8. INDUSTRIAL SECTORAL PLANS AND NATIONAL PLANS

8.1 - INTRODUCTION

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

Proceeding from this 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.

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

Following are the few considerations to fulfill above objective:

1. All the nations, and emerging new nations in particular, face the problem of modeling 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 closure:

- by economic development, in general;

- by the development of traffic and transporting possibilities, and last not least intra-structure.

Every national economy is set of heterogeneous 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 factors:

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 equal. 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 various branches.

8.2 - PROPORTIONS IN INDUSTRIES

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 country to country. But a speedy development is neither possible without national production nor without any imports. A national economic building-up process only based upon imports would inevitably imply that 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 country like India, this is all the more important as it will contribute significantly to further economic independence.

Therefore, all ecountries, 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.

8.2.1 : CONCEPTUAL EXPLANATION

Suppose:
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 = \text{Investment} + \text{Intermediate} + \text{Wages} + \text{Profit}\)$$

Goods

(Investment goods and intermediate goods consumed and wages 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 material and semi-processed goods
Used wages and earned profits = wages, salary and profits

Let

Investment goods are denoted by 'Inv'
Intermediate goods are denoted by 'Int'
and wages plus profits denoted by 'n'

Thus

$$p_1 = \text{Inv}_1 + \text{Int}_1 + n_1$$
$$p_2 = \text{Inv}_2 + \text{Int}_2 + n_2$$
$$p_3 = \text{Inv}_3 + \text{Int}_3 + n_3$$
$$p = p_{1-3} = \text{Inv} + \text{Int} + n$$
a) Assumptions for Simplifying the Problem

1) There is no foreign trade,
2) all the single 'n' are consumed,

that means, there is no expanding production.

b) The Proportions within the Industry

The relationships can be determined by two factors:

1) Technical Factor. The production of a certain volume of goods requires a definite input of investment and intermediate goods according to average technico-economic level of production.

2) The National Factor. Every national economy should have a set of adequately balanced industrial branches which could enable it, potentially, to produce any element of a highly productive modern industry.

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

\[ P_1 = \text{Inv}_1 + \text{Inv}_2 + \text{Inv}_3 \]

(the production of investment goods was to cover all the forecasted demands for investment goods.)

\[ P_2 = \text{Int}_1 + \text{Int}_2 + \text{Int}_3 \]

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

\[ P_3 = n_1 + n_2 + n_3 \]
(There is no foreign trade and no expanding production; all wages, salary and profit will be consumed. The demand 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

$p_1 = Inv_1 + Int_1 + n_1$
$p_2 = Inv_2 + Int_2 + n_2$
$p_3 + Inv_3 + Int_3 + n_3$

Intra branch exchanges are thus marked by squares.

All the other parts must be distributed by inter branch exchanges as follows:

$Int_1 \rightarrow Inv$, therefore, $Int_1 = Inv_2$
$Inv_3 \rightarrow n_1$, therefore, $Inv_3 = n_1$
$Int_3 \rightarrow n_2$, therefore, $Int_3 = n_2$

These mentioned conditions must be fulfilled in case of sustaining reproduction only. In case of expansion of production, there must be a surplus in investment and intermediate goods. If this will be the case the above equilibrium will be distributed as:

$Inv_3 < n_1$
$Int_3 < n_2$
or in otherwords, the national income produced in branch 1 and 2 must be greater than the investment and intermediate goods used within branch 3.

Therefore, each developing country will face the following relationships:

\[ p_1 < \text{Inv}_1 + \text{Inv}_2 + \text{Inv}_3 \]
\[ p_2 < \text{Int}_1 + \text{Int}_2 + \text{Int}_3 \]
\[ p_3 > n_1 + n_2 + n_3 \]

In otherwords, developing countries, usually are unable to realize sustaining reproduction, because 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 very aim of developing countries to reach this level in the shortest time possible. The existing deficits in developing countries must be compensated by foreign trade activities. But it will not 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 economically nor potentially an independent country.

8.3 - DEMONSTRATION OF RELATIONS

To start with let us assume:
a) Relationships between physical structure of total output and physical structure of production requirements must be made evident.

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

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

These three points implied the whole linkage, of national economy, or in otherwords, the relation of industry sectoral plan 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 can analyze by using interlacing balances to go deeper into the various economic processes and structure of productions in view of the following points:

1. regarding the rise;

2. regarding the appropriation of produced goods within production and within consumption.

The further analysis can provide the relationship by using interlacing balances to connect the single sectoral plans so as to form a national plan of industrial and economic development in general.
<table>
<thead>
<tr>
<th>Source</th>
<th>Power</th>
<th>Mining</th>
<th>Metallurgy</th>
<th>Trade</th>
<th>Sundry Branches</th>
<th>Total Used Mat.</th>
<th>Depreciations</th>
<th>Wages</th>
<th>Surplus</th>
<th>Net Product</th>
<th>Increased Stocks</th>
<th>Imports</th>
<th>Total Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
</tr>
</tbody>
</table>
According to the Table XYZ, horizontally and vertically there is the same classification up to column and rows.

This sub-division is taken according to the classification of industry. By this way of sub-dividing the vertically addition will give the gross production of each branch. We can find the gross production within line # 33. Furthermore, we can also find the same composition of the gross product within the line # 28 to 31.

\[
\text{Line \# 28} = \text{Used materials} \quad \{ \text{Consumption} \quad \{ \text{Funds} \} \quad \text{Cost of Production} \\
+ \text{Line \# 29} = \text{Used fixed capital} \quad \} \quad \} \\
+ \text{Line \# 30} = \text{Wages and salaries} \quad \} \\
+ \text{Line \# 31} = \text{Profit} \quad \text{Three surplus} \\
\hline
= \text{Line \# 33} = \text{Gross product (produced)}
\]

By row analysis, it can be seen what total production has actually been used for.

Within the columns 1-27, the compensation in the various branches can be visible. 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:

\[
\text{Means needed to replace used materials and fixed assets (total of Col.1-27 = 28)} \\
+ \text{Means available to be accumulated (investment fund, Col.30) and increase in stocks (Col.31)} \\
+ \text{Means available to be consumed (Col.32)} \\
= \text{Gross product.}
\]
8.4 - SUMMARIZING THESE RESULTS

1) Within the first square of an interlacing balances the more production or 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 the requirements of the single branches are more 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 second square we receive all the expenditures or the structure of cost. After adding the import and decreasing stocks to the produced gross product, the total of goods available within the planning period in question.

3) Finally, it is the task of the third square to inform 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:

a) how to expand production;

b) how to satisfy requirements within the non-productive sphere;

c) how the replacement of fixed capital within the productive environment is covered.
By adding the first and third square, the total application of the gross national product:

a) replacement;
b) accumulation; and
c) consumption

can be obtained.

By considering the export, the application of total of goods and performances available within the planned period can be obtained:

a) the total of the first and second squares must equal to the total of first and third squares;
b) the total of second square must be consistent with the total of third square; and
c) it must be stressed that not the single elements must be in concordance but only the totals of the single square.

8.5 - INTERLACING BALANCES

Generally speaking, interlacing balances explained in section 8.4 largely facilitate economic analysis and decisions. They show the extent of our choice and reflect final decisions provided concepts corresponding to real economic categories are considered.

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

Suppose:
\[ X_1 = \text{Quantities exchanged between sectors in general} \]
\[ X_{11} = \text{Quantities coming from sector 1} \]
\[ X_{11} = \text{Quantities delivered from sector 1 to sector 1} \]
\[ X_{12} = \text{Quantities delivered from sector 1 to sector 2} \]
\[ Y_1 = \text{Final or external use of sector 1} \]
\[ X_{13} = \text{Quantities delivered from sector 1 to sector 3, and so on.} \]

Bringing the mathematical model based on Table XYZ:

<table>
<thead>
<tr>
<th>Industry (1)</th>
<th>Agriculture (2)</th>
<th>Construction (3)</th>
<th>External Use</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>( X_{11} ) + ( X_{12} ) + ( X_{13} ) + ( Y_1 ) = ( X_1 )</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( X_{21} ) + ( X_{22} ) + ( X_{23} ) + ( Y_2 ) = ( X_2 )</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( X_{31} ) + ( X_{32} ) + ( X_{33} ) + ( Y_3 ) = ( X_3 )</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EXHIBIT 1**

Thus by Exhibit 1 the interdependence between the single sectors can be explained by technical coefficient as follows:

\[
\begin{align*}
\frac{X_{11}}{X_1} &= a_{11} \\
\frac{X_{12}}{X_2} &= a_{12} \\
\end{align*}
\]

\[
\begin{align*}
\frac{X_{13}}{X_3} &= a_{13}
\end{align*}
\]

Technical coefficients

In this case \( X_{11}, X_{12}, \) and \( X_{13} \) represent cost elements of \( X_1, X_2 \) and \( X_3 \) therefore \( a_{11} \) has shown the direct dependence of \( X_{11} \) upon \( X_1 \) and so on with \( X_{12} \) and \( X_{13} \).
This dependence is made perspicuous by

\[ X_{11} = a_{11} \cdot X_1 \]
\[ X_{12} = a_{12} \cdot X_2 \]
\[ X_{13} = a_{13} \cdot X_3 \]

By these technical coefficients the Exhibit 1 mathematical equations can be transformed as follows:

\[ a_{11}X_1 + a_{12}X_2 + a_{13}X_3 + Y_1 = X_1 \]
\[ z_{21}X_1 + a_{22}X_2 + a_{23}X_3 + Y_2 = X_2 \]
\[ a_{31}X_1 + a_{32}X_2 + a_{33}X_3 + Y_3 = X_3 \]

**EXHIBIT 2**

By using above model the degree of interdependence between the single branches or sectors as well as the volume of necessary production is obtained if a certain final or external use is given.

This can be explained by the following numerical proof:

8.5.1: **NUMERICAL PROOF**

1) **Introduction and Task**

Increase of production is projected by planning authorities. Task will be to decide the rate of growth of the single branches or sectors.
2) **Conditions (Assumptions)**

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

b) These three branches are linked to each other. The linkage is marked by so called technical coefficients; and can be represented as follows:

\[
0.10 \, X_1 + 0.25 \, X_2 + 0.20 \, X_3 + Y_1 = X_1 \\
0.01 \, X_1 + 0.05 \, X_2 + 0.02 \, X_3 + Y_2 = X_2 \\
0.05 \, X_1 + 0.03 \, X_2 + 0.04 \, X_3 + Y_3 = X_3
\]

In this case \( a_{11} = 0.10 \) implies that 10% of the output of industry is consumed within that industry, etc.

3) The external use expressed by \( Y_{i-j} \), is as

\[
Y_1 = 50 \\
Y_2 = 140 \\
Y_3 = 40
\]

4) The following strategy will be followed to structure the model and represent the results:

a) The corresponding matrix will be found.

b) This matrix will be inverted.

c) The inverted matrix will be multiplied with vector formed by single \( Y \).

d) The results of this calculation will represent the necessary volume of production which must be produced by the single branches for meeting for both the internal and external use.
Let us deal above strategy in detail as follows:

a) According to the task and given condition the following mathematical equation can be drawn:

\[ X_1 = 0.10 X_1 + 0.25 X_2 + 0.20 X_3 + 50 \]
\[ X_2 = 0.10 X_1 + 0.05 X_2 + 0.02 X_3 + 140 \]
\[ X_3 = 0.05 X_1 + 0.03 X_2 + 0.04 X_3 + 40 \]

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 by the external use will be:

\[
Y = \begin{pmatrix}
50 \\
140 \\
40
\end{pmatrix}
\]

c) Now the matrix \( (S-M) \) Standard Matrix - Matrix

\[
\begin{pmatrix}
1 & 0 & 0 \\
0 & 1 & 0 \\
0 & 0 & 1
\end{pmatrix} \begin{pmatrix}
0.10 & 0.25 & 0.20 \\
0.01 & 0.05 & 0.02 \\
0.05 & 0.03 & 0.04
\end{pmatrix} = \begin{pmatrix}
0.90 & -0.25 & -0.20 \\
-0.01 & 0.95 & -0.02 \\
-0.05 & -0.03 & 0.93
\end{pmatrix}
\]

d) The inverse of \( (S-M) \) will be:

1) At first the value of corresponding determinant will 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:

\[ A_{11} = \begin{vmatrix} 0.95 & -0.02 \\ -0.03 & 0.96 \end{vmatrix} = 0.808 \]

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

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

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

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

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

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

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

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

3) For the value of corresponding determinant 0.808 the inverse Matrix will be:
\[
(S-M)^{-1} = \begin{bmatrix}
0.9114 & 0.240 & 0.195 \\
0.808 & 0.808 & 0.808 \\
0.0106 & 0.854 & 0.020 \\
0.808 & 0.808 & 0.808 \\
0.478 & 0.0395 & 0.852 \\
0.808 & 0.808 & 0.808
\end{bmatrix}
\]

or

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

4) Multiplying it by the \( Y \) vector

\[
(S-M)^{-1} \cdot Y = X
\]

\[
\begin{bmatrix}
1.128 & 0.03 & 0.24 \\
0.013 & 1.05 & 0.024 \\
0.059 & 0.049 & 1.05
\end{bmatrix}
\begin{bmatrix}
50 \\
140 \\
40
\end{bmatrix}
= X
\]

or

\[
1.128 \times 50 + 0.3 \times 140 + 0.24 \times 40 = X_1
\]
\[
0.013 \times 50 + 1.05 \times 140 + 0.024 \times 40 = X_2
\]
\[
0.059 \times 50 + 0.049 \times 140 + 1.05 \times 40 = X_3
\]

Thus

\[
X_1 = 108.0
\]
\[
X_2 = 148.6
\]
\[
X_3 = 51.8
\]

Therefore, these will be the share of the single branches in the national gross production to cover the inter branch demands as well as the intra branch demands at the given external use.

This is, of course, a more than simplified example. It is expected to demonstrate the possibility to connect the sec-
toral plans of the industry by considering all the necessary proportions. National economy is not a thing anyhow, but it is expected to yield useful results, it must be very well adjusted system which might be compared with a clock-work consisting of a lot of small components.

This example can be transformed into a real economic system. The three branches used in the example can be replaced by all the branches and for calculation a computer is needed.

8.6 - CONCLUSIONS

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

Finally, it can be concluded that sectoral plans are nothing else but essential ingredients of a comprehensive national plan - proceeding from this point of view, Government should pay attention to the adjustment of single sectoral plans. It is impossible to draft a useful national plan only by adding the single sectoral plans. All the sectoral plans have to be brought together and to be looked for real interdependence between all the single branches.

The necessary proportions for developing economy cannot be seen by single enterprises or organization. On the other hand, the Central Planning Authority would not be able
to estimate true situation regarding supply and demand. Thus planning itself must be a division of responsibilities carried out carefully. In otherwords, planning cannot be the matter neither of Planning Commission nor of single organizations or enterprises, no matter the dominating ownership relations - planning, however, must rather be realized by close collaboration between Planning Commission and private organizations. And that in such a way some main indicators of national economic proportions must be elaborated by Planning Commission. To fulfill this plan, these main indicators will be the task of organizations. These main indicators given by the planning authority may not be looked upon as mere proposals. Quite the contrary these main indicators must be looked upon as true plan tasks bound to be reached.