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Relation of Industrial Sectoral Plans to National Plans

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0. Introduction

It is industry that makes a country rich, powerful, and, therefore, independent as well from the economic as political point of view.

Proceeding from his fact many of the economists are using the share of industry in national gross production so as to differ between developed or advanced countries and less developed or developing countries. In this case even the western and the eastern economists are in consistence.

For this very reason it must be the main task of developing countries - for the prospective, of course - to aim at building-up a strong industrial sector and to make this sector dominate within national economy.

What's to consider in such a case?

1. All the nations, and emerging new nations in particular, face the problem of modelling its own national economy. Planning, therefore, has to outline a comprehensive pattern of economic and industrial development.

2. Industrial development must be brought into line with modern techniques and technologies.

3. No one national economy can be an isolated one, but by all national economies a world-wide economic framework or mechanism is formed connected by production and foreign trade. This connection becomes closer more and more:

   - by economic development, in general,
   - by the development of traffic and transporting possibilities, and - last not least -
   - by political development forming and fixing regional international unions.

Thus, all nations must manage their national industrial development with due regard to the existing and forming types of international division of labour. Therefore, all the countries must coordinate their own industrial development with trends on the international scale. Every national industry conceived as a comprehensive and will-balanced system of division of labour must find its adequate international position..

When planning industrial development, these three main aspects must be considered urgently.

Another point in question:

Every national economy is set of heterogenous branches or activities. There is no possibility for developing all the single branches at the same rate of rapidity and at the same moment of time. Every national economy must roughly be subdivided into two main sectors:

1. Production of producer goods.
   (investment and intermediate goods)
2. Production of consumer goods

The development or the rate of growth of each of them can never be an equal one. But even within these two main sectors there are no possibilities for an equal development of all the separate branches and activities. That means, industrial development as a whole is pushed ahead by putting differentiated emphasis on the various branches.

A third point.

In all national economies equipments, outfits, as well as intermediate goods are needed in rapidly growing quantities. These growing quantities must be made available by both local production and imports.

The percentage of either source is varying from time to time and from country to country. But a speady development is neither possible without national production of such means of production nor without any imports. A national economic building-up process only based on imports would inevitably imply that the national economic growth is becoming:

- more and more dependent on imports, and
- the own possibilities of exports could not keep step with import needs

Consequently, every country must have a national production of machinery, equipment, and intermediate goods. For developing countries this is all the more important as it will contribute significantly to further economic independence.

Thus, the following is to be seen:

All countries, without considering the reached level of industrial development, need an industrial structure consisting of:

1. production of investment goods
2. production of intermediate goods
3. production of consumer goods

1. Proportions in Industry:

a- conceptional explanations

Gross production of investment goods	= p_1
Gross production of intermediate goods	= p_2
Gross production of consumer goods	= p_3
Gross production, in general	= p

The gross production of the single branches must be expressed by the single value elements forming the production:

p = investment goods + intermediate goods + wages + profit

(investment goods and intermediate goods used and wages paid so as to produce a new gross production plus profits earned after selling the goods).

We find the counterparts to these value elements in accountancy as:

used investment goods = depreciations
used intermediate goods = cost of raw-materials and semi-fabricated goods
used wages and earned profits = wages, salaries, and profits

Wages and profits are empraced and called "n"; for investment goods the abbreviation "inv" and for intermediate goods the abbreviation "int" is used.

Thus, we can state:

$$\begin{aligned} p_1 &= inv_1 + int_1 + n_1 \\ p_2 &= inv_2 + int_2 + n_2 \\ p_3 &= inv_3 + int_3 + n_3 \end{aligned}$$

$$p = p_{1-3} = inv + int + n$$

b- First assumptions for simplifying the problem

1. There is no foreign trade
2. All the single "n" are consumed,
   that means, there is no expanding reproduction, or, in other words production proceeds always at the same level.

c- The proportions within industry

The relationships, we have in mind, are determined by two factors:

1- <u>the technical factor.</u>
That means, the production of a certain volume of goods requires a definite input of investment and intermediate goods according to the average technico-economic level of production.

2- <u>the national factor.</u>
Every national economy should have a set of adequately balanced industrial branches which could unable it, potentially, to produce any element of a highly productive modern industry.

Proceding from the assumptions, mentioned above, we can state:

$$p_1 = inv_1 + inv_2 + inv_3$$

(the production of investment goods was to cover all the being demands for investment goods of these main branches)

$$p_2 = int_1 + int_2 + int_3$$

(all demands for intermediate goods must be covered by p_2)

$$p_3 = n_1 + n_2 + n_3$$

(There is no foreign trade and no expandir reproduction; all wages salaries and profits shall be consumed. The demands for consumer goods must be covered by p_3)

In connection with production and turnover we have to distinguish between

- intra branch exchanges
- inter branch exchanges

$$p_1 = \boxed{inv_1} + inv_2 + inv_3$$
$$p_2 = int_1 + \boxed{int_2} + int_3$$
$$p_3 = n_1 + n_2 + \boxed{n_3}$$

Intra branch exchanges marked by squares.

All the other parts must be distributed by inter branch exchanges; and that:

$int_1 \longrightarrow inv_2$;	therefore:	int_1	$= inv_2$
$inv_3 \longrightarrow n_1$		inv_3	$= n_1$
$int_3 \longrightarrow n_2$		int_3	$= n_2$

These mentioned conditions must be fulfilled in case of sustaining reprodustion only. In case of expanding reproduction, however, there must be

a surplus in investment and intermediate goods. That means, the equations, mentioned above, must became unequations. And that in the following way:

$$inv_3 < n_1$$
$$int_3 < n_2$$

or in words: The national income produced in branch 1 and 2 must be bigger than the investment and intermediate goods used within branch 3.

Each developing country will face the following relationships:

$$p_1 < inv_1 + inv_2 + inv_3$$
$$p_2 < int_1 + int_2 + int_3$$
$$p_3 > n_1 + n_2 + n_3$$

In words, developing countries usually are unable to realize sustaining reproduction, for there is a shortage of investment and intermediate goods. Accordingly, it is most essential for developing countries to raise, above all, the production of p_1 and p_2 at least at a level possible to ensure production at the very same level. This will, of course, not be possible at once, but it must be the very aim of developing countries to reach this level in the shortest time possible. The existing deficits in developing countries must be compansated by foreign trade activities. But it will not be enough to compensate the existing deficits by foreign trade. A less developed country would never become a developed country by doing so; over and above, it never would become neither economicaly nor politically an independent country.[1)]

2. Demonstration of relations

Which problems must be solved?

1. Relationships between physical structure of total output and physical structure of production requirements must be made evident;

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1) c.f. Memo No. 384, Dr. Engert, The role of industry in economic development.
Memo No. 409, Dr. Engert, Structural problems of industry.

2. The same for the relationships between physical structure of total output and physical structure of final demand.

3. An analysis concerning value and physical composition of the gross national product must be made.

These three points imply the whole linkage of national economy, or, in other words, the relation of industry sectoral plans to national plans.

These relations can only be made demonstrable by so-called interlacing balances or input-output tables. An interlacing balance is an aggregate table of the results of all detailed planning operations rather than a plan. We are enabled by using interlacing balances to go deeper into the verious economic processes and into the structure of production.

And that, under two points of view:

1- regarding the rise and
2- regarding the appropriation of produced goods within production and within consumption

We are enabled by using interlacing balances to connect the single sectoral plans so as to form a national plan of industrial development and of economic development in general.

USE / SOURCES		POWER	MINING	METALLURGY	CHEMICAL INDUSTRY	CONSTR. MAT. IND.	HEAVY ENGINEERING		TRADE	SUNDRY BRANCHES	TOTAL USED MATER.	USED FIXED CAPTT.	INVESTMENT	INCREAS. STOCKS	CONSUMPTION	EXPORT	TOTAL APPROPRIATT
		1	2	3	4	5	6		26	27	28	29	30	31	32	33	34
POWER	1																
MINING	2																
METALLURGY	3																
CHEMICAL IND.	4																
								1.SQUARE				3.SQUARE					
TRADE	26																
SUNDRY BRANCHES	27																
TOTAL USED MATER.	28																
DEPRECIATIONS	29																
WAGES	30																
SURPLUS	31																
NET PRODUCT	32																
GROSS PRODUCT	33							2.SQUARE									
INCREAS. STOCKS	34																
IMPORT	35																
TOTAL SOURCES	36																

Please look at the skeleton

Horizontally and vertically there is to be seen the very same subdivision (up to column and line 29).

This subdivision is taken in accordance with the classification of industry, valid in all socialist countries. It goes without saying that countries which embarked upon a policy of international coordination and specialization of their production must have adequate tools of planning.

By this way of subdividing we are able to add vertically the gross production of each branch. We find the gross production within line No. 33. Furthermore, we find the same composition of the gross product within the lines No. 28 to 31.

	Line No. 28	=	used materials	compensation fund	Cost of production
+	" " 29	=	used fixed capitals		
+	" " 30	=	wages and salaries		surplus
+	" " 31	=	profit		
=	Line No. 33	=	gross product (produced)		

Horizontally, there can be seen what total production had actually been used for.

Within the columns 1-27 the compensation in the various branches can be seen; within 30 and 31 the means ready for accumulation can be found, and, finally, within column 32 the possible consumption is contained. Thus, we have horizontally the appropriation of the produced gross product as:

means needed so as to replace
used materials and fixed assets
(total of columns 1-27 = 28)

\+ means available to be accumulated
(investment fund (col. 30) and increase in Stocks (col 31)

\+ means available to be consumed (col 32)

= gross product (produced)

summarizing, there can be stated:

1. Within the first square of an interlacing balance the more reproduction of used means of production is reflected:
   - by the lines of this square the appropriation of materials for replacing used working capital is made demonstrable;
   - by the columns the structure of cost as well as the requirements of the single branches are made visible.

   By the first square, therefore, the total of used materials and the replacement of working capital is made visible, and thus, simultaneously the production relationships of all branches are shown.

2. The second square contains the depreciations and the net product as well. By adding the figures of the first and the second square we receive all the expenditures of dead and living labour, or, in other words the structure of cost. After adding the import and the decreasing stocks to the produced gross product, we receive the total of goods available within the planning period in question.

3. Finally, it is the task of the third square to inform us how the national income and the compensation fund of fixed assets is covered physically.

   While by the first square the sustaining reproduction of working capital is reflected, the third square shows us:

   a- how the expanding reproduction
   b- how the satisfaction of requirements within the non-productive sphere, and
   c- how the replacement of fixed capital within the productive sphere is covered.

   By adding the first and the third square we'll receive the total application of the gross national product for the sake of:

   a- replacement
   b- accumulation, and
   c- consumption.

By considering the export, too, we receive, finally, the application of the total of goods and performances available within the planned period.

The following balancing connections become perspicuous:

1. The total of the first and the second square must be equal to the total of the first and the third square.
2. The total of the second square must be consistant with the total of the third square.
3. It must be stressed that not the single elements must be in concordance but only the totals of the single squares.

Generally speaking, interlacing balances largely facilitate economic analyses and decisions. They show the extent of our choice and taking of final decisions, provided, of course that we use concepts corresponding to the real economic categories.

For realizing these possiblities all balances have to be transformed into mathematical shapes which actually permit calculations.

Usually, the following mathematical symbols are used:

x = quantities exchanged between sectors, in general;
x_1 = quantities coming from sector 1,
x_{11} = quantities delivered from sector 1 to sector 1;
x_{12} = quantities delivered from sector 1 to sector 2;
x_1 = total quantities delivered by sector 1
y_1 = final use or external use from sector 1

Brought into a mathematical shape that will look like:

		ind. (1)		agri. (2)		constr. (3)		external use		Total
industry	(1)	x_{11}	+	x_{12}	+	x_{13}	+	y_1	=	x_1
(1) agriculture	(2)	x_{21}	+	x_{22}	+	x_{23}	+	y_2	=	x_2
construction	(3)	x_{31}	+	x_{32}	+	x_{33}	+	y_3	=	x_3

Thus, it can be seen the degree of interdependence between the single sectors. This mentioned interdependence can be made evident by a so-called technical coefficient; for instance:

$$\frac{x_{11}}{x_1} = a_{11} \quad (= \text{technical coefficient})$$

$$\frac{x_{12}}{x_2} = a_{12}$$

$$\frac{x_{13}}{x_3} = a_{13}$$

In this case x_{11}, x_{12}, and x_{13} represent cost elements of x_1, x_2, x_3; therefore, by a_{11} is shown the direct dependence of x_{11} upon x_1, by a_{12} that of x_{12} upon x_2, by a_{13} that of x_{13} upon x_3 a.s.o.

This dependence in made perspicuous by:

$$x_{11} = a_{11} \cdot X_1$$
$$x_{12} = a_{12} \cdot X_2$$
$$x_{13} = a_{13} \cdot X_3$$

Now we are able to transform our first mathematical shape (1) into (2):

$$\begin{aligned} a_{11}X_1 + a_{12}X_2 + a_{13}X_3 + y_1 &= X_1 \\ a_{21}X_1 + a_{22}X_2 + a_{23}X_3 + y_2 &= X_2 \\ a_{31}X_1 + a_{32}X_2 + a_{33}X_3 + y_3 &= X_3 \end{aligned} \qquad (2)$$

By using such a mathematical shape we are enabled to calculate the degree of interdependence between the single branches or sectors as well as the volume of necessary production, if a certain final or external use is given.

Let us explain this by using a figurative example.

1. Introduction and task

By planning authorities an increase of production is projected. Now the rate of growth regarding the single branches shall be decided.

1.1 Conditions

a. There are three main branches, for instance, industry, construction, and agriculture.

B. These three branches are linked to each other. The linkage is marked by so-called technical coefficients; and that:

$$0.10X + 0.25X_2 + 0.20X_3 + y_1 = X_1$$
$$0.01X_1 + 0.05X_2 + 0.02X_3 + y_2 = X_2$$
$$0.05X_1 + 0.03X_2 + 0.04X_3 + y_3 = X_3$$

In this case there are:
$a_{11} = 0.10$; that means, 10% of the output of P_1 is used within P_1; $a_{12} = 0.25$, or 25% of P_2 is used within P_2 etc.

c. The external use, expressed by y_{i-j}, is as:

$y_1 = 50$
$y_2 = 140$
$y_3 = 40$

1.2 The way of solution

a. The corresponding matrix must be found
b. This matrix must be inverted.
c. The inverted matrix must be multiplied with the vector formed by the single y.
d. The result of this calculation will represent the necessary volume of production which must be produced by the single branches for meeting both the internal and the external use.

2. Solution:

a. According to our task and according to the given conditions as well, the following system of mathematic equations can be formed:

$$X_1 = 0.10X_1 + 0.25X_2 + 0.20X_3 + 50$$
$$X_2 = 0.01X_1 + 0.05X_2 + 0.02X_3 + 140$$
$$X_3 = 0.05X_1 + 0.03X_2 + 0.04X_3 + 40$$

b. Accordingly, the matrix M will be:

$$M = \begin{pmatrix} 0.10 & 0.25 & 0.20 \\ 0.01 & 0.05 & 0.02 \\ 0.05 & 0.03 & 0.04 \end{pmatrix}$$

the corresponding vector, formed by the external use, is:

$$y = \begin{pmatrix} 50 \\ 140 \\ 40 \end{pmatrix}$$

c. Now the matrix S-M (standard matrix-matrix) must be formed:

$$\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} - \begin{pmatrix} 0.10 & 0.25 & 0.20 \\ 0.01 & 0.05 & 0.02 \\ 0.05 & 0.03 & 0.04 \end{pmatrix} = \begin{pmatrix} 0.90 & -0.25 & -0.20 \\ -0.01 & 0.95 & -0.02 \\ -0.05 & -0.03 & 0.96 \end{pmatrix}$$

d. The matrix S-M must be inverted into $(S - M)^{-1}$.

1. Therefore, at first, the value of the corresponding determinant must be calculated:

$$D = \begin{vmatrix} 0.90 & -0.25 & -0.20 \\ -0.01 & 0.95 & -0.02 \\ -0.05 & -0.03 & 0.96 \end{vmatrix} = 0.808$$

2. The single algebraic complements must be formed:

$$A_{11} = \begin{vmatrix} 0.95 & -0.02 \\ -0.03 & 0.96 \end{vmatrix} = 0.9114$$

$$A_{12} = - \begin{vmatrix} -0.01 & -0.02 \\ -0.05 & 0.96 \end{vmatrix} = 0.0106$$

$$A_{13} = \begin{vmatrix} -0.01 & 0.95 \\ -0.05 & -0.03 \end{vmatrix} = 0.0478$$

$$A_{21} = - \begin{vmatrix} -0.25 & -0.20 \\ -0.03 & 0.96 \end{vmatrix} = 0.246$$

$$A_{22} = \begin{vmatrix} 0.90 & -0.20 \\ -0.05 & 0.96 \end{vmatrix} = 0.854$$

$$A_{23} = - \begin{vmatrix} 0.90 & -0.25 \\ -0.05 & -0.03 \end{vmatrix} = 0.0395$$

$$A_{31} = \begin{vmatrix} -0.25 & -0.20 \\ 0.95 & -0.02 \end{vmatrix} = 0.195$$

$$A_{32} = - \begin{vmatrix} 0.90 & -0.20 \\ -0.01 & 0.02 \end{vmatrix} = 0.020$$

$$A_{33} = \begin{vmatrix} 0.90 & -0.25 \\ -0.01 & 0.95 \end{vmatrix} = 0.852$$

2. For the value of the corresponding determinant has been: 0.808, we will receive the following inverted matrix:

$$(S-M)^{-1} = \begin{pmatrix} \frac{0.9114}{0.808} & \frac{0.246}{0.808} & \frac{0.195}{0.808} \\ \frac{0.0106}{0.808} & \frac{0.854}{0.808} & \frac{0.020}{0.808} \\ \frac{0.0478}{0.808} & \frac{0.0395}{0.808} & \frac{0.852}{0.808} \end{pmatrix}$$

or:

$$(S-M)^{-1} = \begin{pmatrix} 1.128 & 0.3 & 0.24 \\ 0.013 & 1.05 & 0.024 \\ 0.059 & 0.049 & 1.05 \end{pmatrix}$$

4. Now, we have to calculate:

$(S - M)^{-1} \cdot y = X$, and according to our results, there must be calculated:

$$\begin{pmatrix} 1.128 & 0.3 & 0.24 \\ 0.013 & 1.05 & 0.024 \\ 0.059 & 0.049 & 1.05 \end{pmatrix} \cdot \begin{pmatrix} 50 \\ 140 \\ 40 \end{pmatrix} = \begin{matrix} X_1 \\ X_2 \\ X_3 \end{matrix}$$

or

$$1.128.50 + 0.3.140 + 0.24.40 = X_1$$

$$0.013.50 + 1.05.140 + 0.024.40 = X_2$$

$$0.059.50 + 0.049.140 + 1.05.40 = X_3$$

Thus, we will get:

$X_1 = 108.0$
$X_2 = 148.6$
$X_3 = 51.8$

Thus, we have calculated the shares of the single branches in the national gross production so as to cover the inter branch demands as well as the intra branch demands and the given external use.

This is, of course, a more than simplified example. It is expected to demonstrate you the possibility: how to connect the sectoral plans of industry by considering all the necessary proportions. National economy is not a thing anyhow, but if it is expected to come to useful results it must be a very well adjusted system which might be compared with a clock-work consisting of a lot of small and smallest wheels.

We can transform our example into a real national economic system. In our example we only used three branches. We can, of course replace these three branches by all the existing branches; that means, we are able to form a matrix, proceeding from our used interlacing balance, containing all the available industrial branches. It goes without saying that such a matrix cannot be calculated manually. In such a case we need computers. But that is another question, not to be dealt with in our memorandum.

Final Remarks

It has been my aim to explain to you the close connections between the single sectoral plans on the one hand and the national plan on the other.

Finally, we can state: sectoral plans are nothing else than essential ingredients of a comprehensive national plan. Proceeding form this very fact we have to pay due attention to the adjustment of the single sectoral plans. That means, it is impossible to draft a useful national plan only by adding the single sectoral plans. We have to bring all these sectoral plans totally. We have to look at the fact that there is a real interdependence between all the single branches. And according to this we have to set our planning system in action.

The necessary proportions for developing economy cannot be seen by single enterprises or organizations of enterprises. On the other hand, a central planning authority would not be able to estimate the true situation regarding supply and demand. Thus, planning itself must be a system of division of labour thought out carefully.

What does that mean in detail? Planning cannot be the matter neither of a centrelized planning authority nor of the single enterprises or organizations of enterprises, no matter the dominating ownership relations - planning, however must rather be realized by a close collaboration between enterprises and centralized planning authority. And that in such a way that some main indicators, concerning the national economic proportions and fixing the aims of national economic development in general, must be elaborated by the planning authority (for instance, ministry of planning, planning committee or what the name ever will be). To fulfil this plan, these main indicators with life, will be the tasks of the enterprises and the organizations of enterprises. But-and it is all the more important to stress this, since in developing countries there are mainly privately-owned enterprises, these main indicators given by the planning authority may not being looked upon as mere proposals. Quite the contrary, these main indicators must be looked upon as true plan tasks bound to be reached.

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