DIRECTORATE OF THE AREA OF
TRADE AND AGRIBUSINESS

DIRECTORATE OF STRATEGIC PLANNING
AND INSTITUCIONAL MODERINZATION

1997 SOCIAL ACCOUNTING MATRIX FOR COSTA RICA (SAM 97)

Final Results and Methodology Used to Construct the Matrix

Inter-American Institute for Cooperation on Agriculture
Technical Cooperation Secretariat

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FOREWORD

Social accounting matrixes (SAMs) are a useful tool for analyzing national and international policies, measuring external shocks to the economy and studying the dynamics of the market and the institutional framework. They are useful not only because they provide a consistent framework for socioeconomic accounting, but also as they are the primary source of data for a wide variety of economic models, such as SAM multipliers, computable general equilibrium models, and multi-market models. SAMs are more useful than the System of National Accounts, and provide specialists with a dynamic, reliable tool for analyzing economies and the impact of policies.

IICA constructed a Social Accounting Matrix for Costa Rica for 1997 (SAM_1997), with a disaggregation of the Agriculture and agrifood sector that made it possible to conduct a more comprehensive analysis of the economy as a whole, the agrifood sector in particular, and the interrelationships between them. Policymakers also have better information for evaluating policies and external factors that impact economic performance.

This document describes how the matrix was constructed and prepared under the IICA-Fontagro project, with IICA's objective being to make this methodological experience available to the member countries. In formulating the matrix, IICA's specialists tapped the enormous amount of economic information available for 1997, compiled that year as the basis for establishing Costa Rica's current national accounts series. The authors also benefited from the development of Costa Rica's national accounts in recent years, *achieved thanks to the outstanding work of the professionals of the country's Central Bank, whose invaluable assistance we wish to acknowledge.*

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I. INTRODUCTION

In this document we explain how we constructed the social accounting matrix for Costa Rica for 1997 (SAM 97). We show, clearly and concisely, the process of constructing a SAM based on information contained in the System of National Accounts. This document thus provides a methodological guide for anyone wishing to attempt the construction of a SAM.

The document contains details of the data required, the sources, and the procedure used to construct the Social Accounting Matrix (SAM). A MACRO SAM is obtained and interpreted, and the different agents in the structure of the SAM are analyzed, along with the method and way of cross-tabulating economic accounts. Taking rice as an example, the authors explain how an economic sector of special interest can be disaggregated, to show the flexibility of this analytical instrument. Finally, they show how a SAM can be used to describe a country's chief socioeconomic characteristics.

Why would someone want to construct a SAM in the first place? Because SAMs are a tool of vital importance in the field of economic research, offering flexibility and a consistent analytical framework. The purpose of this document is not to provide a conceptual introduction to SAMs, as this would simply be to repeat what is to be found, both in detailed and summarized form, in many of the studies listed in the bibliography. Indeed, in case the reader needs more background information, and to help disseminate this topic, the bibliography has been extended to include references to certain texts about which nothing else is known. It is important to explain the importance of the instrument, however.

The literature suggests at least four main uses for SAMs:[1]

1. As a tool for national, regional, and even local, socioeconomic analysis, since it provides information not only about the flow of the value of production but also the distribution of the income generated. In addition, if it is complemented with some satellite environmental and social accounts, a SAM can provide a comprehensive analytical framework of sustainable development.
2. As a source of descriptive information about a country's economy, including details of production, income distribution, investment, financial flows, indebtedness, and trade.
3. As a database and as the main source of information for the formulation of other, more complex analytical tools, such as multiplier models and computable general equilibrium models. These other tools make it possible to simulate and study the possible impacts of changes in exogenous economic variables - for example, changes in tariffs, the terms of trade and international prices.
4. As an instrument for integrating the universe of scattered economic statistics that cover a broader panorama than the one shown in the System of National Accounts.

Given the importance of the instrument, IICA prepared the SAM 97 for Costa Rica as one of the most important components of an ambitious program undertaken by the Directorate of the Area of Trade and Agribusiness, and the Directorate of Strategic Planning and Institutional Modernization, aimed at providing the Institute with quantitative tools for policy analysis. The advantage of these tools is that they offer an analytical framework that integrates economic, social, and environmental factors. Hence the aim is to offer models based on the Social Accounting Matrix, such as SAM Multipliers, Computable General Equilibrium Models (CGEs), and Sectoral Models. The SAM 97 for Costa Rica is a guide project, to which physical accounts of natural resources will be linked to conclude with policy analyses using CGE models.

1. Presented by Venegas M., José (1995). Matriz de Cuentas Sociales 1986: Una SAM para Chile, Serie de Estudios Económicos, 39. Central Bank of Chile.

The next chapter of this document presents some important background documentation and definitions regarding social accounting matrixes, since only a minority of professional economists are familiar with studies of this kind. The third chapter begins with an explanation of the procedures followed in preparing the SAM 97 and then presents the methodology for disaggregating the matrix, taking the rice sector/production as an example to analyze and explain the disaggregation of the staple grains sector in the SAM 97.

The document ends with a brief description of the chief characteristics of Costa Rica's economy, using information culled from the SAM 97, with emphasis on the agricultural sector.

II. GENERAL DEFINITIONS AND BACKGROUND INFORMATION

A SAM can be defined as a double-entry table that records the interrelationships that exist among a very wide variety of economic transactions, in a given economic space (usually a country) and period (usually a year) (Venegas, 1995). Clearly, the SAM is closely related to the system of national accounts. It can be argued that a SAM presents the accounts of the System of National Accounts (SNA) in the form of a matrix that establishes the interrelationships among the structural aspects of an economy and income distribution and expenditure among groups of households.

Put more simply, a SAM presents, in an ordered way, the economic flows of an economy. Its theoretical basis is the circular flow of money. Thus, we can imagine a flow in which households purchase goods and services from firms that, in turn, take the money and transfer it to their input suppliers (intermediate manufacturing materials) and the suppliers of factors of production (employees and investors). The factor of production remuneration becomes the income that households will use to purchase goods and services, completing the circular flow of money. So there are actually other actors that must be taken into account besides the firms and households - the government, foreign households and firms, for example. Other flows include payments and receipts of taxes, tariffs, and remittances. Regardless of how many actors are involved in the economic system, the fact is that every *colón*a[2] paid out by someone is a *colón* that someone else receives. The SAM is therefore

2. *Colón* is the currency used in Costa Rica.

a system of accounting in which every colón is recorded, identifying clearly who pays it out and who receives it. The agent that pays (purchases) is recorded in the matrix columns, and the one that receives (sells) is shown in the rows. Hence, the definition of the SAM as a double-entry table.

2.1. STRUCTURE OF A STANDARD SAM

The structure of a social accounting matrixes can be flexible, depending on the objectives sought. As a result, their composition and functionality will be flexible. A standard matrix contains a central input-output matrix that considers intersectoral transactions, as well as the transactions related to the supply and use of goods and services. Alternatively, the use matrix and supply and use matrix may be found separately.

A SAM considers primarily transfers related to the origin and distribution of income. That is why the agents and institutions in the economy are defined. Thus, it is common to find the government, households, employees, firms, owners, and a huge number of agents. None of these agents receive more attention than households, which are divided into various special categories: urban or rural, high, middle and low class, etc. Often, the main purpose in constructing a SAM is to study this area, which is relatively less developed in research and economic measurements. Typically, it reflects the role of people in the economy through, among other things, additional definitions of the households sector and a disaggregated representation of job markets (that is, by distinguishing between several categories of employed people).

A SAM also accommodates financial transactions that link the agents or institutional sectors in terms of the origin and use to which accumulation flows are put, and their financing; in other words, it records the sources and uses of capital funds. This is done through capital and accumulation accounts. When accumulation accounts are present, the SAM can also consider the asset position of the institutional sectors, i.e., the balance of assets and liabilities at the beginning and end of the period defined for the SAM. If these informational elements are incorporated, all the economic transactions are included. Since there is information about stocks at the end and beginning of financial years and all flows of production, income, expenditures, accumulation and financing, the difference in the reconciliation entries reflects the capital losses and gains not attributable to the transactions during the period. Due to the lack of basic information, both the financial transactions and the balances of assets and liabilities were not considered in this work.

Finally, the transactions between the rest of the world and the country, as well as the accounts of the central government, are incorporated into a standard SAM. "Rest of the World" is a general term used in empirical works that refers to the entire foreign economic system. This account contains information about the balance of trade and the net flows of money out of, and into, the economy (transfers).

2.2. SOME PRACTICAL CONSIDERATIONS OF A SAM

The possible dimensions of a SAM vary considerably and depend on the information available and the objectives sought in constructing it. Bearing in mind that input-output matrixes are usually prepared for more than 40 branches of activity, the basic matrix is at least 40 x 40. When the columns and rows for the other transactions described above are added, a SAM usually has more than 100 columns and 100 rows. There is no maximum number of columns and rows, but if more or less complete information about the transactions exists, a matrix can easily have over 500 columns and 500 rows (Venegas, 1995). The SAM 97 has 115 of each. As a matrix with hundreds of rows and columns is hard to display, for practical reasons the versions used are summarized by analytical module, and the disaggregations are made for each module separately.

SAMs are usually prepared for entire countries, but there are works that consider sectors or regions within a given country

(Vargas and Schreiner, 2001, Pleskovic, 1985, Adelman and others, 1988, Rojas, 1993), or international areas (Round, 1991). The problems involved in reconciling national aggregates with regional aggregates continue to be the chief constraint to the implementation of SAMs at the regional level (Vargas, E., Schreiner D., Marcouiller D., and Tembo G., 2000).

In the case of Costa Rica, the System of National Accounts 1993 (SNA 1993) (United Nations, 1993) is available, which explicitly incorporates the progress made in research of this kind. Chapter XX contains a special introduction to the SAM concept. It establishes the international guidelines for studies of this kind and officially recognizes their importance.

2.3. BACKGROUND AND FUTURE

Graham Pyatt, who under the aegis of the World Bank published "Planning techniques for a better future" (Pyatt & Thorbecke, 1975) and then the first empirical work "Social accounting for development planning: with special reference to Sri Lanka" (Pyatt & Roe, 1978) is regarded as the precursor of studies using SAM. However, Pyatt's ideas build on Richard Stone's works on national accounts that were eventually incorporated into the guidelines to the SNA Rev.3. (Venegas, 1995).

Research on SAMs continues to be promoted within the World Bank, the Social Studies Institute of the Netherlands (ISS) and many North American and European universities (Venegas, 1995). Useful efforts have been made to develop regional SAMs. In some countries, with the United States being a case in point, regional information systems (like the IMPLAN) have made it possible to construct accounting matrixes for regions. Recently, Kinkely 1998 began to develop a multi-regional SAM, incorporating two or more regions into a single SAM.

According to Venegas (1995), the first empirical works on SAMs focused on underdeveloped and developing countries in Asia and Africa. In recent years, these empirical studies were extended to some developed countries. As in the case of CGE Models, the phenomenon was due to the fact that SAMs were initially used to study poverty, income distribution and development, but have gradually begun to be used for studies on foreign trade and financial flows, and other current economic issues that are of broad interest in all countries. In Latin America, SAMs have been constructed for Colombia (DANE, 1993), Chile (Venegas, 1995) and, Ecuador (Janvry, Sadoulet and Fargeix, 1991), to mention but a few.

In Costa Rica, groundbreaking studies in the construction of input-output matrixes include those by Leiva et al. (1972), Bulmer-Thomas (1976) and the Economic Research Institute (1985). The basic emphasis was methodological, i.e., to highlight the sources and methods used to construct an input-output matrix (IOM). Adamson and others (1999) developed a methodological proposal for constructing the SAM for Costa Rica that included the modules for the country's economic, social and environmental structure. However, this proposal was not implemented.

III. CONSTRUCTION OF THE SAM 97

This chapter contains a description of the procedures and sources used to construct the social accounting matrix for Costa Rica for 1997, SAM 97. Divided into three sections, it is the core element of this publication. The first section describes the choice of the base year, the primary sources of information, and the construction of a MACRO SAM, the starting point for the construction of the SAM itself. The second section describes in detail the procedures followed to disaggregate the MACRO SAM and construct the SAM 97, also analyzing the cross-tabulation of the accounts and their macroeconomic aggregation. The third section presents the procedure for disaggregating the staple grains sector, to explain how the matrix can be modified for the purposes of sector-specific analyses.

3.1. BASE YEAR, SOURCES AND THE MACRO SAM

3.1.1. Choice of the Base Year

Two main factors determined the base year chosen for the SAM of Costa Rica. First, at the start of the project the Central Bank was consulted about the supply and use tables (SUTs) available. It turned out that the most recent table available at that time with a "definitive closing" was the one for 1997. Second, from the outset the aim of the project was to link physical accounts of natural resources (forest resources) to the SAM, and the base year should therefore help make this possible. The Tropical Agriculture Research and Higher Education Center (CATIE) helped IICA ascertain what maps, statistics, and other information were available that would make it possible to achieve the linkage for 1997.

In 1997 Costa Rica's economy performed very well: production was up, thanks to the growth of domestic demand and the positive expectations of the economic agents; employment and wages rose; the rates of inflation, interest, and devaluation of the national currency were low; the fiscal deficit narrowed; and the international monetary reserves increased. Poverty indicators also fell and foreign investment in the hi-tech sectors peaked, which in subsequent years would become one of the dynamic elements of the country's economic growth. Finally, the balance of payments current account deficit increased, although this was covered by direct foreign investment. Due to all the above, 1997 was a year of solid economic growth, with a change in the production structure and the use of factors, especially in the export sector of goods and services.

3.1.2. Primary Data Source

The SAM 97 for Costa Rica is based on information culled from different government studies published by the Central Bank of Costa Rica (BCCR, 2001 and BCCR, 2000), an unpublished study (BCCR, 1999), and, the multipurpose survey of households (INEC,1997).

The methodology and figures of the official studies are consistent, in accordance with the System of National Accounts document that was used to prepare them. The 1993 System of National Accounts is a document that was prepared under the auspices of the Intersecretarial Working Group on National Accounts, EUROSTAT, the IMF, OECD, the United Nations, and the World Bank. The idea is that this manual be adopted universally, to ensure the international comparability of data. To the extent permitted by the statistical base available in the country, the recommendations made in this manual were followed.

Although background information on national accounts was considered in the unpublished study, the methodology and figures are not altogether consistent with those traditionally adopted in national accounts. The household surveys, on the other hand, provide details that are very useful for preparing the structures for distribution of remunerations, income, etc., although the levels that appear are undervalued with regard to those obtained from the National Accounts. The National Accounts figures are considered more consistent but are usually presented in a very aggregated way (at least in Costa Rica), hence the complementarity among the data sources.

3.1.3. The MACRO SAM of Costa Rica

The work of constructing the SAM for Costa Rica began with a MACRO SAM, which reflects, panoramically in a matrix, aggregated data of the economy (See Table 1). This matrix is used to arrange the modules of the disaggregated SAM, thus making it possible to analyze the sources of information.

In some cases, the data contained in the MACRO SAM consist of only summarized figures with little economic significance. In other cases, they show the set of sub-matrixes or modules that will ultimately contain significant data, such as net production at market prices; gross fixed capital formation; imports and exports; other current payments to the rest of the world; and, other current income from the rest of the world and foreign savings.

The MACRO SAM presents important transactions of the SNA, aggregated for the economy as a whole. Five types of (consolidated) accounts are included: production, supply and use of goods and services; income distribution; use of income; capital transactions; and, transactions with the rest of the world. The MACRO SAM is thus a consolidated version of the SAM 97 of Costa Rica (the complete SAM is included as Annex D), in which each entry in the MACRO SAM can be regarded as the grand total of a sub-matrix.

Presenting the data in a matrix makes it possible to represent each transaction by means of a single annotation and infer the nature of the transaction from its position. Each account is represented by the module annotation "(**row, column**)," and the convention followed is that inflows (income) appear in the rows and outflows

Table 1
Costa Rica: Macro SAM for the Costa Rican Economy (Millions of colones)
Base Year 1997

Account / Incomes ®	Expenditures ®	Commodities	Production	Income Distribution	Income Use	Capital	Rest of the World	Total
		A	B	C	D	E	F	
Commodities	A		Intermediate consumption 2,414,406.6		Final consumption 2,558,971.8	Gross capital formation 539,639.3	Exports 1,215,914.0	6,728,931.7
Production	B	Production and taxes on the net products of subsidies 5,398,426.4						5,398,426.4
Income Distribution	C		Net domestic product 2,815,293.3				Remuneration of employees, rent from property, current taxes and current transfers from the Rest of the World 87,599.7	2,902,893.0
Income Use	D			Disposable net national income 2,786,573.0				2,786,573.0
Capital	E		Consumption of fixed capital 168,726.5		Net savings 227,601.5			396,328.0
Rest of the world	F	Imports 1,330,505.3		Remuneration of employees, rent from property, and current transfers to the rest of the World 116,319.8		Net borrowing (143,311.3)		1,303,513.7
Total		6,728931.7	5,398,426.4	2,902,893.0	2,786,573.0	396,328.0	1,303,513.7	|

Source: IICA, with data from the Central Bank of Costa Rica (BCCR).

(expenditures) in the columns. For example, (C,B) is the net domestic product (NDP) (¢2,815,293 million), which is paid by the producers in the economy, **B**, and received in the income distribution account, **C.**

3.1.4. Description of Modules

Module (**B,A**) records production and the net taxes on products[3] of subsidies.[4] Broadly speaking, production is an activity in which a firm uses inputs to obtain outputs (result of production). The economic analysis of production deals mainly with activities that result in outputs that can be provided or supplied to other institutional units. The datum (¢5,398,426 million) reflects production at market prices and is obtained from "Table 13: Integrated Economic Accounts: Production Accounts" (BCCR, 2001), as total production at basic prices (¢5,133,562 million), plus the taxes on products (¢310,404 million) minus the subsidies for products (¢45,540 million).

Module (**F,A**) reflects importation of goods and services. It consists of purchases, barter trade, or gifts or donations of goods and services that residents receive from non-residents. The total (¢1,330,505 million) is obtained from "Table 19: Account of Current Transactions with the Rest of the World" (BCCR, 2001).

The combined total of production and taxes on the net products of subsidies, module (**B,A**), and the importation of goods and services, module (**F,A**), gives us the supply or quantity of products available in the economy in 1997 (¢6,728,931 million), which is the same as the value of "Table 12: Integrated Economic Accounts: Accounts of Goods and Services."

3. Taxes on products are taxes on the goods and services required as a result of the production, sale, transfer, leasing, or supplying of these goods or services, or as a result of their use for personal consumption or for capital formation.
4. A subsidy for a product is that to be paid for each unit of a good or service. The subsidy can be a specific amount of money by unit of quantity of a good or service, or can be calculated *ad valorem* as a specific percentage of the price per unit; it can also be calculated as the difference between a previously specified price and the market price actually paid by a buyer.

Intermediate consumption that consists of the value of the goods and services consumed as inputs by a production process is recorded in module (**A,B**). Fixed assets whose consumption is recorded as consumption of fixed capital are excluded. It includes the goods and services that are processed or consumed in the production process. Table 1 (¢2,414,406 million) is obtained from "Table 10: Production and Gross Value Added by Industry" (BCCR, 2001).

The actual final consumption of households, module (A,D), consists of the consumption goods or services acquired by individual households, either by purchasing them or in the form of social transfers in kind received from government units or non-profit institutions that serve the households (NPISH). The figure for actual final consumption of the households (¢2,558,971 million) is obtained from "Table 12: Integrated Economic Accounts: Accounts of Goods and Services," by adding together the following three components:

a. The amount spent by households on consumption goods or services, including expenditure on non-market goods or services sold at prices that are not economically significant;

b. The amount spent by government units on goods or services for individual consumption provided to households in the form of social transfers in kind; and,

c. The amount spent by the NPISH in goods or services for individual consumption provided to households in the form of social transfers in kind.

Module (**A,E**), gross capital formation, measures the total value of fixed assets acquired by producers, minus those disposed of, during the accounting period, plus certain additions to the value of non-produced assets made by the productive activity of the institutional units, plus the value of inflows of stock minus the value of outflows, and the value of any ordinary loss of goods kept in stock. Fixed assets are tangible and/or intangible assets obtained as a result of production processes and, in turn, are used repeatedly, or continually, in other production processes for more than a year. The amount (¢539,639 million) is obtained from "Table 12: Integrated Economic Accounts: Accounts of Goods and Services."

Module (**A,F**) is used for exports of goods and services. These consist of sales, barter trade, or gifts or donations of goods and services by residents to non-residents. The amount (¢1,215,914 million) is included in "Table 12: Integrated Economic Accounts: Accounts of Goods and Services."

The combined total of intermediate consumption, actual final consumption of households, gross capital formation and exports of goods and services reflects total use in the economy, that is, absorption. In the MACRO SAM, this result would be obtained by adding together modules (**A,B**), (**A,D**), (**A,E**) and (**A,F**). Of course, total supply and total use at buyer's prices are the sbame (¢6,728,931 million).

Module (**C,B**), Net Domestic Product (NDP), is obtained by subtracting intermediate consumption (**A,B**) and fixed capital consumption (**E,B**) from Gross Domestic Product (GDP).[5] To obtain the GDP, care must be taken to avoid duplication stemming from purchase and sale operations among the different producers, since this variable tries to measure the value that each producer adds to the final good or service. The only things considered are the increases in value generated in each stage of production of the final good. The figure for NDP (¢2,815,293 million) can be obtained from many of the tables contained in the National Accounts publication, but appears explicitly in "Table 13: Integrated Economic Accounts: Production Accounts."

Fixed capital consumption, module (**E,B**), also appears in Table 13. The figure (¢168,726 million) can be defined, in general terms, as the decline experienced, during the accounting period, in the standard value of the stock of fixed assets that a producer owns and uses, as a consequence of physical deterioration, normal obsolescence or normal accidental damages.

The combined total of the modules of intermediate consumption, (**A,B**), net domestic product, (**C,B**), and fixed capital consumption, (**E,B**), is exactly the same as the figure for total production that appears in module (**B,A**) that we discussed earlier.

5. The total value of GDP production is sum of the monetary value of the goods and services produced by a country in a given time period (quarter, year).

Module (**C,F**) reflects the remuneration of employees, rent from property, current taxes and current transfers from the Rest of the World; while module (**F,C**) reflects the remuneration of employees, rent from property, and current transfers to the Rest of the World. It is basically used to record transactions between residents[6] and non-residents of the country. In the system, the total economy is made up of all the institutional units that are resident in the economic territory of a country. The figures are obtained from "Table 2: Gross Domestic Product and Disposable Net National Income" (BCCR, 2001).

Disposable Net National Income, module (**D,C**), is the combined total of Net Domestic Product (**C,B**), the remuneration of employees, rent from property, current taxes and current transfers from the Rest of the World (**C,F**), minus the remuneration of employees, rent from property, and current transfers to the Rest of the World (**F,C**). It is interpreted as follows: primary income generated by production and transfers to the resident production units are usually distributed among other resident institutional units. Part of them may go to non-resident units, however. Symmetrically, part of the primary income and transfers generated in the Rest of the World can go to resident units. This leads to the definition and measurement of disposable gross national income (DGNI) at market prices. DGNI is the same as GDP minus the primary income payable to non-resident units, plus primary income receivable from non-resident units, minus transfers made to non-resident units, plus transfers received from non-resident units. Subtracting fixed capital consumption from DGNI gives net national income (NNI) at market prices. Disposable net national income measures the nation's disposable income for final consumption and net savings.

Consequently, net savings, module (**E,D**), comprise the balance of the use of income account and represent part of the disposable income not spent on goods and services for final consumption.

6. The concept of residence is not based on nationality or legal criteria; an institutional unit is said to be resident in a country when it has a center of economic interest in the economic territory of the country concerned, that is, when it carries out business activities in it over a lengthy period.

The figure is obtained by subtracting Final Consumption Expenditure from Disposable Net National Income; that is, module (**D,C**) minus module (**A,D**).

The values of both INN (¢2,786,573 million) and net savings (¢227,601 million) are consistent with the figures published in "Table 2: Gross Domestic Product and Net Disposable National Income."

Finally, module (**F,E**), reflects the changes in (the country's) net worth due to the current balance with the rest of the world and capital transfers. It represents the domestic economy's (positive or negative) disposable resources for accumulating assets from the rest of the world. The result is a balance known as net lending to (if there is a surplus), or net borrowing (if there is a deficit) from, the rest of the world. The result (¢-143,311 million) is the same as net savings, module (**E,D**), minus the gross capital formation, module (**A,E**), plus fixed capital consumption, module (**E,B**). The same result appears in "Table 2: Gross Domestic Product and Disposable Net National Income."

3.2. PROCEDURE FOR CROSS-TABULATING ACCOUNTS IN THE SAM 97

After the authors had constructed the MACRO SAM of Costa Rica for the base year of 1997, they created the expanded version of the SAM by disaggregating each module of the MACRO SAM, maintaining the macroeconomic consistency and cross-tabulating every account. This process is explained below. The end result, the SAM 97 of Costa Rica, is presented in Annex D.

3.2.1. The Agents in the SAM 97 of Costa Rica

Production sectors

In this study's fully disaggregated SAM, goods and activities are divided up into 41 major industries. The Input-Output Matrix for 1997 includes the same sectors as the 1991 matrix estimated by David Roland-Holst in 1993. The authors decided on this due to the lack of sufficient information to break the data down into even more detail. The matrix focuses on the major groups of traditional export sectors that have played a key role in Costa Rica's economic growth. These sectors are integrated vertically between primary production and manufacturing, in line with their institutional organization, e.g., coffee growing and processing; sugarcane growing and refining; livestock and meat and milk production; forestry and fisheries with fish, shellfish, and other sea products. Finally, importance was attached to sectors that, on account of their prices and volume, continue to be key variables in the cost structure of Costa Rica's economy. The other sectors are roughly the same as the single-digit structure of the International Standard Industrial Classification (ISIC) and the disaggregation of large sectors in the publications of national accounts.

Institutional sectors

The following institutional sectors are defined in this SAM:

1. Non-financial Private Sector
   - 1.1. Households
     - 1.1.1. Employees
     - 1.1.2. Independents
   - 1.2. Firms
2. Public Sector
   - 2.1. Gobernment

The non-financial private sector includes all the private agents that are users or producers of non-financial services resident in the country. Thanks to the Household Survey conducted by the National Institute for Statistics and Censuses (INEC), it was possible to extract income by location (urban or rural) and type of employment. The "employees" category includes people who work in the public and private sectors and those who work at home for another member of the household. The "independent" category covers self-employed people, both those who do not employ anyone else permanently, and those who do. The rest of the non-financial private sector comprises people who do not fit into the other categories, i.e., all the private agents that produce non-financial goods and services, whether they are companies or not.

The Public Sector category is limited mainly to public administration services.

3.2.2. Equivalence between the Input-Output Table and the Supply and Use Table

The authors constructed a table of equivalences between the products of the 1997 supply and use table, and the products of the input-output matrix (IOM) for 1991, which was used as the basis for aggregating data.

Supply and use tables are used to record, in the form of matrixes, the way in which domestic industries and imports provide goods and services, and how the latter are distributed between intermediate or final uses, including exports. Creating these tables entails preparing a set of integrated accounts of production and income generation by industries, i.e., by groups of establishments different from the institutional units. They also provide an accounting framework that permits systematic use of the method of the flow of merchandises for preparing national accounts. This method requires that the total supply and use for individual types of goods and services be the same. These tables also provide basic information for preparing detailed input-output tables that are very often used for economic analysis and projections.

Table 2 shows this equivalence for agricultural products. For practical reasons, the table of equivalences for "non-agricultural" sectors is presented in Annex B, as quite a long list of products is involved.

3.2.3. Production Account

The production account draws on the basic information contained in the 1997 Supply and Use Table for the Costa Rican economy, produced by the Central Bank of Costa Rica. In addition to the accounts of flows and balances already described, module (**B,A**), the central framework of the system, contains detailed supply and use tables.

TABLE 2
Equivalence between the products of the Input-Output Table and the products of the Supply and Use Table (SUT)

SAM Sector	SUT Sector	
1 Bananas	01.31.1 Bananas Gross michel bananas	
2 Coffee beans	01.61.1 Coffee beans	
3 Sugar cane	01.82.0 Sugar cane	
4 Cocoa beans, unroasted and roasted	06.61.4 Cocoa beans, unroasted and roasted	
5 Staple grains	01.12.0 Paddy rice	01.22.1 Beans
	01.13.0 Unprocessed	
6 Unprocessed tobacco	01.70.0 Tobacco unprocessed	
7 Livestock	02.11.1 Cattle, live	02.91.0 Milk
	02.12.1 Pigs, live	
8 Forestry and fisheries	03.11.0 Timber	01.92.0 Cultivated active production
	04.12.0 Fish, fresh or frozen	
9 Other agricultural products	02.92.0 Fresh eggs	01.23.1 Cabbage
	02.12.2 Poultry, live	01.23.2 Tomatoes
	01.91.0 Other	01.23.3 Chayote
	01.32.0 Oranges	01.23.4 Plantains
	01.24.3 Carrots	01.52.0 Flowers
	01.24.1 Cassava	01.51.0 Marginata
	01.24.2 Onions and chives	01.49.0 African palm
	01.23.5 Heart of palm	01.34.0 Melons
	01.21.0 Potatoes	01.31.2 Pineapples

Source: Based on data from Central Bank of Costa Rica

3.2.4. Final Utilization of Income Account

The final utilization of income is taken from the same supply and use table and is distributed among the following modules of the MACRO SAM:

- **(A,D)**, which shows the final consumption of the institutional sectors and the Government, valued at user prices as a whole column;
- **(A,E)**, at the point where the goods row intersects with the capital accumulation column, which records the change in supplies plus gross fixed capital formation.

3.2.5. Intermediate Consumption Account

This intermediate consumption account is related to module (A,B) of the MACRO SAM. The ideal way of constructing the account would be to study the economic structure of each production sector. But, as insufficient time and resources were available to conduct a survey that would yield more detailed, reliable information, the authors opted for an updated IOM for 1991 for Costa Rica (Borrajo, 1994). The implicit assumption is that the proportion of resources for intermediate uses in each sector has not changed significantly since 1991. Using the 1991 IOM as the basis, the RAS mathematical algorithm was used as an alternative method of distributing the data contained in the table of intersectoral transactions. Annex A provides a description of this method. The process requires a basic set of "control totals," which are used to construct the table. Table 3 presents the control totals used in the case of Costa Rica.

3.2.6. Value Added Account

To show the complete breakdown of the elements of the input-output matrix in the SAM, value added is presented at basic prices by sector in remunerations, taxes, and subsidies on production and the earned surplus. The basic information is taken from the same Supply and Use Table (COU), for 1997.

In the case of remunerations, the authors decided to apply a greater disaggregation, which is very useful in analyses of income distribution. The basic information for performing the distribution was obtained from the Multipurpose Household Survey conducted in 1997 by the National Institute for Statistics and Censuses (INEC). This survey contains data on the number of people employed and the average income in colones in 194 branches of activity classified according to the second review of the ISIC. The data is separated according to place of residence (rural or urban). For each branch of activity, the data is broken down according to type of employment, as follows:

- Independent workers:
  - self-employed workers

TABLE 3
Control totals for updating the Input-Output matrix (aggregation of sectors of the Supply and Use Table)

Sector MCS	Control Totals	
	Row	Column
(1) Bananas	6,694.2	66,596.0
(2) Coffee beans	82,376.1	12.247.0
(3) Sugar cane	19,222.6	7,597.0
(4) Cocoa beans, unroasted and roasted	1.754.7	17.3
(5) Staple grains	35,417.9	11.276.5
(6) Unprocessed tobacco	23.4	435,8
(7) Livestock	110,189.7	56,703.7
(8) Forestry and fisheries	34,375,1	7,777.4
(9) Other agricultural products	41.655,2	71.844.7
(10) Meat and dairy products	48,467.3	140,506.1
(11) Fish, shellfish and other sea products	20,360.0	32.803.2
(12) Vegetable and animal oils and fats	14,306.9	25,032.1
(13) Green coffee	10,801.7	95,553.4
(14) Milling, excluding coffee processing	37,934.3	52.290.8
(15) Bakery products	2.733,0	14,210.2
(16) Sugar	14,166.9	25,491.3
(17) Other manufactured products	59,015,8	79,909.7
(18) Beverages	148,554.0	31.416.6
(19) Tobacco (cigarettes)	3,890.7	12.589.4
(20) Textiles and garments	46,448.9	137,919.7
(21) Tanning and currying activities	9,186.2	14,205,3
(22) Timber and furniture	20,711.7	14,633.4
(23) Paper and printing	111.482.5	64,136.0
(24) Chemicals	315,571.1	92.414.9
(25) Oil refining (gasoline, diesel, etc,)	118,045,0	24,950.4
(26) Tires	20,992.1	12.925,8
(27) Rubber and plastic products	77,332.5	64,117.3
(28) Glass and ceramic products	12.332.1	10,582.7
(29) Clay products for construction	108,900.5	30,450.9
(30) Base metals	101.379.3	54,236.6
(31) Electrical goods	71.250.1	93,439.8
(32) Transportation equipment	21.360.2	19,825,4
(33) Other manufactures	11.144.1	79,487.1
(34) Construction	6,783.0	114,356.0
(35) Financial services and insurance	260,282.1	71.837.0
(36) Commerce, restaurants and hotels	25,724.1	317,440.7
(37) Transportation, storage and communications	193,235,2	189,299.2
(38) Social, community and personal services	83,566.5	149,077.6
(39) Electricity	56,676.1	26,898.6
(40) Real estate services	50,063.8	35,222.3
(41) Public administration services	0.0	52.651.6
TOTAL	**2,414,406.6**	**2,414,406.6**

Source: IICA, based on data from the Central Bank of Costa Rica

  - workers who have an employer
- Salaried workers:
  - State
  - private enterprise
  - domestic service

This data, grouped into 194 branches of activity, is regrouped according to the aggregation into 41 sectors used in the Social Accounting Matrix. Each branch was manually assigned one of the 41 codes used for the sectors of the matrix, maintaining a sensible consistency between the two classifications.

The total remuneration for each activity and category of employment was calculated by multiplying the average income of each activity by the total number of people employed in it. This calculation was performed maintaining the rural and urban groups.

Based on this data for the entire country, the relative weight of the income of each sector was calculated under the total income received in each category of employment. The results are shown in Table 4.

In Figure 1, the sectoral distribution of income for all employed people in the household survey is compared with the distribution

Figure 1
Structure for Total Income by Sector of the SAM_97
Household Survey vs. National Accounts
1997

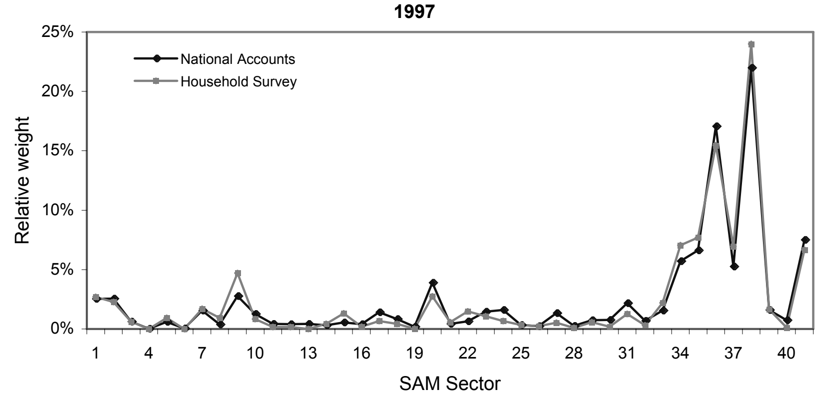

TABLE 4
Structure for Distributing Total Income by Sector of the SAM_97 and by Employment Category

SAM SECTOR	EMPLOYEES	INDEPENDENT WORKERS			WAGE-EARNERS			
	TOTAL	TOTAL	SELF EMPLOYED	EMPLOYER	TOTAL	PUBLIC SECTOR	FIRMS	DOMESTIC HELP
1 Bananas	2.7%	0.1%	0.1%	0.1%	3.6%	0.0%	5.6%	0.0%
2 Coffee	2.3%	4.8%	4.2%	5.7%	1.4%	0.0%	2.2%	0.0%
3 Sugar cane	0.6%	1.1%	1.4%	0.8%	0.4%	0.0%	0.7%	0.0%
4 Cocoa	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
5 Staple Grains	0.9%	2.3%	2.6%	1.7%	0.5%	0.0%	0.7%	0.0%
6 Tobacco	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
7 Livestock	1.7%	3.0%	2.7%	3.5%	1.3%	0.0%	1.9%	0.0%
8 Forestry, fisheries	0.9%	1.0%	1.2%	0.8%	0.9%	0.0%	1.4%	0.0%
9 Other agricultural products	5.0%	7.1%	7.9%	5.7%	4.3%	0.0%	6.6%	0.0%
10 Meat and dairy products	0.8%	0.0%	0.0%	0.0%	1.1%	0.0%	1.8%	0.0%
11 Fish canning	0.2%	0.0%	0.1%	0.0%	0.2%	0.0%	0.3%	0.0%
12 Edible oils	0.2%	0.0%	0.0%	0.0%	0.2%	0.0%	0.3%	0.0%
13 Coffee processing	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
14 Milling of grains	0.4%	0.0%	0.0%	0.0%	0.6%	0.0%	0.9%	0.0%
15 Bakery products	1.3%	2.0%	1.8%	2.2%	1.1%	0.0%	1.7%	0.0%
16 Sugar	0.2%	0.3%	0.0%	0.8%	0.2%	0.0%	0.2%	0.0%
17 Other manufactured products	0.4%	0.1%	0.1%	0.1%	0.5%	0.0%	0.7%	0.0%
18 Beverages	0.4%	0.0%	0.0%	0.1%	0.6%	0.0%	0.9%	0.0%
19 Tobacco products	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20 Textiles and garments	2.7%	2.4%	3.0%	1.3%	2.9%	0.0%	4.5%	0.0%
21 Leather goods and footwear	0.6%	0.5%	0.4%	0.6%	0.6%	0.0%	0.9%	0.0%
22 Timber and furniture	1.5%	1.9%	1.8%	2.0%	1.3%	0.0%	2.1%	0.0%
23 Paper and printing	1.1%	0.4%	0.5%	0.1%	1.3%	0.0%	2.0%	0.0%
24 Chemicals	0.7%	0.0%	0.0%	0.0%	0.9%	0.3%	1.3%	0.0%
25 Oil refineries	0.4%	0.0%	0.0%	0.0%	0.5%	1.3%	0.1%	0.0%

TABLE 4 (Continued)
Structure for Distributing Total Income by Sector of the SAM_97 and by Employment Category

	EMPLOYEES	INDEPENDENT WORKERS			WAGE-EARNERS			
SAM SECTOR	TOTAL	TOTAL	SELF EMPLOYED	EMPLOYER	TOTAL	PUBLIC SECTOR	FIRMS	DOMESTIC HELP
26 Tires	0.2%	0.1%	0.2%	0.0%	0.3%	0.0%	0.4%	0.0%
27 Rubber and plastics	0.5%	0.3%	0.1%	0.7%	0.6%	0.0%	0.9%	0.0%
28 Glass and ceramics	0.1%	0.0%	0.0%	0.1%	0.1%	0.0%	0.2%	0.0%
29 Construction materials	0.6%	0.1%	0.0%	0.4%	0.7%	0.0%	1.1%	0.0%
30 Base metals	0.2%	0.1%	0.1%	0.0%	0.3%	0.0%	0.4%	0.0%
31 Electrical goods	1.3%	0.5%	0.7%	0.4%	1.5%	0.0%	2.4%	0.0%
32 Transportation equipment	0.2%	0.0%	0.0%	0.0%	0.3%	0.0%	0.5%	0.0%
33 Other manufactures	2.3%	3.2%	2.5%	4.4%	1.9%	0.0%	3.0%	0.0%
34 Construction	7.4%	12.3%	12.0%	12.9%	5.7%	2.5%	7.6%	0.0%
35 Financial services and insurance	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
36 Commerce, restaurants and hotels	15.5%	22.8%	21.0%	25.9%	12.9%	0.0%	20.1%	0.0%
37 Transportation	5.9%	10.1%	11.9%	7.1%	4.5%	0.7%	6.6%	0.0%
38 Services	22.9%	22.7%	22.7%	22.7%	23.0%	29.7%	16.8%	100.0%
39 Electricity	1.2%	0.0%	0.0%	0.0%	1.7%	4.4%	0.3%	0.0%
40 Real estate	0.1%	0.1%	0.1%	0.2%	0.1%	0.0%	0.2%	0.0%
41 Public administration services	16.4%	0.5%	0.8%	0.0%	22.0%	61.1%	2.5%	0.0%
99 Non-categorized	0.4%	0.2%	0.3%	0.0%	0.4%	0.1%	0.6%	0.0%
TOTAL	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: IICA, with data from the Central Bank of Costa Rica (BCCR) and the National Institute for Statistics and Censuses (INEC).

recorded in the National Accounts. There are slight differences between the two sources of data, but the weight that is respected is the one obtained from the national accounts. We used the detailed information contained in the household survey to disaggregate the remunerations into urban, rural, employed, independent, self-employed and employer, etc., which is not in the national accounts.

3.2.7 Rest of the World Account

This module is based on the harmonized figures for the balance of payments and foreign transactions account of Costa Rica's national accounts. The publication containing the accounts for 1991-2000 (BCCR, 2001) includes the aggregated version of the foreign transactions account. The data presented in the SAM is based on a more disaggregated version. The trade balance (goods and services) is completely consistent with the disaggregation by goods of the IPM and, in the rest of the current account (income and transfers), consistent with the income and expenditure account of the national accounts. There is no full reconciliation between the study of income and expenditures, and sources and uses of funds, which is reflected in the difference in the net lending figure calculated for the capital accumulation and financial account. This situation is replicated in the foreign account, with the difference in the nation's current account surplus and the balance of the capital account.

The authors also decided to place the Rest of the World in a single column that includes both current and capital transactions. In some SAM studies, they are divided into both types of transactions, duplicating the Rest of the World column and presenting them separately in the respective modules. In our case, Rest of the World could only appear as part of the current account, and, due to lack of information, the accumulation modules could not be disaggregated.

Certain adjustments had to be made to the figures published in the national accounts for both exports and imports of goods, to ensure that the previously defined SAM product classification was consistent with the foreign transactions. In the case of exports, the BCCR's figures present, in an aggregated way, the statistics for the firms that belong to the Duty Deferral/Export Processing system. The statistics available from the BCCR for imports highlighted only some products, while most imports are final consumption goods, intermediate consumption goods and capital goods.

To distribute the data on the Duty-free Zone, the Foreign Trade Development Office was asked to disaggregate the exports of the firms that benefited from the system during 1997. The authors were given a file containing a breakdown of exports under the headings of the Central American Tariff System (SAC), in dollars. As the objective was to obtain a relative structure, the data was used directly in that currency. As already explained, IICA manually assigned each SAC export item in the data file one of the 41 codes corresponding to the sectors of the matrix, so as to maintain a logical and functional consistency between the two classifications. For this new distribution, the percentage weight of exports was calculated for each of the 41 export sectors. The result can be seen in Table 5.

The primary information on imports was obtained from the Customs Bureau. (The format for the data files for 1998 and 1999 is identical). Each file consisted of a list of imports in dollars for the year, grouped under the SAC headings (97 version).

In addition to the SAC classification, each import item was placed under one of the 165 product headings used in the Central Bank of Costa Rica's Supply and Use Table (SUT). The authors then constructed a conversion table and the SUT product headings were reassigned to the 41 sectors listed in the SAM. A computer program was used to assign the corresponding sector in the matrix to each import item.

Secondly, each import (previously coded according to its intended use) was placed into one of three major categories, using FOB imports to achieve a better comparison with the export data. Thus, instead of being listed under one of 25 intended uses, import goods were placed under the heading for capital goods (KG), intermediate consumption goods (IC), or final consumption goods (FC), as shown in Table 6.

TABLE 5
Percentage structure by sector for exports from Costa Rica's duty-free zone (through December 1997)

SAM SECTOR	PERCENTAGE OR EXPORTS
1 Bananas	0.00%
2 Coffee	0.00%
3 Sugar cane	0.00%
4 Cocoa	0.00%
5 Staple grains	0.00%
6 Tobacco	0.10%
7 Livestock	0.00%
8 Forestry, fisheries	0.00%
9 Other agricultural products	2.94%
10 Meat and dairy products	0.00%
11 Fish canning	0.00%
12 Edible oils	0.00%
13 Coffee processing	0.00%
14 Milling of grains	0.00%
15 Bakery products	0.00%
16 Sugar	0.00%
17 Other manufactured products	0.00%
18 Beverages	0.00%
19 Tobacco products	0.00%
20 Textiles and garments	37.93%
21 Leather goods and footwear	2.39%
22 Timber and furniture	0.45%
23 Paper and printing	0.17%
24 Chemicals	2.71%
25 Oil refineries	0.04%
26 Tires	0.00%
27 Rubber and plastics	0.82%
28 Glass and ceramics	0.90%
29 Construction materials	0.00%
30 Base metals	1.49%
31 Electrical Goods	21.65%
32 Transportation equipment	1.67%
33 Other manufactures	26.73%
34 Construction	0.00%
35 Banking, finance and insurance	0.00%
36 Commerce, restaurants and hotels	0.00%
37 Transportation	0.00%
38 Services	0.00%
39 Electricity	0.00%
40 Real estate	0.00%
41 Public administration services	0.00%
TOTAL	**100.00%**

Source: IICA, with data from the BCCR and the Foreign Trade Development Office (PROCOMER).

TABLE 6
Percentage Structure by Sector and Type of Good for Costa Rica's Total Imports 1997

	Imports FOB			Imports at purchaser's prices		
SAM SECTOR	1 Capital Goods	2 Intermed. Consump. Goods	3 Final Consump. Goods	1 Capital Goods	2 Intermed. Consump. Goods	3 Final Consump. Goods
1 Bananas	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
9 Other agricultural products	0.4%	3.9%	12.9%	0.3%	4.2%	10.4%
10 Meat and dairy products		1.3%	0.2%		1.5%	0.2%
12 Edible oils		0.1%	0.5%		0.1%	0.6%
14 Milling of grains		1.2%	0.3%		1.4%	0.3%
15 Bakery products		0.4%			0.6%	
16 Sugar		0.0%	0.1%		0.0%	0.1%
17 Other manufactured products		4.5%	1.1%		5.6%	2.1%
18 Beverages		1.1%	0.8%		1.3%	0.7%
19 Tobacco products		0.0%	0.0%		0.0%	0.0%
20 Textiles and garments	0.3%	4.5%	4.6%	0.3%	5.1%	3.8%
21 Leather goods and footwear	0.0%	2.4%	0.2%	0.0%	2.5%	0.2%
22 Timber and furniture	0.1%	0.7%	0.7%	0.1%	0.9%	0.9%
23 Paper & Printing	0.1%	3.4%	13.5%	0.1%	4.0%	14.2%
24 Chemicals		16.4%	25.6%		19.3%	25.9%
25 Oil Refineries		15.6%	1.6%		18.5%	3.4%
26 Tires	1.2%	0.9%	0.2%	1.5%	1.0%	0.2%
27 Rubber and plastics	0.5%	2.0%	5.9%	0.6%	2.2%	5.8%
28 Glass and ceramics	0.1%	0.9%	1.5%	0.1%	1.0%	1.2%
29 Construction materials	0.2%	0.2%	2.7%	0.2%	0.6%	2.7%
30 Base metals	4.3%	1.2%	18.5%	4.4%	1.4%	17.6%
31 Electrical Goods	32.7%	7.9%	4.6%	26.3%	7.8%	5.9%
32 Transportation equipment	17.5%	0.1%	0.0%	19.3%	0.2%	0.0%
33 Other manufactures	22.3%	5.7%	4.1%	26.0%	5.9%	3.4%
37 Transportation	20.3%	25.6%	0.4%	20.7%	15.1%	0.4%
TOTAL	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: IICA, with data from the General Customs Office and the BCCR

Having un-coded the imports in this way, the figures were added for the 41 sectors of the Matrix. For each sector, the total amount was obtained for each type of good (KG, IC, FC). Finally, IICA calculated the relative weight of each sector's imports as a proportion of all imports of each type of good, as shown in Table 6. Meanwhile, the structure of the uses to which these imports were put is shown on the right of the table (which are added up in the respective columns). In this case, the value of the imports must be based on the purchasers' prices, which means that, in addition to the value of imports FOB, taxes, markup and transportation must be included goods.

3.3. DISAGGREGATION IN THE SAM 97

In this section the authors explain the method used to disaggregate activities in the SAM 97 for Costa Rica. The example used is the staple grains account, which is divided into two new accounts: Rice and Other Staple Grains. To do this, the authors ascertained what technology package was used for rice production, and the original account was disaggregated by a process of subtraction.

3.3.1 Estimate of Rice Production

The data on production and the acreage planted to rice are estimated by the Department of National Accounts of the Central Bank of Costa Rica, which in turn draws on the statistics generated by entities such as the National Production Board (CNP) and the Rice Office.

The Rice Office does not calculate production as such, but rather records the grain purchased by national industry. Given the low level of personal consumption in this activity, it is fair to say that these figures are the same as production.

The harvest year for the production of rice extends from July through June of the following year. There are two harvests during this period.

If we call the first calendar year in the harvest year T, and the second T+1, then the first harvest is gathered in the second half of year T, and the second in the first half of year T+1. The sowing season for the first harvest extends throughout year T, while the sowing season for the second harvest covers the second half of year T and the first half of year T+1.

The production for each harvest in the harvest year was calculated by assuming that the yield in the two harvests would be the same as the yield for the harvest year. Thus, the figure for production is obtained by multiplying the yield by the estimated area in each case.

TABLE 7
Rice: Acreage, Production, and Yields Obtained by Harvest

PERIOD	FIRST HARVEST		SECOND HARVEST		BOTH HARVESTS		
	AREA ha.	PRODUCTION (mt)	AREA ha.	PRODUCTION (mt)	AREA ha.	YIELD (mt/ha.)	PRODUCTION (mt)
1989-90	55,926.8	193,260.0	7,470.8	25,816.0	63,397.6	3.5	219,076.0
1990-91	45,107.0	169,975.0	6,822.8	25,710.0	51,929.8	3.8	195,685.0
1991-92	42,291,7	166,151.0	5,874.7	23,080.0	48,166.5	3.9	189,231.0
1992-93	44,064.3	159,186.0	8,416.7	30,406.0	52,481.0	3.6	189,592.0
1993-94	33,479.8	125,090.0	9,381.8	35,053.0	42,861.5	3.7	160,143.0
1994-95	37,809.2	149,847.0	6,303.2	24,981.0	44,112.4	4.0	174,828.0
1995-96	32,436.0	139,885.0	8,531.0	36,791.0	40,967.0	4.3	176,676.0
1996-97	47,124.6	176,082.0	11,270.1	42,111.0	58,394.7	3.7	218,193.0
1997-98	49,737.4	181,564.0	9,595.8	35,029.0	59,333.2	3.7	216,593.0
1998-99	40,939.8	178,539.0	13,393.2	58,408.0	54,333.0	4.4	236,947.0

Source: Rice Office of Costa Rica

Table 7 presents the figures for acreage, yield and production that were used to prepare this structure.

3.3.2. Disaggregation by Subtraction

Each item included in a row and/or column for rice is subtracted from the corresponding row and/or column for staple grains included in the original matrix. The basic objective is to respect the aggregates that were initially estimated and ensure that the new matrix is consistent. The production of staple grains in the SAM97 was disaggregated in two new products: Rice and Other Staple grains.

Tables 8 and 9 present the production account and the balance of supply and use for rice production, respectively. Both tables draw on the basic information published by the Central Bank.

Described below is the procedure followed to disaggregate the data for intermediate consumption and value added, as more detail is needed if they are to be included in the matrix. Some other values are included in the matrix without modifications, just as they appear in Tables 8 and 9.

TABLE 8
Rice: Production Account, 1997
(millions of colones)

	ITEM	
I.	GROSS OUTPUT	16,252.07
I.1	Sale of goods and services	16,252.07
II.	INTERMEDIATE INPUTS	9,212.86
III.	VALUE ADDED	7,039.22
III.1	Wages and Salaries	5,575.21
III.2	Social security contributions	560.64
III.3	Workers' compensation	166.64
III.4	Other workers' income	0.00
III.5	Depreciation	133.72
III.6	Payroll tax	263.74
III.7	Others taxes	46.71
III.8	Less subsidies	0.00
III.9	Earned surplus	292.55

Source: Central Bank of Costa Rica

TABLE 9
Rice: Supply and Use Balance, 1997
(millions of colones)

CONCEPTOS	
PRODUCTION (g.p.) (1)	16,252.10
OTHER TAXES ON PRODUCTS (2)	33.00
PRODUCTION SUBSIDIES (3)	-
PRODUCTION (p.p.) (1+2-3)	16,285.10
IMPORTS (cif)	5,935.10
TOTAL SUPPLY (p.c.)	**22,220.10**
INTERMEDIATE CONSUMPTION (p.c.)	21,365.50
FINAL CONSUMPTION (p.c.)	466.50
GROSS CAPITAL FORMATION (p.c.)	388.20
Gross Fixed Capital Formation (p.c.)	-
Changes in Stock	388.27
TOTAL USE (p.c.)	**22,220.10**

Source: Central Bank of Costa Rica.
p.c.= consumers pricep.
g.p.= producers price
CIF= cost, insurance and freight price

For example, the gross value of production (¢16,252 million) should be included in the production model at purchasers' prices, at the point where the product "Rice" (row) and the activity "rice production" (column) intersect. The same occurs with the ¢33 million in taxes on the products, which should be included in the module "the net taxes on Products of Subsidies," at the point where the row "Taxes on Products" and the "rice" column intersect. The imports in Table 8 are introduced at the point where the row "Rest of the world" and the "rice" (column) intersect.

The details shown in Table 8 present the information necessary to disaggregate the "rice" row in the "Goods and Services" module. The datum that appears for gross capital formation (¢386.2 million) indicates that in 1997 stocks of the product accumulated. A small proportion of the total supply (¢466.5 million) was used for final consumption - probably small, direct sales that farmers make in addition to self-supply or personal consumption. The lion's share of the supply is used for intermediate consumption by other industries, especially the plants that mill and clean the grain.

3.3.3. Disaggregation of value added and intermediate consumption

This cost structure for 1997 is based on the "Model of agricultural costs for rice," published in Official Gazette Nº 173 of 9 September 1993, as a part of decree 22462-MEIC-MAG. The items included were classified under either intermediate consumption and value added, and these, in turn, under fixed and variable.

Harvesting tasks are regarded as "variable" costs, since they depend directly on the amount of rice produced; while planting tasks do not depend on production but rather on acreage and, as such, are regarded as "fixed" costs.

As a result, the variable costs of the first harvest in harvest year T, T+1, are calculated using the prices in the second semester of year T. The variable costs of the second harvest in year T, T+1 are calculated based on the going prices during the first semester of year T+1.

To calculate fixed costs, the authors first had to estimate the percentage of the acreage planted during each semester in which the costs were incurred. This was done to determine the proportion attributable to each period.

Annex C1 contains a disaggregation of the prices of production inputs by semester for 1997, which the Central Bank uses to estimate rice production, based on the acreage planted in each period.

In addition, Annex C2 presents the rice production account, detailing the components used to disaggregate intermediate consumption that will be included in the new column of the matrix for rice production. This Annex also shows the product in the social accounting matrix to which each input is linked.

As explained at the beginning of this chapter, rice was derived from staple grains in the SAM97. Intermediate consumption was disaggregated in the matrix by subtracting from column 5 "Staple Grains" the levels estimated in the previous Annex, as specified in Annex C3.

The data from the 1997 household survey was used to disaggregate the remunerations, specifically the structure for income distribution in Annexes C1 and C2. The survey data does not provide specific details for rice production. The authors therefore opted to use the survey data for staple grains, where rice production is the most important product. According to the national account figures published by the Central Bank, rice production accounts for 82% of staple grains and 80% of Value Added. The other components that must be considered in the income generation account are taken directly from the production account published by the Central Bank. As in the case of intermediate consumption, rice production is obtained by subtracting the estimated values from the staple grains account included in the original matrix, ensuring it is consistent. The resulting distribution is presented in Table 10.

TABLE 10
Structure Used to Distribute the Value Added of Rice by Occupational Status (Excludes unpaid people or income unknown) July 1997

Income Generation (Value Added)	Estructure used to distribute remunerations		Value added or rice production	Staple grains (97 SAM)	Other Staple Grains
Remuneration Wage Earners (Labor Factor)			6,302.5	8,138.2	1,835.7
URBAN LABOR					
Independent					
Self-employed	22.9	3%	214.5	272.1	57.6
Employer	38.8	6%	364.0	475.5	111.5
Wage Earner					
Public Sector	0.0	0%	0.0	0.0	0.0
Firms	25.0	4%	233.9	261.6	27.7
Domestic help	0.0	0%	0.0	0.0	0.0
RURAL LABOR					
Independent					
Self-employed	286.1	43%	2,680.9	3,769.9	1,089.0
Employer	80.8	12%	756.9	975.2	218.3
Wage Earner					
Public Sector	0.0	0%	0.0	0.0	0.0
Firms	219.0	33%	2,052.3	2,384.0	331.6
Domestic help	0.0	0%	0.0	0.0	0.0
Other Taxes on Production			310.5	347.8	37.4
Production Subsidies (-)			0.0	0.0	0.0
Gross Earned Surplus (Capital Factor)			426.3	-5.1	-431.4

Source: IICA, with data from the BCCR and the INEC.

IV. INTERPRETATION OF THE 97 SAM OF COSTA RICA[7]

This section shows how a social accounting matrix is used to ascertain the most important characteristics of an economy - in this case, the Costa Rican economy. Social accounting matrixes gives us information about the production structure, the composition of value added, income distribution, consumption and savings habits, and the domestic economy's relationships with overseas markets.

Thus, the most important characteristics of the Costa Rican economy can be inferred from the 97 SAM of Costa Rica. In the following presentation, we use the notation ij, (in which i is the row and j, the column). A brief description of the domestic economy is presented below, highlighting its chief macroeconomic characteristics and focusing on the agricultural sector.

Production Structure

With respect to the economy's production structure, it is evident from the SAM that primary agriculture[8] accounts for 11% of gross output.[9] This figure is obtained by means of the following formula:

7. The analysis in this section is very similar to the work of Janvry, Alain and Sadoulet, Elisabeth (1995), in "Quantitative Development Policy Analysis." The John Hopkins University Press. USA.
8. The first nine lines of the Goods and Services or Activities of the 97 SAM refer to the primary sector (includes agriculture, forestry and fisheries).
9. Sometimes the term "gross output" is confused with the term "gross domestic production" (GDP). The difference is that, to estimate GDP, the value of the inputs used in the production process is subtracted from gross output.

$$A = \frac{\sum_{i=42}^{50} t_i}{t_a}$$

where A is the primary sector's share of gross national output
ti is the production of activity i
ta is gross national output

The gross output of the agricultural sector (582,394 million colones) is the sum of the gross output of each of the nine activities that make up the primary sector. The totals for these activities are located in row t of the 97 SAM, between columns 42 and 50. Gross national output (5,133,562 million colones) is to be found at the point where row t and column a intersect in the SAM. The agricultural sector's share is obtained by dividing gross agricultural output by the total.

The primary sector accounts for 13% of GDP. The primary sector's share of GDP is calculated as follows:

$$B= \frac{\sum_{i=42}^{50} t_i - c_i}{t_a - c_a}$$

where B is the primary sector's share of Gross Domestic Product
(ti- cI) is the Value Added of each activity i.
(ta - ca) is Gross Domestic Product (GDP).

The figure for GDP is arrived at by subtracting the value of intermediate consumption in the economy (ca) from total gross output (ta). Agricultural GDP is calculated in the same way, by performing the same operation for the nine activities of the primary sector. Agriculture's 13% share of GDP reflects its declining importance, based on data in the national accounts.

Meanwhile, the Agriculture and agrifood sector,[10] i.e., the agricultural sector plus certain agroindustrial activities closely connected to agriculture, accounts for 32% and 25% of gross

10. The first nine lines, plus the 15 following lines, of the Goods and Services or Activities of the 97 SAM refer to the primary sector plus food and manufacturing derived from this sector.

production and GDP, respectively. The trade and transport sectors are prominent in the production structure. Together, they account for 25% of gross output and 28% of GDP, and are therefore very important to the country.

Generation of Value Added

In economics, the term "value added" basically refers to the remunerations (to capital, to work, and others) generated in the production process of a given activity. The 97 SAM can be used to obtain the percentage of value added of the production of a given activity i, simply by dividing the value added of the activity in question by its respective production, using the formula *(ti-ci)/ti* for each activity *i*.

Thus, the 97 SAM reveals that 60% and 74% of the production of the agricultural and financial services[11] sectors, is generated as value added. Only 32% of the remuneration generated by textile production is value added, however. This highlights the importance of the financial and agricultural sectors to Costa Rica's economy.

Income Generation and Distribution

Using the SAM, we can pinpoint where and how the remuneration to the factors of production is distributed.

Thus, in Costa Rica workers' remuneration accounts for 43% of the value added of the agricultural sector. Workers' remuneration in the rural sector also accounts for 38.5% of the value added of agricultural production. This confirms the sector's continuing importance for our rural communities. These percentages are obtained as follows:

$$\frac{\sum_{i=42}^{50} r_i}{\sum_{i=42}^{50} t_i - c_i}$$

11. Financial intermediation services and insurance (column 76 of the SAM).

Where r_i is the remuneration to the salaried workers of activity i, and (t_i-c_i) is the value added of activity i.

With regard to the households' use of income (column 106 of the SAM), families use 100.5% of income for consumption (2,168,886 million colones, C_{106} in the 97 SAM), resulting in a gross dissaving of 0.5% (10,788 million colones, row 109, column 106) of all income received during 1997. In other words, Costa Rican families use practically all their income for final consumption and have had to draw on part of their savings to cover their consumption.

Macroeconomic characteristics of the economy: investment and the trade balance

At nearly 4% of GDP, the trade deficit[12] is significant. Meanwhile, the economy's investment rate, which is shown in the capital account c_{109} (row c, column 109 of the SAM), is 11% of GDP.

Main Characteristics of Foreign Trade

As for the structure of trade, the main imports (row 110, columns 1-41) are chemical products, transportation equipment, and oil and oil byproducts (which account for 18%, 13%, and 8% of total imports, respectively). Agricultural products make up nearly 2% of all imports.

It can also be seen that agricultural imports account for only 5% of gross national output, while the percentage for Agriculture and agrifood is 16%.

Exports appear in column 110, rows 1-41. Textiles and agricultural exports account for 11% and 21% of the total, respectively. The figure for bananas is 11%.

12. Balance of Trade = Exports – Imports. Exports (column 110, rows 1 through 41) and imports (row 110, columns 1 through 41) are shown clearly in the 97 SAM for CR.

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ANNEXES

Annex A. Methodology for Updating the Input-Output Matrix[13]

a) The Alternatives Available

Basically, two methods have been developed for updating inter-industry tables of technical coefficients. One involves the use of maximum entropy techniques,[14] while the other entails making changes to the matrix's columns and rows.

The first method involves the use of a linear programming algorithm, to replace vectors of a basic, initial solution so that each new solution (or matrix of coefficients) tallies with the control totals for the year that is to be represented in the table. Some of the advantages of this procedure are as follows:

1) It takes account of the interdependence between rows and columns when the coefficients[15] are adjusted.
2) It makes it possible to add additional restrictions to the row and column totals of the new matrix.
3) Additional restrictions can be specified for the matrix, as it updates in the form of inequalities rather than equalities.
4) It can assume that the matrix of the base year is not balanced.

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13. Most of this methodology was taken from the document Leiva, Carlos, and Soto, Max (1980). "Antecedentes y Metodología en la Actualización de una Tabla de Insumo-Producto para Costa Rica." IICE UCR, San Jose, Costa Rica. Working document.
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5) More recent additional information can be incorporated, both in the form of exact values and a range of values for a coefficient.[16] The method is therefore highly recommended when there is evidence that a structural change took place in the economy between the base year and the year that is to be updated.

The second updating procedure is based on an iterative process of adjustments, not an optimization algorithm, performed separately on the rows and columns of the matrix of coefficients. To make these adjustments, the row and column totals indicated in the information for the year that the matrix is going to be used to project must be respected. Several alternatives have been developed for this approach; the chief ones are described briefly below.

The most general algorithm is obtained by establishing a set of weights or weighing factors for each coefficient of the base table. The new coefficients are then calculated by adjusting the rows and columns in successive stages, until a new set of coefficients is obtained which differ only minimally from the coefficients of the base year in percentage terms, and meet the condition that the sum of the flows by rows and by columns is the same as the totals taken from the information for the year for which the new coefficients are to be calculated. The purpose of the system of weights is to direct the magnitude of the changes toward the coefficients that are thought to be less stable, based on additional information.

The other algorithms are special cases of the one described above, and differ depending on the weighting system that is adopted. One system entails forcing all the weighting factors to the unit (making them all equal to one). The problem in this case is that, because it does not discriminate according to the relative stability of each coefficient, it can produce negative coefficients that have no possible economic interpretation. This method is also biased toward the bigger coefficients, with the result that most of the changes between the base year and the estimated year are

16. Ibid.

concentrated in those coefficients. As has already been pointed out, it can be argued that this does not reflect the true situation.

Another method is to assign different weighing factors for the adjustments by rows, and for those by columns. The weights, or factors of adjustment, used for the rows are the flows, while the technical coefficients[17] are used for the columns. This is what has become known as the RAS method. It is the one that will be used for the updating work to be done under this research project, and therefore is explained in greater detail below.

b) The RAS method[18]

The basic premise of the RAS method, and of the other updating methods, is that there is a functional relationship between the coefficients in the base year and the coefficients in the projected year. What distinguishes one method from another is the type of relationship. Some of the factors that affect or determine this relationship are technological change, the relative prices of factors and products, the form of the function of production of each sector, and the homogeneity of the sectors defined.

The purpose of the methods described above is to develop updating procedures that emphasize the effect of one or more of the determining factors, or that orient the adjustments in the coefficients in a way that is similar to what experience suggests is more likely. It should be borne in mind, then, in theoretically terms, these methods are very rudimentary, even though the solution procedures are sometimes sophisticated.

As developed by R. Stone, the method argues that the coefficients are modified in relation to two factors: the so-called “backwash” (or row) effect that reflects the substitution that has occurred between intermediate inputs; and the “manufacturing” (or column)

17. For a demonstration of these properties, see the article by Guill, G. D., “The Ras Method of Coefficient Adjustment and Soviet Input-Output Data,” Soviet Model, Working Paper No. 34, Revised version, September 1975.

18. This method was formulated by W. Leontief, and developed by R. Stone and the Cambridge Development Project. See Stone, R., and Brown, A., “Behavioral and Technical Change in Economic Models”, in Robinson, E., ed., Problems in Economic Development, MacMillan, New York, 1965.

effect that makes adjustments based on the changes that occurred in the proportion of intermediate inputs within the gross value of the production in each sector. This relationship may be understood more easily in algebraic terms, as follows:

$$a_{ij}^{1} = r_i \, a_{ij}^{0} \, s_j \, (i, j = 1,2,3,...,n) \qquad (1)$$

where a_{ij}^{0} is the technical coefficient for sector ij in the base year; a_{ij}^{1} is the coefficient of the same sector in the later year; and r_i and s_j are constants to be determined in the adjustment procedure. Note that it is argued that the coefficient of the later year is related to that of the base year, and that the relationship is determined entirely by premultiplying and postmultiplying the original coefficient by the scalars r_i and s_j, respectively, which represent the row effect and the column effect. There would be a substitution in favor of, or against, good *i* if r_i were less or greater than 1.

Furthermore, the proportion of value added to value of intermediate inputs increases or decreases for sector j depending on whether s_j is greater or less than 1. If both r_i and s_j are equal to 1, this implies clearly that neither the row effect nor the column effect occur, which, in turn, means that the coefficient of the base year does not change at all.

To explain the procedure followed by the RAS, it is best to express the above relationship in matrix terms, as follows:

$$A_{(nxn)}^{t+1} = R_{(nxn)} A_{(nxn)}^{t} S_{(nxn)} \qquad (2)$$

where A^t is the matrix of technical coefficients for year t, or the base year; A^{t+1} is the matrix of coefficients in year t+1, comprised of the transformed coefficients, and R and S are diagonal matrixes that reflect the backwash and manufacturing effects, respectively. The reader will see that the right side of the equation forms the word “RAS,” hence the name of the method.

Two elements of the Input-Output Tables are essential for the RAS method. The first is that the output that each sector uses to obtain inputs for itself and for the other sectors is equal to the multiplication of the coefficients of the respective row by the gross production vector. In matrix terms, it would be expressed as

$$A^t X^t = Z^t \tag{3}$$

where X^t is the order vector for gross production (nx1) and Z^t is the vector for intermediate production (which is not used to meet final demand), also an order vector (nx1).

The second characteristic is that the sum of the coefficients throughout each column of the matrix is equal to the proportion of intermediate inputs within the gross production of each sector. Note that, while the first condition works for the sales of each sector, the second does so for the purchases. In matrix terms, this condition is expressed as follows:

$$\sum_{i=1}^{n} a_{ij}^t = W_j^t \tag{4}$$

Equations (3) and (4) are what are known as the limitations on the rows and the columns, which must be respected in making adjustments to the coefficients.

Given the above conditions, the logic of the procedure is relatively simple. The first step involves obtaining an initial estimate of coefficients for year t, working exclusively in the rows of matrix A^t and accepting the limitation imposed by equation (3). This is achieved by multiplying the base matrix by the gross product vector for year t, obtained from information contained in the National Accounts. If no price adjustment is made, the implicit assumption in this first step is that no changes occurred between the two years in question in either the technical coefficients or prices. Normally, the result of this estimation, represented by

$$A^t X^{t+1} = \hat{Z}^{t+1} \tag{5}$$

produces an estimated vector of intermediate production $\hat{Z}^{t+1}$, different from the one observed for year t, which is Z^{t+1}. The method then proceeds to correct the coefficients, applying a single adjustment factor for each row. This factor is equal to the proportion in which the vector observed differs from the one estimated, i.e., $Z^{t+1}/\hat{Z}^{t+1}$.
Adjusting the rows in this way makes the coefficients meet condition (3), but not necessarily condition (4).

An analogous adjustment is then made to the columns, multiplying each one by the factor $w^{t+1}/\hat{w}^{t+1}$. But observe that $\hat{w}_j^{t+1}$ is the sum of the coefficients of column j after the initial adjustment made to the rows, so that it differs from w_j^t. Hence matrix S postmultiplies matrix A in equation (2). For the rest, as the new adjustment by columns meets condition (4), but in making it condition (3) is again broken, the procedure is repeated iteratively as many times as necessary so that conditions (3) and (4) are met approximately.

Thus, the adjustment to each row and each column during each interaction is unique, which implies a proportional adjustment to all the coefficients throughout the rows and the columns. This is known as the assumption of biproportionality, implicit in the RAS method. The fact that this assumption is not adhered to strictly is what distinguishes this from other matrix adjustment procedures for updating technical coefficients.

The chief advantages of the RAS method are that it always produces non-negative coefficients, the coefficients that have a value of zero in the base matrix remain unchanged, and it produces a single solution.[19]

c) The method proposed for updating the I-O Table in Costa Rica

The authors decided to use the RAS method because the base table is for 1991 and there is little evidence to suggest that structural changes occurred in the Costa Rican economy that would cast doubt on the veracity of the coefficients produced by the simple

19. To test these properties, see Bacharach, M., "Biproportional Matrices and Input-Output Change," Cambridge University Press, 1970.

application of the RAS method. Consequently, it is proposed that the new matrix be used with other indicators that would make the results obtained more reliable, especially if they are used to evaluate policies and/or simulate strategies with a reasonable degree of confidence.

One methodological issue yet to be considered is that of the prices used. Basically, there are two approaches. One argues that technical coefficients are invariable technological relationships that are not affected by prices,[20] while the other asserts that they are determined by functions of production, functions of demand and the elasticity of supply of the production factors in a context of imperfect competition, which means that these coefficients will respond to changes in relative prices.[21] In this case, estimating the flows in current prices would ensure the stability of the coefficients, provided that the elasticities of the supply of the production factors do not vary significantly.

It is interesting that some of the empirical results tend to confirm the current prices argument in the long run.[22] The RAS updating will therefore be made at current prices. The alternative would be to use the constant prices method, but this presents additional problems. The initial coefficients must be adjusted, due to the price variations that occurred in each sector from 1991 to 1997, the year for which the table is to be updated. A method could be used to do this similar to the one used by Thomas Bulmer in 1972, adjusting the coefficients of the base year by premultiplying the matrix of coefficients of the base year by a diagonal matrix containing the price index (based on 1991) of each good produced or imported, and postmultiplying the result by a diagonal matrix containing the price indexes of the output of the different domestic sectors.[23]

20. Leontief, W. “The Structure of the American Economy,” op. cit.
21. Sarma, K. S., “Comparison of Alternative Methods of Improving Input-Output Forecasts: A Simulation Study,” Sixth International Conference on Input-Output Techniques, Vienna, April 1974.
22. Klein, L. R., “In the Interpretation of Professor Leontief’s System,” The Review of Economic Studies, Vol. 20, 1952-53.
23. Bulmer, Thomas, “An Input-Output Model for Costa Rica,” op. cit.

The RAS method is very simple, although a great deal of work is involved. The following is a very simple example:

INPUT 1 FOR THE RAS					
BASE INPUT-OUTPUT MATRIX (OR MATRIX TO BE UPDATED)					
IN 1991 BILLIONS					
ACCOUNTS	**SECTOR 1**	**SECTOR 2**	**SECTOR 3**	**SECTOR 4**	**SUBTOTAL**
SECTOR 1	6.0	68.2	0.1	0.1	74.3
SECTOR 2	23.1	106.8	32.0	36.9	198.8
SECTOR 3	22.4	76.4	61.4	48.5	208.7
SECTOR 4	2.3	18.8	32.7	32.6	86.4
TOTAL	53.8	270.1	126.2	118.1	568.2

INPUT 2 FOR THE RAS					
CONTROL TOTALS OF THE NEW INPUT-OUTPUT MATRIX					
IN 1997 BILLIONS					
ACCOUNTS	**SECTOR 1**	**SECTOR 2**	**SECTOR 3**	**SECTOR 4**	**SUBTOTAL**
SECTOR 1	0.0	0.0	0.0	0.0	331.7
SECTOR 2	0.0	0.0	0.0	0.0	1.406.4
SECTOR 3	0.0	0.0	0.0	0.0	292.8
SECTOR 4	0.0	0.0	0.0	0.0	383.5
TOTAL	234.5	1.223.1	503.6	453.1	2.414.4

AFTER APPLYING THE RAS…					
RESULT OR OUTPUT OF THE RAS:					
UPDATED INPUT-OUTPUT MATRIX					
IN 1997 BILLIONS					
ACCOUNTS	**SECTOR 1**	**SECTOR 2**	**SECTOR 3**	**SECTOR 4**	**SUBTOTAL**
SECTOR 1	26.5	304.8	0.1	0.3	331.7
SECTOR 2	176.2	762.5	188.8	278.9	1.406.4
SECTOR 3	17.5	52.7	166.1	56.5	292.8
SECTOR 4	14.3	103.1	148.6	117.5	383.5
TOTAL	234.5	1.223.1	503.6	453.1	2.414.4

ANNEX B
Classification of Input-Output products and their equivalents in the Supply and Use Table (SUT)

Input-Output Sectors		SUT Sectors
10 Meat and dairy products	21.11.0	Meats (includes beef, pork, poultry)
	22.00.0	Dairy products
11 Fish and other sea products	21.20.0	Fish, shellfish and other sea products
12 Animal and vegetable oils and fats	21.60.0	Vegetable and animal oils and fats
13 Green coffee	23.12.0	Green coffee
14 Milling industry, excluding coffee	23.11.0	Milling industry, excluding coffee processing
15 Bakery products	23.40.0	Bakery products
16 Sugar	23.51.0	Sugar
17 Other manufactured products	16.20.0	Salt
	21.30.0	Bottling and canning of fruits and vegetables
.	23.60.0	Cocoa, chocolate and sugar confectionery
	23.99.1	Assorted food products
	23.99.2	Animal feed
18 Beverages	24.10.0	Spirit beverages
	24.30.0	Malted beverages and malt (beer)
	24.40.0	Soft drinks
19 Tobacco (cigarettes)	25.00.0	Tobacco (cigarettes)
20 Textiles and garments	26.00.0	Spun goods, fabrics and finished extile goods
	27.10.0	Items made using textiles
	27.20.0	Draperies and carpets
	27.30.0	Rope industry
	27.90.0	Textiles n.e.c.*
	28.10.0	Knitwear
	28.20.0	Garments
21 Tanning and currying industry	29.10.0	Tanning and currying industry
	29.20.0	Leather and substitute leather products
	29.30.0	Footwear, excluding rubber or plastic

ANNEX B
Classification of Input-Output products and their equivalents in the Supply and Use Table (SUT) (continued)

Input-Output Sectors		SUT Sectors
22 Timber and furniture	31.10.0	Sawed and dressed lumber
	31.90.1	Wood and cork products n.e.c.
	31.90.2	Furniture and accessories, excluding those mainly made of metal
23 Paper and printing	32.15.0	Paper and cardboard containers and boxes
	32.19.0	Pulp, paper and cardboard items
	32.20.0	Newspapers, magazines, leaflets, etc.
24 Chemicals	33.10.0	Assorted oil- and coal-based products
	34.10.0	Basic industrial chemical substances
	34.60.0	Fertilizer and pesticides
	34.70.0	Synthetic resins, plastic materials, etc.
	35.10.0	Paint, varnish and lacquer
	35.20.0	Pharmaceutical products and medicines
	35.30.0	Soaps and cleaning agents, perfumes and toilet preparations
	35.40.0	Chemical products n.e.c.
25 Oil industry (gasoline, diesel, etc.)	33.30.0	Oil industry (gasoline, diesel, etc.)
26 Tires	36.11.0	Tires
27 Rubber and plastic products	36.20.0	Rubber products n.e.c.
	36.30.0	Plastic products n.e.c.
28 Glass and ceramic products	37.10.0	Glass and glass products
	37.20.0	Earthenware, china and porcelain objects
29 Products for construction	14.20.0	Non-ferrous minerals
	15.00.0	Rocks, sand and clay
	16.39.0	Minerals n.e.c.
	37.30.0	Clay products for construction
	37.40.0	Cement, lime and gypsum
30 Base metals	37.90.0	Non-metallic minerals n.e.c.
	38.10.0	Furniture and accessories, mainly metal

ANNEX B
Classification of Input-Output products and their equivalents in the Supply and Use Table (SUT) (continued)

Input-Output Sectors		SUT Sectors
	41.10.0	Iron and steel
	41.60.0	Non-ferrous minerals
	42.10.0	Structural metal products
	42.99.0	Metal products n.e.c., excluding machinery and equipment
31 Electrical Goods	43.10.0	Engines and turbines, and parts for same
	44.10.0	Machinery and equipment for agriculture
	44.40.0	Machinery and special equipment for industries
	44.81.0	Electrical appliances and accessories for domestic use
	44.90.0	Machinery and equipment n.e.c., excluding electrical machinery
	45.10.0	Machinery for offices, calculations and accounting
	46.10.0	Electrical industrial machinery and appliances
	46.90.0	Electrical appliances and supplies n.e.c.
	47.00.0	Radio, television and communications equipment and appliances
	48.10.0	Prof. and scientific equipment, measuring and control instruments n.e.c.
	48.30.0	Photographic equipment and optical instruments
32 Transportation equipment	49.10.0	Rebuilding of cars
	49.30.0	Ships and ship repair
	49.91.0	Motorcycles and bicycles
	49.96.0	Transportation material n.e.c. Airplane repair and maintenance services

ANNEX B
Classification of Input-Output products and their equivalents in the Supply and Use Table (SUT) (continued)

Input-Output Sectors		SUT Sectors
33 Other manufactures	38.90.0	Manufactured products n.e.c.
	48.40.0	Watches and clocks
	38.20.0	Jewelry and related items
	38.40.0	Sports and games items
	42.90.0	Knives, manual tools, general hardware items
34 Construction	52.11.0	Construction
35 Financial services, insurance and other services provided to firms	81.11.1	Financial services, excluding insurance
	81.21.1	Insurance
	83.10.9	Leasing or hire of other kinds of machinery
	84.10.0	Consulting services for installation of informatics equipment
	86.10.0	Legal services
	82.20.0	Accounting, auditing and bookkeeping services
	86.40.0	Market research and public opinion poll services
	86.71.0	Architecture and engineering services
	87.10.0	Publicity services and other services to firms
36 Commerce, restaurants and hotels	61.10.0	Commerce
	64.10.0	Hotel and related accommodation services
	64.20.0	Food services
37 Transportation, storage and communications	71.10.0	Rail transportation services
	71.21.1	Bus services
	71.22.1	Taxi services
	71.23.3	Road haulage services
	71.23.9	Transportation of securities
	72.00.0	Coasting trade services
	73.00.0	Aviation services

ANNEX B
Classification of Input-Output products and their equivalents in the Supply and Use Table (SUT) (continued)

Input-Output Sectors		SUT Sectors
	74.20.0	Warehouse and storage facility services
	74.43.0	Parking services
	74.51.0	Quay and port services
	74.70.0	Travel agent services
	74.80.0	Customs' agent services
	75.00.0	Mail and telecommunications services
	83.10.1	Car leasing or hire services
38 Social, community and personal services	85.00.0	Research and development services
	92.11.0	Education services
	96.12.0	Medical and dental services
	96.20.0	Veterinary services
	96.30.0	Social assistance services
	96.00.0	Sewers, waste disposal and sanitation services
	96.11.0	Services provided by commercial and prof. org.
	96.91.0	Religious services
	96.99.0	Assorted social and community services
	96.11.0	Movie production and distribution services
	96.12.0	Movie projection services
	96.13.0	Radio and television services
		Theatre and leisure services
	96.30.0	Library services, archives, museums and other cultural services
		Recreation and leisure services n.e.c.
		Footwear repair service
		Electrical repair service
		Car and motorcycle repair service
		Other repair services n.e.c.
	97.01.0	Laundry services

ANNEX B
Classification of Input-Output products and their equivalents in the Supply and Use Table (SUT) (continued)

Input-Output Sectors		SUT Sectors
	97.02.0	Domestic service
	97.09.0	Hairdressing services and beauty salons
	98.00.0	Photographic studios
		Other personal services n.e.c.
39 Electricity	17.10.0	Electrical services
	18.00.0	Natural water
40 Real estate services	82.10.0	Real estate services related to property owned or leased
41 Public administration services	91.11.1	Public administration services

Source: IICA, with data from the Central Bank of Costa Rica.

ANNEX C 1 Rice production by semester (in current colones)				
			1997-1998	
	U.M	AMOUNT	I SEMESTER	II SEMESTER
1. FIXED INTERMEDIATE CONSUMPTION				
- Seed			127.9	160.2
Fertilizers:				
Applied to crops (10-30-10)	Kg	132.0	62.6	64.2
Second and third applications (UREA)	Kg	324.2	56.1	57.5
- Insecticides:				
Granulated to crops (Volatán)	Kg	14.2	385.2	397.7
Pyrethroids (Decis)	Lt	0.3	5,789.6	5,977.9
Phosphated (Counter)	Lt	2.0	624.8	645.1
- Herbicides:				
Pre-emerging (Prowl 330E)	Lt	2.0	812.6	839.0
Propanil (1.84 kg) (Stam 540)	Lt	15.1	1,744.3	1,801.0
Hormonal (Afalón)	Lt	0.5	4,516.9	4,663.9
- Fungicides:				
Organ-phosphate (2nd applic.) (Kitasin)	Lt	3.0	2,901.1	2,995.5
Carbonate (Dithane)	Lt	3.5	820.9	847.6
- Transportation of inputs:				
Solids	Kg	470.4	3.8	4.1
Liquids	Lt	26.4	3.8	4.1
- Electricity, phones, etc.		1,0	344,9	342,7
- Electricity, phones, etc.		1.0	344.9	342.7
- Heavy harrowing	One operation	1.0	4,970.0	5,338.7
- Light harrowing	One operation	3.0	4,681.9	5,029.2
- Seeding, 1st fertil. and applic.				
Granulated insecticide	One operation	1.0	6,606.7	7,096.8
Fuel for 48 km/ha			24.0	22.5
1.1. VARIABLE INTERMEDIATE CONSUMPTION				
Freight to point of sale	Kg	1/	4.6	4.9
Drying				
2. VALUE ADDED:				
- Ronda and clearing	Ha	32.0	380.7	407.4
- First applic. herbicide and				
second applic. of insecticide	Lt	81.0	56.8	60.8
- Second applic. fertilizer	Kg	162.1	30.2	32.3

ANNEX C 1
Rice production by semester (in current colones) (continued)

			1997-1998	
	U.M	AMOUNT	I SEMESTER	II SEMESTER
- Second applic. herbicide	Lt	81.0	56.8	60.8
- Third applic. fertilizer	Kg	162.1	30.2	32.3
- Third applic. insecticide (phosphated)	Lt	54.0	56.8	60.8
- Fourth applic. insecticide and 1st fungic.	Lt	54.0	56.8	60.8
- Second applic. fungicide	Lt	54.0	56.8	60.8
- Administrator (agronomist 6 months)		0.0	191,200.6	204,584.6
- Accountant		0.0	95,982.7	102,701.5
- Indirect taxes				
2.1 . VARIABLE VALUE ADDED				
Harvesting	Kg	2/	9.9	10.6
Cartage	Kg	1/	0.9	1.0

Source: Central Bank of Costa Rica

ANNEX C 2
Rice: Production Account for 1997
(millions of colones)

		Allocation intermediate inputs according to classification of the SAM 97	
I. VALUE ADDED	**6,487.2**		
Wages and Salaries	**5,575.2**		
Social security contributions	560.6		
Workers' compensation	166.6		
Other income of workers	0.0		
Depreciation	133.7		
Ind. payroll tax	263.7		
Others taxes	46.7		
Less subsidies (CAF)	0.0		
EARNED SURPLUS	292.6		
II. INTERMEDIATE CONSUMPTION	**8,540.6**		
II.1 FIXED INTERMEDIATE CONSUMPTION	8,436.2		
Seed	1,359.0	(-5.1)	Paddy rice
Marketing expenses	74.0	(36)	Commerce, restaurants and hotels
FERTILIZERS			
Applic. to crops (10-30-10)	647.0	(24)	Chemicals
Second and third applic. (UREA)	1,160.0	(24)	Chemicals
INSECTICIDES			
Granulated to crops (Volatán)	425.0	(24)	Chemicals
Pyrethroids (Decis)	113.0	(24)	Chemicals
Phosphated (Counter)	97.0	(24)	Chemicals
HERBICIDES			
Pre-emerging (Prowl 330E)	127.0	(24)	Chemicals
Propanil (1.84 kg) (Stam 540)	2,057.0	(24)	Chemicals
Hormonal (Afalón)	176.0	(24)	Chemicals
FUNGUICIDES			
Organ-phosphate (2nd applic.) (Kitasin)	678.0	(24)	Chemicals
Carbonate (Dithane)	224.0	(24)	Chemicals

ANNEX C 2 Rice: Production Account for 1997 (millions of colones) (continued)		Allocation intermediate inputs according to classification of the SAM_97
TRANSPORTATION OF INPUTS		
Solids	20.0	(37) Transport., storage and communicat
Liquids	15.0	(37) Transport., storage and communicat
Electricity and water	102.0	(39) Electricity
Fuel for 48 km/ha	696.0	(25) Oil refining
Insurance and other financial services	466.0	(35) Financial services and insurance
II.2 VARIABLE INTERMEDIATE CONSUMPTION	104.3	
Freight to point of sale	104.0	(37) Transport., storage and communicat
III GROSS OUTPUT	**15,084.9**	

Source: IICA, based on data from the Central Bank of Costa Rica.

ANNEX C 3
Rice: Production Account for 1997
(Millions of colones)

GOODS AND SERVICES	ACTIVITIES: STAPLE GRAINS	ACTIVITIES: PADDY RICE	ACTIVITIES: OTHER STAPLE GRAINS
(1) Bananas	-		-
(2) Coffee beans	-		-
(3) Sugar cane	-		-
(4) Cocoa beans, roasted and unroasted	-		-
(5) Staple grains	1,912		259
(5) Paddy rice		1,653	-
(6) Unprocessed tobacco	-		-
(7) Livestock	-		-
(8) Forestry and fishing	-		-
(9) Other agricultural products	-		-
(10) Meat and dairy production	-		-
(11) Fish, shellfish and others sea products	-		-
(12) Vegetable and animal oils and fats	-		-
(13) Green coffee	-		-
(14) Milling industry, except coffee processing	-		-
(15) Bakery products	-		-
(16) Sugar	-		-
(17) Other manufactured products	-		-
(18) Beverages	-		-
(19) Tobacco (cigarettes)	-		-
(20) Textiles and garments	172		172
(21) Tanning and currying industry	-		-
(22) Timber and furniture	-		-
(23) Paper and printing	-		-
(24) Chemicals	6,623	5,704	919
(25) Oil refining (gasoline, diesel, etc.)	825	722	104
(26) Tires	190		190

ANNEX C 3
Rice: Production Account for 1997
(Millions of colones) (continued)

	ACTIVITIES		
GOODS AND SERVICES	**STAPLE GRAINS**	**PADDY RICE**	**OTHER STAPLE GRAINS**
(27) Rubber and plastic products	-		-
(28) Glass and ceramic products	-		-
(29) Clay products for construction	-		-
(30) Base metals	161		161
(31) Electrical goods	-		-
(32) Transportation equipment	-		-
(33) Other manufactures	-		-
(34) Construction	16		16
(35) Financial services and insurance	518	466	52
(36) Commerce, restaurants and hotels	108	74	33
(37) Transportation, storage and communications	632	492	139
(38) Social, community and personal services	-		-
(39) Electricity	119	102	17
(40) Real estate services	-		-
(41) Public administration services	-		-
SUBTOTAL	**11,277**	**9,213**	**2,064**

Source: IICA, based on data from the Central Bank of Costa Rica.
* n.e.c.: not elsewhere classified.

Annex D. Social Accounting Matrix for Costa Rica, 1997. Millions of colones
(Disaggregation of rice production)

ACCOUNTS	c COMMODITIES: Bananas (1)	Coffee beans (2)	Sugar cane (3)	Cocoa beans, unroasted and roasted (4)	Staple grains (5)	Paddy rice (5.1)	Others Staple grains (5.2)	Tobacco (6)	Livestock (7)	Forestry, fisheries (8)
c COMMODOTIES										
(1) Bananas										
(2) Coffee beans										
(3) Sugar cane										
(4) Cocoa beans, unroasted and roasted										
(5) Staple grains										
(5.1) Paddy rice										
(5.2) Others Staple grains										
(6) Tobacco										
(7) Livestock										
(8) Forestry, fisheries										
(9) Other agricultural products										
(10) Meat and dairy products										
(11) Fish canning										
(12) Edible oils										
(13) Coffee processing										
(14) Milling of grains										
(15) Bakery products										
(16) Sugar										
(17) Other manufactured products										
(18) Beverages										
(19) Tobacco products										
(20) Textiles and garments										
(21) Leather goods and footwear										
(22) Timber and furniture										
(23) Paper and printing										
(24) Chemicals										
(25) Oil refineries										
(26) Tires										
(27) Rubber and plastics										
(28) Glass and ceramics										
(29) Construction materials										
(30) Base metals										
(31) Electrical Goods										
(32) Transportation equipment										
(33) Other manufactures										
(34) Construction										
(35) Banking, finance and insurance										
(36) Commerce, restaurants and hotels										
(37) Transportation										
(38) Services										
(39) Electricity										
(40) Real estate										
(41) Public administration services										
(c) SUBTOTAL										
Distribution Margin	7.367	-	-	-	621	-	621	-	3.992	10.816
Internalization costs	-	-	-	-	-	-	-	-	-	-
Transportation and Trade Margins	7.367	-	-	-	621	-	621	-	3.992	10.816
ACTIVITIES	Domestic production at retail prices									
(42) Bananas	125.356	-	-	-	-			-	-	-
(43) Coffee beans	-	83.009	-	-	-	-	-	-	-	-
(44) Sugar cane	-	-	22.123	-	-	-	-	-	-	-
(45) Cocoa beans, unroasted and roasted	-	-	-	509	-	-	-	-	-	-
(46) Staple grains	-	-	-	-	19.757	-	-	-	-	-
(46,1) Paddy rice	-	-	-	-	-	16.252	-	-	-	-
(46,2) Others Staple grains	-	-	-	-	-	-	3.505	-	-	-
(47) Tobacco	-	-	-	-	-	-	-	905	-	-
(48) Livestock	-	-	-	-	-	-	-	-	114.180	-
(49) Forestry, fisheries	-	-	-	-	-	-	-	-	-	26.614
(50) Other agricultural products	-	-	-	-	-	-	-	-	-	-
(51) Meat and dairy products	-	-	-	-	-	-	-	-	-	-
(52) Fish canning	-	-	-	-	-	-	-	-	-	-
(53) Edible oils	-	-	-	-	-	-	-	-	-	-
(54) Coffee processing	-	-	-	-	-	-	-	-	-	-
(55) Milling of grains	-	-	-	-	-	-	-	-	-	-
(56) Bakery products	-	-	-	-	-	-	-	-	-	-
(57) Sugar	-	-	-	-	-	-	-	-	-	-
(58) Other manufactured products	-	-	-	-	-	-	-	-	-	-
(59) Beverages	-	-	-	-	-	-	-	-	-	-
(60) Tobacco products	-	-	-	-	-	-	-	-	-	-
(61) Textiles and garments	-	-	-	-	-	-	-	-	-	-
(62) Leather goods and footwear	-	-	-	-	-	-	-	-	-	-
(63) Timber and furniture	-	-	-	-	-	-	-	-	-	-
(64) Paper and printing	-	-	-	-	-	-	-	-	-	-
(65) Chemicals	-	-	-	-	-	-	-	-	-	-
(66) Oil refineries	-	-	-	-	-	-	-	-	-	-
(67) Tires	-	-	-	-	-	-	-	-	-	-
(68) Rubber and plastics	-	-	-	-	-	-	-	-	-	-
(69) Glass and ceramics	-	-	-	-	-	-	-	-	-	-
(70) Construction materials	-	-	-	-	-	-	-	-	-	-
(71) Base metals	-	-	-	-	-	-	-	-	-	-
(72) Electrical Goods	-	-	-	-	-	-	-	-	-	-
(73) Transportation equipment	-	-	-	-	-	-	-	-	-	-
(74) Other manufactures	-	-	-	-	-	-	-	-	-	-
(75) Construction	-	-	-	-	-	-	-	-	-	-
(76) Banking, finance and insurance	-	5	-	-	-	-	-	-	-	-
(77) Commerce, restaurants and hotels	-	-	-	-	-	-	-	-	-	-
(78) Transportation	-	-	-	-	-	-	-	-	-	-
(79) Services	-	-	-	-	-	-	-	-	-	-
(80) Electricity	-	-	-	-	-	-	-	-	-	-
(81) Real estate	-	-	-	-	-	-	-	-	-	-
(82) Public administration services	-	38	-	-	-	-	-	-	54	3
(a) SUBTOTAL	125.356	83.052	22.123	509	19.757	16.252	3.505	905	114.233	26.617
INCOME GENERATION (Value Added)										
(f) Remuneration Wage Earners (Labor Factor)										
URBAN LABOR										
Independent										
(83) Self-employed										
(84) Employer										
Wage Earner										
(85) Public Sector										
(86) Firms										
(87) Domestic help										
RURAL LABOR										
Independent										
(88) Self-employed										
(89) Employer										
Wage Earner										
(90) Public Sector										
(91) Firms										
(92) Domestic help										
(93) Other Taxes on Production										
(94) Production Subsidies (-)										
(95) Gross Earned Surplus (Capital Factor)										
PRIMARY INCOME RECIPIENT										
(96) WAGE EARNER HOUSEHOLD										
(97) OTHER EMPLOYEE HOUSEHOLD										
(98) OTHER HOUSEHOLD										
(99) FIRMS	Taxes on production net of subsidies									
(100) GOVERNMENT	9.228	-	-	112	33	33	-	-	1	(390)
Indirect Business Tax	-	-	-	111	-	-	-	-	-	-
Products Tax	27.936	-	-	1	33	33	-	-	1	5
Subsidies on Products	(18.708)	-	-	-	-	-	-	-	-	(396)
SECONDARY INCOME DISTRIBUTION										
(101) WAGE EARNER HOUSEHOLD										
(102) OTHER EMPLOYEE HOUSEHOLD										
(103) OTHER HOUSEHOLD										
(104) FIRMS										
(105) GOVERNMENT										
INCOME USE										
(106) HOUSEHOLDS										
(107) FIRMS										
(108) GOVERNMENT										
(109) **CAPITAL ACCOUNT**										
	Imports									
(110) **REST OF WORLD**	-	-	-	1.183	20.949	5.935	15.014	-	-	9.017
(t) **TOTAL**	141.951	83.052	22.123	1.805	41.360	22.220	19.140	905	118.226	46.060

Source: IICA. Based on data from the SAM of Costa Rica for 1997(IICA)

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