for product inflows from (1) Rest of Lao (ROL) and (2) Rest of the World (ROW).

The indirect method assumes that consumption of imported product i is proportional to local demand for that product i. Given the total value of import of product i as recorded in the competitive table, the estimating equations are as follows:

1) Intermediate imports from ROL $: \mathrm{M}_{ij}^{LS} = \mathrm{M}_{i}^{LS} / \mathrm{D}_{i}^{S}$ (11)

2) Intermediate imports from ROW $: \mathrm{M}_{ij}^{WS} = \mathrm{M}_{i}^{WS} / \mathrm{D}_{i}^{S}$ (12)

3) Final Demand imports from ROL $: \mathrm{M}_{ik}^{LS} = \mathrm{M}_{i}^{LS} / \mathrm{D}_{i}^{S}$ (13)

4) Final Demand imports from ROW $: M_{ik}^{WS} = M_i^{WS} / D_i^S$ (14)

where:

M_{ij}^{LS} is the estimated value of product i imported from ROL, in this case, L = ROL, consumed by production sector j in region S, in this case, S = SVK;

M_i^{LS} is the import value of product i as recorded in the ROL import column of competitive table;

D_i^S is the total local demand for product i , which is equal to the sum of Intermediate, final consumption and investment demand;

M_{ij}^{WS} is the estimated value of product i imported from ROW consumed by production sector j in region S, in this case, S = SVK;

M_i^{WS} is the import value of product i as recorded in the ROW import column of competitive table;

M_{ik}^{LS} is the estimated value of product i imported from ROL consumed by final demand sector k in region S, in this case, S = SVK;

M_{ik}^{WS} is the estimated value of product i imported from ROW consumed by final demand sector k in region S, in this case, S = SVK.

These import tables are shown in a separate volume together with this Report. They can be easily referred to in determining the direct import dependencies in production and indirect import requirements of sectors to sustain induced effects of increases in final demands.

4.8 Phase VIII: Deriving Symmetric USE Table, Non-Competitive Type

The final phase of the overall compilation methodology is simply deriving the final output of constructing SVK's non-competitive USE table in the format as shown in Appendix 1. It is derived by subtracting the import tables from the competitive USE table.

The import tables could then recorded in the table as additional 2 separate matrices of import transactions. For simplicity, however, the column sums of the import tables are recorded in the non-competitive table as two distinct rows, i.e. ROL and ROW, although the full import tables could be referred in the conduct of a more comprehensive analysis of import requirements in the SVK economy.

5. HIGHLIGHTS OF RESULTS

This chapter highlights the empirical findings of the benchmark I-O study for the economy of Savannakhet Province. The first part deals with a fairly comprehensive analysis of the economy's macro- and micro-economic structures, based on the 2003 (20-sector) I-O table prepared for the economy of Savannakhet. With the availability of the total requirements table or the Leontief inverse, the inter-industrial backward and forward linkages as well as the multiplier effects are quantified and analyzed.

The second part is an economic impact analysis of the total (direct and indirect) effects of final demands on such economic variables as production, income, employment and import requirements. For convenience and simplicity, an aggregated 12-sector I-O table serves as the basis in the calculation of the multiplier effects. Nevertheless, impact analysis could be expanded to measure the effects at the fairly detailed level of sectoral grouping by referring to the 20-sector I-O table. These 20- and 10-sector I-O tables could be made available to users upon request.

The concluding part summarizes limitations of the study including some recommendatory measures geared towards the development and maintenance of I-O frameworks in Lao PDR, both at the national and sub-national levels.

5.1 Structural Analysis of SVK's Economic Performance, 2003

A macro- and micro-economic analysis of SVK's economy uses the basic 20-sector I-O tables, both competitive and non-competitive imports types. The competitive I-O table traces the flow of goods and services from one sector/industry to another and/or to itself (called inter-industry flows), whether locally produced or imported. Other than providing government policy makers with adequate and effective database for policy formulation and planning, this I-O table could also be referred to by the private business sector in the conduct of cost of production studies as well as in market strategy planning.

The non-competitive type is an extended form of I-O table wherein inter-industry flows in the competitive table are explicitly distinguished between the locally produced and the imported products. With the availability of this type of SVK I-O table, the direct and indirect inter-industry linkages within the local economy were measured and analyzed.

5.2 Supply and Demand Situation

Table 1 shows that total available supply of goods and services in SVK's economy reached K7801.5 billion in 2003, out of which 80.7% or K6294.0 billion was sourced from local production. Importations accounted for K1507.5 billion or 19.3% of total supply, out of which a major portion (70.6% or K1063.6 billion worth) came from foreign countries (ROW) and the remaining 29.4% or K443.9 billion worth sourced from all other areas in Lao (ROL).

From the demand side, 90.3% of total available supply was delivered to satisfy local demand, while the residual 9.7% or K759.1 billion worth of goods and services was set aside to meet exports demand, especially foreign demand/ROW. Within domestic demand, demand by local industries for inputs in production accounted 43.1%, while final consumption by households and government shared 40.3%. Gross domestic capital formation or investment demand reached K1166.3 billion, out of which 85.9% was fixed capital and 14.1% in the form of change in stocks.

In terms of its external trade position, Table 1 shows that SVK's economy appeared to have exhibited an unfavorable external trade balance in 2003, with imports hugely outdistancing exports by roughly a 2:1 ratio (K1507.5 billion imports against K759.1 billion exports).

Table 1. Supply and Demand: Economy of Savannakhet, 2003

ITEM	VALUE (Billion Kip)	PERCENT SHARE
I. TOTAL SUPPLY	**7,801.5**	**100.0**
1. Production	6,294.0	80.7
2. Imports	1,507.5	19.3
2.1. Rest of Lao	443.9	29.4
2.2. Rest of the World	1,063.6	70.6

II. TOTAL DEMAND	**7,801.5**	**100.0**
1. Local Demand	7,042.3	90.3
1.1. Intermediate Consumption	3,037.4	43.1
1.2. Final Consumption	2,838.6	40.3
1.2.1. Households	2,758.9	97.2
1.2.2. Government	79.8	2.8
1.3. Capital Formation	1,166.3	16.6
1.3.1. Fixed Capital Formation	1,002.4	85.9
1.3.2. Change in Stocks	163.9	14.1
2. Exports	759.1	9.7
2.1. Rest of Lao	40.2	5.3
2.2. Rest of the World	718.9	94.7

5.3 Output Structures

Table 2 shows SVK economy's structure of production in 2003, showing the gross and net outputs generated by each of the 20 sub-sectors that comprise the whole productive economy. Gross output is equal to gross input, i.e. gross of intermediate inputs. Gross output less intermediate inputs is the net output or the gross value added (GVA).

Expressed in current producers' prices, SVK's total gross output in 2003 reached K6294.0 billion with the Industry Group accounting for more than half (52.6%), principally buoyed up by the huge performance of the food, beverage & tobacco sector. Agriculture and Forestry produced a total of K1671.6 billion or 26.6%, with the livestock & poultry raising sector getting the lion's share. In the Services Group which accounted for one-fifth (20.8%) of SVK's total production, the personal, social and community services sector and the trade sector are the main output contributors.

At the 20-sector classification level, the top five (5) leading sectors are: (1) Food, beverage and tobacco (29.6%); (2) Livestock and poultry (18.9%); (3) Construction (12.9%); (4) Personal, social & community services (8.4%); and (5) Wholesale and retail trade (7.9%). These sectors accounted for more than three-fourths (76.9%) of SVK's total production.

Table 2. Sectoral Production: Economy of Savannakhet, 2003

PRODUCT		GROSS OUTPUT		NET OUTPUT (=GVA)	
		Value (Bil Kip)	Percent	Value (Bil Kip)	Percent
TOTAL ECONOMY		**6,294.0**	**100.0**	**3256.6**	**100.0**
I. AGRICULTURE and FORESTRY		**1,671.6**	**26.6**	**1178.0**	**36.2**
01	Crops	464.5	7.4	334.5	10.3
02	Livestock and poultry	1,141.3	18.1	785.6	24.1
03	Forestry and logging	65.8	1.0	57.8	1.8
II. INDUSTRY		**3,312.6**	**52.6**	**1255.1**	**38.5**
04	Mining and quarrying	313.2	5.0	137.7	4.2
05	Food, beverage and tobacco	1,862.3	29.6	565.9	17.4
06	Textiles, garments & leather products	48.6	0.8	22.9	0.7
07	Wood & paper products; printing/publishing	106.2	1.7	56.1	1.7
08	Chemical products; petroleum	0.9	0.0	0.4	0.0
09	Non-metallic mineral products	6.2	0.1	2.3	0.1
10	Metal products, machinery, equipment, parts	72.9	1.2	28.7	0.9
11	Other manufactured goods	43.8	0.7	22.5	0.7
12	Electricity and water supply	45.9	0.7	27.6	0.8
13	Construction	812.7	12.9	391.1	12.0
III. SERVICES		**1,309.8**	**20.8**	**823.6**	**25.3**
14	Transportation	6.6	0.1	3.2	0.1
15	Post and telecommunication	6.2	0.1	5.0	0.2
16	Wholesale and retail trade	498.4	7.9	366.4	11.3
17	Banking, insurance, business services	58.3	0.9	50.9	1.6
18	Real estate & ownership of dwellings	92.8	1.5	83.3	2.6
19	Public administration	121.0	1.9	79.8	2.5
20	Personal, social & community services	526.5	8.4	235.1	7.2

Note: 0.0 denotes value is less than half of unit employed.

Sectors with least contributions to SVK's economy are the sectors engaged in the manufacture of industrial and capital goods such as: chemical products, non-metallic mineral products and metal, machinery & transport equipment. Likewise, output shares in the transportation sector, post and telecommunication and in the electricity and water sector are relatively low. The 2003 I-O table shows that SVK is an importer of electricity.

In terms of net output, the sectors that exhibit double-digit shares of GVA are (1) livestock and poultry (24.1%); (2) food, beverage and tobacco (17.4%); (3) construction (12.0%); (4) wholesale and retail trade (11.3); and (5) the crops sector (10.3%).

5.4 Input Structures

Table 3 shows the structure of the cost of production or, in IO parlance, the input structure, broadly categorized into (a) intermediate inputs or the cost of materials, supplies and services consumed in production, and (b) primary inputs or the payments to the factors of production inclusive of operating surplus. The sum of primary inputs consumed by the sector in production is the sector's GVA.

Overall, 48.3% of total production cost in the SVK's economy was allocated for the purchase of intermediate inputs. The residual 51.7% share represents the net output or the total GVA. Its total GVA plus customs duties and import taxes generated from foreign trading equals the economy's GDP. The intermediate input ratio of 0.483 could be regarded as an average measure of SVK economy's direct backward linkage. Alternatively, it can also be perceived as a rough indicator of its degree of industrialization. The lower its intermediate input ratio, the lesser is its perceived degree of industrialization. Compared with recent regional I-O studies in neighboring Vietnam, it can be figured out that SVK's industrialization is still in its developmental stage. Ho Chi Minh's industrial production in year 2000 exhibited a high intermediate input ratio of 0.552, while in Da Nang, it registered 0.537.

Table 3. Sectoral Input Structures in Production

	Production Sector	Total Inputs Value (Billion Kip)	Intermediate Inputs Percent	Primary Inputs (=GVA) Percent
TOTAL ECONOMY		**6,294.0**	**48.3**	**51.7**
I. AGRICULTURE and FORESTRY		**1,671.6**	**29.5**	**70.5**
01	Crops	464.5	28.0	72.0
02	Livestock and poultry	1,141.3	31.2	68.8
03	Forestry and logging	65.8	12.2	87.8
II. INDUSTRY		**3,312.6**	**62.1**	**37.9**
04	Mining and quarrying	313.2	56.0	44.0
05	Food, beverage and tobacco	1,862.3	69.6	30.4
06	Textiles, garments & leather products	48.6	52.8	47.2
07	Wood & paper products; printing/publishing	106.2	47.2	52.8
08	Chemical products; petroleum	0.9	62.8	37.2
09	Non-metallic mineral products	6.2	63.0	37.0
10	Metal products, machinery, equipment, parts	72.9	60.7	39.3
11	Other manufactured goods	43.8	48.6	51.4
12	Electricity and water supply	45.9	39.8	60.2
13	Construction	812.7	51.9	48.1
III. SERVICES		**1,309.8**	**37.1**	**62.9**
14	Transportation	6.6	52.0	48.0
15	Post and telecommunication	6.2	20.4	79.6
16	Wholesale and retail trade	498.4	26.5	73.5
17	Banking, insurance, business services	58.3	12.7	87.3
18	Real estate & ownership of dwellings	92.8	10.2	89.8
19	Public administration	121.0	34.1	65.9
20	Personal, social & community services	526.5	55.4	44.6

At the 20-sector level, the heavy direct users of intermediate inputs, proportion-wise, are in the Industry Group, while the least direct consumers belong to the Agriculture and Forestry Group and Services Group. In the Industry Group, intermediate input shares range from a low 39.8% for electricity and water production to a high 69.6% for food, beverage and tobacco manufacture.

5.4.1 Source of Intermediate Inputs

With the availability of the non-competitive type of I-O table, it is possible to determine the sources of intermediate inputs. Table 4 shows indicators on the sources of supply of intermediate inputs. These ratios were calculated based on the import tables (see Table 6 of Annex C) that were built, given foreign trade and I-O survey data on the import content of production.

Table 4 shows that SVK's economy is highly dependent on local sources, with roughly two-thirds (67.7%) of total intermediate input requirements coming from within the local (provincial) economy itself. The remaining one-third (32.3%) was sourced from outside, 8.7% from ROL and 23.6% from the ROW.

The economy's relatively low dependency ratio on imported inputs could be traced to the low degree of import dependence exhibited by the largest sector which is the Food, beverage and tobacco sector. Consumption by this sector on imported inputs accounted for a just 4.4% of its total production cost. The same is true with the second largest sector, Livestock and Poultry, with a mere 15.7% imported input share.

In contrast, the sectors that are highly dependent on imports are the least contributors to SVK's gross production such as: Chemicals, plastics, Mining, Machinery & equipment and other manufacturing.

Table 4. Intermediate Inputs by Source

Production Sector			SOURCE OF INTERMEDIATE INPUTS (%)			
		Total	LOCAL	IMPORTED		
		Bil. Kip	(SVK)	Total	ROL	ROW
TOTAL ECONOMY		**3,037.4**	**67.7**	**32.3**	**8.7**	**23.6**
I. AGRICULTURE and FORESTRY		**493.6**	**75.4**	**24.6**	**4.9**	**19.7**
01	Crops	129.9	52.6	47.4	4.9	42.5
02	Livestock and poultry	355.7	84.3	15.7	4.7	10.9
03	Forestry and logging	8.0	51.5	48.5	13.5	35.0
II. INDUSTRY		**2,057.5**	**73.3**	**26.7**	**8.5**	**18.2**
04	Mining and quarrying	175.5	18.8	81.2	14.2	67.0
05	Food, beverage and tobacco	1,296.4	95.6	4.4	2.6	1.7
06	Textiles, garments & leather products	25.6	53.6	46.4	10.7	35.7
07	Wood & paper products; printing/publishing	50.1	69.1	30.9	7.9	23.0
08	Chemical products; petroleum	0.6	13.9	86.1	10.0	76.1
09	Non-metallic mineral products	3.9	30.3	69.7	30.0	39.7
10	Metal products, machinery, equipment, parts	44.2	24.5	75.5	9.5	66.0
11	Other manufactured goods	21.3	25.0	75.0	3.3	71.8
12	Electricity and water supply	18.3	69.8	30.2	12.6	17.6
13	Construction	421.6	37.3	62.7	23.7	39.0
III. SERVICES		**486.2**	**36.1**	**63.9**	**13.1**	**50.9**
14	Transportation	3.4	37.1	62.9	10.6	52.3
15	Post and telecommunication	1.3	45.3	54.7	9.1	45.5
16	Wholesale and retail trade	132.0	32.0	68.0	19.7	48.3
17	Banking, insurance, business services	7.4	67.9	32.1	24.9	7.2
18	Real estate & ownership of dwellings	9.5	84.5	15.6	12.8	2.7
19	Public administration	41.2	60.5	39.5	12.4	27.2
20	Personal, social & community services	291.4	32.0	68.0	9.9	58.1

Note: 0.0 denotes value is less than half of unit employed.

5.5 Gross Value Added (GVA)

Table 5 presents the structural composition of GVA by sector. It shows what sectors are labor-intensive in terms of compensation to labor; which is capital-intensive as measured by their depreciation ratios; and which are highly profitable in terms of their operating surplus ratios.

Out of K3256.6 billion GVA generated in 2003 by the SVK economy's production activities, 34.7% came in the form of labor income by the household sector; government derived 3.7% paid as net production taxes by producers; 11.7% as depreciation allowance due to wear and tear of capital goods; and a high 49.9% as operating surplus which is gross of interest, land rent, direct taxes and other prime charges.

By major sector, results suggest that industry sector is less labor-intensive than agriculture and services. In effect, the degree of intensity of industry sector in terms of profitability (44.8%) is shown to be lower compared with Agriculture (55.4%) and Services (49.8%). The Services Group registered the highest tax rate payment (5.1%) among the 3 major groups, which could be attributed to high tax revenues generated from the trade sector and the high tax rate imposed on the communications sector (15.2%).

Table 5. Composition of Primary Inputs (=GVA) in Sectoral Production

PRODUCTION SECTOR		PRIMARY INPUTS				
		Total (=GVA) Billion Kip	CE %	PT-S %	DEP %	OS %
TOTAL ECONOMY		**3,256.6**	**34.7**	**3.7**	**11.7**	**49.9**
I. AGRICULTURE and FORESTRY		**1,178.0**	**34.0**	**1.8**	**8.8**	**55.4**
01	Crops	334.5	50.1	1.6	3.1	45.2
02	Livestock and poultry	785.6	26.6	1.5	10.7	61.2
03	Forestry and logging	57.8	41.4	7.3	15.8	35.6
II. INDUSTRY		**1,255.1**	**33.9**	**4.6**	**16.8**	**44.8**
04	Mining and quarrying	137.7	35.1	7.0	35.0	22.8
05	Food, beverage and tobacco	565.9	32.2	2.2	13.0	52.6
06	Textiles, garments & leather products	22.9	31.9	0.9	10.9	56.2
07	Wood & paper products; printing/publishing	56.1	28.0	5.3	13.9	52.8
08	Chemical products; petroleum	0.4	24.0	3.1	14.6	58.3
09	Non-metallic mineral products	2.3	34.2	0.6	11.7	53.5
10	Metal products, machinery, equipment, parts	28.7	31.5	7.8	14.4	46.3
11	Other manufactured goods	22.5	26.7	1.2	8.6	63.4
12	Electricity and water supply	27.6	25.4	8.7	23.0	42.9
13	Construction	391.1	38.1	7.0	16.6	38.2
III. SERVICES		**823.6**	**36.9**	**5.1**	**8.3**	**49.8**
14	Transportation	3.2	50.1	5.6	23.4	20.9
15	Post and telecommunication	5.0	33.1	15.2	16.4	35.3
16	Wholesale and retail trade	366.4	31.9	7.4	4.9	55.9
17	Banking, insurance, business services	50.9	8.4	0.0	5.0	86.5
18	Real estate & ownership of dwellings	83.3	17.2	6.0	22.1	54.7
19	Public administration	79.8	100.0	0.0	0.0	0.0
20	Personal, social & community services	235.1	36.4	3.8	11.7	48.1

Note: 0.0 denotes value is less than half of unit employed

5.6 Demand Structures

Tables 6 and 7 present the sectoral structures of product demand, categorized into (a) local and (b) export demands. Local demand, which accounted for 90.3% of total supply, is further broken down into (i) total intermediate or industry demand (38.9%), (ii) final consumption by households & local government (36.4%), and (iii) capital formation or investment demand (15.0%). Export demand, which accounted for the residual 9.7%, is further deconsolidated into outflows of SVK-produced products to two destinations: (i) ROL (0.5%) and (ii) ROW (9.2%).

By major sector, Table 6 shows that the greatest bulk (72.6%) of total supply of agriculture & forestry products (K1693.1 billion) was delivered to meet total intermediate demand, largely brought about by the high demand for livestock & poultry (82.3%) as inputs into meat processing. Household consumption shared 10.2%, while capital formation, due to change in stocks of livestock & forestry products, accounted for 7.7% of total supply. 9.5% of SVK's produce of agriculture & forestry products went into exports.

Deliveries of Industry products are observed to be highly induced by final consumption demand (39.1%), followed by intermediate demand (28.6%) and investment demand (21.5%). Exports demand for Industry goods shared 10.8%, largely contributed by the mining and wood processing sectors. In Services group, demand is relatively high for final consumption (57.2%), while intermediate demand for services accounted for 32.8%. Exports of services, including tourism services, accounted for 6.8%.

Table 6. Product Demand Structures by Type of Demand

PRODUCT SECTOR		TOTAL DEMAND (Bil. Kip)	LOCAL DEMAND			EXPORTS	
			ID	C	I	E^L	E^W
			%	%	%	%	%
TOTAL ECONOMY		**7,801.5**	**38.9**	**36.4**	**15.0**	**0.5**	**9.2**
I. AGRICULTURE and FORESTRY		**1,693.1**	**72.6**	**10.2**	**7.7**	**0.5**	**9.0**
01	Crops	478.5	52.7	33.5	4.9	1.7	7.4
02	Livestock and poultry	1,146.3	82.3	0.5	7.9	0.0	9.3
03	Forestry and logging	68.4	49.3	11.4	23.5	0.0	15.8
II. INDUSTRY		**4,592.3**	**28.6**	**39.1**	**21.5**	**0.3**	**10.5**
04	Mining and quarrying	316.1	0.9	0.0	5.6	0.0	93.5
05	Food, beverage and tobacco	1,980.8	11.4	76.5	4.1	0.5	7.5
06	Textiles, garments & leather products	104.5	27.7	60.6	2.5	2.5	6.7
07	Wood & paper products; printing/publishing	202.5	62.5	13.9	7.5	0.0	16.1
08	Chemical products; petroleum	407.8	93.0	16.1	-9.1	0.0	0.0
09	Non-metallic mineral products	52.5	164.4	2.7	-67.1	0.0	0.0
10	Metal products, machinery, equipment, parts	513.4	59.4	11.4	29.2	0.0	0.0
11	Other manufactured goods	56.0	61.8	28.3	9.9	0.0	0.0
12	Electricity and water supply	146.0	69.6	30.4	0.0	0.0	0.0
13	Construction	812.7	2.5	0.6	96.9	0.0	0.0
III. SERVICES		**1,516.0**	**32.8**	**57.2**	**3.3**	**1.3**	**5.5**
14	Transportation	151.8	32.4	60.8	4.2	0.6	2.1
15	Post and telecommunication	65.8	36.5	38.6	17.9	3.0	4.0
16	Wholesale and retail trade	498.4	51.1	31.2	6.3	0.4	11.0
17	Banking, insurance, business services	58.3	94.5	5.5	0.0	0.0	0.0
18	Real estate & ownership of dwellings	92.8	8.8	91.2	0.0	0.0	0.0
19	Public administration	121.0	0.0	100.0	0.0	0.0	0.0
20	Personal, social & community services	527.8	20.0	73.0	0.0	2.7	4.3

NOTES:

ID: Intermediate Demand
C: Final Consumption (PCE + GCE)
I: Investment (GFCF + CI)
E^L: Exports to ROL
E^W: Exports to ROW
0.0 denotes value is less than half of unit employed

Table 7 shows the product composition in each type of demand. It indicates that industry products account for 58.9% of total demand, followed by demand for agriculture & forest products (21.7%) and Services (19.4%). By type of demand, Industry ranked first in terms of percent shares except its demand by ROL's economy where demand for services such as hotel & restaurant services is seen to be relatively higher than its demand for agriculture and industry goods from SVK.

Table 7. Product Composition by Type of Demand (Percent)

	PRODUCT GROUP	Total Demand	Local Demand			Exports	
			ID	C	I	E^L	E^W
TOTAL ECONOMY (Billion Kip)		**7801.5**	**3037.4**	**2838.6**	**1166.3**	**40.2**	**718.9**
I. AGRICULTURE and FORESTRY		**21.7**	**40.5**	**6.1**	**11.1**	**19.7**	**21.3**
01	Crops	6.1	8.3	5.6	2.0	19.7	4.9
02	Livestock and poultry	14.7	31.1	0.2	7.7	0.0	14.9
03	Forestry and logging	0.9	1.1	0.3	1.4	0.0	1.5
II. INDUSTRY		**58.9**	**43.2**	**63.3**	**84.7**	**32.7**	**67.2**
04	Mining and quarrying	4.1	0.1	0.0	1.5	0.0	41.1
05	Food, beverage and tobacco	25.4	7.4	53.4	7.0	26.0	20.5
06	Textiles, garments & leather products	1.3	1.0	2.2	0.2	6.6	1.0
07	Wood & paper products; printing/publishing	2.6	4.2	1.0	1.3	0.1	4.5
08	Chemical products; petroleum	5.2	12.5	2.3	-3.2	0.0	0.0
09	Non-metallic mineral products	0.7	2.8	0.0	-3.0	0.0	0.0
10	Metal products, machinery, equipment, parts	6.6	10.0	2.1	12.9	0.0	0.0
11	Other manufactured goods	0.7	1.1	0.6	0.5	0.0	0.0
12	Electricity and water supply	1.9	3.3	1.6	0.0	0.0	0.0
13	Construction	10.4	0.7	0.2	67.5	0.0	0.0
III. SERVICES		**19.4**	**16.4**	**30.6**	**4.2**	**47.5**	**11.6**
14	Transportation	1.9	1.6	3.3	0.5	2.2	0.4
15	Post and telecommunication	0.8	0.8	0.9	1.0	4.9	0.4
16	Wholesale and retail trade	6.4	8.4	5.5	2.7	4.8	7.6
17	Banking, insurance, business services	0.7	1.8	0.1	0.0	0.0	0.0
18	Real estate & ownership of dwellings	1.2	0.3	3.0	0.0	0.0	0.0
19	Public administration	1.6	0.0	4.3	0.0	0.0	0.0
20	Personal, social & community services	6.8	3.5	13.6	0.0	35.6	3.2

Note: 0.0 denotes value is less than half of unit employed.

Table 8 summarizes the sources of supply to meet local product demand, as can be observed in the non-competitive type of IO table. A little less than four-fifths (78.6%) of SVK's product demand comes from within the local economy, with the residual one-fifth (21.4%) sourced from outside, broken down into: 6.3% and 15.1% from ROL and ROW, respectively

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Table 8. Structure of Local Demand by Source of Supply (Percent)

Source of Supply	LOCAL DEMAND		
	Total	Intermediate	Final
Total Demand	**100.0**	**100.0**	**100.0**
1. Local (SAVANNAKHET)	78.6	67.6	86.9
2. REST OF LAO (ROL)	6.3	8.7	4.5
3. REST OF THE WORLD (ROW)	15.1	23.7	8.6

By type of demand, a little more than two-thirds (67.6%) of intermediate demand came from local production, while importations accounted for the residual one-third (32.4%), broken down into: 8.7% from ROL and 23.7% from ROW. The biggest bulk of SVK's final demand for goods and services was sourced from within (86.9%). It is shown that dependence by final consumers on imported goods appeared to be quite relatively low at 13.1%.

5.8 External Trade Flows

One salient feature of the SVK I-O table is that it provides analysts with clear-cut indicators on the structure of SVK's external trade transactions. As shown in Table 9, it specifically quantifies, in monetary terms, SVK's volume of trade flows to and from the domestic (ROL) economy as well as to and from foreign countries (ROW).

It should be noted, however, that, while SVK's export and import transactions are fully accounted for, external trade transactions by ROL's economy with ROW have been left out in this intra-regional type of I-O table. Thus, recorded ROL exports that pass thru SVK's customs zone were excluded. In order to fully account for Lao PDR's total foreign trade transactions, it is ideal to extend the I-O framework from intra-regional to inter-regional, which, in this case, would be a bi-region (SVK and ROL) inter-regional I-O table. Additionally, in-transit product flows, e.g. Vietnam's imports from Thailand via Lao PDR and vice versa, were likewise excluded.

Nevertheless, an assessment of product outflows and inflows based on the intra-SVK I-O table showed that, in 2003, SVK's economy recorded an unfavorable external trade balance. As shown in Table 9, total imports in 2003 were estimated to reach K1507 billion, whereas exports of SVK-produced products amounted to only K759 billion, thus resulting to a negative terms of trade of K748 billion or 33.0% of total external trade of K2,267 billion. By source of imports, SVK registered negative trade balances of K404 billion and K345 billion with ROL and ROW, respectively.

Table 9. Structure of SVK's External Trade: 2003

Product Group	Total External Trade	REST OF LAO			REST OF WORLD			TOTAL			
										Trade Balance	
		E^L	M^L	Trade Bal	E^W	M^W	Trade Bal	E	M	Value	%
	(1)	(2)	(3)	4=2-3	(5)	(6)	7=5-6	(8)	(9)	10=8-9	11=10/9 *100
TOTAL ECONOMY	**2,266.6**	**40.2**	**443.9**	**-403.6**	**718.9**	**1,063.6**	**-344.7**	**759.1**	**1,507.5**	**-748.3**	**-33.0**
I. Agri & Forestry	**182.3**	**7.9**	**18.6**	**-10.7**	**152.9**	**2.9**	**150.0**	**160.8**	**21.5**	**139.3**	**76.4**
1. Crops	57.2	7.9	11.1	-3.1	35.2	2.9	32.3	43.2	14.0	29.2	51.0
2. Livestock, poultry	111.8	0.0	5.0	-5.0	106.9	0.0	106.9	106.9	5.0	101.9	91.1
3. Forestry	13.3	0.0	2.5	-2.5	10.8	0.0	10.8	10.8	2.5	8.2	61.8
II: Industry	**1,775.7**	**13.2**	**253.0**	**-239.8**	**482.8**	**1,026.8**	**-544.0**	**496.0**	**1,279.8**	**-783.8**	**-44.1**
4. Mining	298.5	0.0	2.9	-2.9	295.6	0.0	295.6	295.6	2.9	292.7	98.0
5. Food, beverage & tobacco	276.6	10.5	44.1	-33.7	147.6	74.4	73.2	158.1	118.6	39.5	14.3
6. Textiles, garments	65.5	2.7	13.0	-10.3	7.0	42.9	-36.0	9.6	55.9	-46.3	-70.7
7. Wood & paper products	129.0	0.0	22.4	-22.3	32.6	74.0	-41.3	32.7	96.3	-63.6	-49.3
8. Chemical products; petroleum	406.9	0.0	11.0	-11.0	0.0	395.9	-395.9	0.0	406.9	-406.9	-100.0
9. Non-metallic mineral products	46.3	0.0	46.3	-46.3	0.0	0.0	0.0	0.0	46.3	-46.3	-100.0
10. Metal products, machinery, parts	440.5	0.0	1.1	-1.1	0.0	439.5	-439.5	0.0	440.5	-440.5	-100.0
11. Other manufactured goods	12.2	0.0	12.0	-12.0	0.0	0.2	-0.2	0.0	12.2	-12.2	-100.0
12. Electricity & water	100.2	0.0	100.2	-100.2	0.0	0.0	0.0	0.0	100.2	-100.2	-100.0
III. Services	**308.5**	**19.1**	**172.3**	**-153.2**	**83.2**	**33.9**	**49.3**	**102.4**	**206.2**	**-103.8**	**-33.7**
14. Transportation	149.3	0.9	123.2	-122.3	3.1	22.1	-19.0	4.0	145.2	-141.2	-94.6
15. Communication	64.2	2.0	47.8	-45.8	2.6	11.8	-9.2	4.6	59.6	-55.0	-85.7
16. Trade	56.6	1.9	0.0	1.9	54.7	0.0	54.7	56.6	0.0	56.6	100.0
20. Personal & other services	38.5	14.3	1.4	13.0	22.8	0.0	22.8	37.1	1.4	35.7	92.9

NOTES: Sectors with zero external trade transactions in 2003 are excluded.
0.0 denotes value is less than half of unit employed.

By sector, records show that the biggest bulk of imbalances in external trade are in the industry group, accounting for a total of negative K784 billion, primarily caused by heavy importations of: chemical products & petroleum and metals, machinery, appliances & transport equipment, even as the mining sector recorded a favorable trade balance due to heavy exports

of gold ingots to ROW, specifically Australia. Table 9 interestingly shows that SVK is heavily dependent on imported electricity as K100 billion worth was purchased from ROL.

The Services group also recorded a negative terms of trade amounting to K107 billion, caused by the sizeable negative trade balance in the transportation sector. This finding tends to suggest that traffic of people and goods in SVK is highly dependent on services rendered by non-local transport operators. This could be the prevailing situation as evidenced by the sector's recorded low output estimate of only K6.6 billion in 2003.

5.7. Self-Sufficiency Rates

The self-sufficiency rate is defined as the ratio of total production to total local demand, i.e.:

$$SSR_i = \frac{X_i}{TLD_i} \tag{15}$$

where: SSR_i is the self-sufficiency rate of product *i*;

X_i is the gross output of product *i* ; and

TLD_i is the total local demand for product *i* , which is estimated as the sum of intermediate and final demands less exports.

A sector with SSR ≥ 1 means that its output is sufficient to sustain its local demand. On the other hand, a sector with SSR < 1 suggests that imports are needed to meet that sector's total domestic demand.

Table 10 presents the regional self-sufficiency rates by sector for 2003. It can be observed that, on the whole, SVK's economy is quite dependent on imports to satisfy the needs of domestic demand as its overall SSR is below unity. Nine out of the 20 industries are found to be less than self-sufficient, seven of them belonging to the industry group. In contrast, the mining and quarrying industry is found to have a very high SSR of 15.287. This could be because of the extraordinarily high demand from the ROW for its main output of gold ingots for reprocessing and refining. The table also shows that the transportation and communications industry exhibited a very low SSR in 2003. This could be because it is heavily dependent on external sources for its supply of transportation services.

Table 10. SELF-SUFFICIENCY RATES BY SECTOR, 2003

SECTOR		SSR
ALL SECTORS		**0.894**
I	**AGRICULTURE & FORESTRY**	**1.091**
01	Crops	1.067
02	Livestock and poultry	1.098
03	Forestry and logging	1.143
II	**INDUSTRY**	**0.809**
04	Mining and quarrying	15.287
05	Food, beverage and tobacco	1.022
06	Textiles, garments & leather products	0.512
07	Wood & paper products; printing/publishing	0.625
08	Chemical products; petroleum	0.002
09	Non-metallic mineral products	0.118
10	Metal products, machinery, equipment, parts	0.142
11	Other manufactured goods	0.782

12	Electricity and water supply	0.314
13	Construction	1.000
III	**SERVICES**	**0.927**
14	Transportation	0.045
15	Post and telecommunication	0.102
16	Wholesale and retail trade	1.128
17	Banking, insurance, business services	1.000
18	Real estate & ownership of dwellings	1.000
19	Public administration	1.000
20	Personal, social & community services	1.073

5.8. Multiplier Analysis

A very useful analytical application of IO tables is input–output multipliers. A multiplier is a ratio that quantifies the effect on the whole economy arising from the initial effect of an exogenous change in any of the final demand components. It is the amount by which the initial effect is magnified (or multiplied) to become a total effect. The relationship between the first-order change and the total effect on the economy generated by the change is known as the multiplier effect.

Depending on the purpose of the analysis, different kinds of multipliers can be computed. The most common kinds include the output, income, import and employment multipliers. Total output multipliers by sector are derived as the column sums of the Leontief inverse. Income (or GVA), import and employment multipliers are calculated, as follows:

a) For income:

$$\mathbf{GVAM_j} = \mathbf{(I - A)^{-1}}\,\hat{\mathbf{GVAR}}_\mathbf{j} \qquad (16)$$

where: $\mathbf{GVAM_j}$ is the GVA (income) multiplier of sector j; $\hat{\mathbf{GVAR}}_\mathbf{j}$ is the diagonal matrix of GVA ratios as shown in the IO table; and $\mathbf{(I - A)^{-1}}$ is the Leontief inverse.

b) For imports:

$$\mathbf{MPM_j} = \mathbf{(I - A)^{-1}}\,\hat{\mathbf{MCR}}_\mathbf{j} \qquad (17)$$

where: $\mathbf{MPM_j}$ is the import multiplier of sector j and $\hat{\mathbf{MCR}}_\mathbf{j}$ is a diagonal matrix of import content ratios as recorded in the I-O table. In this case study, imports refer to imports from Rest of Lao (M^L) and Rest of the World (M^W).

c) For employment:

$$\mathbf{LEM_j} = \mathbf{(I - A)^{-1}}\,\hat{\mathbf{LOR}}_\mathbf{j} \qquad (18)$$

where: $\mathbf{LEM_j}$ is the employment multiplier of sector j and $\hat{\mathbf{LOR}}_\mathbf{j}$ is a diagonal matrix of estimated labor-output ratios.

Tables 11A and 11B present the output, income and import multipliers for the 20 production sectors that comprise Savannakhet's economy in 2003. Due to employment data constraints, the employment multipliers were estimated at the more aggregated 10-sector level and these are shown in Table 11D.

In terms of output multipliers, Table 11A shows that four (4) of the top five (5) sectors with the highest output multipliers belongs to the industry group, led by the food, beverage & tobacco manufacturing with a high 1.912 output multiplier, way above the calculated all-sector weighted average of 1.484. Its resulting high indirect effect of 0.912 units, calculated as the difference between total effect and the first-order change of one unit, suggests that the food manufacturing industry in Savannakhet had the greatest impact on the output of the economy than the typical or average industry.

Table 11A. Total Output Multipliers by Sector: Savannakhet, 2003

Sector		TOM*	Rank
01	Crops	1.175	11
02	Livestock and poultry	1.435	2
03	Forestry and logging	1.070	20
04	Mining and quarrying	1.124	14
05	Food, beverage and tobacco	1.912	1
06	Textiles, garments & leather products	1.349	4
07	Wood & paper products; printing/publishing	1.363	3
08	Chemical products; petroleum	1.100	17
09	Non-metallic mineral products	1.219	9
10	Metal products, machinery, equipment, parts	1.172	12
11	Other manufactured goods	1.138	13
12	Electricity and water supply	1.313	5
13	Construction	1.233	7
14	Transportation	1.229	8
15	Post and telecommunication	1.107	15
16	Wholesale and retail trade	1.099	18
17	Banking, insurance, business services	1.101	16
18	Real estate & ownership of dwellings	1.098	19
19	Public administration	1.243	6
20	Personal, social & community services	1.213	10
ALL SECTORS (WEIGHTED AVERAGE)		**1.484**	

* Total Output Multiplier

The other top sectors include: wood & paper products, printing/publishing (1.363), textiles, garments & leather products (1.349), electricity & water supply (1.313) and livestock & poultry (1.435). In contrast, three (3) of five (5) sectors having low output multiplier effects belong to the services group. These are: real estate & ownership of dwellings (1.098), wholesale & retail trade (1.099), and banking, insurance & business services (1.101). The other sectors include forestry & logging (1.070) and chemical products & petroleum refineries (1.100).

In terms of GVA multipliers, high-value-added sectors such as those in the agriculture & forestry and services groups tend to show total multiplier effects higher than those in the industry group, as can be observed in Table 11B. However, the indirect income multiplier effects show the reverse, i.e. sectors in the industry group tend to have a greater impact on income than those in the agriculture and services groups, with the exception of the livestock & forestry sector that exhibits the highest indirect effect as its inter-industrial linkage is observed to be relatively stronger than the other sectors. At the overall economy level, its total income multiplier effect amounts to 768 units per 1000 units of change in final demand, with its indirect effect accounting for 251 units or roughly 30% of the total effect.

In terms of import multipliers, Table 11B shows that, in order to sustain final demand change of 1000 units, the production sectors need to import a total of 170 units, on the average. Its indirect import multiplier effect of a low 14 units per 1000 units is attributable to low inter-industrial linkages shown by the import-dependent sectors such as chemicals & petroleum, metal & machinery and transportation sectors.

Table 11B. Income & Import Multipliers by Sector: Savannakhet, 2003

SECTOR		INCOME (GVA)			IMPORT		
		Total	Direct	Indirect	Total	Direct	Indirect
01	Crops	0.846	0.720	0.126	0.156	0.133	0.023
02	Livestock and poultry	0.988	0.688	0.300	0.071	0.049	0.021
03	Forestry and logging	0.940	0.878	0.062	0.063	0.059	0.004
04	Mining and quarrying	0.494	0.440	0.054	0.512	0.455	0.056
05	Food, beverage and tobacco	0.581	0.304	0.277	0.060	0.031	0.028
06	Textiles, garments & leather products	0.637	0.472	0.165	0.331	0.245	0.086
07	Wood & paper products; printing/publishing	0.720	0.528	0.192	0.199	0.146	0.053
08	Chemical products; petroleum	0.412	0.374	0.037	0.593	0.539	0.054
09	Non-metallic mineral products	0.451	0.370	0.081	0.536	0.439	0.096
10	Metal products, machinery, equipment, parts	0.461	0.393	0.068	0.537	0.458	0.079
11	Other manufactured goods	0.584	0.514	0.071	0.415	0.365	0.050
12	Electricity and water supply	0.790	0.601	0.188	0.158	0.120	0.038
13	Construction	0.593	0.481	0.112	0.401	0.325	0.076
14	Transportation	0.590	0.480	0.110	0.402	0.327	0.075
15	Post and telecommunication	0.881	0.796	0.085	0.123	0.111	0.012
16	Wholesale and retail trade	0.808	0.735	0.073	0.198	0.180	0.018
17	Banking, insurance, business services	0.961	0.873	0.089	0.045	0.041	0.004
18	Real estate & ownership of dwellings	0.986	0.898	0.088	0.017	0.016	0.002
19	Public administration	0.820	0.659	0.161	0.168	0.135	0.033
20	Personal, social & community services	0.542	0.446	0.095	0.457	0.376	0.080
ALL SECTORS (WEIGHTED AVERAGE)		**0.768**	**0.517**	**0.251**	**0.170**	**0.156**	**0.014**

In terms of employment multipliers, Table 11C shows that, in order to satisfy a **billion kip** worth of increase in final demand for **agriculture and forestry products**, a total of 189 persons are needed – 163 persons directly by the sector itself and 26 persons indirectly by the other sectors that provide inputs to the agriculture sector for further production due to the **billion kip** increase in its final demand. It can be observed that among all sectors, the manufacturing sector exhibits the largest indirect effect of 104 persons, which is roughly seven times its direct multiplier of 14 persons. This finding is due to the sector's high linkages with the other productive sectors in the economy. At the overall economy level, approximately one-third of total employment requirement (93 persons) per billion kip change in final demand is attributable to indirect effect (30 persons).

Table 11C. EMPLOYMENT MULTIPLIERS BY SECTOR: 2003

(Number of Persons per Billion Kip Change in Final Demand)

Sector		Total	Direct	Indirect
01	Agriculture and forestry	189.0	162.6	26.4
02	Mining and quarrying	11.5	5.6	5.9

03	Manufacturing	117.7	14.0	103.7
04	Electricity and water supply	43.7	7.6	36.1
05	Construction	58.1	42.8	15.3
06	Transportation & communication	47.0	38.3	8.7
07	Wholesale and retail trade	44.0	39.7	4.3
08	Finance, real estate & business services	13.3	10.4	2.9
09	Public administration	46.6	34.9	11.7
10	Personal, social & community services	71.5	56.1	15.4
	ALL SECTORS (WEIGHTED AVERAGE)	**93.0**	**62.6**	**30.4**

5.9 Inter-industrial Dependencies

Economic fluctuations vary by the ways different industries are related to each other. Some industries depend heavily on many other industries while some rely on a few others. Changes therefore in some industries will effect greater reactions than changes in others. With the availability of the Leontief inverse, I-O analysis could be extended to measure the total (direct and indirect) effects, both backward and forward, of the production sectors. Backward and forward linkages are means to measure the inter-sectoral linkages of a particular industry with other industries as user and provider of inputs, respectively.

5.9.1 Backward – Forward Linkages[6]

Backward linkage is a measure of relative importance of a sector's cumulative inputs from the entire production system. At the sectoral level, it is estimated as the ratio of the sum of the column elements of the inverse matrix of the non-competitive-imports type I-O table to the average of the inputs used by the whole system. The ratio is called an index of dispersion, μ_j defined as:

$$\mu_J = \frac{\sum_{i=1}^{n} r_{ij}}{\frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{n} r_{ij}} \qquad (19)$$

where the r_{ij}'s are the elements in the Leontief inverse, $(I-A)^{-1}$.The higher the ratio, the greater is the dependency of the sector to the entire production system.

Forward linkage indicates the relative importance of a sector as a supplier of raw materials to the entire production system. It is measured by the index of sensitivity, μ_i, expressed as a ratio of the sum of the elements along any i^{th} row of the inverse matrix to the average of the entire system. It is defined in equation form as:

[6] This analysis should be carried out with cautions. The technique is more an ad hoc compared to the full-pledge impact analysis by predicting the probable growth path of the full vector of final demand and then using the I-O basic impact equation to calculate total impacts in gross outputs.

$$\mu_i = \frac{\sum_{j=1}^{n} r_{ij}}{\frac{1}{n}\sum_{i=1}^{n}\sum_{j=1}^{n} r_{ij}} \qquad (20)$$

Table 12 shows the sectoral backward and forward linkages in the SVK's, economy as measured by their indices on dispersion and sensitivity, μ_j and μ_i, respectively. In terms of dependency, food, beverages, and tobacco, livestock and poultry, and wood products are highly dependent in the output of the entire economy while those sectors with low dependency ratio are admittedly reflected among forestry, real estate, and wholesale trade as they require more labor than other sectors. Meanwhile, sectors with high influence to changes in supplies are trade, livestock and poultry, and personal services such as motor suppliers as they are supplier of inputs to the rest of the industries.

Table 12. Sectoral Backward - Forward Linkages

SECTOR		Backward Linkage		Forward Linkage	
		Index	Rank	Index	Rank
I. AGRICULTURE and FORESTRY		**0.96589**		**1.1181**	
01	Crops	0.95069	11	1.04533	7
02	Livestock and poultry	1.16222	2	1.37426	2
03	Forestry and logging	0.86598	20	1.19340	4
II. INDUSTRY		**1.17077**		**0.9581**	
04	Mining and quarrying	0.90944	14	0.85581	15
05	Food, beverage and tobacco	1.54850	1	1.05386	5
06	Textiles, garments & leather products	1.10215	4	0.92679	11
07	Wood & paper products; printing/publishing	1.10321	3	0.93093	10
08	Chemical products; petroleum	0.89060	17	0.81338	18
09	Non-metallic mineral products	0.99095	9	0.83339	16
10	Metal prods, machinery, equipment, spare parts	0.94836	12	1.01228	8
11	Other manufactured goods	0.92066	13	0.88979	13
12	Electricity and water supply	1.06363	5	0.96556	9
13	Construction	0.99639	7	0.91979	12
III. SERVICES		**0.86334**		**0.9238**	
14	Transportation	0.99499	8	0.81322	19
15	Post and telecommunication	0.89572	15	0.81459	17
16	Wholesale and retail trade	0.88940	18	1.53664	1
17	Banking, insurance, business services	0.89152	16	1.04615	6
18	Real estate & ownership of dwellings	0.88848	19	0.88108	14
19	Public administration	1.00579	6	0.80917	20
20	Personal, social & community services	0.98133	10	1.28459	3

Table 13 presents a grouping of the sectors based on their calculated degrees of interdependencies as measured by their backward and forward linkage indices. This special grouping is particularly useful to economic planners and policy makers in the assessment and setting of industrial priorities in regional development. The industries are grouped into 4 categories, as follows:

- In Group I are sectors with high degrees of industrial interdependence, both backward and forward, and are therefore the top priority sectors to be considered in economic development formulation and planning;

- In Group II are sectors with high forward but low backward linkages;

- In Group III are sectors with high influence as users of intermediate inputs (high backward) but low influence as suppliers of raw materials (low forward). These sectors cater most of their outputs to final demand.

- In Group IV are sectors with low backward and low forward linkages.

Table 12A. Grouping of Industries Based on Their Degrees of Interdependencies

		FORWARD LINKAGE	
		HIGH	**LOW**
BACKWARD LINKAGE	**HIGH**	*GROUP I* 02 – Livestock & poultry raising 05 – Food, beverage & tobacco	*GROUP II* 06 -Textiles, garments 07 - Wood & paper products 09 - Non-metallic mineral products 12 - Electricity, water 13 – Construction 14 – Transportation 19 - Public administration
	LOW	*GROUP III* 01 – Crops 03 - Forestry & logging 10 - Metal prods, machinery, equipment, spare parts 16 - Wholesale & retail trade 17 – Banking, insurance 20 - Personal, social & community services	*GROUP IV* 04 - Mining & quarrying 08 – Chemical products; plastics 11 – Other manufacturing goods 15 – Communication 18 – Real estate

5.10 Impact Analysis

Final demand for products has multiplier effects on the economy. In the first round, an increase in demand for a product of a particular sector will require additional output requirement for that sector. This is the first-order or the direct effect. Subsequently, the first-order increases in output would require further inputs to generate them. The increased demand therefore translates to an increase in output, which in turn result to increases in income of the sectors involved and so on. These repercussive effects are best measured and examined through IO analysis.

In IO-based economic impact studies, whether for a national or sub-national economy such as Savannakhet Province, the above-mentioned multiplier effects[7] can readily be calculated and analyzed, given the IO table's Leontief inverse matrix, $(I-A)^{-1}$. An economy's inverse matrix is a coefficient table showing, in its comprehensive but compact format, the total (direct and indirect) output requirements of the economy's production sectors to sustain unit changes in final demands.

[7] Multiplier measures the total effect on either output, employment, or value added, given an increase in one unit of output of a particular industry. In an ad hoc sense, multipliers can be used as useful indicators to assess the variation in effects for a particular activity in microanalysis such as at the regional level. However, if multipliers are used as criteria for development for the whole economy, there is a tendency to conclude that the industry with the highest multiplier and that industry alone will be selected for development. This conclusion tends to lead to the misuse of multipliers (UN 1999, Handbook, p. 250).

In this section, impact analysis is conducted to examine the total (direct plus indirect) effect of final demands on production (output), value added (income), employment and import requirements. For simplicity, the aggregated 10-sector, non-competitive I-O table served as the basis in the analysis. Impact assessment, however, could be extended using the basic 20-sector as the need arises.

5.9.2 Final Demand on Production

Total (direct + indirect) output requirements induced by final demands are estimated using the Leontief matrix equation:

$$\mathbf{X} = (\mathbf{I}-\mathbf{A})^{-1}\,\mathbf{Y} \qquad (21)$$

where: $\mathbf{X}$ is the matrix of total output requirements, $\mathbf{Y}$ is the matrix of final demands, and $(\mathbf{I}-\mathbf{A})^{-1}$ is the inverse coefficient matrix.

Table 13 provides estimated total outputs that sectors need to produce to sustain the demands by the final sectors, namely: final consumption (**C**), capital formation or investment (**I**), and exports, broken down into: exports to Rest of Lao ($\mathbf{E}^{L}$) and exports to Rest of the World ($\mathbf{E}^{W}$).

Overall, the biggest share of SVK's total output (61.0%) was produced to sustain its final consumption (**C**) demand, while a significant portion (22.6%) was induced by demand for investment (I) goods and services. Export demand induced local production by 16.4%, the bulk (15.5%) of which was produced to sustain export demand by ROW (E^{W}). Less than one percent (0.9%) of total production was induced by demand for outflows of goods to Rest of Lao (EL).

Except mining and quarrying and construction, all sectoral groupings registered high final consumption-induced output shares. As expected, mining production, particularly gold, is induced by (foreign) export demand (E^{W}) and construction is induced by investment demand.

The total multiplier effects, as shown in the last row of the table, suggests that, among the 3 components of final demand, C exhibits the highest output multiplier of 1.590. This means that SVK economy needs to produce K1613 worth of goods and services to satisfy K1000 final consumption demand. Investment demand shows the lowest output multiplier effect of 1.332 because finished capital goods flowing into the local economy are most imported. Induced output for export to ROW requires 1.359 units for every unit of its export demand, significantly lower than ROL's output multiplier of 1.445.

Table 13. Impact of Final Demand on Industrial Production

	Industry	Total Output Requirements (Billion Kip)					Percent Distribution				
		C	I	E^L	E^W	TFD	C	I	E^L	E^W	TFD
I	**Agriculture & forestry**	**1,111.7**	**249.2**	**17.9**	**292.8**	**1,671.6**	**66.5**	**14.9**	**1.1**	**17.5**	**100.0**
01	Agriculture and forestry	1,111.7	249.2	17.9	292.8	1,671.6	66.5	14.9	1.1	17.5	100.0
II	**Industry**	**1,733.6**	**1,017.5**	**17.5**	**543.9**	**3,312.6**	**52.3**	**30.7**	**0.5**	**16.4**	**100.0**
02	Mining and quarrying	0.3	17.2	0.0	295.6	313.2	0.1	5.5	0.0	94.4	100.0
03	Manufacturing	1,682.5	206.1	16.9	235.3	2,140.9	78.6	9.6	0.8	11.0	100.0
04	Electricity and water supply	30.4	4.2	0.3	11.0	45.9	66.3	9.1	0.6	24.0	100.0
05	Construction	20.4	790.0	0.3	2.0	812.7	2.5	97.2	0.0	0.2	100.0
III	**Services**	**992.4**	**154.1**	**22.7**	**140.6**	**1,309.8**	**75.8**	**11.8**	**1.7**	**10.7**	**100.0**
06	Transportation & communication	3.1	0.8	2.9	6.0	12.8	24.4	6.5	22.5	46.7	100.0
07	Wholesale and retail trade	302.2	100.1	4.2	91.9	498.4	60.6	20.1	0.9	18.4	100.0
08	Finance, real estate & business services	130.6	11.5	0.5	8.4	151.1	86.5	7.6	0.3	5.6	100.0
09	Public administration	121.0	0.0	0.0	0.0	121.0	100.0	0.0	0.0	0.0	100.0
10	Personal, social & community services	435.5	41.7	15.1	34.2	526.5	82.7	7.9	2.9	6.5	100.0
A: TOTAL INDUCED OUTPUT		**3,837.7**	**1,420.8**	**58.1**	**977.3**	**6,294.0**	**61.0**	**22.6**	**0.9**	**15.5**	**100.0**
B: TOTAL FINAL DEMAND		**2,413.9**	**1,067.0**	**40.2**	**718.9**	**4,240.1**					
A/B: OUTPUT MULTIPLIER		**1.590**	**1.332**	**1.445**	**1.359**	**1.484**					

NOTES:

C: Final Consumption (private + government)
I: Investment (Fixed Capital formation + Change in Inventory)
E^{ROL}: Exports to Rest of Lao PDR
E^{ROW}: Exports to Rest of the World
TFD: Total Final Demand
0.0 denotes value is less than half of unit employed

5.9.3 Final Demand on Income

Gross Income is measured in the I-O table as the sum of primary input payments or in national accounts terminology, the GVA. The total impact of final demand on sectoral GVA is calculated as:

$$V = \hat{B}(I - A)^{-1} Y$$

OR

$$V = \hat{B} X \qquad (22)$$

where V is matrix of sectoral total income effects induced by final demands;

$\hat{B}$ is a matrix of GVA coefficients (from table of direct input coefficients)

$X = (I-A)^{-1} Y$ = is a matrix of total output requirements induced by final Demands (Table 12)

Table 14 shows the total income multiplier effects generated from production to sustain final demands. It can be gleaned from the table that final consumption-induced production results a total income effect of 0.827 per unit of final consumption. Investment and export-

induced income effects are calculated to be 0.672 and 0.716 per unit of investment and export demands, respectively.

Table 14. Impact of Final Demand on Income (GVA) by Type of Primary Input

Type of Primary Input	Induced Value Added (Billion KIP)					Percent Distribution				
	C	I	E^{ROL}	E^{ROW}	TFD	C	I	E^{ROL}	E^{ROW}	TFD
1. Compensation to Employees	686.7	261.2	10.4	171.8	1,130.1	60.8	23.1	0.9	15.2	100.0
2. Production Tax less Subsidies	58.8	38.7	1.1	21.7	120.3	48.9	32.1	0.9	18.1	100.0
3. Gross Operating Surplus	1,229.6	436.2	19.1	321.3	2,006.2	61.3	21.7	1.0	16.0	100.0
A: Total Induced GVA	**1,975.1**	**736.1**	**30.6**	**514.9**	**3,256.6**	**60.6**	**22.6**	**0.9**	**15.8**	**100.0**
B: Total Final Demand	**2,413.9**	**1,067.0**	**40.2**	**718.9**	**4,240.1**					
A/B: GVA Multiplier	**0.818**	**0.690**	**0.760**	**0.716**	**0.768**					

NOTE: Gross Operating Surplus includes depreciation

Table 14A . Impact of Final Demand on Income (GVA) by Industry

Industry		Induced Value Added (Billion KIP)					Percent Distribution				
		C	I	E^{ROL}	E^{ROW}	TFD	C	I	E^{ROL}	E^{ROW}	TFD
I	**Agriculture & forestry**	**783.4**	**175.6**	**12.6**	**206.4**	**1,178.0**	**66.5**	**14.9**	**1.1**	**17.5**	**100.0**
01	Agriculture and forestry	783.4	175.6	12.6	206.4	1,178.0	66.5	14.9	1.1	17.5	100.0
II	**Industry**	**577.4**	**457.5**	**5.9**	**214.3**	**1,255.1**	**46.0**	**36.5**	**0.5**	**17.1**	**100.0**
02	Mining and quarrying	0.1	7.6	0.0	130.0	137.7	0.1	5.5	0.0	94.4	100.0
03	Manufacturing	549.1	67.3	5.5	76.8	698.7	78.6	9.6	0.8	11.0	100.0
04	Electricity and water supply	18.3	2.5	0.2	6.6	27.6	66.3	9.1	0.6	24.0	100.0
05	Construction	9.8	380.1	0.2	0.9	391.1	2.5	97.2	0.0	0.2	100.0
III	**Services**	**614.4**	**103.0**	**12.1**	**94.1**	**823.6**	**74.6**	**12.5**	**1.5**	**11.4**	**100.0**
06	Transportation & communication	2.0	0.5	1.8	3.8	8.1	24.4	6.5	22.5	46.7	100.0
07	Wholesale and retail trade	222.2	73.6	3.1	67.6	366.4	60.6	20.1	0.9	18.4	100.0
08	Finance, real estate & business services	116.0	10.3	0.4	7.5	134.2	86.5	7.6	0.3	5.6	100.0
09	Public administration	79.8	0.0	0.0	0.0	79.8	100.0	0.0	0.0	0.0	100.0
10	Personal, social & community services	194.4	18.6	6.8	15.3	235.1	82.7	7.9	2.9	6.5	100.0
	Total Induced GVA	**1,975.1**	**736.1**	**30.6**	**514.9**	**3,256.6**	**60.6**	**22.6**	**0.9**	**15.8**	**100.0**

Note: 0.0 denotes value is less than half of unit employed

5.9.4 Final Demand on Employment

Total impact of final demand on sectoral employment can be calculated using the matrix equation:

$$N = \hat{L}(I - A)^{-1} Y = \hat{L} * X \qquad (23)$$

where: N is matrix of total sectoral employment induced by final demands; $\hat{L}$ is diagonal matrix of calculated sectoral labor-output ratios; and X is matrix of total output requirements induced by final demand (Table 12).

In this case, some proxy indicators on labor-output ratios were used due to unavailability of labor force data at the sub-national level. In particular, labor-output ratios for the agriculture and the services sectors of finance and public administration were "borrowed" from available indicators derived from I-O data of neighboring Danang province, Vietnam.

Table 15. Total (Direct & Indirect) Impact of Final Demand on Employment

	Industry	Induced Employment (000 persons)					Percent Distribution				
		C	I	E^{ROL}	E^{ROW}	TFD	C	I	E^{ROL}	E^{ROW}	TFD
I	**Agriculture & forestry**	**180.7**	**40.5**	**2.9**	**47.6**	**271.8**	**66.5**	**14.9**	**1.1**	**17.5**	**100.0**
01	Agriculture and forestry	180.7	40.5	2.9	47.6	271.8	66.5	14.9	1.1	17.5	100.0
II	**Industry**	**24.7**	**36.8**	**0.3**	**5.1**	**66.9**	**36.9**	**55.1**	**0.4**	**7.7**	**100.0**
02	Mining and quarrying	0.0	0.1	0.0	1.7	1.8	0.1	5.5	0.0	94.4	100.0
03	Manufacturing	23.6	2.9	0.2	3.3	30.0	78.6	9.6	0.8	11.0	100.0
04	Electricity and water supply	0.2	0.0	0.0	0.1	0.3	66.3	9.1	0.6	24.0	100.0
05	Construction	0.9	33.8	0.0	0.1	34.8	2.5	97.2	0.0	0.2	100.0
III	**Services**	**42.1**	**6.5**	**1.1**	**5.9**	**55.6**	**75.8**	**11.6**	**2.0**	**10.6**	**100.0**
06	Transportation & communication	0.1	0.0	0.1	0.2	0.5	24.4	6.5	22.5	46.7	100.0
07	Wholesale and retail trade	12.0	4.0	0.2	3.7	19.8	60.6	20.1	0.9	18.4	100.0
08	Finance, real estate & business services	1.4	0.1	0.0	0.1	1.6	86.5	7.6	0.3	5.6	100.0
09	Public administration	4.2	0.0	0.0	0.0	4.2	100.0	0.0	0.0	0.0	100.0
10	Personal, social & community services	24.4	2.3	0.8	1.9	29.5	82.7	7.9	2.9	6.5	100.0
A: Total Induced Employment (Thousand Persons)		**247.6**	**83.8**	**4.3**	**58.6**	**394.3**	**62.8**	**21.3**	**1.1**	**14.9**	**100.0**
B: Total Final Demand (Billion KIP)		**2,413.9**	**1,067.0**	**40.2**	**718.9**	**4,240.1**					
A/B: Employment Multiplier (Persons/Billion Kip)		**102.6**	**78.6**	**106.8**	**81.6**	**93.0**					

Note: 0.0 denotes value is less than half of unit employed.

Table 15 above indicates that total employment required to sustain final demands numbered around 394.3 thousand persons in 2003, broken down into: 247.6 thousand laborers or 62.8% of total that are needed in the production of goods and services for final consumption; 83.8 thousand workers (21.3%) in the production of investment goods; 4.3 thousand (1.1%) and 58.6 thousand or 14.9% of total workers required in producing export-oriented goods to ROL and ROW, respectively.

Total employment multiplier effects are calculated to be 103 persons per K billion of final consumption demand; 79 persons per K1 billion of investments demand; 107 persons per K1 billion of ROL demand; and 82 persons per K1 billion of ROW demand for export goods.

5.9.5 Import Requirements

With the availability of the import table, it is possible to determine the total import requirements induced by the components of final demand. These are obtained using the matrix equation:

$$M = \hat{\omega}(I-A)^{-1}Y = \hat{\omega}X$$

(24)

where: M is a matrix of sectoral import requirements induced by final demand, $\hat{\omega}$ is a diagonal matrix of imported input coefficients and X is a matrix of total output requirements induced by final demand (Table13).

Table 16. Total Impact of Final Demand on Imports

	Industry	Induced Import Requirements					Contribution Ratio (%)				
		C	I	E^{ROL}	E^{ROW}	TFD	C	I	E^{ROL}	E^{ROW}	TFD
I	**Agriculture & forestry**	**64.7**	**14.5**	**1.0**	**17.1**	**97.3**	**66.5**	**14.9**	**1.1**	**17.5**	**100.0**
01	Agriculture and forestry	64.7	14.5	1.0	17.1	97.3	66.5	14.9	1.1	17.5	100.0
II	**Industry**	**77.3**	**175.4**	**0.8**	**122.1**	**375.6**	**20.6**	**46.7**	**0.2**	**32.5**	**100.0**
02	Mining and quarrying	0.1	6.5	0.0	111.0	117.6	0.1	5.5	0.0	94.4	100.0
03	Manufacturing	70.9	8.7	0.7	9.9	90.2	78.6	9.6	0.8	11.0	100.0
04	Electricity and water supply	2.1	0.3	0.0	0.8	3.2	66.3	9.1	0.6	24.0	100.0
05	Construction	4.1	159.9	0.1	0.4	164.5	2.5	97.2	0.0	0.2	100.0
III	**Services**	**191.2**	**26.4**	**5.9**	**23.9**	**247.4**	**77.3**	**10.7**	**2.4**	**9.7**	**100.0**
06	Transportation & communication	0.6	0.2	0.5	1.1	2.4	24.4	6.5	22.5	46.7	100.0
07	Wholesale and retail trade	38.7	12.8	0.5	11.8	63.8	60.6	20.1	0.9	18.4	100.0
08	Finance, real estate & business services	0.7	0.1	0.0	0.0	0.8	86.5	7.6	0.3	5.6	100.0
09	Public administration	11.2	0.0	0.0	0.0	11.2	100.0	0.0	0.0	0.0	100.0
10	Personal, social & community services	140.1	13.4	4.9	11.0	169.3	82.7	7.9	2.9	6.5	100.0
A: Total Induced Imports		**333.2**	**216.3**	**7.8**	**163.1**	**720.4**	**46.3**	**30.0**	**1.1**	**22.6**	**100.0**
B: Total Final Demand		2,413.9	1,067.0	40.2	718.9	4,240.1					
A/B: Total Import Multiplier		**0.138**	**0.203**	**0.194**	**0.227**	**0.170**					

Note: 0.0 denotes value is less than half of unit employed.

Table 17 shows that in order to sustain total final demand amounting to K4,240.1 billion, production had to consume a total of K720.4 billion worth of imported goods and services. The import content therefore per unit of final demand is calculated to be 0.170. By component of final demand, final consumption-induced coefficient is estimated to be 0.138, which is much lower than computed investment, domestic (ROL) and foreign (ROW) export-induced coefficients of 0.203, 0.194 and 0.227, respectively. The results are observed to be reasonable because the main providers to final consumption are the consumer goods sectors such as the food, beverage and tobacco, the crops, the textile & garments and the personal services sectors that are all less dependent on imports. On the other hand, production of capital goods and services are highly import-dependent, hence a higher import multiplier.

One interesting result in Table 17 is the multiplier effect of (foreign) export demand on import requirements. It represents the indirect import requirements to produce export-oriented goods. The import multiplier of 0.227 can be interpreted as the import content per unit value of export. Thus, in order to produce $1000 worth of goods for export, $227 worth of imported materials and services is needed. In short, net foreign exchange earnings would amount to $773 only. The import multiplier of 0.227 is alternatively interpreted as the foreign exchange leakage.

6. STUDY LIMITATIONS/FUTURE CONSIDERATIONS

As already mentioned, the external trade flows, recorded in the SVK I-O table, are limited to SVK economy's transactions with ROW; thus exports and imports by areas outside of SVK, i.e. ROL, have been left out in this single-region I-O model. To be able to measure and assess the external trade structure of ROL with ROW, the I-O framework should be extended into an inter-regional I-O model.

This pioneering I-O study was, understandably, constrained by the utter lack of data; thus restrictive assumptions have to be introduced to be able to fill-in observed data gaps, as follows:

The I-O survey was not able to cover household-operated activities such as crops farming due to fiscal and time constraints; thus, cost or input structures were approximated based on "borrowed" technical coefficients, in this case, from Vietnam's (2000 I-O).

The transformation process from purchaser's price to producer's price table also availed of trade and transport margin ratios derived from Vietnam's 2000 I-O.

Some policy and technical considerations, that are deemed vital in developing and maintaining a doable framework for I-O compilation, both at the national and sub-national level, are as follows:

Corollary to national accounts compilation, the development and maintenance of a national I-O framework should be given due consideration to be able to meet growing international demand of the I-O model in micro-economic analysis;

Capacity building geared towards enhancing the expertise of technical staff not only in national accounts but also in I-O compilation.

7. REFERENCES

Ackello-Ogutu, C. 1996. Methodologies for Estimating Informal Cross Border Trade in Eastern and Southern Africa. Technical Paper No. 29, SD Publication Series, Office of Sustainable Development Bureau for Africa, USAID. Available: http://www.afr-sd.org/publications/29method.pdf.

Ackello-Ogutu, C. 1997. Unrecorded Cross-Border Trade between Kenya and Tanzania: Implications for Food Security. Technical Paper No. 59, SD Publication Series, Office of Sustainable Development Bureau for Africa, USAID. Available: http://www.afr-sd.org/publications/59trade.pdf.

Ackello-Ogutu, C. and Echessah, P. N. 1998. Unrecorded Cross-Border Trade between Tanzania and Her Neighbours: Implications for Food Security. Technical Paper No. 89, SD Publication Series, Office of Sustainable Development Bureau for Africa, USAID. Available: http://www.afr-sd.org/publications/89tanztrade.pdf.

Chandoevwit, W., Chalamwong, Y. and Paitoonpong, S. 2004. Thailand's Cross-Border Economy: A Case Study of Sa Kaeo and Chiang Rai. Report prepared for the Development Analysis Network (DAN).

Chaudhari, S. K. 1995. Cross Border Trade Between India and Bangladesh. Working Paper No. 58, National Council of Applied Economic Research, New Delhi, India.

Chenery, Hollis B., and Clark, Paul G., 1959, "Interindustry Economics", John Wiley & Sons, Inc., New York:

Das, S. and Pohit, S. 2004. Quantifying Transport, Regulatory and Other Costs of India-Bangladesh Trade. Working Paper No. 92, National Council of Applied Economic Research, New Delhi, India. Available: http://www.ncaer.org/WP92.pdf.

Dung, N. T. K. and Loi, C. C. 2004. Cross-Border Economy in Vietnam. Report prepared for the Development Analysis Network (DAN).

Khan, R. K., Yusuf, M., Bokhari, S. and Aziz, S. 2005. Quantifying Informal Trade Between Pakistan and India. Report prepared for the Sustainable Development Policy Institute, Islamabad, Pakistan. Available: http://sdpi.org/tkn/publications.htm.

Leebouapao, L., Souksavath, P., Sone, P., Darachanthara, S. and Norintha, V. 2004. Role and Impact of Border Trade: Case Study in Dansavanh, Savannakhet, and Housysai/Tonpheung, Bokeo, Lao PDR. Report prepared for the Development Analysis Network (DAN).

Macamo, J. L. 1999. Estimates of Unrecorded Cross-Border Trade between Mozambique and Her Neighbours. Technical Paper No. 88, SD Publication Series, Office of Sustainable Development Bureau for Africa, USAID. Available: http://www.afr-sd.org/publications/88.pdf.

Miller, Ronald E. and Blair, Peter D., 1985. "Input Output Analysis: Foundations and Extensions". Prentice Hall, Inc , Engelwood Cliffs, New Jersey

Minde, I. J. and Nakhumwa, T. O. 1998. Unrecorded Cross-Border Trade between Malawi and Neighbouring Countries. Technical Paper No. 90, SD Publication Series, Office of

Sustainable Development Bureau for Africa, USAID. Available: http://www.afr-sd.org/publications/90malawitrade.pdf.

Pohit, S. and Taneja, N. 2003. "India's Informal Trade with Bangladesh: A Qualitative Assessment." *The World Economy* 26(8):1187-1214.

Portes, R. and Hélène Rey, 2005. *THE DETERMINANTS OF CROSS-BORDER EQUITY FLOWS,* Centre for Economic Policy Research Discussion Paper, No. 2225, London

Smarzynska, B.K and Shang-Jin Wei, 2002. "Corruption and Cross-Border Investment: Firm-Level Evidence, The Brookings Institution, Washington, D.C.

Taneja, N., Sarvanathan, M., Karmacharya, B. K. and Pohit, S. 2002. Informal Trade in the SAARC Region: A Case Study of India, Sri Lanka and Nepal. Report prepared for the South Asia Network of Economic Research Institutes, Islamabad, Pakistan. Available: http://www.saneinetwork.net/pdf/SANEI_II/InformalTrade.pdf.

UN. 1999. Handbook of Input-Output Table Compilation and Analysis, New York.

Appendices

Appendix – 1 Technical Notes on Non-Competitive SVK I-O Framework

FROM			TO	INTERMEDIATE DEMAND: SVK 1 ..... j 20	TID	FINAL DEMAND: SVK 1 ... k... 4	Exports E^L	Exports E^W	Imports M^L	Imports M^W	TFD	TGO
INTERMED	INPUTS	SVK	1 2 : i : 20	Xij^{SS}		Yik^{SS}	Ei^{SL}	Ei^{SW}	0	0		Xi^S
		ROL	M^L	Mj^{LS}		Mk^{LS}	0	0	$-\Sigma M^L$	0		0
		ROW	M^W	Mj^{WS}		Mk^{WS}	0	0	0	$-\Sigma M^W$		0
		TII		Xj^S							ΣY^S	ΣX^S
VALUE	ADDED		1 : p : 4 MTX	Vpj^S	Vp^S	0	0	0	0	0 mtx	0 mtx	$V_p{}^S$ mtx
		TPI		Vj^S	ΣV^S	0	0	0	0	mtx	mtx	GDP
TGI				Xj^S	ΣX^S	$Y_{ik}{}^S$	E^{SL}	E^{SW}	$-\Sigma M^L$	ΣM^W	GDE	

ABBREVIATIONS:

SVK: Savannakhet
ROL: Rest of Lao
ROW: Rest of the World
TII: Total Intermediate Inputs
TPI: Total Primary Inputs (=GVA)
TGI: Total Gross Input
TID: Total Intermediate Demand
TFD: Total Final Demand
TGO: Gross Output
GDP Gross Domestic Product
GDE Gross Domestic Expenditure
MTX: Import Tax

DEFINITIONS:

Xij^{SS} Local I-O matrix showing the value of product i produced in region S consumed by production sector j in region S, where i = j and S = SVK

Yik^{SS} Local final demand matrix showing the value of product i produced in region S delivered to final demand sector k in region S

Ei^{SL} Vector of values of products produced in region S exported to region L, where L = Rest of Lao

Ei^{SW} Vector of values of products produced in region S exported to region W, where W = Rest of the World

Yi^S Vector of total final demand for products produced in region S

Xi^S Vector of values of products produced in region S

Mj^{LS} Vector of imports of products produced in region L consumed by production sectors in region S, where L = Rest of Lao

Mk^{LS} Vector of imports of products produced in region L consumed by final demand sectors in region S

$-\Sigma M^{LS}$ Total value of imports by region S from region L , (with negative sign)

Mj^{WS} Vector of imports of products produced in region W consumed by production sectors in region S, where W = Rest of the World

Mk^{WS} Vector of imports of products produced in region W consumed by final demand sectors in reg. S

$-\Sigma M^{WS}$ Total value of imports by region S from region W , (with negative sign)

Vpj^S Matrix of Value Added generated by production sectors in region S

Vj^S Vector of GVA generated by production sectors in region S

Xj^S Vector of values of total gross inputs consumed by production sectors in region S

mtx Total import duties & taxes

Final Demand Sectors, k:

1: Private (household) consumption expenditures
2: Government Consumption Expenditures

Primary Input Sectors, p:

1: Compensation of Employees
2: Indirect (production)Taxes net of Subsidies

3: Gross Fixed Capital Formation	3: Depreciation
4: Change in Inventories	4: Operating Surplus

The I-O Equations

The following accounting identities can be observed from Table 1: The total gross output of product i is equal to the total gross input of product j, where i = j. That is, in the case of SVK I-O, in matrix form:

$$VectorX_i^S = VectorX_j^S$$

SVK's total primary input, ∑VS, is equal to its total final demand, ∑YS. Adding the value of import taxes, we have:

$$\sum V^S + mtx = \sum Y^S + mtx$$

OR: Gross Domestic Product (GDP) = Gross Domestic Expenditure (GDE)

Without loss of generality, the balance equation for the output of product i is, in matrix form,

$$X_i^S = X_{ij}^{SS} + Y_{ik}^{SS} + E_i^{SL} + E_i^{SW} \quad (1)$$

Based on Leontief's assumption of linearity in production cost functions, the general structural equation, in matrix form is:

$$A_{ij} = X_{ij} * \hat{X}_j \quad (2)$$

where A_{ij} is the input coefficient matrix and $\hat{X}_j$ is a diagonal matrix of X_j, where X_j is the vector of total gross inputs which is equal to vector total gross outputs, X_i.

Substituting Eq.2 into Eq.1, the result would be

$$X_i = X_{ij} + Y_{ik} + E_i^L + E_i^W$$

$$\text{Or } X_i - A_{ij}X_j = Y$$

$$\text{where } Y = Y_{ik} + E_i^L + E_i^W$$

Since $X_i = X_j$, its generalized matrix form is

$$(I - A)X = Y$$

Multiplying both sides by $(I - A)^{-1}$, the Leontief's I-O equation is given by

$$X = (1 - A)^{-1}Y \quad (3)$$

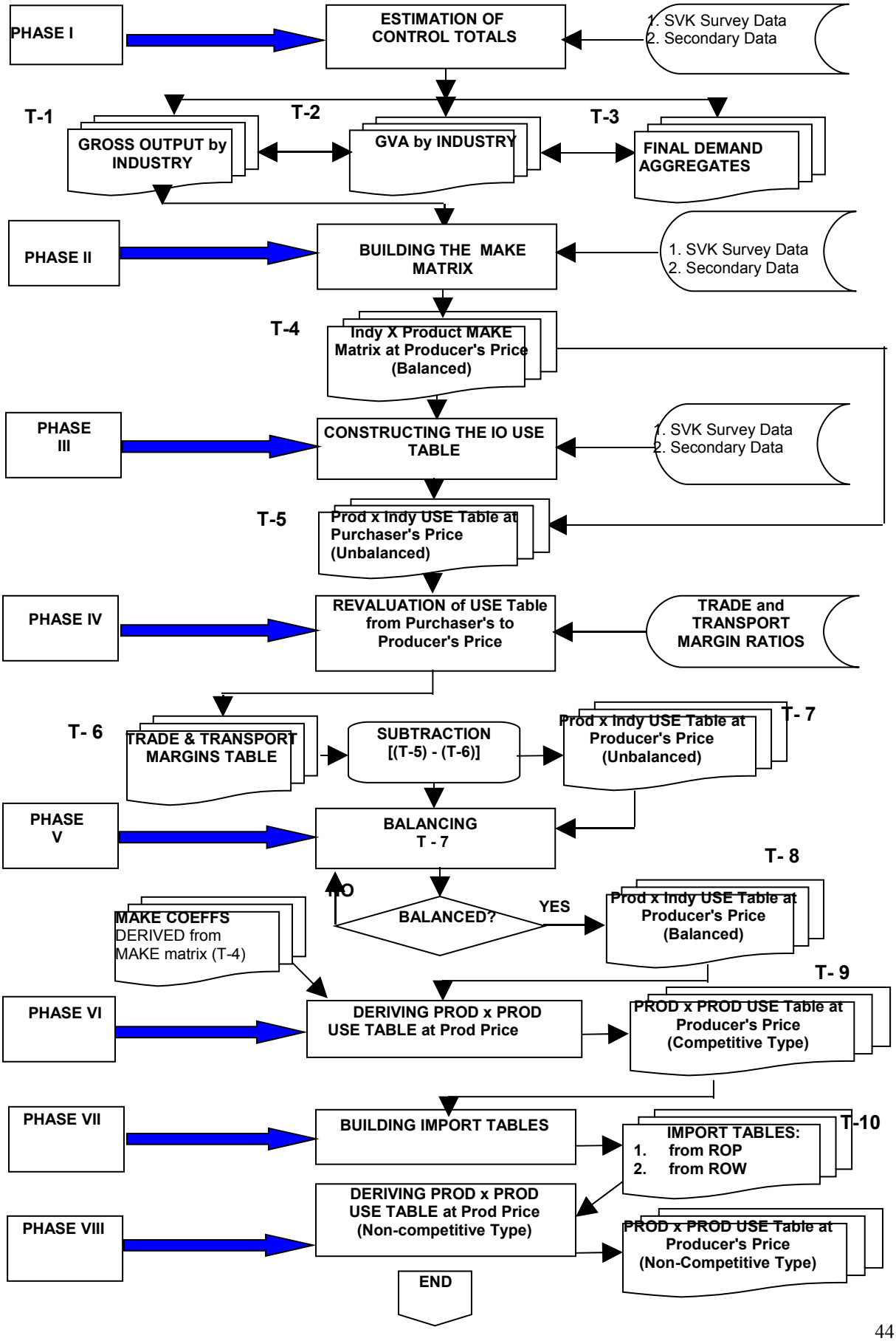
where $(I - A)^{-1}$ is the so-called Leontief inverse.

The Leontief inverse matrix, $(I-A)^{-1}$, is a table of multipliers that links production, X, and final demand, Y. It shows the total (direct plus indirect) output requirements induced by a unit change in final demand. It thus unravels the inter-industrial interdependencies brought about by the repercussive effects of changes in final demand.

Appendix – 2: Production Sector Classification Scheme

20-sector Table		10-sector Table		3-sector Table	
CODE	**DESCRIPTION**	**CODE**	**DESCRIPTION**	**CODE**	**DESCRIPTION**
01	Crops				
02	Livestock & poultry; fishery	**01**	Agriculture and forestry	**I.**	**AGRICULTURE & FORESTRY**
03	Forestry				
04	Mining & quarrying	**02**	Mining and quarrying		
05	Food, beverage & tobacco products				
06	Textiles, garments and leather products				
07	Wood and paper products; publishing & printing				
08	Chemical, rubber, plastic, petroleum products	**03**	Manufacturing	**II.**	**INDUSTRY**
09	Non-metallic mineral products				
10	Metal products, machinery, equipt & spare parts				
11	Other manufactured goods				
12	Electricity and water	**04**	Electricity and water		
13	Construction	**05**	Construction		
14	Transportation	**06**	Transportation and communication		
15	Communication				
16	Trade	**07**	Trade		
17	Banking, insurance, business services	**08**	Banking, real estate, and business services	**III.**	**SERVICES**
18	Real estate & ownership of dwellings				
19	Public administration	**09**	Public administration		
20	Personal, social & community services	**10**	Other services		

Appendix – 3 General Work Flowchart



Appendix – 4: Adjustment Notes for GDP and GO Data

1. GVA and GO by Industry

1.1. The basic source of data comes from the CPI branch office in SVK, as this project's principal local counterpart. The raw data came in the form of a detailed industrial breakdown of GVA and GO estimates as well as its corresponding GDP levels made available for years 2002 and 2003.

1.2. The sectoral compositions and their corresponding recorded estimates were first reviewed for consistency and coherence with the conceptual and accounting framework of the SNA, in general, and of the I-O, in particular. Data assessment, as documented in Table 1 shown below, revealed the following observations/findings:

C-1. Data Assessment of 2003 GDP Data: Savannakhet Province

			2003-2004			REMARKS
NO.		SECTOR/SUB-SECTOR	GO	GVAR	GVA	
I		**AGRICULTURE**	**1,957,844**	**0.90**	**1,759,094**	
	1	**Rice**	**392,553**	**0.85**	**333,670**	**includes: (1) paddy farming and**
						& (2) rice milling done in farms
	2	All other crops	182,636	0.85	155,032	
	3	**Livestock and poultry**	**1,316,849**	**0.92**	**1,212,480**	**includes (1) livestock & poultry raising**
						& (2) meat processing done in farms
	4	Forestry	65,806	0.88	57,912	
II		**INDUSTRY**	**1,291,732**	**0.46**	**592,824**	
	5	**Mining/quarrying**	**8,240**	**0.56**	**4,640**	**understated; include gold exports by OXIANA**
						as reported in foreign trade stat for 2003
	6	**Rice milling**	**18,713**	**0.25**	**4,678**	**Adjust to include rice milling done in farms**
	7	**Meat processing**	**436**	**0.25**	**109**	**Adjust to include meat processing in farms**
	8	Other food processing	4,759	0.43	2,034	
	9	Beverage & tobacco	8,554	0.40	3,410	
	10	Textiles, garments	58,193	0.40	23,277	
	11	Wood products	169,580	0.33	55,294	
	12	Paper products; publishing/printing	4,775	0.32	1,538	
	13	Cosmetics, plastic products	1,943	0.29	558	
	14	Non-metallic mineral products	5,602	0.42	2,348	
	15	Metal, machinery, appliances, transp eqpt	83,362	0.37	30,939	
	16	Other manufactured products	98,872	0.40	39,549	
	17	Electricity	32,742	0.80	26,194	

C-1. Data Assessment of 2003 GDP Data (Continuation)

	18	Water supply	2,744	0.60	1,646	
	19	Construction	793,218	0.50	396,609	
III		**SERVICES**	**2,413,067**	**0.31**	**739,740**	
	20	Transportation	9,401	0.34	3,210	
	21	Post and Telecommunication	9,932	0.50	4,966	
	22	**Wholesaling and Retailing**	**1,621,879**	**0.20**	**324,376**	**GO should be adjusted**
						using correct GVAR; trade is high value added
	23	**Banking**	**50,948**	**1.00**	**50,948**	**GO should be adjusted**
						using correct GVAR - not 1.00
	24	**Room accommodation rental**	**736**	**0.80**	**589**	**Adjust levels to include imputed rent of**
						owner-occupied dwellings using LECS III data
	25	**Local govt (salary only)**	**92,902**	**1.00**	**92,902**	**GO should be adjusted**
						using correct GVAR - not 1.00
	26	Hotel and tourism	33,459	0.50	16,730	
	27	Other services	593,811	0.41	246,020	
		TOTAL	**5,563,456**	**0.56**	**3,091,658**	
IV		**Import tax**			**115,000**	
		GDP			**3,206,658**	

Data Source: Savannakhet CPI

a) Recorded GO for RICE under AGRICULTURE is believed to be the output of an integrated agro-industrial activity, i.e., (i) from paddy farming to (ii) rice milling done in the farm. This observation seems reasonable because figures for RICE MILLING under the INDUSTRY group are grossly understated as can be seen in Table C-1. Since I-O accounting is concerned with inter-sectoral flows of products, it is therefore necessary that an explicit distinction should be made between paddy and rice, hence, the need to break down the recorded lumped figures for RICE into separate estimates for (i) paddy and (ii) rice milling. Given these breakdowns, we can now quantify how much paddy (output) was consumed and how much income (GVA) was generated in rice milling done in the farms. Strictly speaking, rice milling belongs to industry, while paddy farming is agricultural.

b) Similarly, the same observation can be qualified for the recorded levels for the LIVESTOCK & POULTRY sector that should also be subdivided to account for: (i) livestock and poultry raising and (ii) slaughtering/meat processing that is done in farm households.

c) GO and GVA figures for MINING appeared to have excluded the sizeable output of gold ingots as recorded in the 2003 export statistics;

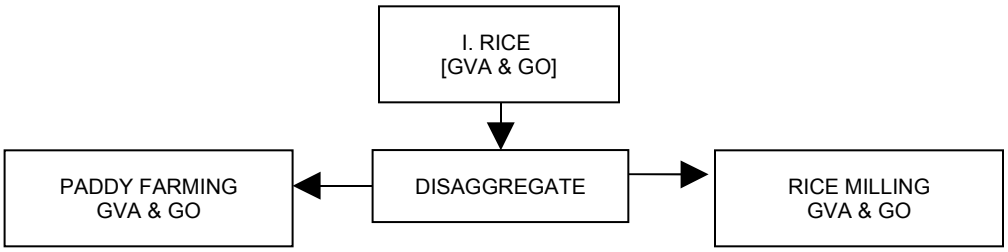
d) Industry sub-sectors (i) Rice milling and (2) Meat processing may absorb the GVA and GO levels estimated in (a) and (b), respectively in order to satisfy the homogeneity property assumption of I-O tables.

e) Under the SERVICES sector, GVA ratios for sub-sector (i) wholesale & retail trade and (ii) government services are observed to be incorrect and therefore their GO levels should be adjusted; and

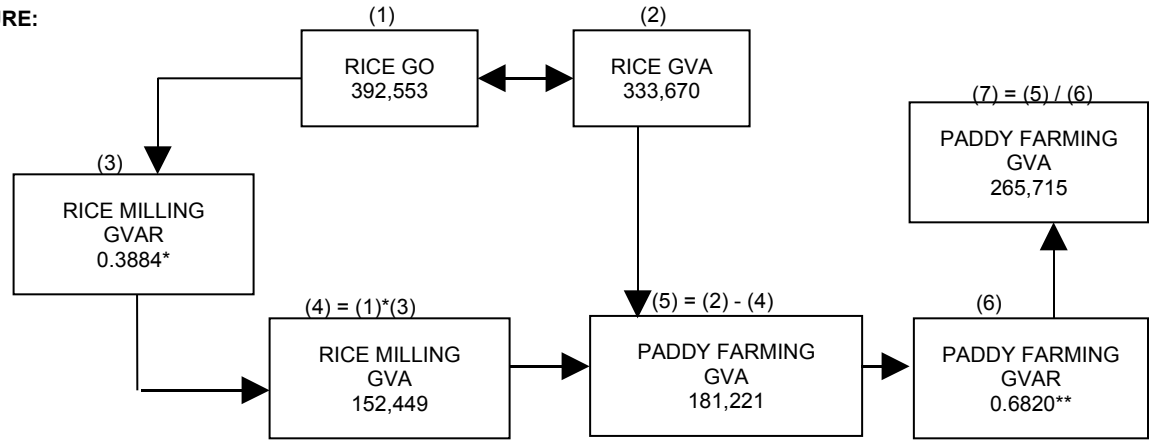
f) GVA and GO estimates for sub-sector HOUSING RENT excluded IMPUTED RENT OF OWNER-OCCUPIED DWELLINGS which, in SNA concept, forms part of the output of the REAL ESTATE sector.

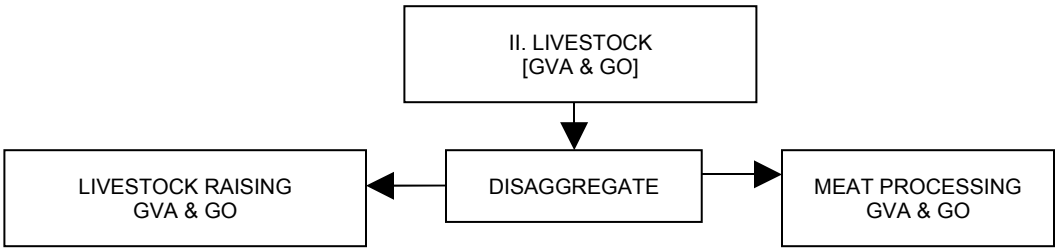
1.3. Taking into consideration the above findings, the next step involved the process of re-estimating and revising, if necessary, the recorded levels, given available relevant indicators derived from various sources, one of which is the 2004 SVK I-O Survey.

1.4. Shown below is the procedure followed in disaggregating recorded GVA and GO levels for (1) RICE into (i) Paddy farming and (ii) Rice milling, and for (2) LIVESTOCK & POULTRY into (i) Livestock & poultry raising and (ii) Slaughtering/meat processing. It should be noted that the sum of the breakdowns is equal to the recorded estimated total, in both cases. These resulting disaggregated estimates were then inputted into the series of adjustments and revisions made.

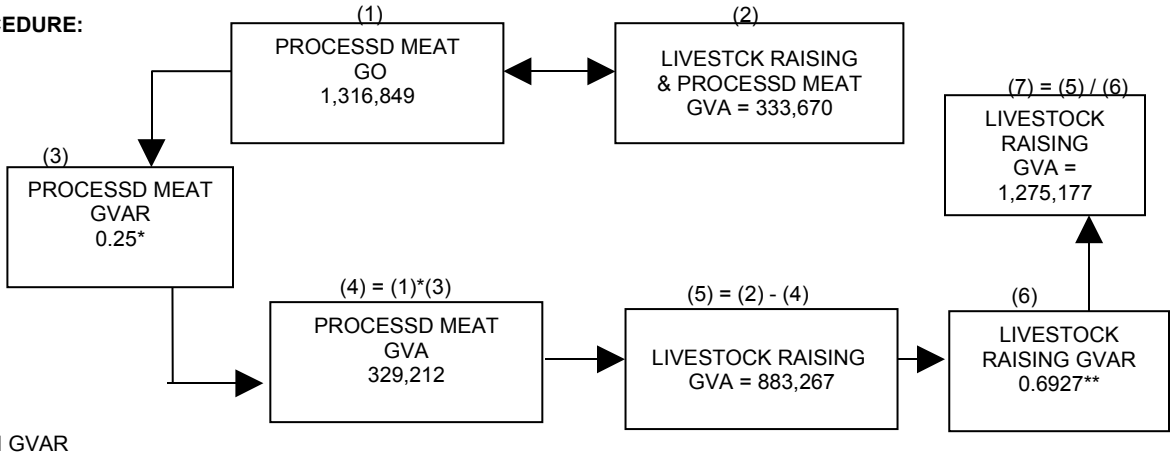


PROCEDURE:





PROCEDURE:



* CPI GVAR
** IO survey

Disaggregation Procedures:

1.5. Annex Tables C-2 & C-3 show the preliminary and final revisions made. These are presented at the 20-sector classification.

Table C-2. GVA _1st Revision

NO.	SECTOR/SUB-SECTOR	2003			REMARKS
		GVA	GVAR	GO	
I	**AGRICULTURE**	**1,759,094**	**0.50**	**3,498,736**	
	1.1.1. Paddy farming	**181,221**	**0.6820**	**265,715**	
	1.1.2. Rice milling done in the farm	**152,449**	**0.3884**	**392,553**	**Combine w/ II.2.1**
	1.2 Other crops	**155,032**	**0.85**	**182,636**	
	2.1. Livestock & poultry raising	**883,267**	**0.6927**	**1,275,177**	
	2.2. Meat processing done in farm	**329,212**	**0.25**	**1,316,849**	**Combine w/ II.2.2**
	3. Forestry	**57,912**	**0.88**	**65,806**	
II	**INDUSTRY**	**728,188**		**1,596,656**	
	1. Mining	**4,640**	**0.56**	**8,240**	
	ADD: GOLD MINING OUTPUT	**135,364**	**0.44**	**304,924**	**export value of gold ingots (OXIANA)**
	2.1 Rice mill service	**4,678**	**0.25**	**18,713**	
	2.2 Meat processing	**109**	**0.25**	**436**	
	2.3 Other food processing	2,034	0.43	4,759	
	2.4 Beverage & tobacco	3,410	0.40	8,554	
	2.5 Textiles, garments	23,277	0.40	58,193	
	2.6 Wood products	55,294	0.33	169,580	
	2.7 Paper products; publishing/printing	1,538	0.32	4,775	
	2.8 Cosmetics	102	0.40	255	
	2.9 Plastic products	456	0.27	1,688	
	2.10 Non-metallic mineral products	2,348	0.42	5,602	
	2.11 Metal products	2,821	0.33	8,551	
	2.12 Household appliances	4,400	0.30	14,666	
	2.13 Transport equipment	23,719	0.39	60,145	
	2.14 Other manufactured products	39,549	0.40	98,872	
	3.1 Electricity	26,194	0.80	32,742	
	3.2 Water supply	1,646	0.60	2,744	
	4. Construction	396,609	0.50	793,218	
III	**SERVICES**	**809,508**		**1,327,836**	
	1. Transportation	3,210	0.34	9,401	
	2. Post and Telecommunication	4,966	0.50	9,932	
	3. Wholesaling and Retailing	**324,376**	**0.79**	**409,132**	**rev GO based on IO survey GVAR**
	4. Banking	**50,948**	**0.87**	**58,261**	**rev GO based on IO survey GVAR**
	5. Building/house rental	**589**	**0.80**	**736**	
	plus imputed rent of o.o.d.	**82,877**	**0.90**	**92,074**	**estimated based on LECS III data**
	6. Public administration	**79,793**	**0.66**	**121,030**	**rev levels based on actual data**
	7. Hotel and tourism	16,730	0.50	33,459	
	8. Other services	246,020	0.41	593,811	
		3,296,790	**0.51**	**6,423,227**	
IV	**Import tax**	**115,000**			
	GDP	**3,411,790**			

SUMMARY: Additions to GVA:

GOLD MINING	**135,364**
Imputed rent of Ownership of Dwellings	**82,877**

Table C-3. Revised GVA & GO Estimates: Savannakhet, 2003

20-sector IO Code	DESCRIPTION	2003		
		GVA	GVAR	GO
I. AGRICULTURE & FORESTRY		**1,277,433**	**0.7075**	**1,805,443**
01	Crops	336,253	0.7240	464,460
02	Livestock and poultry	883,267	0.6927	1,275,177
03	Forestry and logging	57,912	0.8800	65,806
II. INDUSTRY		**1,199,687**		**3,221,945**
04	Mining and quarrying	140,004	0.4471	313,164
05	Food, beverage & tobacco	491,730	0.2835	1,734,463
06	Textiles, garments & leather products	23,277	0.4791	48,587
07	Wood & paper products; printing	56,832	0.5344	106,356
08	Chemical products; petroleum	558	0.3803	1,467
09	Non-metallic mineral products	2,348	0.3780	6,212
10	Metal products, machinery, spare parts	30,939	0.4013	77,107
11	Other manufactured goods	29,549	0.3885	76,060
12	Electricity & water	27,840	0.6068	45,879
13	Construction	396,609	0.4880	812,651
III. SERVICES		**779,508**		**1,266,590**
14	Transportation	3,210	0.4870	6,592
15	Post and telecommunication	4,966	0.7986	6,218
16	Wholesale and retail trade	324,376	0.7928	410,139
17	Banking, insurance, business services	50,948	0.8745	58,261
18	Real estate & ownership of dwellings	83,466	0.8993	92,810
19	Public administration	79,793	0.6593	121,030
20	Personal, social & community services	232,749	0.4072	571,540
	TOTAL GVA	**3,256,627**	**0.5174**	**6,293,978**
IV. IMPORT TAX		**115,000**		
	GDP	**3,371,627**		

C-4. COMPARISON OF GDP ESTIMATES: 2003

	NSC		SVK CPI		IO[1]		IO[2]	
	Value	%	Value	%	Value	%	Value	%
GDP (BIL KIP)	3,461	100	3,207	100	3,372	100	3,372	100
I Agriculture	1,681	49	1,759	55	1759	52	1,277	38
II Industry	898	26	593	18	718	21	1,200	36
III Services	883	26	740	23	780	23	780	23
Import tax			115	4	115	3	115	3

IO[1]: rice milling & meat processing done in farms remained in agriculture
IO[2] : rice milling & meat processing done in farms transferred to industry

	DEVIATIONS			
	IO[1]/CPI	IO[2]/CPI	CPI/NSC	IO/NSC
GDP (BIL KIP)	5.1%	5.1%	-7.3%	-2.6%
I. Agriculture	0.0%	-27.4%	4.6%	-24.0%
II. Industry	21.1%	102.4%	-34.0%	33.6%
III. Services	5.4%	5.4%	-16.2%	-11.7%
Import tax	0.0%	0.0%		

NOTE: I-O[2] Estimates were adopted in compiling the SVK I-O Table 2003