OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

D03848

Distr.
LIMITED

ID/WG.113/27
27 September 1972

ORIGINAL: ENGLISH

United Nations Industrial Development Organization

Regional Seminar on Machine Tools
for Countries in Latin America

Buenos Aires, Argentina
16 - 25 October 1972

Sao Paulo, Brasil
26 - 27 October 1972

[redacted]

by

Arturo Cannetta
Unione Costruttori Italiani Macchine Utensili
U.C.I.M.U.
Milan, Italy

1/ The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the Secretariat of UNIDO. This document has been reproduced without formal editing.

id.72-5742

We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche.

C O N T E N T S

INTRODUCTION page 1

Chapter I - The Engineering Industry and Machine Tools in the economies of developed countries " 3

1.1. Some features of the machine tool industry " 3
1.2. Some features of the engineering industry " 7
1.3. A concrete example: engineering and machine tool production in Italy in 1970 " 12

Chapter II - Consumption of machinery and of machine tools in the economies of developing countries " 16

2.1. Introduction " 16
2.2. Consumption of machinery " 17
2.3. Consumption of machine tools " 19

Chapter III - Development processes " 22

3.1. Introduction " 22
3.2. Some general aspects of programming and planning " 23
3.3. The chief instruments of programming " 28
3.3.1. Accelerated growth of in-puts " 30
3.3.2. In-puts for improving utilization of given resources " 31
3.3.3. Democratization of the control over economic affairs " 32

Chapter IV - Engineering and machine tools in development " 34

4.1. The terms of this survey
4.2. General problems of development: demand and investments " 34
4.3. The structure of industrialization " 36
4.4. Some general parameters for industrial development " 39
4.5. The engineering industry in general development " 47
4.6. The metal processing machine tool industry in the general development " 52

Chapter V - Some examples of programming " 58

5.1. Introduction " 58
5.2. Some declarations of objectives " 59
5.3. Some programmatic assumptions relating to industry and to engineering in particular " 62
5.4. Programmatic assumptions relating to the development of machine tools " 64

NOTE " 67

INTRODUCTION

When we accepted the invitation to present this report to the Buenos Aires seminary, we at once tried to contact the principal countries through CECIMO and MTTA, or through the individual authorities representing them in Italy, to secure as much information as possible about their programming and planning activity.

A considerable number of replies were received, especially from the CECIMO and MTTA member countries. Some of the answers were merely negative as, for that matter, was to be expected; for example, from the United States, Holland and Denmark, and others too, where little or no planning is going on. But from others we received positive replies accompanied by explanatory literature.

We take this opportunity of thanking the industrial federations and/or diplomatic representatives of Italy, France, England, Poland, Chile, Spain and Israel, whose material we have used in drawing up this report.

Unfortunately, however, the majority of countries who plan their economies (whether collectively or otherwise) either sent in evasive replies or none at all. Perhaps we were too optimistic or perhaps they found our special interest in data on machine tools disconcerting.

At this stage we must stress the fact that, in spite of all our efforts, we were unable to obtain details of the most recent economic plan for our own country, even though it was of particular interest to us because it includes a special section devoted to machine tools. What documentation

we did manage to secure does not in fact mention them. Where programming is concerned, engineering is generally treated as a whole, and only the French and English plans deal specifically with machine tools.

What was then to be done? We decided all the same to present the seminary with a general picture based on the incomplete material supplied to us and, at the same time, we tried to work out some assumptions concerning the position which the machine tool industry should or could hold in a policy of development. Special attention was of course given to the position the problem would assume in South American countries.

We apologise to those taking part in the seminary for the inadequacy of this information which, not entirely through our own fault, we have been unable to present in a more complete form. But we hope that the conclusions drawn in our report will at least attract the attention of everyone present to a question we believe to be important, and that it will encourage the undertaking of more detailed studies leading to better results than those we have been able to achieve.

CHAPTER I

The Engineering Industry and Machine Tools in the economies of developed countries

1.1 Some features of the machine tool industry

In the economic structures of developed countries, the machine tool industry (1) holds a special place; on the one hand it represents a key sector in the industrialization of any one country (seeing that, to some extent, machine tools form the basis of the entire productive process - the matrix for making not only other machines but also for the production of machine tools themselves) while, on the other hand, in money terms the value of its products represents a negligible part of the various G.N.Ps and even of the country's industrial output as a whole. (As will be seen further on, these ratios are expressed in thousandth parts) Only in the category in which the machine tool industry is usually included for statistical purposes (engineering or metal working) does its output reach even low percentage levels.

This situation naturally derives from the very nature of technological development itself, whereby the machines and even more so, the machine tools (which are the machines for building machinery), give a higher yield in those economies where optimum use is made of resources.

---

(1) The machine tools referred to in this study are only those for processing metal and do not include those for wood and plastic materials and for tool making. The term "machine tools" will be expressed by the letters m.t.

Thus the scissor-like trend between output (in quantitative terms expressed in the number of machine, or in terms of non-inflated currencies) of m.tn. and the G.N.P. or industrial output, represents a main feature of this branch of industry in the economy of each developed country.

Though aware that generalizations can be risky, we would indeed state that the quicker the process of industrial development of a country is, the greater is the gap between the volume (as described above) of output in each field and that of the country as a whole.

It is not so easy however to identify this trend between branches of any one industry and the industry itself. The output of these branches being so heterogeneous, evolution of the industry in the different countries varies, depending as it does on historical conditions and on the particular economic and social aims of each single country.

Even without considering those countries with collective planning systems (where, for example, precedence is given to manufacturing the means of production rather than consumer goods) the incidence of output from the engineering industry in developed countries in relation to the G.N.P., and also to the entire industrial output, varies a great deal. This is of course due to some extent to differing statistical methods, but it depends in the main on structural differences within the systems themselves (productivity, extent to which plant is made use of, etc.). In this connection Table I gives some significant comparisons.

Table I

Proportion held by the engineering industry in the G.N.P. and in the overall output of the manufacturing industries, in some industrialized countries

(calculated on current market prices)

- - - - - -

		Proportion held by the engineering industry (in %)	
		G.N.P.	Mfg. industries
	German F. R. (1969)	9,75	22,81
	France (1970)	8,80	24,80
	Italy (1970)	7,13	22,37
(1)	Holland (1968)	4,00	12,49
	Belgium (1960)	8,43	27,62
	U.K. (1969)	8,32	18,40
(1)	U.S.A. (1970)	5,63	8,64
	Japan (1970)	9,65	24,30

(1) The figures for Holland and the U.S.A. are lower in proportion than those for the other countries, partly because their respective engineering industries quoted are only those producing means of production.

Note: For the sake of interest we may remind readers that the U.N. survey (Commission for Latin America) supplied the following overall average ratios for the South American countries: proportion held by the engineering industry in the G.N.P. = 4.0%, and for the manufacturing industries 17.0%.

Sources: E.E.C. Institute of Statistics

USA - Bureau of Census

By rights what has been said up till now should be further corrected seeing that the ratio to establish is that between internal consumption or absorption levels and the other parameters. Particularly in the case of m.ts., rates of output rarely coincide with absorption since we are dealing with an international commodity and 30% of all m.ts. made is exported both to non-producer countries (or developing countries) and also to producer countries themselves. A feature of m.ts. is in fact that of being not only upstream of industrial processes, but also to embody the most advanced technologies. No country, therefore, is self-sufficient because the diversification of its production as a whole must be fed by the process of research and development, and this is international in character. (2)

Further, and especially in countries with a market economy, the structural features of the individual engineering industries (3) make it economic only to produce certain types of m.ts. so that the others must be imported. Even in countries run by collective planning, there is trade in m.ts. reaching quite appreciable figures in each country's budget. Indeed, when one of these countries decides to make a special drive in a particular branch of engineering (e.g. the recent emphasis on car and truck production in the U.S.S.R.) the importance of m.ts. becomes very great and even of absolute priority. (Subsequently imports may be limited to acquisition of know-how.)

---

(2) Not even in the U.S.A. there is self-sufficiency though though it produces the highest percentage out of all countries (about 20%) of its own m.t. requirements.

(3) The engineering industry is responsible for about 80-85% of m.t. consumption, the remainder going to school workshops and being used for research carried on inside the m.t. industry itself.

1.2 Some features of the engineering industry

The following points may be noted on the engineering industry and the difficulties involved in considering it both from the technological and structural points of view, according to the number of branches included in it:

a) technology

Here the chief common denominator consists of half finished metal goods (cast iron, representing about 60% of the total, sheet steel which incorporates considerable percentages of nickel and chrome, and plating) from the metallurgical industry. In this way many branches, differing both as regards processing techniques and in their final products, may be included under a single heading. Up to now a common factor to processing techniques in engineering has, however, been their intermittent nature (a greater or lesser amount of idle time) contrary to the situation prevailing in metallurgy and in the chemical industry where the flow of work is continuous. Historically speaking, the fundamental stage in the technological development of engineering processes - particularly in the production of m.ts. - occurs in the change-over from mechanization to automation which means in practice reducing idle time. This stage is affected by large-scale production (on which in turn it has its own counter-effect), and is organized by splitting up the work into a number of movements for each single worker, and by standardization. This development in industrial technology has in turn led to the deterioration in man to machine relationships (Taylorism, for example) (4).

(4) Automation achieves the highest rate of productivity of all factors (capital, and labour in particular) rather than splitting up complex jobs into a number of repetitive movements. In the case of m.ts. this has led to the creation of special machines (up to transfer types) but thereby greatly reducing plant flexibility. In engineering too, vertical integration has become an important feature in the drive towards scale economies.

In other words, the complementary functions of capital and labour (which technical evolution should bring about) have now been modified in the sense that the one is becoming more and more replaceable by the other (this possibility being conditioned solely by their varying costs in each single market).

It would appear that, with the application of electronics to machine tools (numerically controlled m.ts.) a <u>third stage</u> is now taking shape in the development of mechanical processes (alongside the introduction of computers in the field of business and administration), this being the combination of process automation with the entire range of m.t. uses, however versatile these may be, with plant of any and every degree of flexibility, and with the application of non-repetitive processes. Amongst other things, this should assist the creation of a new and different man-machine relationship (i.e. between capital and labour) a feature of which should be a growing tendency away from repetitive manual operations towards managerial, designing and planning work etc. making ever greater demands on brain power. (5) Due allowance must be made for this when discussing the problems concerning programming or planning which form the main subject matter of this study.

Before ending these notes on engineering, we would emphasise the fact that, contrary to the criteria referred to above,

---

(5) Electronic drive advantageously replaces electro-mechanical control which makes alterations in plans of work very expensive, economically possible only if they do not occur too frequently. For this reason, electro-mechanical control must remain limited to very large scale production.

many classifications also include those foundries making semi-finished goods only by continuous cycle processes. The reason for this is that over 60% of their output goes to the engineering firms amongst which the biggest consumers are makers of m.t.s. (6) In nearly all countries this has resulted in a decided tendency on the part of the industries using such goods to operate a policy of vertical integration with the foundries (in some cases, however, it is the foundries which have appropriated the industries using their products). To some extent, integration has been encouraged by the need to ensure a supply of cast iron of a particular quality. For these reasons, partly functional and partly determined by the difficulty of separating the foundry from the engineering workshop, where they operate on the same site, the main sources of statistics include foundries making semi-finished goods in with the engineering industry.

b) Structure

While the metallurgical industry produces semi-finished goods, the engineering industry only turns out finished articles which may be divided as follows:

1. Intermediate goods to be mounted or assembled by engineering firms other than the makers;
2. Means of production, i.e. investments, of a durable nature forming part of a company's fixed capital (as will be seen further on, engineering as a whole supplies about half of all industrial investments in the technologically

(6) The remainder goes to the building industry, to iron metallurgy, ingot casting, rollers for rolling mills.

developed countries;

3. durable consumer goods.

As usually only the items under points 1 and 2 go to form the fixed and moveable capital of companies, it is important to note that there are big variations in the structures of engineering firms, per final product, between one country and another.

For example, in Table II we are giving some figures for this group of industry in the most important countries with a market economy (in those with a collective economy the structural features of this industry differ on account of the differing function of the demand).

TABLE II

Structure according to final product in engineering output in certain countries in 1967 (percentages)

Final product	U.S.A.	Japan	W.Germany	U.K.	France	Italy
Intermediate and capital goods	81.0	81.0	79.7	85.0	78.0	68.9
Durable consumer goods	19.0	19.0	20.3	15.0	22.0	31.1
Totals	100.0	100.0	100.0	100.0	100.0	100.0

Source: ISPE

There is another structural feature of the engineering industry which is of special interest for the purposes of this study, this being the way the flow of input goods is organized. Among

all sections of the manufacturing industry, engineering shows the highest degree of interdependence among its various branches. Taking Italy as an example, the results given by the table on inter-branch activity for 1967 show that 65% of the inputs came from sections of engineering itself and from foundries (especially those making semi-finished articles).

Finally, as regards location of factories and numbers of employees, the different branches of the industry are so unlike each other as to make any structural definition meaningless. Engineering in fact includes branches such as: workshops, precision engineering, general engineering products etc. and, even in the most highly developed countries, most of the work is still organised along artisan lines. On the other hand, in other branches such as machine construction, transport vehicles, electrical machinery, foundries, industrial machinery and m.ts., over 90% of the work is organised on an industrial basis.

As far as concerns the sizes of the individual manufacturing units, only some organize the greater part of their output in large-scale plants (over 1000 employees,, these being the makers of transport vehicles, haulage vehicles and electrical high-precision machinery. But while in the case of haulage vehicles, centralization is made necessary by the nature of the product - most often very large and requiring highly specialized work - centralization in the other branches is due to the fact that large-scale production prevails (cars, typewriters, roller bearings, etc.). The small and medium-sized firms predominate in the other branches (machine construction). With the sole exception

of transport vehicle production, it would seem, however, that the most recent tendencies in engineering work as a whole in the industrialized countries, lie towards expanding total productive capacity alongside a reduction in centralization. (7)

1.3 A concrete example: engineering and m.t.production in Italy 1970

Before examining the features of engineering production and seeing where its products go in the developing countries, we think it advisable to give those attending this Seminary an overall picture of the relationships which engineering and especially m.t. production, have in the developed countries throughout the world, under the most significant headings.

As explained earlier, two serious obstacles lie in the way of drawing up an overall picture enabling these relationships to be examined comparitively; these being the intrinsic differences in the social and economic structures of the different markets, and the heterogeneous nature of statistical data.

As regards the first obstacle, we already have seen how the positions of the class of industry and of its branches differ in collectively planned economies compared with market economies. The amount of pressure exercised by user demand and by the political aims of the planners in creating these relationships, does in fact differ. (8)

---

(7) As far as concerns the m.t. industry in countries with market economy, the medium and small firms predominate (e.g. 70-80 employees in Italy and the U.S.A., 200 in the German Federal Republic.

(8) For example, the main structural feature of the m.t. industry in countries with collectively planned economies, is that of great centralization of productive units and employees.

Regarding statistical data, emphasis has already been laid on the lack of homogeneity in the way engineering is classified between one country and another (which to some extent renders uncertain the meaning of the data in our Table I). There seems no point here in going further into the question of the ways statistics are compiled for each branch, category and even product of the engineering industry. Only this year UCIMU has published a report on the serious lack of method applied to ISTAT's survey on the number of machine tools in Italy in 1967 which, even though, was carried out covering over twelve thousand operational units and which, therefore, provides one of the most comprehensive and complex studies available in this field.

For this reason we think it would be most significant and useful to provide a picture on a macroeconomic scale, with recent data relating to a single developed country like Italy (the seventh in the world taken as a whole) with a mixed economy (extensive privately owned industry alongside a considerable sector of publicly-owned companies and services), and with long experience of planning.

In Table III we are therefore giving some of the most important data on the engineering and m.t. industries under the most significant economic and financial headings for the purposes of this study.

TABLE III

Comparison between the engineering and machine tool industries in Italy in 1970 under the main economic headings.

Panel A Productive factors (in billions of lire)

	Quantity	% of G.N.P.	Factors	Quantity	% of total investment
Production:			Investments: total:	12,327	100.0
G.N.P.	58,212	100.0	of these:		
Industry	20,983	36.0	Industry	3,721	30.1
Mfg.industry	14,901	25.7	Mfg.industry	2,800	22.7
Eng.industry	4,065	6.8	Eng.industry	520	4.2
1) M.t.industry	294	0.5	M.t.industry	17	0.1

1) Consumption (production + imports - exports) of m.t. amounts to 243 billion lire of which about 85% is estimated as taken up by industry (i.e. about 207 billion lire, as calculated in panel B 2).

Panel B Ratios between the engineering and m.t. industries

B 1 Production

	%
a) Engineering / G.N.P.	6.8
Engineering / Industry	19.0
Engineering / Mfg.industry	27.3
b) M.t. industry / G.N.P.	0.5
M.t. industry / Industry	1.47
M.t. industry / Mfg. industry	1.64
M.t. industry / Engineering	7.3

contd.

TABLE III (contd.)

B 2 Investments in machinery (°) and in m.ts.

1. Machinery out of total investments
(2.845 billions out of 12.237) = 23.0%
out of which m.ts. are 243 = 2.0%

2. Machinery out of investments in industry
(1,685 billions out of 3,721) = 44.0%
out of which m.ts. are 207 = 5.5%

3. Machinery out of engineering investments
(338 billions out of 520) = 65.0%
out of which m.ts. are 207 = 39.8%

(°) For the reasons given in Table II, in 1970 machinery is considered as 70% of engineering production, this being 2,845 billions.

Sources: data from ISTAT

CHAPTER II

Consumption of machinery and of m.ts. in the economies of developing countries

2.1 Introduction

The definition "developing" includes countries at different stages on the road to progress and these may be: industrialized, even though less extensively than the most important European countries, the U.S.A., USSR, Japan and the Chinese People's Republic; semi-industrialized, in that the percentage of their G.N.Ps from manufacturing sources is extremely low compared with that from primary activity; and lastly, countries whose development has not even yet begun.

In this report we can only follow the United Nations' general classification which defines them all as "developing" countries. South and Central America (9 and 10 countries respectively), Africa (19 countries), Asia (22 countries, excluding Japan) and some European countries (4) discuss their positions with the developed countries at the Seminaries which UNO (through UNIDO) organized, first on an interregional basis in 1966, and later (since 197) on a regional basis, regarding problems of the metal working industries, especially of machine tool makers. A total of 65 countries is concerned and, even if 1968 only is considered, they can offer very few parameters able to serve as a basis for comparison: not the G.N.P. per head, on the whole very low but which also may exceed 1000 dollars a year in countries like Israel ($1460) whose wealth mainly comes from industry, and like Libya ($1412) (9) whose economy is tied to its oil wells; not their size and/or population, and even less their economic structures

---

(9) Kuwait is not included though it has the highest income per head in the world.

seeing that Mexico, the big countries of Latin America, Israel, India and Poland, to cite only a few examples, cannot be compared structurally with many of the smaller African and Asiatic countries. (10)

But if a sufficiently applicable point of reference must at all costs be sought, this may well be found in m.t. production which, as we shall see, is at a very low level, or even non-existent, in all the developing countries (except for the six in Table IV).

The expression "developing countries" is therefore used in this study with the limits and the reservations proper to it, referred to above.

2.2 Consumption of machinery

The lack of statistics, and their incommensurable nature where they do exist, is even greater for the developing countries; although there is plenty of documentary material concerning them, quite as good as that for the more industrialized countries, as regards figures, all that is available from particular branches of industry or from the United Nations, only gives approximate estimates. For this study, therefore, we have decided not to take output from engineering and from the m.t. industry as a basis, but rather consumption of industrial machinery and of m.t.s. in particular. This will enable us not only to supply some overall and, we hope, significant data, but also to avoid any kind of contraposition between producer and non-producer countries.

---

(10) According to the U.N. conventional classification, there are 26 industrialized countries (the 23 in the O.E.C.D., plus Australia, New Zealand and South Africa). Now obsolete, this classification is based on the ceiling of $1000 income per head.

With regard to consumption of industrial machinery or, we might say, of the means of production, average figures for 1965-68 are available (11) and in view of the periodical fluctuations which are a characteristic of purchases of such commodities, the data relating to one year only is more significant. The same data is available for m.ts. as well, and this is given in Table IV under regional groupings.

It is impossible to correlate the figures given in Table IV with those available for industrialized countries because our source does not precisely state the basis of classification adopted in compiling the data relative to the term "consumption of machinery" (see Note 11). However, comparing this data with the chief ratios between the G.N.P. and the engineering industry (Table II) in these countries, or with the parameters for investments in plant and machinery made in Italy in 1970 (Table III), it is clear that, even considering the developing countries in their regional groupings, industrialization is only now making a start.

---

(11) Data given in Table IV were supplied by the courtesy of UNIDO. As stated in the notes to Table III B, in Italy about 70% of engineering output consists of producer goods. Allowing for the information contained in Table II, this percentage may be considered as an optimistic indication for the developing countries.

Table IV

Gross national products, consumption of means of production and relative percentages.

Round averages for 1965/68 (in millions of dollars)

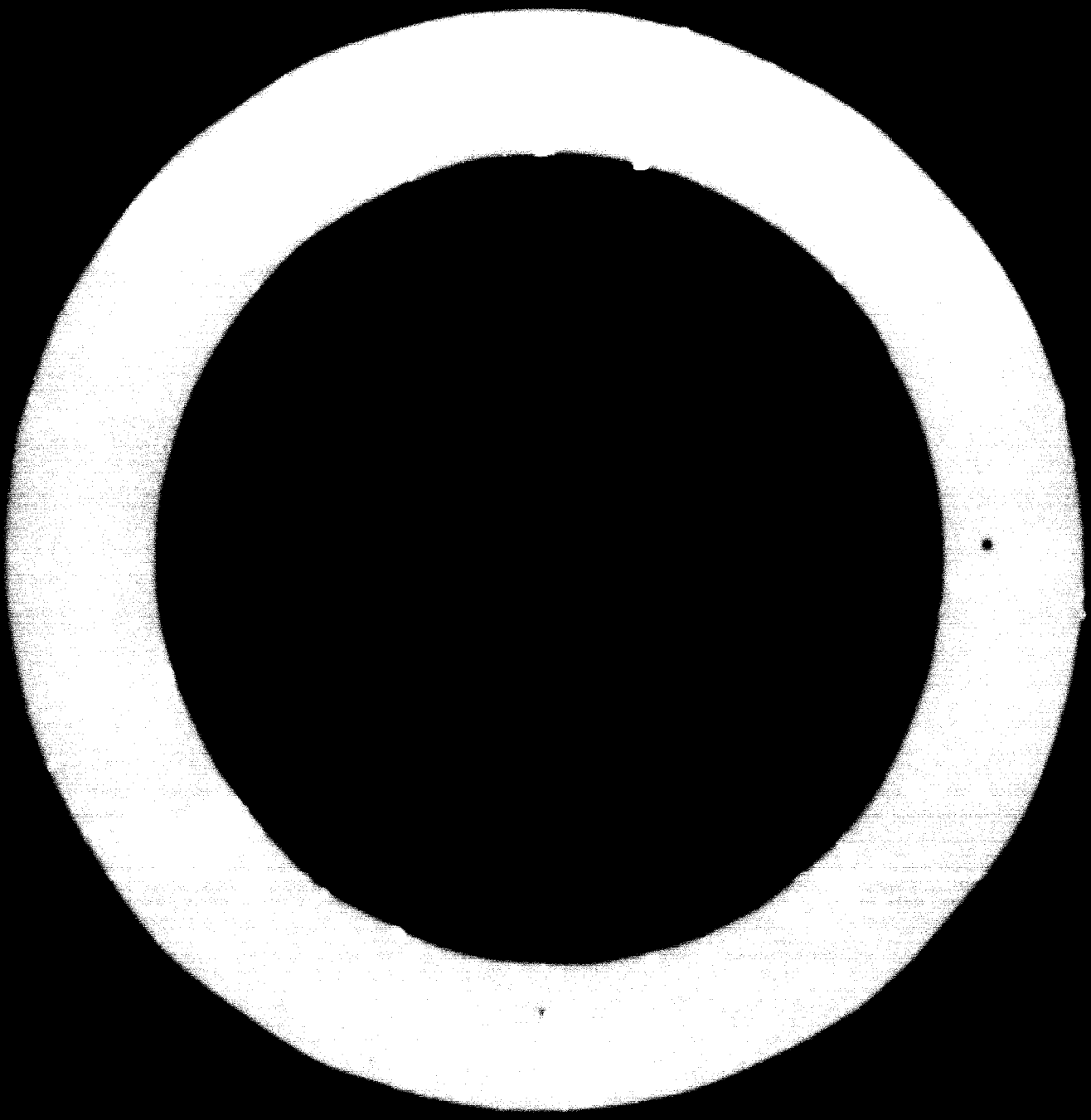
for 59 developing countries

Regions	Nº of countries	G.N.P.	Consumption of machinery	Perc. of G.N.P.
Central America	10	27.304	973	3,5
South America	9	83.304	1.379	1,7
North African	6	31.[illegible]	[illegible]	1,1
Central African	1	1.[illegible]	[illegible]	0,8
South African	8	7.[illegible]	[illegible]	0,5
West African	4	15.[illegible]	[illegible]	0,9
Middle East	7	14.[illegible]	[illegible]	0,7
Asia Iº (**)	7	66.[illegible]	[illegible]	0,8
Asia IIº (**)	7	184.[illegible]	1.[illegible]	0,8
Totals	59*			1,3 average

* Round numbers

(**) The I Asian group includes: Indonesia, the Philippines, Thailand, Korea, South Vietnam, Malaysia, Singapore.

The II Asian group includes: India, Pakistan, Burma, Laos, Taiwan, Ceylon, Hong Kong.



2.3 Consumption of machine tools

For m.ts. we also have data concerning overall world production including that in developing countries (already included among the producer countries). According to the journal American Machinist, in 1970 the value of world production (31 countries) of metal cutting and forming m.ts. was 7,803 million dollars, while trade in these machines was 2,618.4 million dollars worth of exports and 2,190.4 million dollars worth of imports. 76.6% of world production, 64% of exports and over 42% of imports is confined to six countries: the German Federal Republic, the U.S.A., U.S.S.R., Japan, U.K. and Italy.(12)

It would be best to pause and consider these figures before proceeding. First of all, world production, in value, of m.ts. is only slightly higher than that of the engineering industry in one medium-sized country alone (Italy in 1970, for example). Concentration of production and trade to a few countries is very high indeed. Exports represent over 33.7% of overall production and go to all countries in the world (including producer countries); this is why at the beginning of our report we recalled the fact that the m.t. is an "international commodity".

Now to consider consumption: out of the 31 producer countries, 25 are in the so-called developed class (as defined above) and 6 in the developing class. Table V shows the position of these latter in the same year - 1970.

---

(12) see details in Table VI.

TABLE V

Forward developing countries, producers of m.ts.

Production, and import-export in 1970 (in millions of dollars)

	Production	Export	Import
Chinese People's Republic	52.0	3.0	40.0
Brazil	33.8	4.6	34.6
Argentina	32.4	2.0	36.9
India	31.2	3.7	24.0
Taiwan	14.2	3.1	9.8
Mexico (estimates)	5.0	0.1	65.0
Totals	168.6	15.5	210.3

Source: American Machinist '72

The other 59 developing countries, included in Table IV, do not appear to have produced any quantity of m.ts. by industrial methods.

Table VI gives the general situation regarding production, exports, imports and consumption throughout the world.

TABLE VI

Production, exports, imports, consumption and percentages of m.ts. throughout the world, in 1970 (millions of $)

Countries	Output	Export	Import	Consumption	% of consumption
Industrialized (25)	7,635.1	2,602.9	1,940.1	6,972.3	90
Forward developing of. Table V)	168.6	15.5	210.3	363.4	+ 4
Developing (59)	--	--	468.0	468.0	+ 6
Totals	7,803.7	2,618.4	2,618.4	7,803.7	100

Source: data from U.N. and American Machinist

In view of the key position held by the machine tool in engineering (a concrete example is given in Table III) and of engineering in the economy of a system, the technological, industrial and economic gap existing between industrialized and developing countries can only be described as extremely serious. This is brought out by the fact that 59 countries who are not m.t. producers have a total annual consumption (about 280,000 million lire) which is less than the output of one single medium-sized industrialized country like Italy (cf. Table III).

CHAPTER III

DEVELOPMENT PROCESSES

3.1 Introduction

The social crises which have accompanied technological evolution in the industrialized countries have helped to create an ambiguous attitude towards machines. On the other hand we have indiscriminate praise of mechanization and automation (verging on dreams of a science fiction society of robots), and on the other, censure and disparagement of machinery and of industrialization as a whole. While the first attitude is symptomatic of technocratic ideology gone mad, the other, in its many and varied forms, from the theories of alienation to a wholesale rejection of the "consumer society", often betrays traces of Luddite tendencies. In our opinion the divergent aspects of this attitude embody the basic idea common to both, that is, of men being replaced and ousted by machinery, rather than that of machinery providing the means for creating more and more new products, freeing men to an ever greater extent from manual operations and increasing the use of his intellectual powers.

In other words, one of the essential parameters for estimating technological evolution is not only the quantity of goods produced, but the extent to which the operator can assume a directional function, and can plan and control his work. Thus alienation is replaced by participation, passive subordination by responsibility, and we think it is by these standards that intensive technological progress, and the industrialization that goes with it, must be judged, as to whether or not they are essential parts of real progress towards a higher form of civilization.

Considered in this light, technological evolution today can only make sense if its aim is not merely that of replacing men by machines or, in economic terminology, labour by capital (public and private), but rather of making the two complementary. As however, the interchangeability of both factors is conditioned by their price ratio, or rather by a market operating in competitive circumstances (13) which are more or less "perfect", alongside the use of the price factor, as expressed by the demand, the criterion of complementariety also imposes the adoption of other economic and financial instruments, even if external to the market, in order to correct and complete a system which, if allowed to drift under the effect of internal factors, would evolve in a lop-sided fashion.

3.2 Some general aspects of programming and planning

Apart from the question of contemporary political ideologies (even though these are of importance in helping to create a higher form of society, as briefly referred to in the introduction to this chapter) there is no doubt that all countries, whatever their degree of industrialization, are afflicted by deep structural, social, cultural and economic crises, and it is in this context that the enormous problems facing the developing countries - in deciding how best to industrialize and which way to develop - must be seen. The correlation between man and machinery, between man and his surroundings, between development and resources, is the subject of general attention (14) and, for

---

(13) For the question of prices in collective economies, see below.

(14) See, for example, the recent survey carried out by the M.I.T's System Dynamic Group (Italian translation: "I limiti dello sviluppo" Mondadori 1972).

the first time in the history of Western culture, it seems that specialization, that driving force (even to the point of destructiveness) behind our technologically based "civilization", is meeting with a growing resistance expressed in the need for domestic and international companies to coordinate all the components of the economic and social process, one with another, and to act in harmony with the natural surroundings in which they exist and function.

"Industrialization" being the subject of our survey, we should now consider one of its essential aspects: that concerning programming and planning which, within the general picture given above, provide the main theme in the economic policies of many countries.

A few concepts may here be usefully recalled: first of all the distinction between collective and other types of economies. This is not merely an expedient to avoid the usual contraposition between socialist and capitalist countries, the aim being rather to avoid risking the confusion which the question of ownership of the means of production may create when the main discussion concerns their use (that is, the aim behind production and who controls it). This distinction in fact serves not only to clarify the features of each system, but also to single out those they have in common, or which are similar to both; this seems to us of the highest importance.

By the expression "collectively run economy" we mean those productive structures in which there is a monopoly on the entire output as far as concerns its management, while at least to some extent, it is independent of the demand.

More precisely, we might say that in these economies there is very little flexibility in the demand and prices are of a purely administrative character. (15)
But to some extent at least, the concept of optimum use and efficient distribution of resources is also a feature of collectively planned economies. Proof of this is found in the adoption of "shadow prices" and the growing use of linear programming in finding solutions to particular problems of Soviet planning. Social aims, as compared with economic ones do, however, prevail in the USSR and, generally speaking, in those countries with a similar economic structure. In other words, instead of basing income distribution on strictly technological factors (like the marginal product of the factors of production), these are correlated to social factors. Emphasis is thus placed on the relationship between productive forces rather than on their rational organization. A main feature of these economic systems is the priority given to the manufacture of the means of production instead of consumer goods. This aspect of the matter is not however related to the system itself, in theory flexible for any other purpose, but is determined by certain historical reasons.
A useful example of how economic development is subordinated to social aims (even though the purpose of this effort is that of securing an optimum exploitation of resources) is seen in the aims announced for the most recent centralised plan in Poland (1971-1975), arranged in the following order:

---

(15) In view of the highly concentrated nature of American economy, Furtado states that over 90% of prices in that market may be considered "administrative", i.e. fixed independently of the law of supply and demand, on a different basis (marketing, publicity, etc.) This is of course only a short term policy.

a) concentration on the essential social and economic objectives, and on the means for realising them;
b) assurance of conditions of objectivity, of the scientific and modern aspect of the demand;
c) the fight against bureaucracy;
d) inclusion of the Five-Year Plan into an overall one lasting until 1990.
e) greater importance for economic calculations, to be applied to all fields of the country's economy. (16)

In countries with a non-collective economy, programming and planning may or may not exist officially (17) according to whether productive activity is partly public and partly private ("mixed" economies) or whether it is entirely run by private enterprise (apart from some public services).

But in these latter countries too - habitually called free market or free enterprise countries - where planning is not a question of policy, laissez faire is a thing of the past. Even according to the "neoclassic" conception, the task of public bodies is in fact that of continually removing the obstacles lying in the way of full market flexibility so as to make the best possible use of available resources over a long-term period. Every one knows that this can only be done in a condition of general economic balance (expressed by price stability), where productive factors and the products themselves are as fully competitive as it is possible for them to be. The structure of the demand is thus altered by internal factors. The means available

(16) Source: The 1971-1975 Polish Plan. Material supplied by the local I.C.E. office.

(17) As conditions of imperfect competition always prevail, programming does in fact take diverse forms and, within certain limits, is carried out by the oligopolies and monopolies.

to public bodies have very little to do with management in the field of production as such (except for services, public works or special programmes like the famous Tennessee Valley); in the main they are of a financial and fiscal nature.

In countries with a mixed economy the need to operate harmoniously between a wide field of public administration and a much wider one of private enterprise most often involves recognition of programming and economic planning as necessities. At present, in what is after all an experimental stage, programmes include different types of objectives and a greater or lesser degree of rigidity in planning. Even so, generally speaking we have the following two fundamental lines common to both private and public fields:

a) the need to achieve over a long period, not a state of balance, but of growth or development of the productive systems. Thanks to technical progress, to accumulation of reproductive capital and to quantitative and qualitative changes in population, resources are not considered as merely given but as progressively expanding; (18)

b) the existence of big savings excluded from the economic, social, cultural and political life of the country. The need to bring them into the system altering the structure of the demand by means of external factors of an economic, but also extra-economic nature (istitutional, cultural, etc.).

---

(18) The "capital" provided by Nature (land, mines, etc.) cannot be reproduced. But that capital which expresses the overall sum of work done in the past can be reproduced, and enables the productivity of present-day factors to be increased. Thus, the greater the accumulation the higher the utilization of technological progress.

While point (a) is a fundamental starting point for economic programming in the strict sense of the word, point (b) is the basis for a planning or development policy, as it aims to secure active participation of all those taking part in the given economic system, and involves profound social evolution (distribution of incomes), political evolution (democratic management of institutional and economic power) as well as cultural evolution (democratic conservation and development of the cultural and environmental heritage).

3.) The chief instruments of programming

All we will give here is a summary outline of the means at the disposal of public bodies for development and planning. (19)

Declaration of aims: as already stated, programming may present a very wide range of methods of application. For the sake of simplicity we will single out the two extremes including between them a whole series of mixed or intermediate solutions: overall programming carried out by regulating decisions on the market through public intervention, and project programming in which there is no public decision making, but which can put into effect specific promotional programmes using public and productive administrational means (in addition to the usual financial and fiscal means).

The overall type should also include collective programming and most of those hitherto put into effect in mixed economy countries. The second type includes, for example, British and French programmes (and after its much disputed course, the latest Italian one as well), so that in this

(19) The most common methods used for programming are detailed on the Harrod/Domar type (cf. respectively Harrod "Dynamic Economics" and Domar "Capital Expansion")

one we have available with a view to planning a centrally directed economy.

It is clear that the overall programmes, to some extent more for effort and decisive, are found necessary in the initial stages of development when the kind of demand handed down from the past must gradually be given a new structure, and the use of resources must undergo radical alteration. These programmes are of course characterized by rigidity as regards time aspect and size, and further, the social aspect decidedly prevails over the economic, leaving variations to be made in line with basic political decisions.

Although programming is one of the needs created by the social crises of our times, we feel it is more pertinent here to evaluate it more as an economic instrument, and we shall therefore only refer to the general type of programming.

A determination of the aims that any Plan sets before it, and the methods proposed for carrying it out, always precede details of the means that will be used for doing so.

The objectives (or intentions, or terms of reference) related to a diagnosis of the present situation in which the system finds itself, are _____ (that is, they give more or less prominence to the social and economic aims; or else they are strictly economic and concern the optimum exploitation of resources; or else again they have a merely circumstantial character) and _____ (meaning that they establish the annual rate of growth, this being cumulative for the period covered by the Plan, for the whole system, for its divisions and sections, as well as the rate at which productivity must increase etc.).

The determination of time also includes indications of the op-

[illegible] ... elongation ... agreement between ... etc.). ... simulation ... consumption and investment in each branch of industry, as after (as has happened for example in working out the French plans) private enterprise forms that estimates for the different industrial branches will cause a conflict of competitive forces while strengthening monopoly positions.

3.3.1 Accelerated growth of income

This is the first large group of instruments a Plan usually lists. Their function consists essentially in stimulating an increase - cumulative and qualitative - of the resources given. Having fixed the annual average (or cumulative) rates of increase of the labour force and of product per employee which it is expected will be achieved (e.g. in the Italian Plan for 1961-64 these were respectively 0.6% and 3.8% annually), indication is given of the physical and human investments which it is thought will be made.

Before looking at this latter group of instruments more closely, we will note, once again, that they contribute to increasing the productivity of the whole system (which in turn acts on the accumulation of capital). For the amount of capital investments too, the percentage of G.N.P. which the State or the employers must allocate in time, the employers' percep-

[illegible] investments which the [illegible] are [illegible] by using [illegible] on public works (social and private programs) and on [illegible] not worth [illegible].

With regard to human investment, the public works also support [illegible] spending there are a burden on the State, but a big percentage is contributed to private enterprise (research and development, and technical training). Taxes levied by the State also ensure training (due to the failure [illegible] of public education, not only of technical training) as well as to research and development. (21).

3.3.2 [illegible] Distribution of the Increase

This represents the second big group of investments - previously controlled by public bodies. As we have seen, this group [illegible] with the rest of the area of spending on

---

(20) The [illegible] from additional taxes which can be obtained by the increase in capital investments (from 18% to 19%) on a profit of about 15% p.a. (net of depreciation but not of taxation) on private investments. About 40% of this percentage can be [illegible] (private profit) and the difference on the average on a basis in the form of [illegible] employee [illegible], payroll of technology, etc. but of taxation and in additional consumption on the part of private profit [illegible] to G.D. We see that [illegible] that half the rise in productivity is contained in the complementary growth inputs and the other half is the [illegible] obtained by I.D.

(21) Referring once more to the British Plan, 0.8% of the G.D.P. (1964) devoted to expenses of public education (i.e. of more than in the previous five years) caused acceleration of annual average growth estimated at around 0.15% and 0.2% per. [illegible] the [illegible] from 1.5% in the period 1954-1964 to 1.9% of the G.D.P. devoted to research and development caused a [illegible] of about 0.4% p.a. in the rate of growth.

productivity generally. There is a great number of these instruments and they grow with the development of research in economics and econometrics. Here, we will therefore only list the chief ones, the effects of which are already well known:

a) a lessening of the obstacles standing in the way of mobility of labour and capital;

b) tax relief and incentives for investments and, generally speaking, factors which affect productive units, their purchase, installation and management;

c) reaction to price variations;

d) creation of areas or centres of development;

e) taxation on motor vehicles, on land values, car parking;

f) environmental safeguards;

g) publicity about and control over the real costs of public utility expenses.

3.3.3 [illegible] the social and economic effects

This is obviously one of the characterizing points and is decisive for the conduct of programming within planning policy. Examples occur in a number of operations, both institutional and economic, the aim of which is the

a) ensure the co-operativity of "intermediate" bodies (free associations, trade unions, etc.) in controlling execution of the programme, in addition to its formulation;

b) clarification of the particular interests pursued by each group;

c) over all consequent relationship between private and community interests.

d) frequent, continuous and reliable documentation, data and macroeconomic indices relating to the system and each part of it;

e) an equitable degree of participation by all groupings for the benefit of general development.

Without going into the details of each single operation, we will merely emphasise the fact that democratic management of the economy provides the main theme for the debate going on in all countries on income distribution. It is outside the scope of this study to make any estimation of this problem. However we cannot but recall that the two extremes within which economists are discussing the matter may thus be summed up:

1. subordination of income distribution to democratic control of the system and of the whole economic structure, or
2. giving precedence to optimum economic management, and subordinate income distribution to the marginal income of the factors concerned.

CHAPTER IV

ENGINEERING AND M.TS. IN DEVELOPMENT

4.1 The terms of this survey

In our report we have set as a limit the assumption of development taking place under the impulse of industrialization, to see to what extent is affected by engineering and machine tool production. As mentioned on several occasions, the interrelation between all factors of the different major economic divisions (primary and tertiary activity, with special reference to foreign trade, as well as public administration) and also non-economic (culture, research and/or transfer of technology) is so close that the phenomenon of industrialization cannot be considered alone. But the limits which this report imposes on us prevents us from carrying forward the analysis beyond the boundaries laid down for it.

For this and other reasons we shall not even consider the assumption - so important for some developing countries - of a form of development founded in the main on the expansion of foreign trade by a more intensive exploitation of the given resources (agricultural, mining, etc.) and a parallel growth of imports of the most essential manufactured goods (for that matter, as will be seen below, foreign trade also carries out an important function in the type of development we are about to examine).

4.2 General problems of development : demand and investments

Industrial development only takes place when the supply of manufactured goods increases more quickly than the overall income of the community. This growth, which is more than

proportional, of industrial production allocated to the home demand, is also accompanied by an increased coefficient of foreign trade.

The increase in flow necessarily assumes the character of an increase in and diversification of the demand. This is the fundamental aspect of development. If the structure it has inherited from the demand does not undergo any changes i.e. it remains substantially the same as at the time when the growth process began - supplementary income would be distributed and the demand be diversified within the restricted circile of the already priveleged classes. This would not only deprive development of the social aims proper to it, but would also make it economically contradictory. Diversification of an increase in demand by already priveleged classes would, in fact, turn towards the production of ever more sophisticated products, with a high technological content, such as cannot be produced at internationally competitive prices in a restricted market.

Restructuration of the demand must therefore be the constant parameter of development; it in fact expresses increasing absorption of the large isolated groups previously mentioned, within the system.

Once the process has been given its initial stimulus, and its inner impulses are renewed by restructuration and diversification of items of consumption, the flexibility of productive structures must be increased. Industrialisation in fact works towards this end because, manufacturing being so versatile, it is always able to introduce new products. But this requires more investments (a quantity of capital for each unit of the other factors in the system: labour, means of production, research, etc.), a more thorough assimilation of technological progress and a constant improvement of the quality of the various productive factors.

In the developing countries, where alterations in the total demand generally tend to be quicker, international trade which offers practically unlimited flexibility, makes it possible to adapt the internal productive system in a more rational manner to suit diversification of demand. Further, and this also applies to countries already highly industrialized, international trade is an essential component for the assimilation of technological progress - international itself beyond all doubt.

4.3 The structure of industrialization

According to the research done by Chenery (22), confirmed by recent economic analyses as well, there is a close relation between development and industrialisation. Chenery made a comparison between the economic structures of 51 industrialized and developing countries and examined the chief productive factors relating to two variables; one internal - income per hand, and one external - the size of the country. The productive factors examined are: labour, fixed capital, skilled and specialised work, natural resources. For the purposes of this survey we will only give the essential conclusions:

a) income per head and productive factors (that is, electricity/income from the growth of industrialized production): the correlation coefficient is very high indeed: 1.36 for the whole of industry, and still higher if related to the manufacturing industries only in 51 countries, i.e. 1.44. According to Chenery, the correlation depends on:

1. replacing imports by home production;
2. increasing the demand for final products;

---

(22) H.B.Chenery "Patterns of Industrial Growth" in The American Economic Review, 1960; and H.B.Chenery and Clark "Interindustry economics" Wiley and Sons.

3. expanding the demand for home made products (induced by the processes referred to under points 1 and 2). This latter point is especially important for the purposes of developing the engineering industry and, in particular, the means of production.

As regards the consequences of this close correlation, two main structural modifications must be given prominence. The first consists in the continuous increase in the share of industrial production in total output. For example, by passing from an income per head of 100 dollars up to 1000 dollars, this share rises from 17% to 36%. At the same time that of transport, services and communications (infrastructures) doubles, while that in primary activity drops from 45% to 15%.

The second consequence appears in the deep-seated changes which development brings about within the industrial structures themselves, that is, an increase in the share held by means of production goods and investments (cf. point 3) to total production (23). A very significant example for the developing countries consists in the structural changes taking place when an income per head of 100 dollars rises to 300 and 600 dollars.

	100	300	600
Means of production goods	12.0	23.6	34.5
Intermediate goods	19.7	22.3	22.6
Consumer goods	68.3	54.1	42.9
Totals	100.0	100.0	100.0

As, at the 600 dollar per head level (cf. note below), industrial output represents about 35% of the total product, and in the stage we are assuming, this signifies that means of production goods would contribute about 12% (buildings in-

(23) cf. Leontieff and A. Carter "The position of metalworking industries", referred to further on.

cluded) to the G.N.P. As these means of production goods represent about [illegible] of gross investment, it may be concluded that the country concerned can maintain this structure or condition that is gross investment rate is 10% (with the trade budget balanced).

Evidently the example given, very roughly applicable to developing countries, cannot be applied without big changes to medium or highly industrialized countries (to these, that is, where we assume the per head income to be over 1000 dollars). In this present context it will be sufficient to say that, industry's share in the creation of the G.D.P. having reached a "ceiling" of about 40% (to happen in countries with a per head income of about 1,000 to 2000 dollars), the tendency appears to reverse itself in favour of services and public administration. Roughly speaking it may be said that, at the start of the development process, having satisfied the demand for immediate and essential consumer goods (food and clothing, etc.), this demand came to a standstill and there is then an increase in that for more durable consumer goods (means of transport, refrigerators, TV sets and radios, causing a rise in the production of intermediate and investment goods). But once a high level of development has been reached, the demand for lasting consumer goods slows up and there develops another for services and cultural expenses (which in turn leads to a rising demand for more and more complex industrial products, such as computers, commercially controlled e.tc. and others of the same kind).

b) [illegible] for [illegible] of [illegible] for, under [illegible] [illegible].

According to these, only 10% of the difference in industrialization levels between the various countries can be

explained by the [illegible] The rest of the explanation is to be found in the size of the market. This observation is confirmed only in a very slight degree by the correlation coefficient worked out by the economist, which is very low: 0.29. All the same, even if only used as a point of reference, it is important to emphasize that, the development levels being equal (expressed in income per head), the degree of industrialization in a country with a population of 50 millions is greater than that in a country with one of 10 million. The economic systems which have been born in continental-sized markets like the U.S.A., U.S.S.R. and China, for example, have developed with a speed and at a level unlikely to be reached by systems confined within the boundaries of a small country. This is one of the reasons why countries, even if already highly industrialized, are in substance economic dilettantes (the U.S.A. no more so) who rest they can successfully refuse to carry their industrial development a step forward. All the more reason for removing structural rigidity which may cause development economics to stagnate, and it is important that every national institution should go forward within the framework of some form of continental integration.

[illegible] of physical investment

As already seen in section 1.2., programming and choosing policy in general call themselves of a number of instruments, among the most important, to a varying degree and in accordance with the main scope to each social system (whether a state or a collectively run type of economy).

The question may be posed as to whether there are any reference parameters for this to use. The answer cannot be other than negative there, nevertheless, a strictly scientific analysis

[illegible] to [illegible] to be applied to any [illegible] of the civilian [illegible] the [illegible] may freely [illegible]. If, on the other hand, the question is [illegible], certain reference [illegible] are [illegible], and in what [illegible] they [illegible], the answer may [illegible] be in the affirmative.

a) Let us take the [illegible] to begin with; for this reference must be made to the U.S. forecasts regarding development of the [illegible] product which, in some respects differs from the [illegible] product, as it does not include maintenance from abroad, as does the [illegible]

[illegible]

[illegible] rate of growth [illegible] as well as the [illegible] product and of the U.S. per head of the [illegible] and [illegible]

	[illegible]	[illegible]	[illegible]
U.S.A.	[illegible]	[illegible]	[illegible]
U.S.A. per head	[illegible]	[illegible]	[illegible]

[illegible] figures [illegible] [illegible]

In a long-term period, therefore, the average annual rate of growth of the U.S. will be between 2% and 3% considering that the average rate in the first long-term period ought to show a slight increase in the second. The rate of growth per head of the U.S.A. will, however, be appreciably lower although for demographic reasons, particularly in [illegible] [illegible] [illegible] [illegible] are based on

[illegible]

As regards the exports actually realized, we refer to the estimate annexed by O.E.C.E. for the I.M.F. over the same period (see Table VIII).

[illegible]

Estimated growth of the Gross National Product in the O.E.C.E. countries during the period 1960/63 (average annual compound rate)

	1960/61	1961/62	1962/63
O.E.C.E. total	5.4	3.1	4.3
Total of O.E.C.E. countries in Europe	4.7	4.9	4.8
U.S.A.	2.2	1.3	1.8
O.E.C.E.	7	3.1	3.6

Source: O.E.C.E.

[illegible]

[illegible] In its examination it was therefore to result that, according to the already mentioned I.M.F. study "an average annual increase in industrial exports of 7% or 8% in real terms [illegible] would permit the annual world economic rate of growth [illegible]. In the case of exchanges between the rich countries [illegible] and the world [illegible].

These figures are in fact [illegible] and for the growth of the other [illegible] they also assume normal use of productive [illegible] without serious inflation or unemployment. It will be noted that the OECD forecasts are not very different from those made by the United Nations (both are in real, non-inflation terms).

It may thus be concluded that a rate of growth between 5% and 6% should apply to this decade, with a resulting average increase in income per head of about 4%. The above annual rates correspond to an overall increase in 1970-80 of 63-70% for the G.I.P. and of 57.3% for the G.I.P. per head. (25)

Like all macroeconomic averages, the rates indicated can only give a general indication, while any and every real programmatic decision must be based on the structural analysis and on the social and economic aims of each country (we consider that the first thing to be estimated is the ratio between growth of incomes and growth of population).
To underline once and for all the enormous structural differences to be considered in this connection only, Table IX below shows the real growth of population and of the Gross National product (not of the G.I.P., see above) found between 1961-68 in the ten most highly populated countries in the world.

---

(25) The annual rates of growth in the 8 most industrialised countries in the world (USSR excluded) in 1955-70 (long period) was 8% in monetary terms, and 5% if disinflated. These countries are: USA, Japan, Italy, UK, W.Germany, Holland, Belgium and France (which in these same years produced 66% of world output and consumed 58%). Taking away the USA, the rate of growth of the other countries was 12 p.a. in monetary terms and 9% in real terms. However the average of 12% consists of highly differing values, for example: Japan 40%, Italy 13%, France 12%, Germany 9%, Belgium 7%, U.K. 6% and Holland 4%. The annual rate for the U.S.A. was only 3%.

[illegible]

[illegible]	Population (1)		Gross per capita (1)	
	millions of persons	average annual rate of growth in the period 1960-68	US $	average annual rate of growth in the period 1961-68
[illegible]	73	1,9	90	0,2
[illegible]	300	0,3	600	1,0
[illegible]	200	1,1	1.100	3,0
[illegible]	200	1,0	1.200	3,0
[illegible]	123	0,6	900	3,0
[illegible]	113	0,6	500	0,0
[illegible]	101	1,0	1.100	0,0
[illegible]	66	3,0	250	1,0
[illegible]	63	2,6	70	- 0,3
[illegible]	60	1,0	1.170	2,4

(1) Figures relate to 1968

Source: International Bank for Reconstruction and Development - Washington

e) The [illegible] percentages as already mentioned, in the [illegible] there are normally [illegible] and building to the extent of 60-70% (in Italy [illegible] 58 and 41 [illegible] respectively), improperly called "productive investments". The remaining [illegible] are spread over a very wide range of fields (for example, Italy in 1970: agriculture 7.0%, transport and communications 8.9%, commerce, banking, insurance and services 13.4%, public administration 5.4%).

When programming is in progress, as a basis total investments are considered, this being the absolute percentage of the G.N.P. to allocate to the different sectors in accordance with the declared aims. Where industrialisation is under way in developing countries, it is clear that the largest shares will be allocated to industry, to building and to infrastructures (particularly: housing, schools, roads, communications and, as soon as can be managed, research). In any case the standard on the basis of which the various rates of investment must be calculated (particularly the "productive" ones) is always that which came to light in relation to flexibility/increases of the growth of industrial production, discussed under point 4.3 (a).

For the purposes of indication we may add that the percentages of G.N.P. at present allocated to overall investments in the industrialized countries are around 20-25% (e.g. Italy in 1970: 21.1%; E.E.C. average in the ten year period 1960-1970: 24.0%; Spain (26) ditto: 23.2%, while for the U.K.

(26) Between 1960 and 1970 Spain passed from a per head income of 290 dollars to 900 dollars. Irrespective of the size and content of its "development" plans, the figures for this country are of special significance when technically estimating rapid industrialization

[illegible]

[illegible] productivity and [illegible] ing thus to effect [illegible] productive [illegible].

For example, [illegible] the physical productivity of labour is not only the result of the accumulation of capital, but also of the technical improvements accompanying this accumulation (improvement of the given resources) but, most of all, perfecting the human factor which always remains the essential problem when acting any economic type of development. We could recall that this latter factor is related to the diversification and/or restructuring of the demand which, together with the accumulation of capital, provides the main thesis for growth.

Once more referring to point 3.1, we also see now a hypothetical increase of productivity as if a year is roughly two, half to physical (capital) and human investments (as specified above) and half to better use of the human and capital resources [illegible].

It now remains to examine more closely the role of technical progress as such, in the general development. Before doing to it should be noted that, from the economic point of view, technical progress (according to the most authoritative economists such as Solow, Abramovitz, etc.) means

---

(27) As regards the countries which still have to begin their industrialization process, the rates of investment may be appreciably lower. According to Rostow's "take-off" theory, in this stage (the third in the five items he enumerates there will be) it would be enough to raise the "productive" investments to about 10%, i.e. the overall investments to 16-17% (of the G.N.P.).

1. that, <u>ceteris paribus</u>, a technically advanced country manufactures more products than a technically backward country;

2. that there is no technical progress where the product increases at a rate equal to that of the inputs (capital and labour), but if the product increases faster, the difference, or remainder, is to be attributed to technical progress. (28) When it can be concretely identified, this in fact shows itself in perfection of the goods produced (product innovating) by inventions or innovations; otherwise it manifests itself in an improvement in productive methods (process innovating) or organization. (29)

Technical progress is obviously of decisive importance to development, but even so its extent is difficult to estimate. One of the eminent economists, Solow, states that the rate of technical progress in the U.S.A., during the years of maximum development (1909 to 1949) was 1.9 p.c., or seven eighths (!) of the annual income per head.

---

(28) On this particular aspect of increases in total output, not wholly attributable to an increase in employment and/or capital used, but also to the qualitative alterations in structure in which the two factors are combined, attention is today concentrated by those engaged in research, on the so-called <u>third factor</u> (cf. Rey's studies in Italy).

(29) Inventions are changes made because of progress in research, and are usually typical of the industrialised countries; innovations are changes made due to the market following diversification of the demand, and are typical of the developing countries, making their appearance by transfer of technologies from the more advanced countries.

4.5 The engineering industry in general development

In Chapter I we tried to outline the main features of the fundamental role played by engineering in an industrialized or developing country. As brought out in the masterly survey made by Leontieff and Carter (30), all fields of industry are dependent on engineering while, to a very great extent, engineering depends only upon itself. Further, it holds a unique position in relation to investments; in fact, not only does its productive capacity of capital goods limit the rate of expansion of the consumer goods industries, but any increase in output of one branch of industry must be preceded by a sequence of investments spread over a number of previous years.

Thus, considering that any type of programming must allow for intertemporal dependence (direct and indirect) of the levels of output, investments and labour in all branches of a country's economy, from this aspect too engineering enjoys an absolutely privileged position.

What are the main reference parameters for engineering in an economic system? Before making mention of the elements we have in this connection, we would here recall that the quality of mathematic models in physics (31) is still very different from that of the mathemntic models in economics (31) and in social questions. In the main, the correlation coefficients mentioned here and in the subsequent paragraph have been established using the system

---

(30) W. Leontieff and A.P. Carter "The position of metal-working industries in the structure of an industrialising economy" Unido 1966

(31) At present a number of econometric models are being prepared in Italy; one of 155 equations (Andreatta). In the U.S.A. a model of 400 equations has been worked out.

of square minima which, if applied to physics produces estimates with a minimum degree of error, if used in economics gives only a very approximate answer. We have in fact already noted that statistical surveys based on economic analyses are too heterogeneous and inadequate for their data to supply a scientific basis on which mathematical instruments of calculation may be used.

We have no wish, of course, to underestimate the present and future role of econometrics which is as basic an instrument as the structurally interdependent natures of national and international economics are complex. We only wish to underline the fact that, with research being in its present state, the figures given by econometric methods only express tendencies and, as such, must be used.

a) Relationship to factors

We have no parameters with labour and capital at the level of comparative international surveys, and can only refer to data found by surveys made in this connection in Italy. We consider, however, that these data are of great interest and significance, because, while our country is very advanced from the point of view of data on capital (in the north), there is also a persistent state of unbalance in labour factors to be observed in the south. These latter indications may to some extent serve as reference data for the developing countries.

As regards labour, its marginal productivity (calculated by the lines of regression and using excellent correlation coefficients)in the north and centre, over a long period (1950-1970) is in fact about 1.50% which means that, lacking a constant factor, an increase of 1% in the quantity of

labour gives rise to an increase of [illegible] in the quantity of product. In the northern region marginal productivity increases to 2.0% which indicates that the improved utilization of this resource can only be exploited by the introduction of more advanced techniques in an industrial situation which started off from extremely low levels in the immediate post-war period. (32).

As regards capital on the other hand, for the same period we find that the marginal productivity of installed power (which may approximately be considered as representative of investment yields) was 0.70% which indicates that, ceteris for a constant factor, there was an increase of 1% in the quantity of power due to a rise of 0.7% in the quantity of product. On the whole, therefore, it may be stated that from the aspect of factors, engineering shows a high intensity of labour and a medium intensity of capital.

b) Relationships to macroeconomic indices

Interesting research has been done in several quarters to establish the degree of correlation between the engineering industries and the chief economic items. An attempt has been made to determine the degree of variation in the consumption of intermediate investment goods and of durable goods produced by engineering corresponding to the most

---

(32) It will help to recall that the Unido Economic Commission for Latin America, in its study on the possibility of achieving the objectives of the "3° plan de la Nacion" (1963-66) in Venezuela, found that the extreme backwardness of their engineering industry determined a very low marginal productivity rate of labour (only 9.7% of added value). It should here be emphasised, once and for all, that all the percentage indications given in our study only apply as related to individual situations (of countries or groups of countries, industrialized or developing, for example) and to given historical situations. For this reason we always try to illustrate them by giving concrete examples.

[illegible] and intensity [illegible] efficient, [illegible] applications of very great interest to programmers and manufacturers.

As far as we know, [illegible] of reliability, and only some parameters concerning raw materials, and the main semi-finished goods and utilities, are included in the indices used by industrialized countries.

All we will do here, therefore is to indicate the closest correlations (i.e. those the index of which is nearest to 1, and whose probability level lies between values that are in any case less than 0.1).

In order of degree these correlations are: with the G.N.P. - extremely high in the industrialized and developing countries; with fixed investments (in this case for the most part they are self-correlations); with marginal productivity of capital, but measured in terms of utilities. Finally, the correlation of engineering with the final product of one of its main branches (transport vehicles) is very high; the vehicles in use per thousand inhabitants. Amongst these correlations, for the purposes of programming the close interdependence of engineering with overall investments is of special interest.

Parameters of evaluation (33) also exist concerning employment.

---

(33) We refer again to the indications emerging from the Symposium on engineering industries held at Moscow in 1966 under the auspices of CID (later UNIDO). For some of what is said in this paragraph we are indebted to UNIDO for information kindly supplied (degree of correlation with the vehicles in use and with overall investments).

[illegible] with the number of [illegible] in use in [illegible]
U.S.A. = 5.1; U.K. = 3.; [illegible] = 1.6; W. Germany = 1.3;
France = 2.2; Italy = 1.6; Japan = 1.3; Canada = 2.3;
Chile = 1 %). It can also be estimated that at the initial stage of industrialization, for every million of the population from 10 to 15 thousand units are needed for the engineering industry with an average productivity of 2.5 (at most three working inputs are not more than one third of outputs.

In a subsequent stage of development (that is when engineering exports reach at least 5% of their total production) those employed in this industry should reach 25-30 thousand for every million inhabitants. In these figures the percentage of specialized technical staff should rise from 5% to 9% in the two stages, while clerical staff should be from 1 to 2%.

It is important to emphasize that the use of automated equipment does not increase the percentage of specialized technical staff in proportion to the additional production capacity which this equipment makes possible.

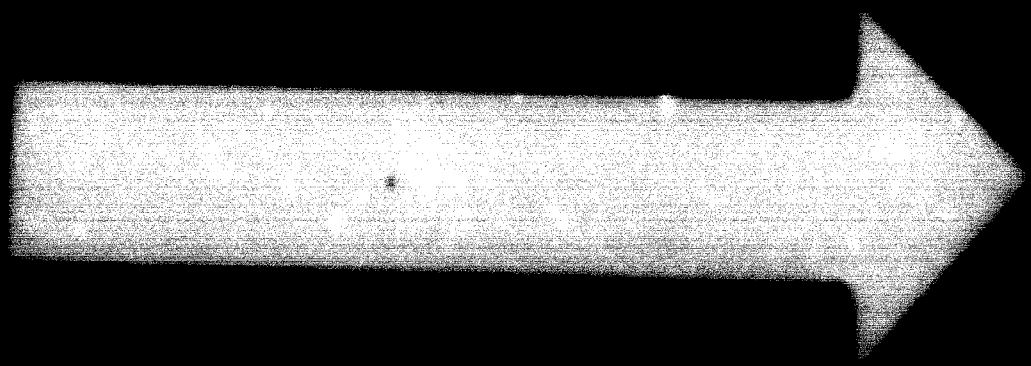
c) Production capacity

Obviously no general [illegible] can be established under an economic heading like this which depends on the degree of mechanization and/or automation, on the type of plant, on the dimensions (scale economies) and on external and internal economies; and, finally, on the extent to which they are used.

In addition to the final considerations made in the preceding

---

(34) cf. "Report" on the Moscow Seminary, already mentioned, p.76.



23.7.74

2 OF 2

DO

3848

paragraph, we will only say that, in the industrialized countries, the rate of added value in engineering is higher than that for the whole of secondary activity. For example in Italy, where engineering in the south does not represent more than 5% of the country's total engineering output, in the medium-length period (1951-1970) the total rate of increase of added value in engineering was 13% against 90% for the whole of industry.

4.6. The metal processing m.t. industry in the general development

First of all we will remember the considerations made at the beginning of the previous subsection of this chapter regarding the trend of econometric parameters. These considerations should be born well in mind when we are concerned with parameters relating to the m.t. industry within the context of the economic system. We will also recall points 1.1 and 3.3. concerning the structural features of this branch of industry for the purposes of our survey, and the data on its production and consumption relevant to it.

a) Relationship to factors

As far as concerns the relationship with the directly productive factors, we have not available any sufficiently reliable econometric data. However, as regards labour, it is clear that its nature in the m.t. producing industries is less repetitive than what it is in the industries utilizing the m.ts. (a machine capable of mass scale production cannot yet itself be made on a mass scale); this means among other things that, in percentages, the number of persons employed in the m.t. making industry is higher than that in the industries using these machines; (as we have seen, this ratio is 2 : 1).

From this we may presume that, speaking generally, the development of labour productivity in the engineering industry (which is mainly the user) makes for a lower rate of labour productivity in the m.t. industries. As we shall see, however, the problem must be more correctly interpreted by analysing the particular importance which technological progress possesses in this branch of industry.

Turning to the relationship with capital, we can refer to the indications provided by Leontieff (35) in his model of the input-output structure of American economy (1966). This is a medium-low coefficient: 0.49, which, however seems to represent well the percentage of capital stocks per unit of product (expressed in monetary terms) which a branch of industry not characterised by intensive capital may require.

All the same, in our view the fundamental factor to which this branch must be correlated, is the third factor, this being the degree of technical progress which the machine tool requires for its production and transmits during its utilization. (36)

As a product, it in fact depends on the experience acquired and progress made in the most varying fields of human activity; on metallurgy, for raw materials, on electro-engineering and electrotechniques, for driving each single machine; on electronics for all applications connected with numerically controlled m.ts., etc.

---

(35) Op.cit. (cf. Note 30).

(36) Robinson's phrase may be recalled: "an improvement in the field of machine construction only, reduces the cost of capital more than that of labour, and an improvement in the field in which the machines are made only, reduces the cost of labour more than that of capital".

As technological progress is tied to the research on qualitatively and quantitatively new products, as a commodity the machine tool incorporates qualities through its diversification in production while, as an instrument, it produces the quantity (with the special m.ts. for standardized large and medium-scale output) and the quality (with multiple-use m. ts. and with those for small and medium-scale output but technologically very complex, like the numerically controlled machines).

Other important aspects of this particular correlation with the third factor are those concerning Research and Development which in all industrialized countries are carried on alongside the production of m.ts. Even in the developing countries a research centre is essential. (37).
Last but not least the correlation relating to training technical cadres of the 1st and 2nd class, and it is well known that this is one of the key problems the m.t. industry has to face.(38)
In the developing countries the establishment of Institutes for training staff in new m.t. techniques, in their design

---

(37) In the large producer countries, research is carried on by the firms themselves (as in the U.S.A. at the big M.T. Research Institute owned by Cincinnati Milacron) and/or at the universities, or else at institutes financed by the Industrial Federations (e.g. in Germany at Achen University, in the U.K. by the M.T.Industry Research Association; in Franch by the C.E.R.M.O., and in Italy by SVIMU, etc.).

(38) In the U.K. a National Training Agency is being projected, this is a body which amongst other things should coordinate the work of the 52 training centres already in existence. The courses are specifically directed towards the field of machine tools and represent a big part of the whole N.T.A. project.

and on the problems connected with standardization are an essential instrument for the development of this field. The transfer of techniques at these levels must be made by an intense exchange of information and contacts on an international scale.

b) Interdependence with engineering

We have already noted at length the correlations existing between engineering and its branches (39); to this we will add that, from the econometric aspect as well, research has shown that there is a very high correlation ratio between the added value produced by the engineering industry, and the machine tools possessed by an industrialized country (Italy in this case), this ratio being higher than 0.90. In other words with an increase of 1% in the availability of m.ts. we have an increase of more than 0.90% in the gross product of the engineering industry.

Other research studies (40) have, however, given differing indications, showing that in all countries the flexibility rate concerning the demand for machine tools is higher, even if only slightly, than that of the demand for industrial machinery in general. The two sets of figures are not contradictory - as they refer to different items (engineering and industrial machinery: total of m.ts. in the country and the demand for m.ts.) - but rather, one set completes the other and confirms the very close correlation and interdependence between engineering and its branches.

---

(39) According to ISTAT, the interdependence between the branches of engineering, (in Italy in 1970) was 65%

(40) Carried out by UNIDO (cf. Note 33).

c) Relationships with macroeconomic indices

Neither has research on definition of parameters regarding the ratio between consumption and/or production of m.ts. with the chief economic headings, reached a sufficient degree of reliability. And yet it is of the highest importance to have certain data, both for operative and forecasting purposes, available for this fundamental means of production.

In this case too, all we shall do is indicate the closest correlations; (however for the m.ts. we must be satisfied with indices much lower than one, and with not always very high probability levels). These are (in order of degree of correlation): with the G.N.P., high in all industrialized and developing countries but in any case lower than those for engineering; (research carried out in Italy has shown that the correlation between the number of m.ts. in the country and the G.N.P. is about 0.70%, this meaning that an increase of 1% in the availability of m.ts. corresponds to an increase of about 0.70% in the G.N.P.); with marginal productivity of capital the correlation is medium to high, if measured in monetary investment terms, and medium if measured in terms of utilities; finally, the correlation with vehicles in use per 1000 inhabitants is high(on account of the close relationship existing between this branch and transport vehicles).

Finally, as far as concerns the number of people employed in this branch, we would recall that the optimum size for this industry is medium to small, and that in the most highly industrialized countries, the ratio between employee and m.t. varies from 0.40 to 0.60.

d) Productive capacity

As stated in Chapters I and II, in quantitative or monetary terms the productive capacity of this branch is very small, not only in the individual countries, but also at a world level. Thus, rather than consider it from the standpoint of productive capacity as such, in the case of the m.t. industry, as already touched on, it is much more significant to go more thoroughly to consider more at length the "catalyst" nature the industry has in technological progress, and especially from the aspect of incorporating and spreading quality.

We will however give just one interesting parameter which relates the production of m.ts. in terms of value, to the engineering industry. According to R. Grosse (41), for every dollar's worth of engineering product, from 15 to 25 cents' worth of m.ts. would be needed: where the flexibility of the parameter given for the m.ts. is in relation to the innumerable number of engineering products which would make impossible, and in any case meaningless, the definition of a single parameter.

(41) R. Grosse "Capital requirements for the expansion of industrial capacity". 1953.

CHAPTER V

Some examples of programming

5.1 Introduction

While we refer to our main "Introduction" as far as concerns the quantity and quality of the material we have managed to collect for drawing up this report, we wish once more to draw the reader's attention to the nature and to the limits of the information and data we shall make use of in this final chapter.

The programmes, the essential details of which we shall quote, only have in common the fact that they relate to the '70s, and they are thus implicitly linked together by having to function in an international context dramatically characterized by extremes of high and low development. This too ffs importance since, as we shall see, it leaves a more or less deep impression in nearly all the "declarations of aims" accompanying each programme by accentuating, or even only mentioning, social objectives (this too when in reality the Plans concern merely productivity and little else).

Another feature, and a limiting one, common to the documents to which we shall refer, is that nearly all of them refer to "mixed" economies (with more or less agreed programming). Unfortunately the documentation we have for the countries with collectively run economies is very inadequate. We shall mention them but shall not be able to attempt any real comparison between the two methods.

Finally, there is another limit which does not concern the quantity and quality of the material provided: this is the

data cannot be compared since it refers to situations, structural and conjunctural, which are entirely different. (42)

5.2 Some declarations of objectives

As the aims declared by the programmes vary according to the decisions dictated by the political policy expressed by the system (e.g. social, economic or social and economic), so the situations in which these decisions are made vary according to an endless series of combinations (differing availability of factors, quality of the labour available, localization of the natural and productive resources, market stability or lack of it, etc.). In physical terms therefore, the maximum productivity of the factors of production cannot be pursued in itself as an abstract entity, but is always related to given situations. For the countries with a market economy, consideration must also be given to the variants introduced by the diversity of factor prices and, for the private section, by the aims of the employers (endeavouring to achieve the maximum active difference between costs and prices).

---

(42) As an example illustrating this rather obvious consideration, we will refer once more to the Venezuelan Plan for 1963-66. In it the G.N.P. rate of growth was fixed at the reasonable limit of 7.9% p.a. but that for engineering was calculated at 25.6% p.a.! Such an assumption would seem absurd if included in the plan of a country already in course of development, but the prospect changes when we consider that in 1962 the Venezuelan engineering industry was in one of the most difficult situations of all; it was in fact providing only 4.2% of the means of production goods consumed by the country, and employed 14.2% of industrial labour. Energetic action both in the direction of a policy for substitution of imports by others, and for a better use (or greater productivity) of labour, was essential. The high rate of growth indicated simply meant they wanted to raise the home market's take-up of Venezuelan engineering products from 4.2% to a little more than 10%.

The optimum use of resources remains, however, the essential point of reference for all programmes, whether expressed by mixed or by collective economics. As stated, this implies a growing realisation of the complementary - not substitutive - nature of labour and capital and, consequently (in such an intense degree of technical progress) the mutually conditioning effect of quantity and quality on production .(43)

The optimum use, effected by economic calculation, is not only considered in theory (cf. point 3.3) one of the basic "instruments" of the accelerated growth of given resources, but also constitutes one of the constant points in declarations of aims. We have already seen it among the 5 objectives of the centralised Polish Plan 1971-1975 (cr. point 3.2); it is also present in the British, Italian, French, Spanish, Chilean Plans, etc. As we know, in the USSR optimum use of resources is by now one of the instruments taken for granted in their Five-Year Plans, even if for the time being, its application is limited to some special fields.

The quantification of objectives is first of all effected by the assumed variations in the overall G.N.P. for the given or cumulative annual period. Generally speaking the rates to which reference is made in the latest Plans are not appreciably different from the indications the United Nations have already supplied in this connection (cf.point 4.4), and OECD as well. The variations in fact assumed by

---

(43) For example, in certain circumstances, an optimum solution from the quantitative point of view (i.e. with the lowest consumption of factors) also coincides with the optimum of quality and quantity of the product. This is the case with the automatic (and numerically controlled) m.ts. which, contrary to what is generally thought, can be more advantageous in developing countries than simpler and less costly ones (from the point of view of the community and, consequently, of deferred income).

industrialised or developing countries like the U.K., France, Spain, Italy, Chile, USSR, average 7% annually, corresponding to an overall increase of 50% in the five-year period. The rate assumed by Israel (8% p.a.) is slightly higher, while the Polish assumption (in total 36-39%) is slightly lower (44)

As far as concerns productivity, precise quantification is generally avoided in view of the extremely problematical nature of the forecasts and calculations connected with them. As an indication only we may say that an annual average rate of growth of 1% (as for example is given in the British Plan) may be considered as a good point of reference for the highly industrialised countries, while for the developing countries an accurate structural analysis of the degree to which resources are used, may provide indications of more rapid and bigger increases in the short period (cf. the Venezuelan example quoted).

As regards methods, while we will refer to the theoretical considerations under point 3.3, we shall not do more than state that both the collective economy plans (45) and the others postulate a growing degree of collaboration by intermediate bodies (associations. trade unions, etc.).

Finally, in relation to investments and to their quotas allocated in the various Plans, we will avoid troubling the reader with a list which in any case has little significance (on account of the relative value they have in the individual

---

(44) In the third session of UNCTAD held at Santiago in Chile in April 1972, one of the main aims of the second U.N. decade for furthering general development was given as: "raise the annual rate of growth of the developing countries to at least 6.5% for the G.N.P and at 3.5% for income per head.

(45) Once and for all we would recall that the term "collective planning" in this report means "democratic centralism" as understood in socialist doctrines.

economic situations). We will however refer to the indications already given at point 4.4 (b), reminding the reader that, for the developing countries, special decisions were made by the 3rd Session of UNCTAD in connection with this. (46)

5.3 Some programmatic assumptions relating to industry and to engineering in particular

On the basis of the quantitative estimates made in 5.2 above (47), the different Plans pass on to the assumptions of growth made programmatically, both from the point of view of supply and from that of demand (in its external and internal aspects). The collective Plans make no mention of assumptions, but refer to "decisions" or at least to "forecasts", seeing that the demand does not induce variables, with the exception, partially, of exports.

Here we are only concerned with examples of assumptions of growth from the supply aspect, especially those relating to industry with engineering included in it. From this point of view we can therefore give some indications derived from both "mixed" and collective economies.

The annual average growth of added value by industry and its branches is not only related to the available productive capacity and to factor productivity (labour and capital) in the conditions prevailing at the outset, but also to the unutilized quota of productive capacity.

(46) For example, 20% of the investments made by developing countries appear to be covered by an annual transfer of resources from industrialized countries, equivalent to 1% of their G.N.Ps.

(47) Obviously to these an estimation of salaries and income distribution in the short period must be made in relation to the effects this has on the level of demand, on investments and also on the rate of growth. These estimates are essential in "mixed" economies where tendencies to consume differ from one income category to another.

Within this framework the programmatic assumptions for industry, in the various Plans available for the five-year period 1971-1975, converge on average levels of about 7% p.a. (for example Italy, USSR (7.3%), France, Chile ... etc.). England and Poland make exceptions with annual averages of 4% and 5% respectively.

In industry, the assumed rate of growth for engineering is usually appreciably higher. In the bigger countries it varies between 9 and 10% annual average. Some examples are: USSR 9 to 9.5%; France 9%, Italy 10%, Poland 10%. Very roughly speaking these rates - which mean doubling productive capacity of engineering within 7 or 8 years - should enable a calculation to be made of the decisive weight which is attributed to the development of engineering in the highly industrialised economies.

In some other less industrialized countries, or in the initial developing stages, a function is attributed to the development which is in relation to the immediate aims in the short period. In the already quoted case of Venezuela, where the rate of growth of means of production goods was fixed according to particular structural and conjunctural situations, productive capacity was expected to be doubled within less than 3 years. Chile provides an example of the opposite as, among the various branches of industry, engineering was given a rate of growth of 50% in the six-year period 1970-76, against 92% for the building industries. Evidently, in this case too, problems of priorities were considered which are implicit in aims of a certain type of planning and in its particular context.

In countries well on the road to industrialization too - and always in relation to priority "social" aims - engineering is

given a slower rate of development, e.g. Spain whose Plan proposes two assumptions of development: one based on an annual growth of 8% and the other of 7.7%.

5.4 Programmatic assumptions relating to the development of machine tools

In the majority of Plans and/or programming reports that we have been able to examine (see in this connection the Introduction to this study), assumptions of development do not go beyond the main groups of industry which cover the whole of industrial production. No mention is made of the m.t. industry.

Among the highly industrialised countries, only France (1971-1975 Plan) gives full and detailed information on this point. (48) The British Plan too (but only for the period 1964-70) makes some reference to development rates for m.ts.

Both indications coincide around an average annual increase of consumption of 8% (between 7 and 8% in the French Plan, and 7.8% in the British Plan). The French Plan also specifies an assumption of annual increase in production of 10%.

Comparing these figures with those for the class of industry in point 5.3 above, we may deduce that the m.t. industry should develop at a slightly slower rate (8% equivalent to doubling itself within 10-11 years, against the 7-8 years for engineering). This seems to confirm the "scissor" trend which must inevitably appear between engineering and the m.t. industry over a long period (cf. 1.1).
As this is a branch of industry of very peculiar characteristics, it is understandable if many plans neglect it altogether

(48) Cf. "VI Plan de Développement National 1971-1975" Rapport sur l'industrie mécanique.

(this also indirectly explains why so many Plans do not include a section on it) or else, on the contrary, give it special attention. In the latter case of course, the assumed rates of increase cannot be the subject of any kind of valid generalization. (49) This for example, is the case of India whose Plans have always given prominence to the m.t. industry to such an extent that they have managed to create, from nil, a very modern m.t. industry within little more than twenty years, both quantitatively and qualitatively. As, for that matter, Table V clearly shows, India, which is among the forward developing countries, is only second to Brazil in exports of machine tools. However, this particular type of development has not taken place by mere stimulation of forces external to the system; the Indian Government did in fact immediately realise that, on account of the relatively capital intensive nature of this branch of industry (but with slow returns) it would not have attracted sufficient private capital. It therefore decided to go in itself by a rapid financial scheme and by action of a public nature.

For that matter, in all the collectively run countries, where the problem of productive investments is entrusted to the State only, in this post-war period there has either been a development of the industry from nothing (e.g. in Bulgaria and in Rumania) or intense promotion of the existing one (e.g. in Czechoslovakia, Poland, etc.). (50).
As a particularly significant example, we give in Table X the absolute annual rate of growth of the m.t. industry in the U.S.S.R. in the long period from 1929 to 1970.

---

(50) Basically, what has occurred in the development of the m.t. industry throughout the world is the inversion of the tendency which appeared, in world trade, from the position of the U.S.A. Within the framework of world production, the U.S. share has fallen from 31% to 12% in five years 1967-71) only.

Table X

Machine tools for metal processing in the U.S.S.R.
Average annual absolute growth for five-year periods and some production data (in thousand of units) from 1917 to 1970

Rate of growth	5-yr. period	Output	Year
4,4	1929/1932	0,2	1917
5,8	1932/1937	2,0	1928
3,3	1938/1940	58,4	1940
6,4	1946/1950	38,4	1945
9,3	1951/1955	156,0	1960
7,1	1956/1958	192,0	1966
6,8	1959/1965		
6,8 to 8,8	1966/1970 (1)		

(1) 23rd Congress

Source: Annuaire de l'URSS 1968
Centre nationale de la recherche scientifique Paris

It will be seen that the rate fixed in the last 5-year plan differs only slightly from those indicated above as being typical of hyghly industrialised countries.

* * *

NOTE

To complete the data given in this report, in Table XI we show the principal average annual rates of growth forecast in the collective economy countries for the period 1971-75 taken directly from the Plans mentioned in the Introduction. Where available EEC forecasts are also given for the period 1971-1980.

The information is taken from an unofficial Italian publication (1) and from information contained in the bulletins published by the Italian delegations to the I.C.E. in some countries. The rates refer to Plans which have been approved or not yet ratified by the legislative bodies concerned, but already discussed by the higher political organizations.

As will be noted, there is no reference to Engineering: there are only two pieces of data relating to increases in m.t. production. The rates refer to the variations assumed under the main economic headings and are in line with the considerations already made on that score. (The data relating to the USSR complete that already given in the text).

---

(1) The "Portolano of Monde Economico" for the Socialist Countries, published by the Banca Commerciale Italiana, April 1972.

Table XI

Average annual rate of growth in the period 1971-75
in the plans for collective economy countries
under the main economic headings
(and forecasts made by the E.C.E. in the period 1971-80)

Country	G.M.P. (1)	Industrial production	Agricult. product.	Internal trade	Foreign trade	Income per head
Albania (V P.)	9,1-9,8	10,0-10,5	8,5-9,2	6,2-6,7	9,1	2,6-3,2
Bulgaria	7,0-8,4	9,0-9,8	3,2-3,7	6,7-7,0	9,8-10,5	4,5-5,4
ECE estimate (2)	8,0	-	-	-	-	7,0
Czechoslovakia (III P.)	5,1	6,0-6,4	2,6	5,1-5,4	7,4-7,7	-
ECE estimate	5,3	-	-	-	-	4,4
North Korea (3)	18,7	21,4	-	-	-	-
German D.R. (*)	4,7-5,1	6,0	2,5	4,5	9,6	-
ECE estimate	5,0	-	-	-	-	4,8
Yugoslavia (IV P.)	7,5	9,0	3,0	9,0	11,0	-
Mongolia (V P.)	5,5-6,7	8,9-9,3	7,0-8,4	-	-	4,1-4,2
Poland	6,7-6,8	8,0-8,4	3,4-3,9	-	9,4	-
ECE estimate	6,0-6,3	-	-	-	-	4,5-5,0
Rumania (V P.)	11,0-12,0	11,0-12,0	6,0-8,0	-	12,0-14,0	4,0
ECE estimate	8,1	-	-	-	-	6,9
Hungary (IV P.)	5,4-5,7	5,7-6,0	2,8-3,0	-	-	-
ECE estimate	5,4	-	-	-	-	5,0
USSR (IX P.)	6,8	8,0	3,7-4,1	7,3	-	5,4
ECE estimate	7,1	-	-	-	-	5,8

(*) Average annual increase in n.to. is 7.8 - 9.0

Note: Plan number are shown between brackets

Sources: - Il Portolano del Mondo Economico E.C.I. 1972
- Bulletin of I.C.E.

(1) G.M.P.= Gross Material Product: includes manufacturing only and excludes non-productive Government and private services
(2) E.C.E.= Economic Commission for Europe. All estimates relate to the period 1971-1980
(3) For North Korea the Plan covers six years (1971-1976)

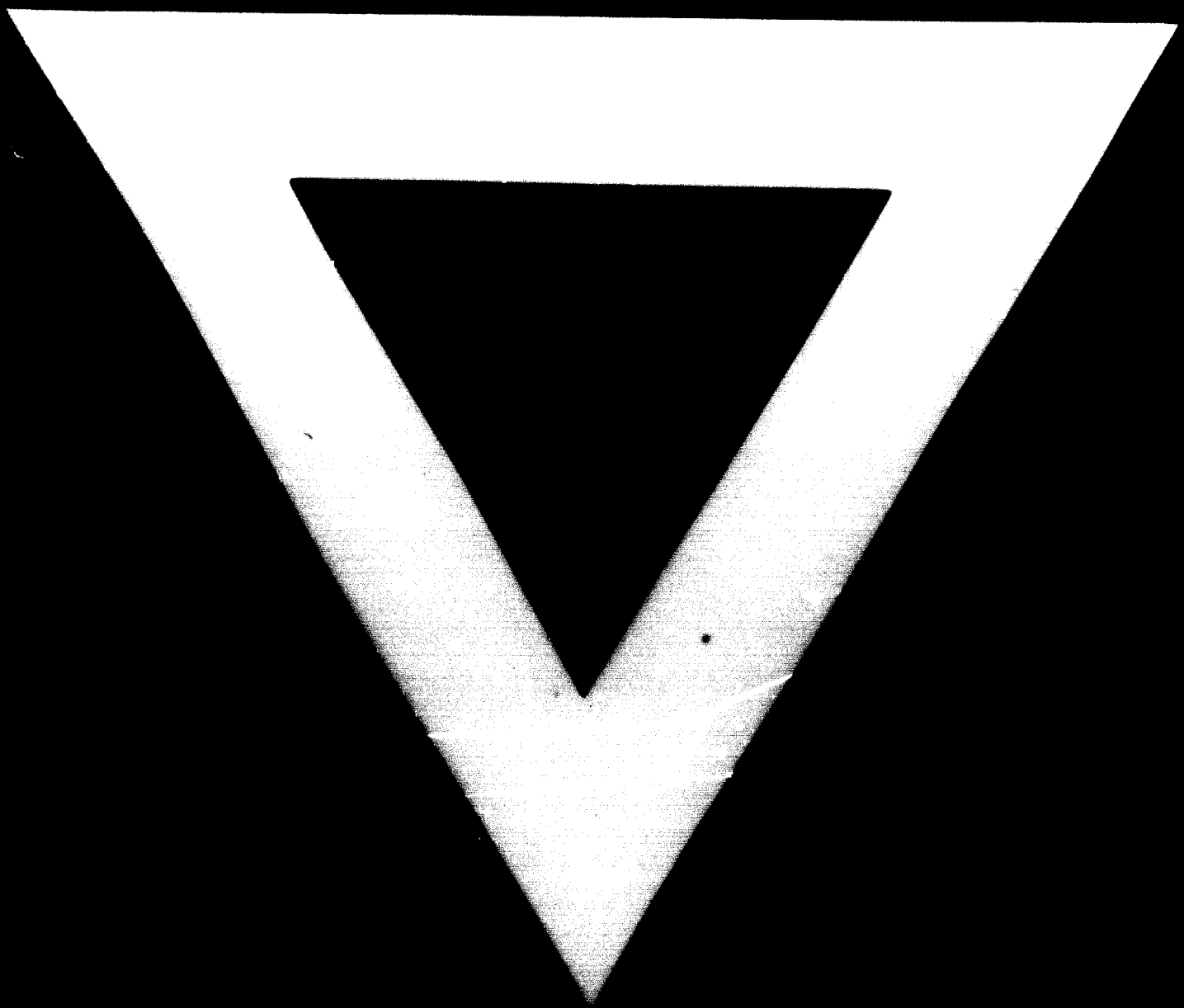
Table XI does not give information about three collective economy countries, these being Cuba, North Vietnam and the Chinese People's Republic.

Cuban economy is in fact undergoing thorough reorganization and the lines along which it will be developed are in progress of being worked out. There is thus no possibility of knowing quantities for the variables indicated.

The most recent North Vietnam Plan too only gives outlines of reference based on agricultural records achieved, on the development of light industry and on the reconstruction of heavy industry. There is thus a tendency only to face fundamental questions of military defence and of production of essential goods for the survival of the country.

Finally, as regards the Chinese People's Republic we will only quote the declaration of aims from the last Plan, as this constitutes one of the keys for understanding how radically different are the development modules for their society compared with those examined in this report. The declaration is taken from the 4th five-year Plan now in progress. It says: "A refusal to base the country's technical development on western and socialist technology, the importance of which implies a continuous state of subjection and a permanent condition of being behind as compared with foreign countries, at the same time involving the introduction of techniques which are highly profitable for the already industrialized countries, but which are unsuitable and counter-productive for a country like China.

Source: Il Portolano, op.cit. p.95



23.7.74