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THE INSTITUTE OF NATIONAL PLANNING



SOME PROBLEMS OF WORKING OUT AND UTILIZATION IN PLANNING THE STRUCTURAL BALANCES (INPUT-OUTPUT TABLES) IN CZECHOSLOVAKIA

by

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Introduction.

The importance of the system of structural balances (or inputoutput tables) and structural analysis is not necessary to emphasize in the time when the complexity of the national economy and mutual interdependencies have been growing and the role of management and planning have been increasing both on the national economy level and enterprise level. The main methodical tool and instrument for description, observation, analysis and forecasting of the network of mutually interdependent relationships is, according to the present state of our knowledges, the system of structural balances (input -output tables).

This memorandum deals with some practical experiences and problems of working out and utilization in planning of the system of structural balances in Czechoslovakia. The author gained some practical experiences in the construction and utilization in planning of the over-all inter-branches balance for the national economy as a whole. Therefore, the other fields of observation will not be fully covered.

This paper serves as an introduction for the discussions arranged by the Operations Research Centre. In this connection I would like to express my gratitude and appretiations to the Director of the Operations Research Centre Dr. Salib Rofail for his great interest and the work done in the field of further development of this progressive method of planning in the United Arab Republic.

1. The Significance of the System of Structural Balances.

The significance of the system of structural balances have been seen in Czechoslovakia first of all in these main fields of observations and planning:

a) In the field of <u>description and analysis</u> of the national economy as a whole, not only in the very aggregative form as it is done in the balance of the national economy (a system used in socialist countries and similar to the system of national accounts), but in a detailed form, in a structural breakdown, and in the form which enables us to express main relationships and interdependencies within the national economy. To these purposes serves the inter-branches balance in a statistical form both in money and physical terms.

b) In the field of <u>balancing</u> the national economy as a whole. To reach the equilibrium and the balanced, harmonized economic development among the different economic phenomena and activities is one from the most important tasks of national planning. The inter-branches balances represent a methodical tool for ensuring the equilibrium in the economic development. For this purpose the inter-branches balances must be elaborated in a planned form, on the basis of a planned information, and data in the money terms.

c) In the field of <u>elaboration a harmonizing the plans of material</u> <u>technical supplies</u>. Structural balances for this purpose are constructed only for the limited groups of commodities in physical terms.

The utilization of structural balances in the field b) and c) is typical for the planning in the socialist countries.

d) In the field of <u>long-term economic projections and plans</u>. The process of elaboration of a long-term plan is made in an iterative way and some approximations are based on the balance of the national economy and on the inter-branches balances.

e) In the field of <u>regional analysis and planning</u>. In this case the structural balances are worked out for different regions and mutual interbranches and interregional relationships are analyzed.

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f) In the field of <u>analysis and planning of single production comp</u>-<u>lexes</u> such as sectors or ministries, companies and enterprise. These structural balances are constructed both in value and physical terms.

g) In other fields, such as calculations of prices, investment and manpower planning.

We shall see later that different requirements arise in different fields of utilization of the system of structural balances.

2. <u>Pyramidal System of Structural Balances from the Enterprise Level to</u> the National Economy Level.

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The system of structural balances is introduced on a relatively broad basis in Czechoslovakia, because we think that the progressive technique of analysis and planning can be utilized not only on the national economy level for macro-economic projections, but also on the enterprise level for purposes of analysis and planning. This approach is important also from a psychological point of view, because the basic information in interindustry relations will be compiled by enterprises from their accountancy, statistics and plans. If this necessary information is useful also for enterprise planning, the accuracy will be much more greater and the interest of enterprises will be consistent with the interest of society.

We want to set up gradually the pyramidal system of structural balances which can be schematically drawn in this way:



The whole system of structural balances may be classified according to the different criteria. In this connection I would like to emphasize some difficulties which is necessary to overcome in using the terminology, especially in this relatively young field of economics, since there is up to now no dictionary explaining special terms.

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The stem of structural balances we can divide:

Structural balances in money terms

a) According to the used terms

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Structural balances in physical terms

Statistical structural balances

Enterprises structural balances

b) According to the gained ______ Planned structural balances

c) According to the level of _______

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Inter-branches balances in money terms and intercommodities balances in physical terms for the national economy as a whole.

Sectoral (ministries) structural balances

Schematically:

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		Enterprise level	Ministry level	National economy level
Statistical	Money terms	x	x	x
balances	Physical terms	x	x	x
Planned structural	Money terms	X	x	x
balances	Physical terms	x	x	x

Of course, other criteria may be also used for classifying the system of structural balances. For exmaple, very important criterium for the system of structural balances is classifying the balances according to the organizational (institutional) structure and according to the pure commodities branches and groups. We have seen that the sketched system of structural balances is relatively complicated and immodest on the sources of information and qualification of staff personnel. Therefore is not in all circumstances necessary to elaborate the structural balances on all levels and in all forms.

I would say that preference must be given to the construction of interbranches balances in money terms according to the pure commodities branches for the national economy as a whole (especially in the statistical form) on one hand and to construction of enterprises structural balances in a detailed form both in money and physical terms.

Different levels of management (enterprise, ministry, national economy) represent also different degrees of aggregation of production. The order of structural balances which is given by the number of branches or commodities groups which are included in the structural balance, will be higher on the lower levels of management. For utilization of information which is contained in enterprise structural balances on higher levels of management (by aggregation of this information) is necessary, as we shall see later, to have an unified classification of production which is obligatory for all organizations and institutions in the national economy. This is the basic assumption for setting up the pyramidal system of structural balances;

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3. The Basic Principles of Construction and Computation of the Structural Balances in Money and Physical Terms.

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In this paragraph we shall explain only the basic schemes and symbols which are used in Czechoslovakia in construction of structural balances. General questions of construction of input-output models are described in relatively rich literature dealing with interindustry economics.

Structural balances in money terms

The first Czechoslovak statistical inter-branches balance in money terms constructed for the year 1962and containing 96 branches of the national economy, has the form of a static, open and linear model of reproduction.

The basic scheme of Czechoslovak inter-branches balance looks as follows:

		-8-		
Utilization	Receiving branches.	itve ptior	Final Consumption	Utili-
Sources	1 2 3 96	Product Consum _I	Personal Collec- Consump- tion Collec- sumption general and re- repairs serves Construction Serves Construction Serves Construction Serves Construction Serves Construction Serves Construction Server	tion
Delivering branches 1				
3	I. Quadrant		II. Quadrant	
96				
Material costs of production				x
Depreciation allowances				
Wages and salaries				
Profits	(Section) (The section of	10 -		11 ¹⁰ J -
Turnover tax	N.			
Residual net production				
Gross production	III. Quadrant			
Decrease in stocks and reserves				
Import				
Sources total		X		

I. Quadrant of the inter-branches balance contains the mutual relationships among the productive branches of the national economy. In this connection it must be borne in mind that in socialist countries is recognized so called productive sphere of reproduction which comprises only commodities branches and productive-services branches (transportation of weight, productive communications, trade and marketing organizations). It means that personal and other services are excluded from I. quadrant and the material consumption of these services is included in II. quadrant as collective consumption.

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Secore (lations doansides ind) application (secore

In working out the first Czechoslovak inter-branches balance was accepted commodity conception of branches. The flows of goods and services are reflected as the flows among pure commodity branches, not as the flows among organizational units.

I. quadrant comprises only the productive consumption of intermediate products and not the consumption of capital goods (the depreciation allowances) and therefore the investments in II. quadrant are in brutto form.

II. Quadrant of the inter-branches balance includes the final consumption of a social product.¹⁾ Final consumption is divided into these items:

- a) personal consumption
- b) collective consumption
 - c) investments and general repairs
- d) increase in stocks and services
- 'e) export

The contents of individual items is described in mentioned memoranda.

<u>III. quadrant</u> of the inter-branches balance reflects the added value according to the individual branches of the national economy. The added value comprises these main items:

¹⁾ See momoranda No. 636 dealing with the theoretical principles of the balance of the national economy and with the balance of production and utilization of social product.

a) depreciation allowances (consumption of capital goods)

b) the value of production for workers (wages and salaries)

c) the value of production for society (profits, turnover tax, insurance allowances of enterprises, net incomes of co-operatives).

Generally, the figures in rows show the distribution and utilization of production both in productive consumption (according to the individual branches of the national economy) and in the sphere of final consumption.

The data in columns express the material inputs divided according different delivering and receiving branches of the national economy and the added value according to the individual branches.

The sums of figures in rows must equal to the sums of figures in columns.

Now, we shall briefly explain the mathematical symbols which are used in describing the system of inter-branches balances. Mathematical symbols are, unfortunately, not unified and standardized and this of course, aggravate the reading and understanding of input-output technique in different countries.

	Receiving b:	canches	Final con- sumption	Total pro- duction
Delivering branches 1 2 : n	x11 x12 x21 x22 x1 x22 xn1 xn2	xin xin xin xin	الم الم	x ₁ x ₂ : x _n
Added value	^z 1 ^z 2	z _{nı}	an air geo	
Total production	x1 x5	X _{n.}	NGC dan sel deta Bearlesi	

The basic input-output table is following:

From this table we can derive the two basic systems of equations:
a) Distribution equations (these equations are given by a summation the
data in rows)

$$x_{11} + x_{12} + x_{1n} + y_1 = x_1$$

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$$x_{n1} + x_{n2} \cdots + x_{nn} + y_n = X_n$$

$$x_{n1} + x_{n2} \cdots + x_{nn} + y_n = X_n$$
Generally,
$$\sum_{j=1}^{n} x_{ij} + y_i = X_i \quad (i = 1, 2 \dots n)$$

$$i \dots \text{ symbol for delivering sector}$$

$$j \dots \text{ symbol for receiving sector}$$

b) <u>Inputs (costs) equations</u> (these equations are given by a summation of data in columns)

$$\begin{array}{rcl} x_{11} + x_{21} \cdots + x_{n1} + z_{1} &= & x_{1} \\ x_{12} & x_{22} \cdots + & x_{n2} + & z_{2} &= & x_{2} \\ & x_{1n} + & x_{2n} \cdots + & x_{nn} + & z_{n} &= & x_{n} \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & &$$

The system of technical coefficients

On the basis of input table we can calculate the system of technical coefficients. These coefficients are the norms of consumption and express the amount of production of the delivering branches (symbol "i") which was consumed per one unit of production in receiving branches (symbol "j").

Generally,
$$a_{ij} = \frac{x_{ij}}{x_j}$$

 $x_{ij} \cdots flows of goods from the branch i to the branch j$
 $x_j \cdots total production of the branch j$.

Magnitude a ij is called "technical coefficient".

The system of technical coefficients we can write in a square and the state of the state of the table or matrix:

On the basis of technical coefficients we can write the system of distribution equations in the following form:

$$\sum_{j=1}^{n} a_{ij} X_{j} + y_{i} = X_{i}$$

If we use the symbols of matrix algebra, we can write:

 $x = A \cdot x + y$ x ... column vector of total production A matrix of technical coefficients y column vector of final consumption

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The system of coefficients of direct and indirect requirements per unit of final demand. enter a serie a

Mathematically we can obtain the system of coefficients of direct and indirect requirements per unit of final demand or by iteration (gradual approximation) or by inversion.

The basis for calculating the system of coefficient of direct and indirect requirements per unit of final demand is the system of technical coefficients.

The system of distribution equations is used in the case of inversion: he entered to all do not to receip a tracking by

$$x = A \cdot x + y$$

$$x - Ax = y$$

$$x (E-A) = y$$

$$E \dots \text{ unit matrix}$$

$$x = \frac{y}{(E-A)}$$

$$x = y \dots (E-A)^{-1}$$

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If the expression $(E-A)^{-1}$ we denote as R, we can write : x = y. R

Expression $(E-A)^{-1} = R$ express the matrix of coefficients of direct and indirect requirements per unit of final demand.

We have seen that mathematically the matrix of coefficients of direct and indirect requirements per unit of final demand is obtained by inversion of the matrix which is gained if we substract the matrix of technical coefficients from the unit matrix. In the time of computors it is not difficult to perform an inversion of relatively big matrixes.

On the basis of above mentioned equations and coefficients we can solve three main types of exercises:

- a) To determine the final consumption of branches, if we know the total production of these branches. In this case we use the equation y = x (E-A)
- b) To determine the total production of branches, if we know the pattern of final consumption.

In this case the calculations are based on the equation $x = R \cdot y = (E - A)^{-1} \cdot y$

c) To determine the total production of branches in the case of limited production capacities in some branches and the knowledge of final demand in other branches. This type of exercises is a combination of both preceding exercises.

The basic input-output table can be expanded especially in these directions:

- a) by inclusion of labour forces.
 - b) by inclusion of fixed assets, investments and capacities

c) by inclusion of foreign trade.

We shall not discuss these problems in detail, but the type of exercises is much more broader when we have for disposal input-output tables expanded in mentioned directions. Schematically we can draft the expanded input-output tables in

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this way:

Total complementary import

dl

dn

Scheme of expanded input-output table

			Productiv branches	ve s n	Final con- sump- tion	Total production	
	Delivering branches	1	x ₁₁ x	xln	y.	x x	X matrix of flows of in- termediate. products
-		n	×nl******	^x nn	yn	×n	
-	Value added		znl	zn	10993	ortano ito es	augumente south affine
	Total production		×1	x _n	into i		Advatbavez (h
			(89)		d azəd		borgo (LAGA) -
	The groups of labourers	l	tll	tln	• ຄອງ ອຸດ	T ma	trix of labour forces
			T		o strea	and end on Rend Janei)	tenssen ov (a.). To ats seen
		°p	tpl	t _{pn}	okteta 1- (hao		es arectain
-	Total number of labourers		ant _{le} nt to m	tn	bine 4		Reverse of the
	The groups of fixed assets	1	f _{ll} .	fln		F ma	trix of fixed assets
		• • •	F			a an	
		k	fkl	fkn	-		t shall we want
	Total fixed asset	s	fl	fn	peot. v		and the start
	and the second second			-		bardel to no	heatonic and the
	Complementary imports	1	d 11	dln		D ma in	trix of complementary port.
		0. 0.	D			n all next an	
		q	d _{ql}	d _{q2}		nos coseris. h	enconter at some

Competitive	1	i ₁₁	i _{ln}
imports	•		
	•		T
	•		-
			.
	n	nl	nn
Total competitive imports		il .	in

I.... matrix of competitive import.

Structural balances in physical terms

The structural balances in physical terms are constructed only as the complementary, auxiliary balances to the system of interbranches balances in money terms. They reflect the flows of goods and products . among different commodities groups. Therefore are called the inter-commodities balances (or material balances). The number of commodities groups included in the inter-commodity balance is always greater than the number of branches in the inter-branches balance. For example the first Czechoslovak statsitical inter-commodities balance in physical terms constructed for the year 1962 comprised 226 different commodity groups of production and the first planned inter-commodities balance worked out on the basis of planned figures for the year 1964 included 444 commodity groups. The classification of production in inter-branches balances must be linked up with the classification of production in inter-branches balances.

The scheme of inter-commodities balance in physical terms we can sketch as follows:

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			Sour	ces		u U		Pr	odu	cti	ve	Con	sum	otic	on	ve ion		Fir	al,	Co	nsum	ptio	n			ion
		Produc- tion	Import	Stocks and Reserves	Others	Source	Total	1	2	3	•	•	•	•	n	Producti Consumpt	Danco	nal con sumption	Collec- tive con	sumption	Invest- ment and	Stocks and re-	serves	Export	Others	Utilizat Total
Commodity Groups	1 2 3						The second second							an outside					in the same							
	•	(Jos)	•				ale di proc. L				I,	qu	adra	ant						II	• qu	.adra	nt			
	•																									4

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The scheme of the inter-commodities balance is a little similar to the scheme of the inter-branches balance.

I.quadrant comprises production-consumption relationships among different commodity groups in physical terms.

III..quadrant (value added) is not worked out because the data in columns we can not add - they are in different physical units. Therefore is necessary to set up the calculation of sources. The data in the columnsources total must be the same as the data in the column-utilization total. Only in this case the balance and mutual consistency between sources and utilization is reached according to the commodity groups which are included in the inter-commodities balance.

The main purpose of the inter-commodities balance in physical units lies in the field of material technical supplies planning. The plans of material technical supplies can be constructed on the basis of the inter-commodities balances both on the national economy and enterprise levels. Also from the viewpoint of available statistical and planned data it is easier to construct the inter-commodities balances in physical terms. If the necessary conditions are created (especially with regard to the prices) it is possible to transfer the inter-commodities balances in physical terms into the inter-branches balances in value terms by means of aggregation and evaluation.

It is also possible to expand the scheme of inter-commodities balances in physical terms by inclusion of the labourers, fixed assets, investments, capacities and imports.

We have explained the schemes of structural balances in money and physical terms on the national economy level only. The schemes of structural balances on enterprise level are similar to the above mentioned schemes, only with the distinction that T. quadrant comprises only material inputs which were produced and also consumed within the framework of enterprise. It means that I.quandarnt of enterprise structural balance expresses the mutual interdependencies and relationships among the different branches

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cr commodity groups which are produced within the enterprise. It involves that II. quadrant reflects not only deliveries to final consumption, but also deliveries of the enterprise for productive consumption in other productive enterprises. III. quadrant comprises not only value added (in the case that enterprises structural balance is elaborated in money terms), but also material inputs purchased by the enterprise from other enterprises.

Schematically we can draw the enterprise structural balance in this way:

san tirch na birna Tirch no bir ag	Productive con- sumption in en- terprise	Productive consumption in other en- terprises 1 2k
Commodity groups 1 (or branches) pro- 2 duced in enterprise 3	I.quadrant	II.quadrant
Material inputs 1 purchased from 2 other enterprises 3	III.quadrant	
Value added	te successive to the	

The interbranches balances may be elaborated in three main forms:

- a) Statistical inter-branches balances.
- b) Planned inter-branches balances.
- c) Orientation (preliminary) inter-branches balances

On the basis of statistical input-output tables the structural analysis is made and statistical coefficients are obtained.

The planned balances are constructed on the basis of the planned figures. Major task of this form of balances lies in the field of balancing the national economy, in ensuring the proportional relations between production and consumption not only for the national economy as a whole (this to get is given to the balance of production and utilization of social produced), but also according to the individual branches of national economy. The system of planned inter-commodities balances in physical terms insures the proportion between production and consumption according to the individual commodity groups. Besides these above mentioned planned structural balances are in Cnechoslovakia also worked out the material balances of individual industrial and agricultural products in physical terms which assure the mutual consistency between sources and their utilization. The scheme of material balance is following:

SOURCES:

- 1) Production
- 2) Import
- 3) Stocks at the beginning of the period
- 4) Other sources

SOURCES TOTAL

UTILIZATION:

- 1) Productive consumption (according to the different sectors)
- 2) Personal consumption
- 3) Collective consumption
- 4) Capital formation
- 5) Export
- 6) Reserves
- 7) Stocks at the end of the period

UTILIZATION TOTAL

Material balances are not included in the framework of structural balances, but they give us important information for construction of intercommodities balances in physical terms.

The inter-branches balances in the orientation (preliminary) form are constructed first of all for the purposes of long-term projections and plans. They are elaborated on the basis of statistical information and coefficients and their dynamization. They represent the first over-all picture in the structural breakdown in the process of elaboration the longterm plan.

a. Compilation of Information.

The model of input-output relationships itself is theoretically clear. Also the possibilities of its dynamization have been outlined in theory. The main difficulties have been arisen in its practical filling in by accurate statistical or planned data.

Organization of available statistical and planned data represent from the practical point of view a key problem which must be solved to utilize the progressive input-cutput technique in analysis and planning.

The following main sources of information must be for disposal to construct input-output tables:

- a) Information about the value of gross production according to the individual branches of the national economy.
- b) Data about the material inputs divided according to the delivering branches. Compilation of this information represent the most difficult problem, in particular, when we apply the commodity conception of branches. In this case the enterprises must break down the inputs not only according to the delivering sectors, but also according to the branches which are produced within the enterprise. In some cases the number of different commodity branches which are produced in one enterprise is relatively high. It depends upon production targets of enterprise and upon the classification of production.

Let's give an example: according to the unified classification of production, the national economy have been divided into 450 commodity branches (from it 420 industrial branches) in Czechoslovakia. Say, that within the production programme of an enterprise, 35 different commodity branches have been produced. In this case the enterprise accountancy, statistics or planning must give this necessary information for construction of input-output table (we shall draft it in the form of a table);

	Branches produced in enterprise (according to the unified classification)
	1 2 3
Delivering branches 1 (according to the 2 unified classification) 3	

In the case that the organizational structure of the enterprise is in an accordance with the unified classification of production, compilation of above statistic information does not represent a serious problem. In this case the commodity branches correspondent to the establishments within the enterprise.

Sometimes may be necessary to make a compromise and the information on the inputs to compile according to the establishments. Nevertheless, organizational arrangements with regard to the primary information about the flows of goods and services in enterprise and its processing are necessary. c) <u>Information about the value added</u> is also necessary for elaboration of input-output tables in money terms. Value added must be divided according to the individual items of added value (depreciation allowances, wages and salaries, profits, turnover taxes, residual net incomes) and according to the different commodity branches which are produced in enterprise. In this case also some difficulties must be overcome - for example, if the worker produces goods of different branches, his wage must be divided among these branches if we want to apply the commodity conception of branches.

d) <u>Other information</u> about stocks, reserves, foreign trade, personal and collective consumption, investments. The depth of this information depends upon the form of input-output tables and the details of analysis and planning.

According to the experiences won in Czechoslovakia, these main stages are important for introduction the input-output technique and compilation the necessary information:

a) Introduction of an <u>unified classification of production</u> which is obligatory for all enterprises, trade and marketing organizations and other institutions in the national economy.

b) Decision-making about the system of input-output tables, their forms, methodology, used terms, conception of branches (organizational or commodity conception) periodicity of construction and other conceptual questions. This stage we can name as the <u>elaboration of a unified methodology</u> of input-output tables. This stage is very important because of ensuring the consistency of time series of input output tables and consistency between the input-output tables in a statistical and planned form.

c) <u>Elaboration and introduction of an unified system of accountancy</u>, <u>statistics and planning</u> which is on one hand obligatory to all enterprises and other organizations and satisfies the needs of construction of input-output tables.which were defined in second stage, on the other hand.

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Methods of Measurement of the Value of Production.

The accuracy of reflection of inter-branches relations depends, inter alia, upon the chosen method of measurement of the value of production. Generally, the methods of measurement of a social product in different branches of the productive sphere of the national economy in Czechoslovakia are described in memorandum dealing with the balance of production and utilization of social product.

In industry so called "enterprise method" is used for calculation the value of social product. According to this method only a value of production which has been left the border of enterprise and has been entered in an economic turnover of a country may be included in the value of social product. The value of production which has been circulated and has been to sumed inside the enterprise (for example among different establishments and workshops) cannot be included in the gross value of industrial production.

From that follows that gross production calculated according to the enterprise method includes:

a) production for final consumption

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- b) production for accumulation (in this case an exception is made and also capital goods produced and consumed in the same enterprise have been included in gross production)
- c) intermediate production, but only in such a case that intermediate products have been delivered to other enterprises.

The main problem of calculating the gross production is inclusion of intermediate products and decision about the border line defines the products that are allowed to be included in the gross production. The border line is apparently a matter of statistical convenience.

Now, we shall observe the enterprise method of calculation of the value of gross production from the viewpoint of inter-branches balances. For the purposes of reflection the mutual relationships among the different branches of the national economy, the enterprise method has some disadvantages.

In particular, if different commodity branches have been produced within the enterprise, the enterprise method of calculation of the gross production does not reflect the mutual inter-branches relationships within the enterprise, but only the inter-branches dependencies among various enterprises. In some cases (especially in machinery) these inter-branches relationships within the framework of enterprise are very complicated and important and must be taken into account in construction of input-output tables. Therefore, it is necessary to change the enterprise method of calculation of the value of production, if we want to apply the commodity conception of branches and to reflect also inter-branches relationships inside the enterprise. From above mentioned reasons the new method of calculation of the value of production, so called branch method, is introduced in present time in Czechoslovakia and the next statistical inter-branches balance for the year 1966 in money terms containing about 450 branches of the national economy, will be calculated according to the branch method. The branch method reflects the flows of goods among different branches of the national economy as have been defined by the unified classification of production irrespective if these flows take place inside the enterprise or among different enterprises. In the case when the organizational structure of enterprises correspondents to the commodity structure (within the framework of one establishment only one commodity group of production is produced), the branch method is coincident with the establishment method of calculation of the value of gross production. Complications have been arisen in the case that inside the establishment different commodity groups have been produced, because the accountancy on the costs of production is led according to the establishments and not according to the commodity groups of production. In this case the classification according to products and commodity conception of branches is in contradiction with accountancy and statistics which are recorded according to organizational structure. If we want to be precise, information about cost structures of different commodity branches produced inside the establishment must be taken from the primary evidence. The processing of primary evidence needs the mechanization of administrative works. Here again, the accepted inaccuracy depends upon the guesses about the gains that would result and the sacrifies that would have to be incurred with greater attention to precision.

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If we apply the commodity conception of branches, the differentiation of the subsidiary products (for example the production of refrigerators in a motor-car factory) and by-products (for example different products of processing the oil in chemical industry) is recommended to reflect in input-output tables:

Prices in Input-Output Tables.

If we include the prices in input-output tables, the technical coefficients don't reflect only the technical relationships in the sphere of production, but also the value and distribution relations given by the system of used prices. It must be borne in mind that used prices can very significantly influence the system of technical coefficients and utilization of input-output tables in planning. However, the prices are the only mediator of transforming the different use values on the common denominator.

Generally we can use two main groups of prices for the valuation of production:

- a) Consumers' prices
- b) Producers' prices

<u>Consumers</u>[†] prices are the prices for which the goods are purchased by consumers. These prices reflect the actual expenditures of consumers and the costs of production are calculated also in these prices. They reflect the actual money flows in the national economy. The sales and purchases of goods are mediated by the trade and marketing organizations. Therefore, the consumers' prices comprise the transportation expenses, trade margins and turnover taxes (in the sphere of personal consumption).

For better understanding we can draw the structure of price in this way:

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Retail price

The main disadvantage of the consumers' prices lies in the fact that the same use values are purchased for different prices. For example, for the purposes of productive consumption the products are saled without turnover tax while for personal or collective consumption are saled including turnover tax. In the sphere of productive consumption the prices of same products may also differ because of different transportation expenses and trade margins.

The data in rows in input-output table are therefore inconsistent when we use consumers' prices for valuation of production.

The advantage of consumers' prices consist in fact that the data about input-output flows: in consumers' prices are relatively easy obtainable from accountancy and statistics.

<u>Producers' prices</u> are the prices in which the value of output and sales is recorded by producers. Practically the producers' prices are the wholesale prices in the field of industrial production. The main advantage of utilization the producers' prices for the valuation of production lies in fact that the same products are evaluated by the same prices. It means that the data in rows are consistent and reflect better the technical relationships in the national economy. It is the main reason for which the priority is given to producers' prices in the construction of input-output tables. Nevertheless, some difficulties arise in compilation of data and construction of input-output table when we accept the producers' prices. These difficulties consist in inclusion of transportation expenses, trade margins and turnover taxes in input-output table. In this case, the consumption of goods is recorded in **Who**lesale prices and transportation expenses, trade margins and turnover taxes are recorded on the separate rows according to the branches which consumed the productive services (transportation, trade and services of other marketing organizations). The services of transport and trade are in this case recorded as bought separately from the purchase of goods by consumers. This method ensures a relatively high degree of price-homogenity in rows, but is very intensive on the data which must be compiled by consumers. Practically it means that material inputs of goods in producers' prices and inputs of productive services must be separately calculated in the accountancy and statistics of enterprises and establishments.

Another problem of utilization of prices in input-output tables is the problem of constancy of prices. Time series of input-output tables are apparently necessary for structural analysis and for utilization of input-output technique in planning. Time series must be consistent and needs the constant prices. In Czechoslovakia we suppose that the inputoutput tables will be constructed in current prices (it is necessary because the great majority of statistical data is in current prices, especially as regards the costs of production) and these input-output flows in current prices will be overvalued in constant prices. The overvaluation of input-output table from current to constant prices is not an easy matter, because the price indexes must be for disposal not only for the different branches of the national economy as a whole, but also for the decisive cells of input-output table. Necessary assumption must be therefore created in the field of price statistics.

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Foreign Trade in Input-Output Tables.

We think that the inclusion of foreign trade in input-output table as it was solved in the first Czechoslovak..inter-branches balance (import as the branch which increases the sources, see the scheme) is insufficient and that it is necessary to recognize the import which was consumed in the different branches and differentiate a complementary and a competitive imports. In this direction some complementary tables comprising the utilization of complementary and competitive imports were constructed in the form of matrixes and some analysis were made dealing with the efficiency of foreign trade according to the different branches of the national economy.

5. Utilization of the Structural Balances in Planning.

The significance of the system of structural balances is seen in these main fields of application in Czechoslovakia:

- a) In the field of methodology
- b) In the field of analysis
- c) In planning.

<u>Methodical significance</u> of input-output tables lies in fact that input-output tables give us an over-all framework for organizing the system of evidence, statistics and methodology of planning. In other words, assumptions must be created in evidence and statistics (unified classification of production and unified system of accountancy and statistics which will be able to supply the basic information on the input-output relations). These asassumption have been created in Czechoslokia this year by introduction the unified classification of industrial and agricultural production and unified new system of accountancy which will directly give us the necessary information for construction of the structural balances on different levels ofmanagement.

<u>Analytical significance</u> (structural analysis) consists first of all in an analysis of mutual interdependencies and relationships in the national economy. Input-output tables represent qualitatively new tool of analysis because of the coefficients of direct and indirect requirements per unit of final demand. Through these coefficients we can analyze not only the direct connections and dependencies, but also indirect relationships which are very often very complicated and without input-output tables practically immeasurable. By inclusion of fixed assets, investments and labour forces, the space for analysis has been becoming much larger and the analysis more complex. Structural balances unable us to analyze the influence of structural pattern of the national economy on efficiency in utilization of resources. Different branches are differently intensive on material inputs, fixed assets and investments, labour forces, imports and on the basis of structural balances we can **choose such a structural** pattern of the national economy which is relatively most effective accord chosen criteria and at the same time realistic from the viewpoint of final demand, capacities, material technical supplies (especially from the point of view of imports) and labour forces.

Utilization in planning

In this direction the main importance of structural balances is seen in Czechoslovakia. The application of input-output tables in planning relates to the drafting of:

- a) annual plans
- b) five-year plans
- c) long-term projections and plans.

The space for application of input-output technique in the process of working out of annual plans is limited, because the economic development of a country over the course of one year period is determined by the situation in capacities, unfinished investments, by trade agreements in foreign trade, supplies in skilled manpower e.c. and considerable structural changes cannot be made. Therefore the main function of inter-branches balances in money terms, which will be constructed on the basis of planned figures in annual plans, will consist in verifying, checking the consistency of different parts and figures of annual state development plan - if the plan is balanced and harmonized according to individual branches of national economy.

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This inter-branches balance will be elaborated in a planned form. It means that the methodology of state development plan must give us the necessary information on input-output flows in the national economy. For this purpose is recommended to elaborate the input-output table in a relatively aggregative form and according to the institutional structure (for example according to ministries).

Greater utilization of input-output technique in the process of elaboration annual plans has been seen in Czechoslovakia on enterprise level. As a consequence of a new model of management and planning, greater freedom will be given to the enterprises in decision-making, in particular within the framework of the annual plan. Input-output tables on the enterprise level will be utilized for planning of material-technical supplies and organizing the delivering-receiving relations among the enterprises (for this purpose input-output tables will be constructed in physical terms) and for planning the structure of production which is most advantageous according to given material incentives for enterprises (profits, net incomes of enterprises, value added). We consider that the main method of elaboration production plans in enterprises will be the method of structural balances. The inter-prises balance for the national economy as a whole will be the aggregation of enterprises structural balances.

A much larger space for the application of input-output technique offers the drafting of perspective plans. The inter-branches balance to the five-year plan . makes possible not only to check the mutual consistency of different parts and figures of five-year plan, but also to construct several variants and to select the most advantageous one, from particular points of view. Within the framework of five-year plan it is possible to make alternative solutions of economic development and calculate the effectiveness of individual alternatives on the basis of inter-branches balances. The simplified way how to obtain different alternatives of five year plan is to change the structural pattern of final consumption and according to the equation $x = R_{,y}$ x Vector of gross production Sec. 4. And R matrix of coefficients of to reckon the value of gross producdirect and indirect requiretion according to individual branches ments per unit of final demand. y vector of final consumption. of national economy. at a matter that the state

In the field of long-term projections and plans the main significance of input-output tables is seen, because of greater possibilities in changing the structural pattern of the national economy. The process of elaboration a preliminary over-all long-term projection could comprise these stages:

- a) The over-all analysis of past development on the basis of time series of national accounts and balances and input-output tables. The result of this analysis are the main parameters and coefficients of past development.
- b) Determining the fundamental factors influencing the rates of growth of the national economy (fixed assets and investments, labour forces, division of labour, natural resources, scientific and technical progress).
- c) Preliminary determining of the rate of growth of national income.
- d) Determining the proportion between accumulation and consumption in the field of final utilization of national income.
- e) Setting up the structural pattern of personal and collective consumption.
- f) Projections in the development of fixed assets and investments according to the individual branches of the national economy.
- g) International division of labour and foreign trade.
- h) Dynamization of technical coefficients in input-output tables.
- i) Calculation of several variants on the basis of input-output table.
- j) Selection of relatively most advantageous and realistic alternative from the point of view of chosen criteria.

6. Experiences of Some Socialist Countries in Application of the Input-Output Tables.

Czechoslovakia

The first statistical inter-branches balances in a very aggregative form were constructed for the years 1957, 1958, 1959. These balances contained only 10 branches of the national economy (industry, agriculture, forestry, construction, transportation, communications, material-technical supplies, trade, marketing system for agricultural products and other branches) and were very closely connected with the system of the balance of the national economy. At the end of the fifties the preparations were made in economic research. Central Statistical Office and enterprises for-elaboration of a larger inter-branches balance. In particular, available information was investigated in primary evidence, accountancy and statistics and conclusions were made about necessary arrangements for drafting the input-output table. The statistical inter-branches balance in money terms containing 96 branches of the national economy and the statistical intercommodities balance in physical terms containing 226 commodity groups were constructed in the Central Statistical Office for the year 1962. The information about input-output flows in the national economy was obtained from a comprehensive statistical enquires specifically prepared for this purpose. Also some sectoral and enterprises structural balances were constructed (in machinery, chemical industry, textile industry, food industry, construction, iron and steel industry).

In recent years preparations are made for construction of inputoutput tables in a planned form, on the basis of planned figures or dynamized statistical data. In State Planning Commission the planned inter-commodities balance in physical terms containing 444 commodity groups was constructed for the purposes of material-technical supplies planning. To the five-year plan for the years 1966-1970 an experimental inter-branches balance in money terms containing 92 branches was constructed to verify the internal consistency of the five-year plan. On the basis of this balance some calculations regarding a new reform of prices were also made.

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The next statistical very large inter-branches balance in money terms containing about 450 branches of the national economy will be elaborated for the year 1966. This balance and also all other input-output balances will be based on the unified classification of industrial and agricultural production and on the unified new system of evidence.

The Union of Soviet Socialist Republics.

The first inter-branches balance, which was a part of the balance of the national economy, was constructed for the year 1923/24. The works in this direction were, however, interrupted. The next inter-branches balance was constructed both in money terms (83 branches) and physical terms (181 commodity groups) for the year 1959.

The planning organs then approach to elaboration of the planned input-output tables. For the year 1962 were constructed the planned balances in money terms (83 branches) and in physical terms (365 commodity groups). To the five-year plan for the years 1965-1960 the inter-branches balance in money terms was prepared.

Besides the input-output tables for the national economy as a whole also some regional and enterprises structural balances were worked out.

Poland.

The smaller input-output tables (20 x 20) were constructed for the years 1956, 1957. In the year 1962 preparations were made for elaboration a larger balance containing 145 branches of the national economy. Also the structural balances in physical units were worked out for the purposes of material-technical supplies planning. In the recent time the more detailed structural balances have been elaborated for individual sectors and enterprises.

Hungary

Two larger statistical input-output balances in money terms were finished in Hungary. The first containing 38 branches for the year 1957 and the second with 96 branches was constructed for the year 1959. In recent years have been prepared the input-output table for the year 1961 and 1963. Characteristic feature for input-output balances constructed in Hungary lies in fact that these balances are elaborated according to institutional conception of branches (branches are created by grouping of enterprises).

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Besides the statistical input-output tables also the planned balances have been elaborated in the Central Planning Commission for the year 1959 and 1964 (the order of matrix have been in the range of 20 to 40). The classification according to the ministries have been applied in these balances.

The planned balances have been also constructed at the sectoral and enterprise levels. The input-output technique was also used for price calculations.

Yugoslavia.

The statistical inter-branches balances were constructed for the years 1955 (28 branches) and 1958 (76 branches). Smaller balances (8 branches were elaborated for the years 1952-1956. Similar planned balances were worked out for the planned years 1957-1961.