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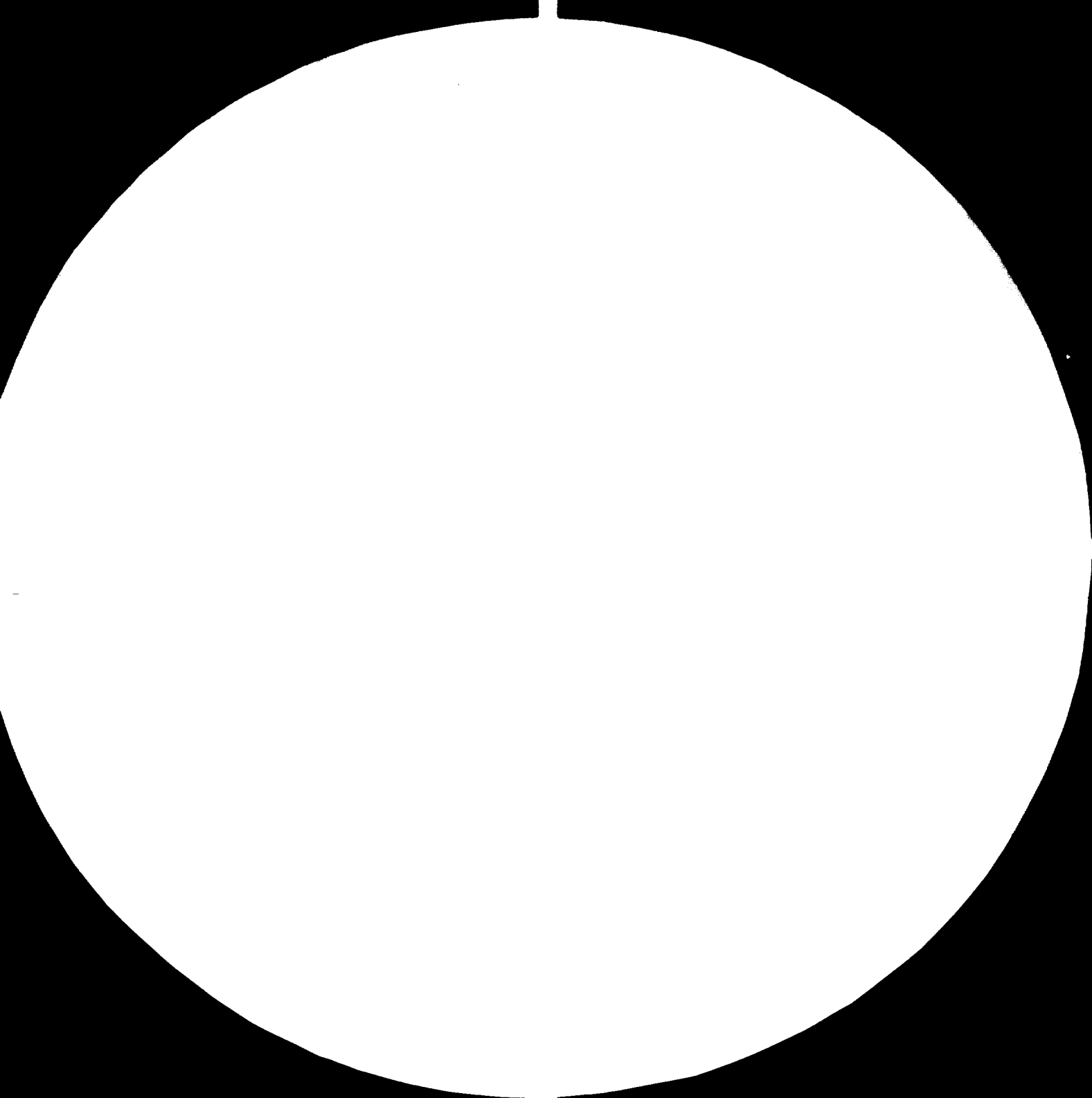

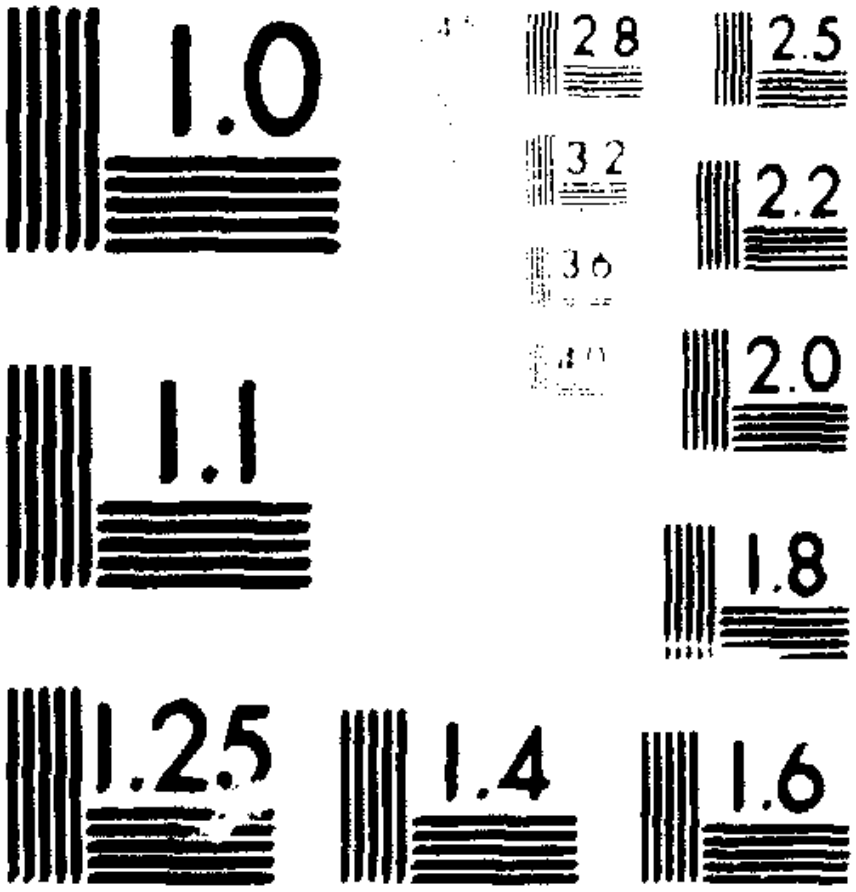

UNIDO - INTERNATIONAL CENTRE FOR INDUSTRIAL STUDIES

SECTORIAL STUDIES SECTION

INSTITUTE OF ECONOMICS, BULGARIAN ACADEMY OF SCIENCES

DEVELOPMENT OF THE CAPITAL GOODS INDUSTRY IN BULGARIA

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DEVELOPMENT OF THE CAPITAL GOODS INDUSTRY IN BULGARIA

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INTRODUCTION

The Sectorial Studies Section of the UNIDO International Centre for Industrial Studies has shown an interest in the working out of a project on the development of the capital goods industry in Bulgaria over the last 30-35 years, and has accordingly approached the Board of the Institute of Economics, Bulgarian Academy of Sciences to effect such a study. Proceeding from the assumption that the experience of Bulgaria might be of some interest as an example for the developing countries in their endeavour for economic development.

To this end representatives of the Sectorial Studies Section of the UNIDO International Centre discussed with research associates of the Bulgarian Institute of Economics the contents and scope of the study envisaged and the guidelines to be followed. It has been agreed upon that particular emphasis should be laid on the evolution of the capital goods industry in Bulgaria and on the specific factors determining the development of this sector.

Taking into consideration the importance of the capital goods industry to the economy of any country, particular attention has been devoted to the role and place of this sector for the country's industrialization and for some specific socio-economic problems of the development of Bulgaria.

Recognizing the relatively small size of the country, with respect both to population and territory, and the fact that some of its natural resources are rather limited, an attempt has been made at enclosing the causes and factors accounting for the rapid development of the capital goods industry over the last 20 years and at evaluating the importance of the country's partici-

pation in the international division of labour and in international trade. Along with the economic and social aspects of the sector's development and the existing situation of the capital goods industry, some specific technical and technological problems have also been treated.

This study has also been concerned with the importance of the prospects of the development of the capital goods industry, as well as with the sector's organization, its improvement, the training and re-training of personnel, etc.

The summing up of the Bulgarian experience was done with a view to presenting a model for the developing countries and enabling them to make their own conclusions.

We have taken into consideration the "Position Paper", prepared by UNIDO for a Seminar in Algiers in 1979, and the "Study on the development of capital goods industry in Spain", which were kindly made available to us by the UNIDO International Centre staff.

The programme of the study comprised the following:

- Determining the scope, contents and specific features of the study.

- Composing a working team.

- Studying the materials available, as well as some other studies in this field.

- Specialized studies on the differences between the classifications used in this country and those adopted by the UNIDO International Centre (ISIC and SITC classifications).

- Breakdowns and analyses of production and foreign trade, as well as of the future prospects of the sector.

- Studies on the structure of personnel and training

of personnel.

- Particular studies on the technical and technological level of the sector in Bulgaria.

- Studying of the specific problems of the country's international specialization and co-operation.

- Summing up of Bulgaria experience and working out of recommendations for the developing countries.

- Preparing the main chapters of the study.

- Proof-reading and incorporating new materials into the body of the study.

- Final reviewing and editing of the text.

- Discussing the draft with UNIDO experts.

- Preparing an extended summary for consideration at the UNIDO conference to be held in Warsaw, November 1980.

- Finalizing the text of the study.

In the course of preparing the study the working group encountered some difficulties due to the following:

- The object of the study is rather complex and touches upon different lines of inquiry.

- No studies in this line have been undertaken till now in this country. Our national classifications do not correspond to those adopted by ISIC and SITC. Particular statistical studies were accordingly made.

- The rather short term for pre-investment studies of a considerable volume. The need of mastering and applying UNIDO methodology to characterizing the technical and technological level of the capital goods sector in the country.

- The necessity of summing up the results of this study and working out of recommendations for testing out of these gene-

ralizations.

It is our hope that most of these problems have been successfully solved.

CHAPTER I.

THE EVOLUTION OF THE CAPITAL GOODS INDUSTRY

A) The Historical Development of the Capital Goods Industry in Bulgaria within the Framework of the Stages of the Country's Industrial Development

1. MAIN ECONOMIC AND SOCIAL OBJECTIVES

The insufficient development of the capital goods industry in Bulgaria until 1944 determined to a certain extent the poor development of the remaining industrial sectors in the country as well as that of the agriculture, building and transport. Besides, it lead to an extremely poorly developed infrastructure, did not contribute to the rapid and complex development of the productive forces, created no conditions for the elevation of the material and cultural level of the population, predetermined the backward character of Bulgarian economy and its great economic dependence on the outside, under a rather unfavourable structure and orientation of the external economic relations.

Owing to the favourable for the country political, social and economic conditions after World War Two, basic social and economic problems were solved in historically very short time. Significant in this case was the role of the capital goods industry. Thus the main objective of the development of this branch was realized and namely: on hand of the available natural, labour and material resources with an active participation in the international economic and scientific-technological co-operation to ensure rapid development rates of the national economy, to build effective economic structure so as to approach the level of coun-

tries with developed economies, securing economic progress and welfare of the Bulgarian people. The accelerated development of the capital goods industry was considered the motive force of the socio-economic progress of this country.

It has to be pointed out first of all, that this branch favoured the very intensive development of production based on the great needs of the country for machines and engines, automatic machines and other types of equipment in the conditions of the current policy of expanded building of industrial units. The large investments require a considerable amount of machinery and equipment for the enterprises under construction. This on its part ensures the realisation of a considerable part of the capital goods produced.

The realisation of the large investment programmes set by all five-year plans allows the continuous expansion of the branch production, whereas conditions are being created for diversification and technological improvement of the range of machinery and equipment produced. Thus this same industrialization and the development of the material production foundation for the remaining sectors is an additional factor for the accelerated development of the capital goods industry.

This way of the accelerated development of the productions included in this branch in the first place aims at the utilization of the favourable potentialities of the accelerated industrialization of this country for the building up of a local capital goods industry. Due to this economic policy the country is now satisfying a great part of its needs of machinery and equipment of local make. In 1978 for example the value of machinery and equipment of local make accounted for 53 per cent of the to-

tal volume of machinery and equipment investments. This fact speaks for the grown importance of the capital goods industry for the material production foundation of the country and in particular for the industry in general. On the other hand it is illustration of the feed-back - the role of the accelerated industralization policy and the establishment of a production foundation for the remaining branches of the rapidly developing and constantly expanding production of this branch itself.

Second. The accelerated development of this sector especially over the recent years aims to most fully provide with local resources the modernization and reconstruction of the basic funds, on the basis of the rapid introduction of the achievements of science and technology. The machinery and equipment of local make account for about 45 per cent of the total investments for modernization and reconstruction.

Third. What was meant by the intensive development of the capital goods industry was to eliminate the concealed unemployment in agriculture which existed in this country before World War Two, to provide occupation and reorient to industry manpower released from agriculture in result of co-operation, amalgamation and mass penetration of mechanization in the agricultural production process.

In Bulgaria now (1978) about 284 thousand people are occupied in the capital goods industry which is 7,3 per cent of the workers and employees in Bulgaria and 21 per cent of those occupied in industry. Since 1960 - some 195 thousand people have entered the capital goods industry which accounts for 34 per cent of the total increase of the personnel occupied in industry for the period 1960-1978.

Fourth. It has to be pointed out that the accelerated development of this sector involving the further technological training of those occupied in industry and the application of modern techniques and technology is directed to creating the conditions necessary for accelerating the process of increasing the social efficiency of labour within the framework of the country's economy and thus to additionally increase the efficiency of the national economy. It suffices to point out, no matter how relative the character of such a comparison may be, that the level of labour productivity in this branch is about 4 times the level of labour productivity in agriculture.

Fifth. A reason for adopting a course towards rapid development of the capital goods industry is the need of ensuring a harmonious development of industry in all districts of the country. This particular industry requires less capital investments and is not greatly dependent on the availability of raw materials in the district where it is being developed, and thus allows the construction of factories at places where there is a more compact mass of free manpower or manpower which is being released from agriculture. Now in our country there are machinebuilding enterprises not only in the large towns but also in comparatively small settlements.

This provides an opportunity for accelerating the building of the infrastructure of the towns and the rural systems, for the improvement of regional and interregional connections for the complete utilization of the resources of each region and every populated area. Thus an opportunity is created for the expansion of the production in the branch itself on one hand and on the other - the very development of this branch creates con-

ditions for the solving of a number of important social problems. It is in the centre of the process of raising the technical level of the population in all regions of the country. And it is known that the level of labour efficiency and the rapid increase of the production volume, and at the end the very standard of life of the population depends on the correct and purposeful realisation of this process.

Sixth. The development of the capital goods industry in this country aims at giving our country the opportunity of a still more active participation in the international division of labour. On this basis potentials are being created for receiving basic raw materials and fuel in exchange for machinery and equipment exports which was and still continues to be of a paramount significance for the industrialization of the country and for the development of the remaining branches. In 1978 the machinery and equipment for production needs accounted for 47,1 percent of the total export of the country. The greater part of the imports of hard and liquid fuels, ferrous metals, various chemicals and others were obtained in exchange. Thus despite the difficulties originating from the world material and energy crisis a prerequisite was created for our industry to continue developing in stable rates. During the period 1970-1978 the average annual industrial production of the country increased by 8,9 percent. At the root of this stable rate of expansion and further development of the industrial potential of the country was the capital goods industry which satisfied the needs of the country for machinery and equipment and at the same time provided part of the currency necessary for the import of fuel, raw material and materials.

2. STAGES AND LEVEL OF THE DEVELOPMENT OF THE CAPITAL GOODS INDUSTRY

One of the main features of the socialist transformation of this country is its turning from a backward country with an elementary agriculture and poorly developed industry into a country with modern industry and developing agriculture.

For over 60 years, until 1944 in Bulgaria there were created about 3500 small industrial enterprises with a semi-craftsman technology of production. These were mainly enterprises of the food, textile, leather and furriery industries. They were quite primitively equipped with machinery, the best proof of which is that their average energy supply was 32 kW.

The output of the machinebuilding and metal- working industries in the last pre-war year (1939) accounted for 2,4 percent of the total industrial input of the country. The basic share, however, was taken by the metal- working industry -a few cast-iron-ware, pipes, several kinds of domestic goods, agricultural tools, nails, stoves, etc. Practically, no capital goods industry existed in 1939. It was represented by 15 industrial steam boilers, 9 threshing machines, 60 waggons, 17 power transformers, several dozens of lathes, drills etc.

The lack of this industry determined to a certain extent the poor development of the remaining industrial sectors, as well as that of agriculture, building, transport. This brought about strong unemployment and low labour productivity. According to the statistics of bourgeois economists the consealed unemplyment among the rural population of Bulgaria surpassed 1 million people.

The backwardness in the capital goods industry significantly influenced the standard of life of the population in this

country which was among the lowest in Europe.

The country's industry including the machinebuilding industry was concentrated mainly in some of the larger towns: Sofia, Rouse, Plovdiv, Varna, Pleven, Kazanluk a.o. This had as a concequence a very poor infrastructure of the populated areas which was ineffective and did not create conditions for the elevation of the material and cultural welfare of the population. Neither did it contribute to the development of the productive forces in the country. Practically it: would not be an evaggeration rat on to say that the development of the capital goods industry, of this most important branch for the rapid industrialization of the country and for the intensive and harmoniuos development of economy as a whole, began immediately after the fundamental social change in Bulgaria which took place in 1944. The government has devoted special attention to this branch in its economic policy ever since. As early as in 1948 the machinebuilding and the metalworking industries produced already 6,2 times the output of 1939 while in 1952 the output exceeded - 18 times that of the same year (1939). In 1952 the capital goods industry accounted for 71 percent of the production of the machinebuilding and metalworking industry and 7,2 percent of the total industrial output of the country for the same year.

The rapid development of the industrial sector in the course of implementation of our five-year plans for social-economic development contributed for the capital goods industry production to grow by the end of 1978 by approximately 90 times in comparison to 1952 and for its relative share in the industrial output to reach almost one fourth. This growth is shown on Table 1.

In 1978 this industry supplied about 15 per cent of the

national income of the country which clearly indicated the primary role of this branch in the national economy, for the rapid industrialization of the country and for the development of the remaining economic sectors.

The development of this branch in such high rates has a fabourable influence on the other branches interlinked with it in the process of production and reproduction of the social product. This influence is bilateral. On the one hand it stimulates the development of these branches for which it functions as a final product supplier. On the other hand this influence is displayed in the branches which supply various kinds of materials, raw materials and details, ensuring the expansion of the production in this sector of industry.

Table 1

Relative share of the capital goods industry in the total industrial output of the country and percentage of the persons engaged to the number of persons engaged in industry

(in %)

Year	Production	Persons engaged
1939	0,9	1,6
1952	7,2	12,1
1960	9,5	14,5
1965	12,2	17,4
1970	15,3	20,3
1975	19,2	23,3
1978	23,5	24,6

The intersectorial linkage balance of the economic sectors (input-output table) prove that in the course of time the

significance of a given sector both as a supplier and consumer is changing. Following data demostrate this:

Table 2

a) The branch production is distributed mainly among:

(in %)

	1971	1978
Industry branches total	25,78	26,48
Capital Building	36,00	30,56
Exports	17,62	26,07

b) Participation of the Branches in the material Expenditure of the Branch as consumer:

(in %)

	1971	1978
Ferrous Metallurgy	21,04	15,31
Machinebuilding and Metalworking industries	47,10	54,94
Chemical and Rubber Industries	3,64	4,13
Other Industry branches	16,13	14,47
Industry Branches-Total	94,98	94,67
Other sectors of the material production	5,02	5,33
TOTAL	100,00	100,00

The data shown above on the general character of the intersectorial linkage indicate that its importance as supplier of machinery and equipment for the national economy is growing both with respect to industry and with respect to the country's exports. This development reflects the changes that have taken place in the production structure of the branch and its importance for the investment process of the national economy and

its increased participation in the international division of labour. On the other hand, the importance of machinebuilding and metalworking industries is growing both as consumer of industrial production, which is due to the greater specialisation and co-operation among the machinebuilding enterprises as well as of the ever increasing share of the machines of local make, included in the basic funds of machinebuilding. The links of the sector with the chemical and the rubber industries are growing as result of the chemization process of production a.o.

The development of the capital goods industry during the last 30 years is characterized by three phases which are approximately outlined below:

The first phase includes the sector's development till 1960. During this period the creation and development of the enterprises in the sector was carried out on the basis of machines and equipment of mainly universal type. During these years there was initiated the building of production capacities with a narrower specialization of the production: machines and equipment for power generation (for the period 1952-1960 the average annual increase of growth being 25%); electrical machinery and equipment (with an annual average increase of 35%); agricultural machines (with an annual average increase of 20,6%) production of spare parts (increase of 38,8%); organization of repair activities under the existing conditions (with 9%); casting and forging machines and equipment (with 30,3%), etc.

During the second phase (which includes roughly the period 1960-1970) the most intensive development have undergone: the sectors producing lifting and transport equipment (with average annual incresement of 44,6% over the period 1960-1970), the

increase being especially great in the production of machines and equipment for inner-plant transport and for mechanization of the warehouse activities, which tendencies are characteristic also today as basic specialization of these sectors; the sectors producing accessories and equipment for automation (with an increase of 53,2% annually); the sectors producing metalcutting machines and especially lathes (with 15,4%); the shipbuilding (with 17,6%); electric-technical machines (with 17,7%), etc.

The third phase comprises approximately the last decade. It is characterized by a very fast development of the radioelectronic industry (by an average annual increase of about 15% over the period 1970-1978), of the instrument building and automation equipment industries (by 43,4%), of the lifting and transport equipment and machines (by 15,3%), ect. All these production activities have already been established as the basic specialization and characteristics of the capital goods industry in Bulgaria.

The following table shows the growth of the capital goods industry broken down by basic industries; 1960 and 1970 being taken as bases:

The different rates of production growth in the above sectors brought to qualitative changes in the capital goods industry structure. Constantly growing over the recent years is the share of the electronic industry, the automation means production and appliances building, the production of specific machines and equipment for the capital goods producing branches. Despite the clearly marked tendency towards certain decrease of the share of the production of transport vehicles and of energy and electrical machinery and equipment they still continue to occupy

Table 3

Development of the capital goods industry output in the main subsectors

	In 1978 compared to	
	1960 (in times)	1970 (in %)
T o t a l	16	313
Electronic industry, instruments building and automation equipment industries	115	712
Production of transport vehicles and means of mechanisation of the storage	16	283
Production of energy and electrical machinery and equipment	11	227
Production of specific machinery and equipment for the capital goods industry branches (metal-cutting and forging machines; machines for the mining and heating industry; machines for the metalurgical and woodprocessing industry, for the industry of building materials and the cellulose - paper industry	7,8	327
Tractors and agricultural machines production	12	186
Production of specific machines and equipment for the consumer goods producing branches (sectors)	76	273
Production of spare parts and repair of machines and equipment in specialized enterprises	13	246

a basic place in the branch. Totally from all the quoted about 80 per cent of the capital goods industry input was produced in 1978. The structural changes are shown on the next table:

Table 4

Structure of the capital goods industry according to its main specialisation lines

(in %)

	1960	1970	1978
T o t a l	100,0	100,0	100,0
Electronic industry and instruments building and automation equipment industries	5,0	14,9	29,0
Production of transport vehicles & storage mechanisation means	24,2	24,9	22,5
Production of energy and electrical machinery and equipment	23,7	21,8	16,0
Production of specific machines and equipment for the capital goods industry sectors (metalcutting and forging machines; machines for the mining and heating industry; machines for the metalurgical and woodprocessing industry, for the industry of building materials and the cellulose - paper industry)	24,3	10,6	11,9
Production of tractors and agricultural machines	6,6	8,0	4,5
Production of specific machines and equipment for the consumer goods producing sectors	1,1	5,3	4,0
Spare parts production and machinery repairs and equipment in specialised enterprises	15,1	14,5	11,7

3. EVOLUTION OF THE MAIN BRANCHES AND PRODUCTION LINES OF THE CAPITAL GOODS INDUSTRY

Electronic industry, instruments building and the automation equipment production are developing very intensively in recent years. Its production is being doubled now in an average of four years.

Typical representatives of this production line are:

- computer techniques: computers, minicomputer systems, external memory units on magnetic tapes and discs, terminals, central processors, programme digital devices for metal-cutting machines;

- various types of appliances and means for automation of the production processes among which: electronic regulators, instruments for control and regulation of the technological processes, operation electrical and pneumatic mechanisms;

- measurement and control devices for electrical parameters;

- telemechanics and teleautomatics devices;

- time reading devices, measurement and regulation of mechanical quantities devices;

- various kinds of apparatuses and laboratory equipment and instruments for plant laboratories etc.

The development of this line is of paramount importance for the capital goods industry. The diversification process has been strongly expressed in it in recent years, and it is of principal importance for the rapid increase of the technical and technological levels both of the machines and the equipment in the whole industry and also for the technical level of the production of this branch. The latter is of exclusive significance for the establishing of the production of this branch as basic in the export list of the country. This process repeatedly emphacises the enormous significance of the evolution of this essential sector of the industry for the general economic development of the country.

One of the main trends of the capital goods industry

which is of great importance for the development of industry and of the other sector in the country, as well as for the exports, is the production of transport vehicles and of storage mechanisation means. In 1978 the hoisting machinebuilding, which is the most significant representative of this trend of the capital goods industry development, produced 192 times more production than it did in 1952 and 3,1 times more than in 1970. A few large for the scales of our country plants are under construction, among which the "6th September" electrical works, in Sofia; the "Danube" electrical works in Lom, and the "Record" works in Plovdiv. In 1978 the electric trucks, electric hoists and motor car works produced about 12 per cent of this branch production.

Table 5

Production of Electric Trucks, Motor-cars and Electric Hoists

	1960	1970	1975	1978	In 1978 compared to	
	(in pieces)				1960 (in times)	1970 (in %)
Electric trucks	3104	29641	39911	43417	14	146
Motor-cars (special trucks) - nonel.	-	2433	11315	21507	-	884
Electric hoists (telphers)	4339	48094	85446	110459	25	230

To illustrate the rates of development and the importance of the country's specialisation in the production of means of the storage mechanisation, factory transport it suffices to point out that in 1978 the electric trucks electric hoists pro-

duced equalled 14 and 25 times those produced in 1960. Intensively developing over the recent years is the motor car production - about 9 times more motor-cars (special trucks) were produced in 1978 compared to those produced in 1970.

Actively developing is also the production of the means of complex mechanisation and automation of the intrafactory hoisting transport processes as well as for the complex storage mechanisation. With the progress of this production conditions have been created for a better mechanisation and automation of the production processes almost in the overall industry of the country as well as for the expansion of the export list, in particular with regard to the developing countries, to many of which Bulgaria has rendered financial aid.

Well developed is also the crane production, which in 1978 exceeded by 1,43 times, that of 1970.

Automobile industry (autobuses, trucks, etc.) is also well in progress. Owing to co-operation with other countries in 1978 its production exceeded by 33 times that of 1960 and by 4,7 times that of 1970.

Important representatives of the transport vehicles production are the shipbuilding and shiprepairing yards, among which is the eldest and largest "Georgi Dimitrov" shipyard. The 1978 shipbuilding output exceeds by 9 times that of 1960 and by 1,78 times that of 1970. Bulgarian shipbuilders nowadays design and construct ships of big tonnage and of various designation - 25000 tonns oretransporters, 38000 cargo ships a.o.

Bulgaria produces also a number of railroad transport equipment, among which freight cars, tanks, refregirator cars, mechanisation and complex automation means for the railroad trans-

port.

One of the oldest lines of the capital goods indusry and of great importance to it is the production of energy and electric machinery and equipment. It was started in the first years after the Socialist revolution of 1944 to meet the needs of the country originating from the rapid electrification. It developed later on mainly to satisfy the needs for energy and electrical machines and equipment for the remaining sectors of the capital goods industry. Its output increase is connected also with the co-operation with other COMECON countries and the exports to the developed capitalist countries as well as to the developing countries, which has become very active recently.

This production is concentrated in two main lines:

- the production of energy machinery and equipment - the output in 1978 exceeded by 9,3 times that of 1960 and by 2,2 times that of 1970;

- the production of electrical machinery and equipment - the output in 1978 being by 12 times that of 1960 and 2,31 times that of 1970.

Most typical here are industrial steam boilers and internal combustion engines. The steam boilers produced in 1978 exceeded by 71 per cent those produced in 1960, for the internal-combustion engines this figure is 22 per cent. In the last years the capacity of the internal-combustion engines considerably increased. Their increase, measured in horse powers is 3,9 times that of 1960.

In connection with the development of the atomic power stations some enterprises are specialised in the production of some kinds of special equipment for atomic power-stations.

Typical for the production of energy machinery and equipment are the electric motors. In 1978 their number reached approximately 1,2 million and they were in the centre of the productions of most of the capital goods industry sectors.

Table 6

Electric Machinery Production

	1960	1970	1978	In 1978 compared to	
	(in pieces)			1960 (in times)	1970 (in %)
Electric motors - thousand pieces	236	751	1161	4,9	155
Power Transformers	3294	4807	8495	2,2	177
Batteried - thousand pieces	364	3274	4272	12,0	130
Units with electric and combustion engines	264	368	1828	6,9	5 times
Electric generators	342	515	2230	6,5	4,3 times

The rapid development of the battery production is connected on the one hand with the internal market needs, originating from the expansion of the electric truck production and on the other - with the participation of our country in the international labour division, connected with the high export of electric trucks and the automobile building within the framework of the economic integration among the COMECON countries.

Lately, considerably expanding is the production of complete technological lines, equipped with all the necessary electric machinery, of complete low and high tension systems; various kinds of electroisolational materials, power rectifiers,

some types of electric furnaces, etc..

The rapid development of heavy industry in Bulgaria which in 1978 exceeded by 6,1 times the level of 1960 and 2,1 times the level of 1970, made possible the development of some trends of the capital goods industry for satisfying the needs for some specific machines and equipment of socialist Bulgaria's industry.

Significant is the share of the metal-cutting, forging and casting machines. Manufactured also are some types of excavators, and equipment for the building materials industry, the manufacture of machinery and equipment for the mining and thermoindustries, ferrous metallurgy, the timber industry as well as for a part of the remaining capital goods producing sectors.

Table 7

Indicators of the Capital goods industry designated for the heavy industry branches compared to 1960

(in %)

	1970	1978
Manufacture of metal-cutting, forging and casting machinery and equipment	609	19 times
Manufacture of machinery and equipment for the mining and thermoindustry	155	373
Manufacture of machinery and equipment for metallurgy (1969 = 100)	122	482
Manufacture of machinery and equipment for the timber industry	410	655
Manufacture of road and excavation machinery for the building materials industry	510	20 times
Manufacture of other machinery and equipment for the production process	173	593

With regard to the metal cutting and forging and casting machinery best developed is the lathes and drilling machines manufacture. Bulgaria produces universal milling machines, camgear machines, finishers, etc. Recently some factories are specialising in the manufacture of agregate machines and of machines with programme devices. Automated and semi-automated lines for the machine building and the metal working industries are being produced.

Table 8

Manufacture of Metalworking Machines and Presses

	1960	1970	1978	In 1978 compared to	
		(in pieces)		1960 (in times)	1970 (in %)
Metal cutting machines	3145	13945	15315	4,9	110
among them:					
metal cutting lathes	1519	3946	6484	4,3	164
stable and semi-stable drills	1229	6259	4212	3,3	67
Milling machines	15	950	812	54,0	85
Eccentric presses	166	815	745	4,5	91
Hydraulic presses	43	162	301	7,0	186

The rapid progress in this sector of the capital goods industry is due on the one hand to the increased needs of the machine building itself for metal working machines and equipment for the production of separate parts and details. On the other hand this industry provides enough of these to meet the needs of the country and to export a considerable part of it. For

example in 1978 Bulgaria exported 5459 lathes to 55 countries and 2960 drills to 48 countries.

One of the important trends of the capital goods industry is the agricultural machinebuilding. The accelerated rates of this production is of a paramount importance for the whole process of the economic development of the country because it presents opportunities for the following.

- on hand of the rapid complex mechanisation of the production processes in agriculture and in particular in the corn production to increase by several times the labour productivity, to release manpower from agriculture and to eliminates the concealed unemployment in this sector, which predetermined the very low standard of life of the rural population in bourgeois Bulgaria. The labour effectiveness in agriculture in 1978 was 3,4 times the level of 1960 and 1,7 times the level of 1970. For the same period of time the number of the manpower occupied in agriculture dropped by 51 per cent against that of 1960 and by 27,7 per cent as against 1970;

- to direct to industry excess manpower from agriculture. This creates additional and significant conditions for the development of the capital goods industry. It meets the needs of both the agriculture and the remaining sectors of the country's economy as well as of export goods.

Agricultural machinebuilding manufactured 59 times the level of the 1952 production. Developing is the tractor building, systems and various types of machinery for the plant-breeding, vegetable-growing, vine-growing, animal-breeding a.o. as well as the manufacture of tractor ploughs, tractor cultivators, tractor drill ploughs, forage mills, automotive chassis, various kinds of dessicators and complex mechanisation equipment for cattle-

poultry pig- and sheep-breeding farms.

Table 9

Production of Agricultural Machinery

(in thousand pieces)

	1960	1970	1978
Tractors	--	3,5	7,7
Tractor drill ploughs	2,0	22,4	22,0
Forage mills	0,3	18,1	9,5

The tractor production in 1978 increased by 2,2 in comparison to 1970. In comparison to 1960 11 times more tractor drill ploughs and 32 times more forage mills were produced in 1978.

The production of machinery and equipment for the food and the light industries, is also developing:

Table 10

Development of the capital goods industry production for the needs of the food and light industries as compared to 1960

(in times)

	1970	1978
Manufacture of machinery and equipment for the light industry	28	68
Manufacture of machinery and equipment for the food industry	16	43

Our industry produces lines for clear and thick fruit juice, bottled fruit lines, autoclaves, meatgrinders, vacuum machines, sunflower seeds shellers, grapes grinders, bread making machines, machinery for the tobacco industry, packing ma-

chinery, refrigeration installation, refrigeration aggregates. There also is a specialisation in the production of some kinds of complete technological lines, shops and factories.

The following machinery and equipment are manufactured for the needs of the light industry:

- textile industry: carding machines, spinning looms, looms, dyeing equipment, as well as complete technological lines, shops, and factories of the textile industry;

- knitwear industry: stockings automatic machines, base knitting machines, flat knitting machines, round-knitting machines;

- sewing: universal industrial sewing machines, steam ironing machines and equipment;

- leather, furriery and shoe-industry: tanning machines, leather cutting machines, and machines for the manufacture of various leather articles;

- polygraphic industry;

- glass and china-faience industry.

The rapid development of the capital goods industry promotes the organisation of spares and maintenance parts in independent industrial units. New in the individual industrial units is the repair work of some kinds of machines.

Manufactured are spare parts for aggregates, tractor and agricultural machines, joints, and details for automobile tractors, for machinery and equipment of: the ferrous metallurgy, the chemical industry, the light industry, the timber industry, the celulose-paper industry, the cement industry and the remaining industrial sectors for the production of mining and oregaining machinery and equipment, the hoisting-transport machines,

Table 11

Development of the production in the units manufacturing spares and maintenance parts and carrying out repair works of machinery and equipment as compared to 1960

	1970 (in %)	1978 (in times)
Manufacture of spare parts	534	10
Repair works of machinery, transport vehicles and equipment	522	15

electronic and electric equipment, rail, air and sea transport a.o. The diversification in the capital goods industry played a very essential role in the development of the spares and maintenance parts production as well as of the repair works of machinery, transport vehicles and equipment.

Specialised industrial units are built in the Bulgaria for repair works of automobiles, tractors, railway transport vehicles as well as of some specific machines for the metallurgy, cement industry, pottery a.o.

4. DEVELOPMENT OF FOREIGN TRADE IN CAPITAL GOODS

The progress of the capital goods industry has led to a rapid development of the foreign trade of the country. Especially over the last 10-15 years the country acquired quite a great popularity in the international markets. A considerable part of the manufactured production of the sector is exported to the socialist countries, while another part is exported to the industrialized and the developing countries. With a view to the needs of the country import is provided of certain kinds and types of machines and of machines not produced in Bulgaria or machines with

higher and specific characteristics. Thus, for example, the exports and imports of some basic capital goods in a natural expression are shown on the following tables (Table 12 and 13).

Table 12

Exports of some basic capital goods from Bulgaria in 1965-1978

(in pieces)

Kinds of Goods	1965	1970	1975	1976	1977	1978
Lathes	1599	1750	410	4602	4647	5459
Shaping machines	14	38	130	121	28	6
Eccentric presses	58	129	257	442	444	460
Diesel motors	755	229	393	380	96	230
Electric motors (in thousands)	215	362	855	936	1051	1285
Threephase Electric motors (in thousands)	159	287	250	237	228	270
Power transformers	2298	470	27	205	533	786
Electric cars	16589	27799	37215	37764	35985	39698
Electric hoists	17951	45836	76964	82964	92806	97834
Bearings (in thousands)	2262	3535	3747	3523	2442	4261
Motor-cars (trucks) - non electric	-	-	10253	10867	14759	18708
Milling machines	-	-	310	330	590	434
Drills	-	-	3580	2580	2407	2960

The data shown on the above table prove that in a short period of time Bulgaria's export of capital goods for a number of productions like: electric hoists, electric trucks, lathes, electric motors a.o. has increased in the range of 5 to 10 times.

Parallely with the exports of these capital goods Bulgaria has imported significant quantities of capital goods with the

purpose of implementing in industry the achievements of the world technology in this field. The import of capital goods for this same period is as follows:

Table 13

Imports of some basic capital goods to Bulgaria in 1965-1978

(in pieces)

Kinds of Goods	1965	1970	1975	1976	1977	1978
Lathes	274	472	662	620	766	1041
Boring machines	104	75	94	105	74	127
Milling machines	127	348	238	201	380	364
Gear cutting machines	82	65	72	83	71	125
Drilling machines	17	108	57	91	84	106
Hobblemachines	8	6	5	2	5	12
Planing machines	243	241	289	305	321	349
Grinding machines	103	112	123	169	92	154
Hydraulic presses	42	43	29	64	29	43
Diesel motors	368	284	3439	2728	1565	1809
Water electric stations (in thousand leva)	306	4740	163	138	242	173
Generators	122	56	1	7	-	-
Electric motors	2185	23086	44248	33927	44990	25072

The data from Table 13 show that for the same period of time no smaller quantities were imported of electric motors, dieses motors, grinders, drilling machines, and lathes and that the increase of this import varies also within the range of 5 to 10 times. Three basic tendencies are present: the increase of imports is accompanied by not so high exports of the respective

type, which means that the needs of the country are met mainly from outside. The second tendency is when exports grow quicker than imports i.e. the home production meets part of the internal needs, but the greater part of it is going to the external market. The third tendency is this at which both the exports and imports of a certain type of capital goods are changing almost equally. This means the specialisation of the country in a certain type and size and the presence of exchange and purchase of other types and sizes from abroad.

No matter how characteristic the natural indices of Bulgaria's foreign trade capacity with the mentioned goods is, the most striking illustration of the export potentials and the needs met by imports are the value indices for groups of goods groups of countries and for several countries. Thus the exports of the country of goods from Section 7 of SITC (machinery, equipment and transport vehicles) is shown on the following table: The exports of Section 7 - capital goods, machinery, equipment and transport vehicles from Bulgaria the period 1971-1978 978 was in its greater part concentrated to the socialist countries - COMECON members and accounted in 1971 for 88 per cent and in 1978 for 89,4 per cent of the overall exports. The exports to the Soviet Union only in 1971 accounted for 57,8% and in 1978 for 63,8 per cent.

With regard to the developing countries in structural aspect it grew from 5 per cent in 1971 to 7 per cent in 1978.

Similar are the tendencies of development of the groups of Section 7 exports of Bulgaria. Thus the export of non-electric machinery and equipment (Group 71) increased from 419 million dollars in 1971 to 2308 mil. dollars in 1978. The share of the

Table 14

Exports of goods from Section 7 (SITC) Total capital goods from Bulgaria in 1971-1978

(in millions $)

Groups of countries and Countries	1971	1972	1973	1974	1975	1976	1977	1978
1. COMECON-TOTAL	584,8	811,7	1141,6	1342,6	1620,9	1946,0	2377,7	2970,4
incl. USSR	384,1	565,0	796,2	925,0	1118,0	1352,9	1656,5	2120,7
GDR	77,8	89,2	129,8	133,8	146,5	189,8	256,5	267,5
2. OTHER SOCIALIST COUNTRIES	15,0	13,2	19,0	22,0	25,3	22,9	25,1	70,0
3. EEC	13,4	9,7	16,3	22,0	24,8	23,4	23,8	32,9
incl. FRG	2,1	1,9	2,9	4,0	6,3	5,6	7,9	14,1
Italy	3,5	4,8	8,6	9,9	9,1	8,3	7,3	8,3
4. EFTA	14,7	13,0	12,4	8,6	11,0	16,8	45,6	14,6
incl. Sweden	0,2	0,4	0,5	1,3	1,4	6,9	31,4	1,3
5. USA, Japan, Canada, Australia	0,3	0,3	1,0	2,0	1,4	2,1	1,6	3,0
6. DEVELOPING COUNTRIES	36,2	40,5	58,9	83,1	140,2	139,2	161,6	232,1
incl. countries from Africa	8,1	9,6	21,5	48,3	75,9	91,0	127,8	140,0
only Libia	0,1	0,5	4,8	7,5	37,8	60,4	72,9	27,0
LATIN AMERICA	0,4	1,2	3,8	0,7	1,4	1,3	2,7	3,3
NEAR EAST	17,8	23,0	28,3	25,2	52,8	37,3	18,9	64,6
only Iraq	12,8	17,7	22,7	19,3	47,7	30,4	9,1	50,4
MIDDLE EAST	2,4	1,8	2,0	4,3	8,1	7,3	6,7	20,9
ASIA	7,5	4,9	3,3	4,5	2,0	2,3	5,5	3,3
T O T A L	664,4	888,4	1249,2	1480,2	1823,6	2150,4	2635,4	3323,0

COMECON-member countries is about 94%_i.e. does not change for this period and is above that of the whole Section. Only for the USSR the export is 66% respectively 67% for the two last years of the period. The exports to the developing countries is increasing slowly - from 9,5 million to 38,2 million dollars. In general the exports of the 72 group (electric machinery and appliances) is smaller in volume and its increase for this period is not so high - from 92 million to 348 million dollars for the same period, but the exports to the developing countries, independently of the small volume increased 12 times their level - from 2 million to 25 million dollars. The group of the transport vehicles exports (group 73) is placed according to its volume between the other two (667 millions in 1978) and also by rates of increase. The volume and the rates of increase of the exports to the developing countries are also quite high (from 24 to 169 mil. dollars for the above period). The country is also exporting limited quantities, mainly to the COMECON-member countries of group 69 products (other metal articles) and of sub-group 861 (instruments and measuring equipment) especially in the last few years.

Bulgaria's exports to the developing countries could be generalised for Section 7 and for the different groups as follows:

The data from Table 15 show that in the period 1971-1978 Bulgaria's capital goods exports to the developing countries had been oriented to the sections: Section 7 - in general, which had increased by 6,4 times; group 71, had increased 4,0 times; group 72, by 11,9 times and group 73 which increased by 6,9 i.e. showed the highest increase.

Table 15

Bulgaria's exports of capital goods to the developing countries during the period 1971-1978

(in million $)

Section and groups of SITC	1971	1972	1973	1974	1975	1976	1977	1978
Section 7	36,2	40,5	58,9	83,0	140,2	139,2	161,6	232,1
Group 71	9,5	11,0	16,1	19,9	30,7	21,2	24,9	
Group 72	2,1	4,2	7,4	8,7	8,5	13,6	9,7	25,0
Group 73	24,4	24,8	35,6	53,9	100,2	103,9	126,7	168,7
Group 69	.	.	.	.	0,7	1,4	2,6	2,8
Subgroup 861	.	.	.	.	1,1	0,8	0,5	1,8
T O T A L	36,2	40,5	58,9	83,0	141,0	141,4	164,7	236,7
Indices (in %)								
Section 7	100,0	111,9	162,7	229,3	387,3	384,5	446,4	641,2
Group 71	100,0	115,8	169,5	209,5	323,2	223,2	262,1	402,1
Group 72	100,1	200,0	352,4	414,3	404,8	647,6	461,9	1190,5
Group 73	100,0	101,6	145,9	220,9	410,7	425,8	519,3	691,4

*Only Section 7 until 1974.

The data from Table 15 show that in the period 1971-1978 Bulgaria's capital goods exports to the developing countries had been oriented to the sections: Section 7 - in general, which had increased by 6,4 times; group 71, had increased 4,0 times; group 72, by 11,9 times and group 73 which increased by 6,9 i.e. showed the highest increase.

Independently of the increase of the absolute volumes the capital goods exports are still unsatisfactory - the overall size of the exports increased from 36 mln. dollars in 1971 to 237 mln. dollars in 1978.

Parallel with the development of the capital goods industry and the exports of its products to other countries, Bulgaria has always imported capital goods in order to maintain and develop its production foundation and to be competitive on the international markets. Thus for example in the period 1971-1978 according to SITC nomenclature Section 7 the imports of Bulgaria varied in the following limits:

Table 16

Imports of goods from Section 7 total capital goods to Bulgaria

(in millions $)

Groups of countries and countries	1971	1972	1973	1974	1975	1976	1977	1978
1. COMECON* - TOTAL	674,6	944,3	1119,6	1315,8	1342,2	1552,2	1814,8	2008,2
incl. USSR	430,8	577,3	675,2	824,3	812,1	916,6	1172,9	1298,4
GDR	104,5	137,2	165,7	186,8	196,9	233,6	146,6	278,6
2. SFRY	4,2	4,2	6,8	7,2	12,7	12,1	7,4	9,1
3. EEC	91,8	76,1	97,5	158,3	392,5	322,7	246,0	247,2
incl. FRG	28,4	39,0	50,9	94,7	213,1	196,7	126,2	159,3
4. EFTA	18,2	25,2	26,3	37,0	66,2	56,4	47,4	161,1
5. USA, Canada and Japan	8,9	10,4	22,6	30,8	30,5	18,9	29,7	33,2
6. India and Hong Cong	0,3	0,1	0,7	0,3	0,9	1,6	0,0	0,0
T O T A L	798,5	1061,1	1275,3	1553,5	1854,0	1970,7	2161,6	2413,8

*ROUMANIA EXCLUDED

The data from Table 16 show that the imports of capital

goods to Bulgaria have considerably increased, from 798 mln. dollars in 1971 to 2414 mln. dollars in 1978 bearing in mind that the scales of imports in the recent years is smaller than those of exports of the same goods. The volume of both the exports and imports is the highest for the socialist countries (COMECON-members) during this period the overall imports of these goods account for about 83% and from the Soviet Union only - for about 54%, with no serious changes in the relative shares.

Similar are the tendencies of development of the imports from Section 7 groups of products and from the remaining groups of capital goods. Greatest is the share of non-electric machinery and equipment imports, next come the transport vehicles, with the difference that the first grow more slowly, especially over the last years and the second have increased about 4 times. The imports of the other metal products and apparatuses show a tendency to decrease with a view of meeting some needs of the home production with a tendency of expanding their exports. Over 2/3 to 3/4 of the imports to the separate groups come from the COMECON member countries. Highest is the growth of the import of electric machinery and appliances from USSR - over 8 times for the period under consideration.

A comparison between the volumes of exports and imports of capital goods (Table 17) shows that after 1975 the volume of exports exceeded that of imports, which was due mainly to group 71, out of which the exports to the COMECON member countries were predominant (Table 18). It should be emphasized that a trend of prevalence of exports over imports in the field of the capital goods has been noticeable in the trade relations with the COMECON member countries since 1973. The ratio of exports against imports

Table 17

General Exports and Imports of Bulgaria in the period 1971-1978 (Capital Goods)

(in mill. dollars)

Section and Groups according to SITC		1971	1972	1973	1974	1975	1976	1977	1978
Section 7	exports	664,4	888,4	1249,2	1480,2	1823,6	2150,4	2635,4	3323,0
	imports**	798,5	1081,1	1275,3	1553,5	1854,0	1970,7	2161,6	2413,8
Group 71	exports	419,1	582,4	847,7	1000,8	1262,0	1480,2	1832,0	2308,3
	imports***	516,5	644,3	764,5	912,5	1040,6	1160,3	347,5	961,3
Group 72	exports	91,7	114,7	133,7	144,7	173,3	212,1	254,8	347,9
	imports***	109,5	142,7	171,0	252,8	259,6	244,3	330,2	205,8
Group 73	exports	153,0	190,8	268,4	334,5	387,2	457,5	549,0	666,9
	imports***	165,1	240,9	293,7	370,7	470,7	445,4	501,2	656,0
Group 69	export	.	.	.	.	18,5	26,8	30,9	43,9
	imports***	.	.	.	.	78,9	64,5	62,9	37,5
Sub-group 861	exports	.	.	.	.	57,5	76,6	100,6	124,9
	imports***	.	.	.	.	58,1	70,0	21,5	14,7
TOTAL*	exports	664,4	888,4	1249,2	1480,2	1899,6	2253,8	2766,9	3491,8
	imports**	798,5	1061,1	1275,3	1553,3	1991,0	2105,2	2246,0	2466,0

* Only Section 7 up to 1974
** Roumania excluded
*** With the exception of the German Democratic Republic, Hungary and Roumania

Table 18

Bulgaria's Exports and Imports of Capital Goods to and from the COMECON member countries in the period 1971-1978

(in mill. dollara)

Section and Groups according to SITC		1971	1972	1973	1974	1975	1976	1977	1978
Section 7	exports	584,8	811,7	1141,6	1342,6	1620,9	1946,0	2377,7	2970,4
	imports**	674,6	944,3	1119,6	1315,8	1342,2	1552,2	1814,8	2003,2
Group 71	exports	396,4	553,3	803,8	943,3	1181,6	1403,2	1722,7	2170,8
	imports***	427,3	570,5	633,8	762,4	705,4	859,0	600,1	745,7
Group 72	exports	82,4	104,5	116,3	124,5	153,9	190,7	235,6	306,0
	imports***	83,5	117,1	139,8	148,1	189,6	185,5	258,6	120,7
Group 73	exports	105,6	154,1	221,6	275,0	285,3	351,9	419,4	493,5
	imports***	156,6	223,4	268,9	338,1	364,3	390,9	473,8	552,1
Group 69	exports	.	.	.	.	14,7	21,0	22,7	32,9
	imports***	.	.	.	.	27,2	23,9	15,9	3,0
Sub-group 861	exports	.	.	.	.	55,3	74,2	96,6	118,0
	imports***	.	.	.	.	45,4	36,4	5,7	4,1
TOTAL*	exports	584,8	811,7	1141,6	1342,6	1690,9	2041,2	2497,0	3121,3
	imports**	674,6	944,3	1119,6	1315,8	1414,8	1612,5	1836,4	2015,3

* Only Section 7 up to 1974
** Roumania excluded
*** With the exception of the GDR, Hungary and Roumania

changed from 0,95 in 1975 to 1,42 in 1978 - which is valid for the trade with all countries. As far as the COMECON countries are concerned the ratio was shifted from 1,20 to 1,55. This ratio, however is unfavourable as far as the trade in capital goods with the developed capitalist countries is concerned. In 1978 it amounted to 0,13. In the same year the export to these countries was 1,4 times the level of 1975 (it amounted to 55,9 million dollars, as against 38,9 in 1975), while the import over the same period decreased from 548,4 mil. dollars to 439,7 mil. dollars (Table 19).

Table 19

Bulgaria's Exports and Imports of Capital Goods to and from the Developed Capitalist Countries in the period 1971-1978

(in mill. dollars)

Section and Group according to SITC		1971	1972	1973	1974	1975	1976	1977	1978
Section 7	exports	28,4	23,0	29,7	32,6	37,2	42,3	71,0	50,5
	imports	118,9	111,7	146,4	226,1	489,2	398,0	323,1	396,5
Group 69	exports	.	.	.	.	1,0	2,5	3,5	2,1
	imports	.	.	.	.	46,7	34,2	43,5	32,6
Sub-group 861	exports	.	.	.	.	0,7	0,9	2,4	3,3
	imports	.	.	.	.	12,5	33,5	15,7	10,6
TOTAL*	exports	28,4	23,0	29,7	32,6	38,9	45,7	76,9	55,9
	imports	118,9	111,7	146,4	226,1	548,4	465,7	382,3	439,7

*Only Section 7 up to 1974

B) The Organisation of the Capital Goods Industry, Management Systems, Education and Training Programmes

1. ANALYSIS OF THE STRUCTURE OF A BASIC ORGANISATIONAL UNIT OF THE SYSTEM OF THE CAPITAL GOODS INDUSTRY OVER THE PERIOD 1970-1976 .

An attempt is made in this part for some important moments in the development of the organization and the structure of the capital goods industry in Bulgaria to be treated and commented upon. This will help to enrich the conception and to faciliate the treatment of the complicated problems of the development of this sector in Bulgarian economy.

The studies of the present practice in the construction of the production structure of the capital goods industry enterprises in Bulgaria has shown that predominantly object-specialization systems of relatively closed character had been created. The greater part of them are almost of universal production structure with the respective set of work-shops - foundry and forging-casting and assembly shops. Even the small territorially autonamous industrial units in their striving of being independent copied the structure of large enterprises. The small size of the existing enterprises did not contribute to the concentration of efforts and potentials in separate, amalgamated production systems where it is possible to increase both the effectiveness and the quality of the manufactured production. In the same time production capacities were duplicated the process of specialisation and concentration was held back.

Independently from the fact that the distribution of the enterprises of the capital goods industry according to the

index - scales of the total industrial output, a gradual saturation of the medium groups was observed, which spoke for the increase of the number of the large enterprises, in fact this process was taking place very slowly. The following facts are in-support of this conclusion. Up to now the development of the concentration process was illustrated by the distribution of the enterprises according to one of these four indicators: Gross industrial output (GIO), capital production funds (CPF), net production (NP) and industrial production personnel (IPP) or a complex evaluation was made of these four to find the base for indluding a respective group of enterprises in one of the intervals determined for each of the above indicators. But the intervals chosen for the distribution of the enterprises, for example for the size of the total industrial output are a result of quite old statistical evaluations. They were introduced long ago and the notions of small and large enterprise have changed and are constantly changing. Nowadays these intervals cannot give a precise picture of the expansion of the sizes of the enterprises and in this sense they are inadequate for the needs of contemporary analysis.

For this study another method was chosen, which throws light to some other sides of the process of structurisation in a way different from the one described above. One indicator was used - the size of the GIO, the basic task being not the study of the concentration of the sector but the concern to check whether a universalization of the production structure of the machinebuilding enterprises leads to expansion of their sizes. From the whole multitude of observed enterprises in 1975 (167 from 11 State Economic Associations (SEA)) we have picked out

two enterprises one having the least value of the GIO indicator and respectively the enterprise with the greatest value of the same indicator. Thus we have obtained the range limints of the enterprises existing in reality. This range was divided into 5 arbitrarily chosen groups (they can be more or less) and the multitude of enterprises was classified according to the closeness of the value of the indicator studied to the respective group. This way the distribution of the enterprises into the respective intervals was made according to the ranges isolated in reality, so that these ranges were not "artificially" obtained or preassigned. According to the distribution made, only 5 large enterprises fell in the last, the highest group and 2-in the next one. In other words only 7 enterprises fell in the range group of 47 million leva to 95 million leva size of the GIO. Similar is the situation in the third group - only 5 enterprises: in the second - 11 and in the first - 144 enterprises. Most generally speaking there are 22 enterprises in the range with a value of the indicator studied varying from 18 to 95 million leva and all the remaining enterprises fell within the range from 152 thousand leva to 18 million leva size of GIO. This way of presentation illustrates the comparatively low level of concentration and the small sizes of the enterprises.

Over a period of 10 years /1965-1975/ the concentration level of production did not increase practically. The comparison of the sizes of the smallest existing machinebuilding enterprise in 1965 and in 1975 indicated no growth. There was an increase of the size only of the largest enterprises.

When studying the production structures of 93 enterprises from 6 SEA on the level of 1975 generalized data were

obtained /see Table 20/. All the investigated 93 enterprises possessed 912 work shops and 863 sections in total or on an average almost every enterprise possessed about 10 basic and ancillary shops. Most mobile production structure possess the enterprises belonging to SEA "Heavy machinebuilding" - on an average 14 shops to one enterprise.

It is seen from the Table that the investigated enterprises possess a well developed network of ancillary and service shops which shows that neither of them is included in the system of production joint (territorially localized system of various enterprises with a common infrastructure). Striking is the extremely high relative share of the servicing shops - 57% of the total number of shops, whereas in this group the biggest share belongs to the storage. The almost equal relative share between the preoperational and assembly shops - 24% and 26% indicates that in fact the enterprises are object-specialized and that in them the greatest is the share of the mechanical shops. One comes also to the conclusion that each enterprise develops independently its own production infrastructure including a large number of power-, transport and storage units. If the ratio between the basic and ancillary shops is approximately 2,6:1 then the ratio of the basic to the servicing shops is 1:1,8.

Obviously these data depend to a greater extent on the peculiarities of the production process, which is differentiated in the respective subsectors, but as we have here 6 SEA of different production it is possible to accept that the situation of the production structures of the whole branch is reflected.

Table 20

Distribution of the number of shops according to types in 93 enterprises of the capital goods industry

(in %)

Types of shops	According to the phases of the prod. process				
	Basic prod.	Auxill. prod.	Servi-cing prod.	Auxill. and servicing prod.	Total
1. Founding Casting	9,82	x	x	x	3,07
2. Forging & Pressing	10,17	x	x	x	3,17
3. Coppersmithery	1,05	x	x	x	0,32
4. Welding	0,70	x	x	x	0,21
5. Servicing	2,45	x	x	x	0,76
Total preoperational	24,39	x	x	x	7,53
6. Mechanical	23,50	x	x	x	7,34
7. Coverings	0,70	x	x	x	0,21
8. Mechanical-assembly	23,50	x	x	x	7,34
9. Other mechan.	1,05	x	x	x	0,32
Total mechanical	48,75	x	x	x	15,21
10. Assembling	17,19	x	x	x	5,37
11. Other ass.	9,12	x	x	x	2,85
Total assemling	26,31	x	x	x	8,22
Total basic	100,00	x	x	x	31,25
12. Repairs	x	48,05	x	8,29	5,70
13. Instrumental	x	50,00	x	8,45	5,81
14. Otherauxill.	x	2,77	x	0,63	0,43
(continues)					
Total auxilliary	x	100,00	x	17,37	5,70
15. Power	x	x	11,70	9,69	6,66
16. Transport	x	x	5,56	4,61	3,16
17. Storage	x	x	82,72	68,52	47,10
Total servicing	x	x	100,0	82,82	56,92
Total servicing & auxilliary	x	x	x	100,0	68,74
T O T A L	x	x	x	x	100,00

The universal character of the production structures indicates also to the lack of formed large intersectorial enterprises. Each enterprise has independently developed preparatory shops. The relative share of the workers from the sectorial enterprise occupied in the preoperational shopos - Founding, forging and casting a.o. accounts for about 21 per cent of the number of the workers from the basic production and for about 16% from the total number of all the workes. For the Soviet Union this index is considerably lower - 11-12% of all the workers are occupied in the preoperational shops, and for the USA machine-building - about 2%. The difference is apparent. In our country about 28% of the total number of the workers are employed in the ancillary and servicing production of the separate enterprises. When we add to them the number of those occupied in the preoperational shops, it is seen that about 56% of all the workers are occupied in the manufacturing and assembly phase of the production. The basic and ancillary workers ratio is 4:1, and that between basic and service workers 6:1. These data compared to the ratios between the number of shops show that in reality these numerous servicing subsectors are very small in size and that a very limited number of workers are occupied in them.

An important aspect, characterizing the production structure of the enterprises is the volume of the fixed capital in each of the shop types.

Highest is the relative share of the fixed capital in the mechanical shops - 26,8% from all the FC. The study of the FC structure showed that 84,0% from the fixed capital is located in the basic shops whic' is a new confirmation of the fact that the developed ancillary and service units in the studied enter-

prises is actually quite partitioned and therefore ineffective.

Of interest is also the study of the capital intensity index of labour per worker (with active capital funds). According to the types of shops this index shows the following situation:

Table 21

Types of Shops	Capital intensity (in thousands lv)
Foundry	5,5
Forging and casting	24,4
Mechanical	9,3
Assembly	3,4
Total in the basic shops	9,8
Repairs	3,7
Instrumental	8,3
Total in the ancillary shops	4,8
Power	8,9
Storage	27,9
Transport	4,2
Total in the servicing shops	4,5

The great significance of the capital intensity index is clearly seen.

Appart from the study of the capital intensity in the various departments an important point is the clarification of the tendencies of change in the production structure of the fixed capital. This made for 5 SEA and for the whole branch. Besides the situation of the production structure of the fixed capital

in 1975 was studied in 5 large machinebuilding enterprises.

The data show the diverse structure which directly depends on the peculiarities of the manufacturing process in the respective enterprise. Thus for example the share of the manufacturing machines in the structure of the "Madara" lorry building plant is quite small - 17% but the very manufacturing process of the plant is such that a lot of manual operations are predominating in it as this is an assembly plant. In the same time an enterprise with a specific production of hydraulic elements like the "Hydraulics" machinebuilding plant has the highest share of manufacturing machines within the structure of fixed capital - 67 per cent. Totally for the machinebuilding industry in the period 1967 - 1975 the relative share of the manufacturing machines increased from 47 to 49%. This increase accompanied by the decrease of the relative share of the buildings and of the equipment from 29% to 28% is also indicating the gradual development of the process of improvement of the structure of the capital.

An important characteristics of the production structure of the enterprises studied which is also supporting our statement as to their small size, is the coefficient of management of the workers occupied in the structural subsectors. This coefficient is calculated by dividing the number of the workers by the number of the leaders of the structural subsectors, the management personnel, the engineering-technical officers, and the employees. Data is obtained for 2-6 workers to one from the administration-management personnel in SEA and in some large enterprises, which speaks for the availability of reserves.

The development of the universal production structures

is also influenced by the level of standardisation, unification and typification. These processes were still of slow progress in our country. They were applied only to separate details, joints, and some articles. Completely lacking was a systematic classification of the typified, unified and standardized joints, details and elements not to speak of the circumstance that it was only recently that we started talking of the creation of technological families.

Independently of the fact that in some countries machinebuilding enterprises of similar size have been quite successful progressive and effective, in our country these enterprises with their present scales did not achieve what was expected from them. They did not recognize the whole compexity of factors and conditions which were to be taken into consideration at the construction of similar structures, not to speak of it that recently such enterprises can not cope with the strategic policy of the national economy for concentration and expansion the scales of production with a view to the international specialization and the external economic relations.

When explaining the situation of the production structures of the capital goods industry enterprises in our country, it should not be understood that this situation is only due to the development of the enterprises themselves. In principle the method that was used up to now, was purely administrative, closed, not reckoning with the targets of the national economy and in accordance with it the same way of procedure was applied on all levels. This revealed the weak points. From them and their negative influence in many socio-economic aspects of the social production originated the new method of improvement of its struc-

ture.

The small scales of the enterprises, their fragmentary universal structure, the duplicating production chains, the expanded nomenclature and assortment of the products manufactured in the branch - this all points to the way of improvement, a way of concentration of the small enterprises into large integrated multi-plant complexes, whose structure chains will be specialized either according to the phases of the production process or according to the products manufactured.

2. DEVELOPMENT AND IMPROVEMENT OF THE PRODUCTION STRUCTURE OF THE UNITS OF THE CAPITAL GOODS INDUSTRY

With the introduction of advanced technologies, with the complex mechanization and automation of the production processes and the more effective construction of the management system gradually was approached the stage of transition from the closed object-specialization principle of the machinebuilding enterprises over to large opened technological systems.

As it was shown, most of the machinebuilding enterprises had an almost universal production structure, built on an autonomous principle (Fig. 1). The orientation toward such a structure was still retained in the projects of reconstruction and expansion of the existing enterprises worked out at the end of the sixties the beginning of the seventies. This autarchic formation of the production structures hindered the rapid renewal of the fixed capital, reduced the productivity of capital, complicated the structure itself and created real prerequisites for idle production capacities, ineffective economic activities and bad management.

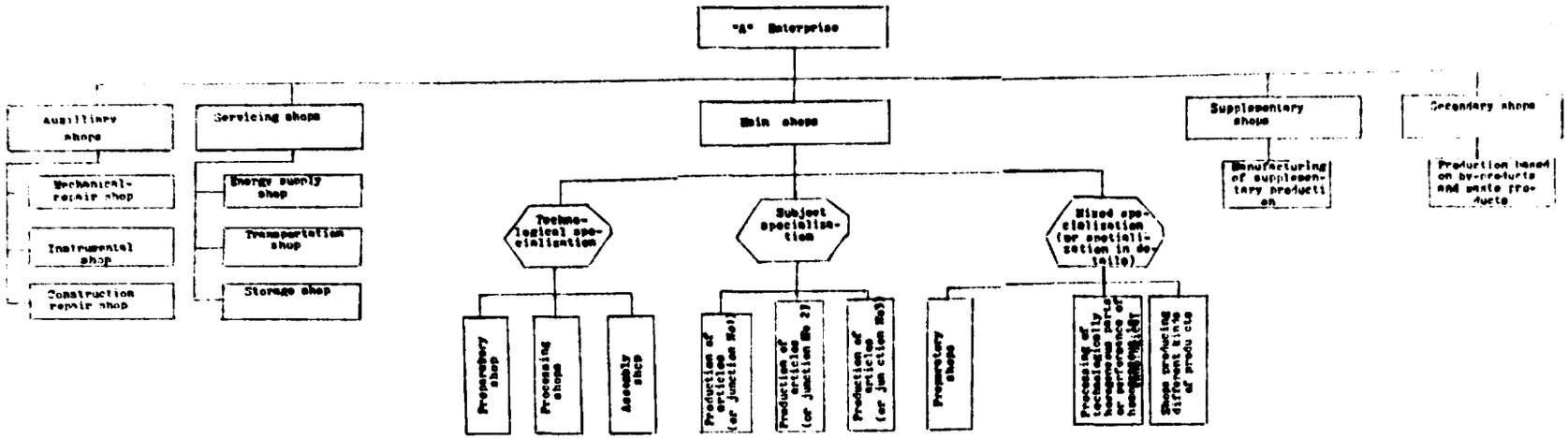


Fig. 1. A generalised graphic model of the universal production structure of a one-plant enterprise of the Bulgarian capital goods industry, having a complete production cycle

The new approach of the problems of specialization and concentration and most of all towards increase of effectiveness gives a completely new direction of the improvement of the production structure, expressed in the specialization of the whole enterprise echelons for primary processing of the raw materials and the production of fabricated elements, details and joints for assembly of the finished products as well as for the construction of optimal capacity manufacturing and assembly enterprises, which will contribute to react rapidly and flexible to the demands of the international and domestic markets and to detect in due time the "weak points" in the development of the individual branches.

In result of the new approach new "general schemes for concentration and specialization of the productive forces" in the different branches and subsectors were adopted. The basic change which is now taking place is the transition from object-closed machinebuilding systems towards an open specialized technological complexes. This change has also another character - The universal production structure is being gradually replaced by "purely" specialized production structure. But there are also some peculiarities that have to be taken into consideration.

The beginning of the practical realization of the new approach towards improvement of the social production structure was made with the production structure of the "machinebuilding" branch. A process began there of rearrangement and "purification" of the almost universal structures, and of the intensification of the basic specialization of the enterprises which was called

"echelonization"*. The essence of this echelonization (lining) was to arrange the various machinebuilding units according to the course of the production process isolated in them to the phases of the production process and included in the branch. It on its side was divided into 3 basic echelons (lines):

I echelon - fabrication phase;

II echelon - processing phase;

III echelon - divided into 2 sub-echelons - assembly of joints and details and assembly of the final product groups.

All the machinebuilding units attached to the respective echelon (the echelon is not organizationally isolated) and in this way the whole multitude of machinebuilding units was structurized in a completely new order, which gave new directions for their structural development. This process of echelonization provides opportunities for systematic accumulation of the effect, obtained in the different chains of the sectorial technological chain for its final realization in the consumer.

Three types of "echelon" production structures in the machinebuilding units according to the principle of including within the framework of the unit of one phase of the production process. In this respect the units fall into three broad groups:

- Production structure of the machinebuilding units of the first echelon - or units in which the preoperational phase of the production process is carried out. Large batches of cas-

*This newly coined term is used for describing a sub-sectorial lay-out of specialized by branch phase technological procceses, implemented by groups of industrial units. Organizationally and economically these groups do not belong to one and the same system. The "echelon formation" serves for raising the level of specialization.

tings, moulds, prints and welded constructions for the needs of the branch and the national economy are produced here. The production structure of these units consists of mainly preoperational shops.

- Production structure of the machinebuilding units of the second echelon - units whose production activities are concentrated on the manufacturing phase process. The mechanical shops predominate in the production structure of these units. Produced are mainly gears, axes, shafts and other details for the needs of the machinebuilding industry.

- Production structure of the machinebuilding units of the third echelon - these are the assembly units for joints or final products. They receive the separate joints, details and aggregates necessary for the assembly of the final products. Predominating in these units are the mechanical-assembly shops.

The development of the "echelonization process of the production structure of the sectors is only the first stage of improvement of the structure, a stage of creating specialized one-plant units in separate echelons (Fig. 2), a stage of transition from an universtal production structure of the former enterprises to an "incomplete" production structure of the units technologically-specialized according to the chain of the social production. But it is seen from the study of the structural evelution tendencies of the industrial units in worldwide scope, that the one-plant unit independently from the level of its specialization is not the last stage of this evolution. The one-plant unit is only the first stage of the structural evolution of the unit itself. The Bulgarian machinebuilding units are already entering the second stage of improvement of the production

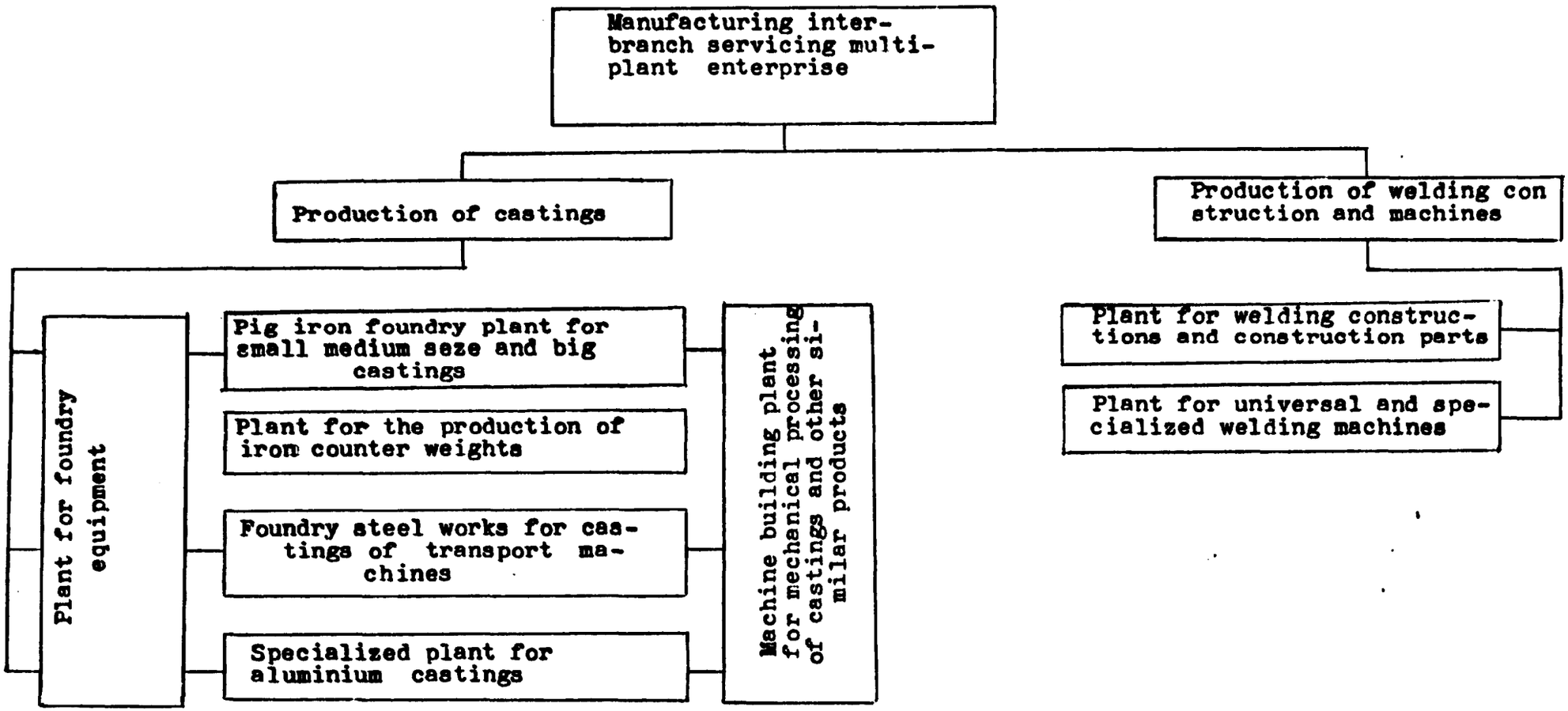


Fig. 2. A generalized graphic model of the production structure of a manufacturing inter-branch servicing multi-plant enterprise of a territirially localized micro-complex - Echelon I (having joint operations of the processing phase)

structures - a stage of creating multi-plant units (combines) through an expansion of the structural elements and the concentration of the other production subdivisions (Fig. 3). This stage can be characterised by the transition from the technologically-specialized units towards their expansion and the formation of large specialized machinebuilding complexes. Most typical of this second stage will be the following units, built on the basis of the echelonized technological sections:

1. The following units are established on the basis of one-plant specialized units from echelon I:

- specialized units for the production of semi-finished products of sectorial designation;

- intersectorial service units for semifinished products like castings, moulds, prints, welded constructions a.o.

2. The following units are established on the basis of one-plant specialized units from echelon II:

- specialized units for the production of unified joints, and details of sectorial designation;

- intersectorial service-units for the production of details and joints.

3. Units established on the basis of one-plant specialized units from echelon III:

- different product-orientated multi-plant assembly and machanical-assembly units.

4. Units established on the basis of one-plant specialized repairs-shops and plants:

- specialized multi-plant units for centralized repair-works of the equipment of the sectors units;

- intersectorial service-units for overhaul repairs of

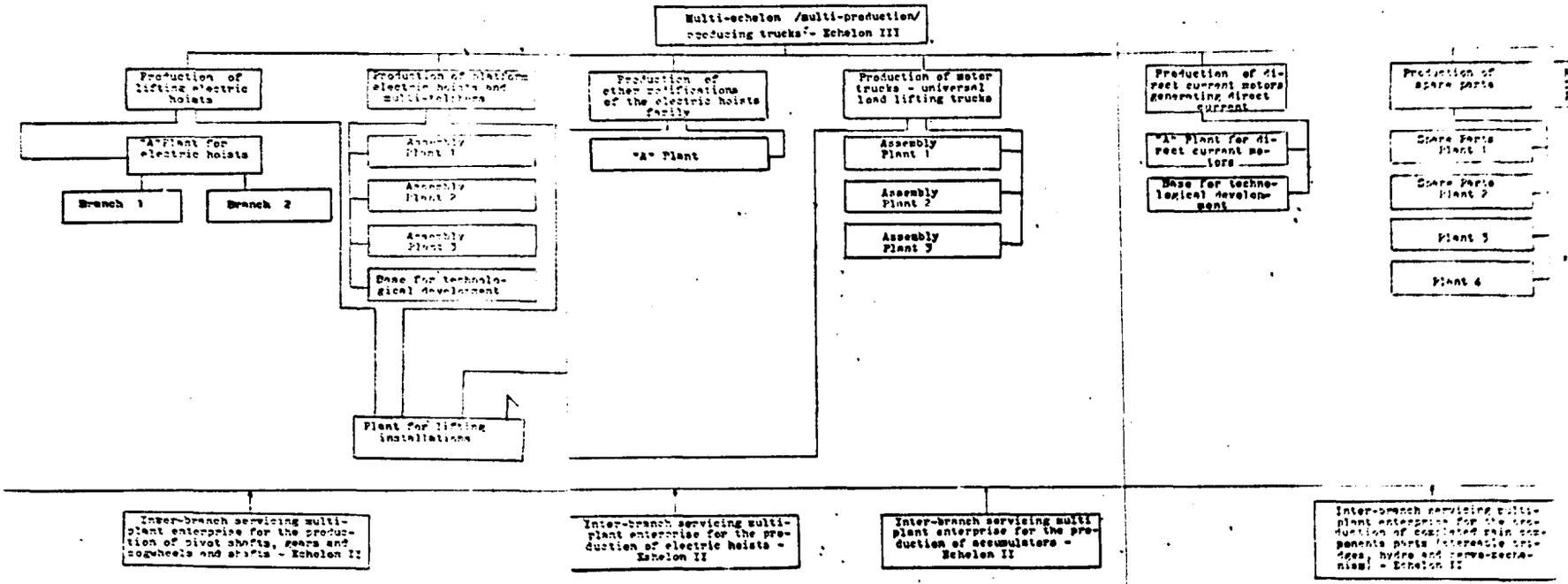


Fig. 3. A generalized Graphic Model of the Production Structure of a Multi-Echelon (according to products) Integrated Enterprise Technological Families of Trucks-II Echelon ... inter-branch servicing multi-plant enterprises of ... also presented, being the enterprises ... Multi-Echelon Enterprise with completed main ...

machinebuilding equipment.

5. Units established on the basis of one-plant specialized instrumental units:

- specialized instrumental multi-plant units for the manufacture of appliances, equipment, prints and press moulds for the needs of the branch;

- intersectorial service-units for centralized machinebuilding equipment.

6. Besides all these the following types of multi-plant units are built for the needs of the various types of enterprises;

- specialized units for centralized manufacture of spares;

- specialized units for the production of equipment;

- specialized units for manufacture of different kinds of equipment for the plants under construction and reconstruction.

All the quoted 12 types of machinebuilding units are also structurally ordered in the echelon technological chain and represent multi-plant complexes.

On the theoretical model, showing the evolution of the industrial system it is seen that in a structural respect there is a third future stage of development of the enterprise - a stage of transition to the formation of multi-echelon machinebuilding units.

The multi-echelon machinebuilding units would fall into the following three types:

- multi-echelon establishment of the vertical type - it has such a production structure in which the basic structural element is the separate echelon of plants, covering a certain

phase of the production process;

- multi-echelon establishment of the horizontal type - the separate echelon includes plants, technologically combined in the production of a certain product. For each final product manufactured in the given echelons of the horizontal system, a vertical structure of plants can be built too, either in every plant or they can be even more detailed specialized. The principles in the name of which these units are being built are two: the first is the formation and enrichment of a wide technological family on the basis of a technological resemblance, and the second on the basis of a complex satisfying the needs of a certain kind of market and meeting the needs of a particular consumer;

- multi-echelon unit of the mixed type - its production structure contains echelons of plants which are specialized both in the phases of the production process and in the different types of products.

All the above types of multi-echelon units would be established built on the basis of the structural expansion of the multi-plant assembly units.

It is obvious that along with these basic types of units where will continue to exist a number of smaller ones in which the character of the manufactured production and some other factors and conditions of national economic significance will determine the positive effect of their existence. Whilst the tendency of transition from the universal one-plant units to technologically specialized echelon-built units is a tendency of the present day, in the nearest future our industry will need large "semi-universal" object-specialized or technologically-specialized machinebuilding multi-plant units. The formation of these multi-

plant and multi-echelon systems will be realized also by means of the expansion of the scales of the various enterprises and first spall through the systematic and strategic merging of separate plants into large machinebuilding complexes.

It can be concluded consequently, that in the evolution of the production structures of the enterprises of the capital goods industry we might differentiale between two distinct stages. They have been determined under the impact of the concentration of production, on the one hand, and the development of the division of labour, resp. the development of inner-plant specialization, cooperation and coalescence under the constantly growing dimensions of production and consumption and the dynamics of the scientific and technological advancement- on the other. These stages are the following:

The period up to 1974. This is a stage characterized by almost universal production structures, each comprising a complete set of storing, basic, auxilliary, supplementary and servicing shops. The setting up and continuous existence of enterprises with such a structure is to a considerable extent due to the dimensions of industrializing the socialist economy of Bulgaria determined by the rather poor level of industry the country had until the 9th of September 1944. It was quite natural that during the years of creating our capital goods industry, the main emphasis was not laid on a regular setting up and structural formation of the machine building plants. The fact that, in view of the size of the country it would have hardly been necessary for each machine building plant to have a foundry and a forge shop of its own, was not recognized. What is more is that the territorial factors determining a reasonable distri-

bution of production capacities were also left out of consideration. This is quite understandable, however, if we take into account the fact that there were hardly any machine building plants in the country in that period and every newly emerged plant had to function and develop quite independently from those already existing or from those that were to be built in the future and no trends wad been taken into consideration. It has been already made a point that in a structural aspect all these plants and enterprises were characterized by inner-plant and inter-shop differentiation of distinct parts of the production process and by their systematically carried out integration. In this case we have a shop-or section production structure of the so-called plant- enterprise, or a one plant enterprise. These enterprises and their extended production structure were too "big" in proportion to the home market (as shown by the studies made), and too insignificant, in proportion to the world market, or even to the socialist market. It was only the production of electric hoists and motor-trucks that developed its own competitive power during that period. We could not afford to continue this line of constructing machine-building plants only for the needs of the country. This is a luxury which is admissible only in exceptional cases. We had to start to comply with our national economic strategy and with the main producers in the COMECON countries and in the world and dimensions, structure, and nomenclature, had to be co-ordinated and directed in conformity with this policy. Such is the logic of the industrial development.

The second stage, as already mentioned began after 1974, when the negative effects were felt of the one-plant uni-

versal production structures on the efficiency of their own functioning. During this stage we have a structural differentiation not of the components of the already obsolete one-plant enterprise, but of those of the new, multi-plant enterprise (or combine). These components are now plants and not shops and we have an inter-plant division of labour and of production processes and the individual plants are specialized within the frame of the enterprise (hence their higher level of co-ordination and integration). Now we have a plant production structure. It should be emphasized, however that the first multi-plant enterprises were formed in the capital goods sector in the period 1975 - 1977 and the experience accumulated in this sector, with respect to organization and functioning, served a lot during the transition to identical structural forms in all the sectors of our industry. At the same time we should bear in mind the fact that essentially it is only the first formative stage that has been completed so far in the transition to Combine production structures. This stage was characterized by structural reorganization, by rationalizing of the already accomplished reform, by attempts to find rational forms of organization. This stage proved to be more complex and long than it appeared in the beginning. The characteristic feature envisaged for the forthcomming period of the early eightees would be the in-depth development of the process of structural improvement. The tasks to be faced in this development line would not only pertain to the formation of new combines, but to the qualitative development of the already existing ones.

As far as the process of sectorial echelonization is concerned, it is considered a specific national intermediary

stage between the first and second stages, the main purpose of which was to do away with the universal production structures and to rearrange them in conformity with the main product specialization, so as to ensure the basis of a more objective incorporation of one-plant enterprises into multi-plant enterprises.

At the same time it would be necessary to differentiate between our echelonization process and the process of divisionalizing of structures, which is characteristic for the West. The former is considered as a two way process- its first direction being the echelonization of the structure of the national economy, of the reproduction taking place within a given sector or group of sectors, while the second direction pertains to the echelonization of the production structure of the existing machine-building enterprises. The first type of echelonization is effected according to the stages of the social reproduction process, while the second could embrace stages (life cycles), products, geographical regions, markets, product-geographical or product-market areas, etc. It is this particular process of internal echelonization, taking place under the impact of the strengthening specialization of expanded multi-plant enterprises, and the first steps towards an inner diversification of these expended systems, that have given rise to the emergence of a third stage of the structural evolution of the enterprises of the capital goods industry. This is the stage of formation of multi-echelon enterprises (all of them being internally echelonized multi-plant enterprises) at which the first joint socialist enterprises are being established. It is similar to the process of divisionalization widely spread in

the practive of the big industrial enterprises. The multi-echelon enterprise represents an integrated complex of strictly specialized production groups of plants (echelons) which are semi- automately managed and differentiated in the production of a complex product; successive processing of raw materials; performance of the individual stages of the production process; performance of complex production projects; production of technological "families" of similar goods. This amalgamation in a united industrial system is grounded on the drive toward improving the efficiency of management, and thus the long term effective functioning of the whole system.

In conclusion it should be emphasized that the transitions between these stages are not strictly resticted in terms of time and that the forms mentioned are not obligatory alternatives, with respect to organization and structure, to all enterprises. Enterprises reflecting the different stages of the evolution of their structure are co-existing in our country, irrespective of the strongly expressed trends of structural development discussed above. These concretely existing historical structural forms are considered as enterprises of the different stages of the development of their production structure.

3. DEVELOPMENT AND IMPROVEMENT OF THE OVERALL ORGANISATIONAL STRUCTURE OF THE CAPITAL GOODS INDUSTRY - LIMITATIONS, CONCLUSIONS, TRENDS

We have so far discussed problems of the organisation of the capital goods industry and the evolution of the production structure of the establishments of this sector. But this evolution is directly connected not only with the factors influencing the different production systems but depends as well

very strongly on the specific character of the whole process of the socialization of production (specific character imposed by the different stages of industrial growth of the countries which have chosen the socialist way of development), a process in which the organisation-structural reorganizations and administrative management reforms act not only as official reactions-concequences of the recognition and demonstration of reasons much more profound and essence determining the nature of these changes. What is it about?

First of all, when studying the evolution of the capital goods industry units, and in particular the evolution in the field of their organization - productive structures, we used as a starting point the internal stimuli for the life cycle of a proved (on a world wide scale - in the industrial history and in the practice of our world) social-productive cybernetic system - the enterprise. But appart from the objective regularities of development of the structure of this system in the countries of the socialist world is also involved a very complicated complex of factors and tendencies of the national economy which play the role of regulators of this development. First of all as far as a given organisational-economic form (enterprise) is not independently existing in the socialist plan system, but is strictly linked in the total hierarchy of the social organisation of production, then there are no reasons for its enlargement, in case it is not connected with the progressive changes in the productive forces in the social organization of the production process, or at least with the presence of material prerequisites for that. In case such profound changes have not been reached and consequently the expanded organisational-

economic form does not possess the adequate material-technological foundation, then it would not obtain the advantages of this enlargement, as the consequences to a greater extent are rooted in the superiority of the gross production, of its potential, its economic effectivity. Once in the practice of our development of this branch - the capital goods industry we made a similar mistake - this was in the years 1964-1968, when an attempt was made for a purely administrative enlargement of enterprises and industrial combines without having the prerequisites and the reasons for this, both in the production system itself and in the total organization of the social production in our country. And of course this error was corrected in 1968 with the transition to an intermediate medium form of enterprise-management, namely the State Economic Association (SEA). Before discussing the specific nature of this form it is essential to make one more and a very important point.

What is meant here, is the basic and very important principle of the socialist system of management of the national economy- the principle of the democratic centralism. The centralism and independence are the two ends of this principle. The management of the socialist economy has always been in the search for unity between centralism (as a condition necessary for the planning of the development of the whole socialist system) and the economic independence of the vital production systems (enterprises); the independence as a condition necessary for initiative and interest in the implementation of the objectives of the "own" system. And this unity, as every unity is contradictory. The experience of our country in the building of socialism objectively indicates that the intensification of

centralism is achieved in a certain way through limiting the independence of the enterprises and vice versa, the expansion of their independence to a certain extent limints centralism. Therefore, when analysing the former development of the capital goods industry organization in Bulgaria and when trying to outline the future tendencies of organisational development of this branch the following basic initial points, determining the trends of this development should be taken into consideration:

I. With regard to the basic productive-economic unit - the enterprise:

1. The development of the organizational structure of the enterprise can not be treated separately from the development of the social organisation of the production process in this country, respectively from the branch;

2. The development of the organisational structure of the enterprise can not be treated separately from the simultaneous and adequate development of its economic functions; of the total economic form (enterprise) in basis parameters: what type of commodity producer is this form; its economic isolation within the framework of the national economy; its economic independence its legal assignment. As an additional significant element of these specifications it should be taken into consideration - the development and compatibility of the subjects to the international-economic relations in the developing organisational-structure of the enterprise and the development and the compatibility of the subjects to the economic relations (the developed economic form - the enterprise) in the organisational structure of the branch management.

With regard to the organisational isolation of the

branch in the organisational structure of the national economic management:

1. In the organisational structure of Bulgaria's national economy as large structural systems are outlined the various types of branches, differentiated under the influence of the general and specific labour division under the influence of the scientific-technological progress and under the influence of the process (result of the previous two factors) of sectorial differentiation of the social production - including in itself the specific and partial labour division. It has to be pointed out for greater clarity, that the organisation-structurally isolated economic sectors in the organisation structure of our national economy do not coincide with the so called "pure" sectors. A number of manufactures exist which according to a complexity of factors impose on the practice the distinction between organisationally-isolated economy-branch and "pure" branch (having a greater significance as an economic unit). Thus the organisationally isolated large units of structural systems in the organisational structure of management of the national economy are controlled by the economy ministries.

2. The development of the organisational structure of the branch has to be treated from two positions: the system of the branch-management (the Ministry) and the individual production-economic systems, which are elements of the larger system with all the originating from that limitations, contradictions and opportunities, provoked by the "mobile" equillibrium between centralism and independence;

3. The really existing controlled system - branch and in particular the system of branch-management (the Ministry) are

not independent bodies of management in the socialist economy either. They are subordinated to the functional ministries and the Council of Ministers. So that the development of the organisation of the branch in the national economy of Bulgaria is determined once more by the national-economic positions and views in regard with this development, identified the above organs of control. Here of course again on a higher level arises the question of centralization and independence, looking for an answer mainly in the trend - what is the Ministry - a bearer of the global interest of the national economy or a spokesman and patron of the interests of the branch?

All these initial points have to be taken into consideration from the expert seeking for objective regularities and economic sense in the complicated way of organisation-structural development of the capital goods industry in Bulgaria.

With a view to the specification of all questions about the concrete organization of the capital goods industry branch in Bulagaria it is necessary to point out that this branch is practically an economic notion, a relatively worked out "pure" branch; it is not an organisationally - differentiated economic system. The enterprises manufacturing production belonging to the line of this branch, organisationally belong mainly to the system of the Ministry of Machinebuilding. According to some groups of products the enterprises producing them belong to the system of the Ministry of Electronics and to the system of the National Agro-Industrial Union (NAIU) (the agriculatural machinebuilding).

From that point of views indicative for the organisation of this branch is the situation with the organisation of

this branch is the situation with the organisation of the machinebuilding industry.

As it was pointed out in the beginning of this paragraph there were two basic tendencies which influenced the organisational decisions:

- the development of the scientific-technological progress combined with the intensification of the labour division, the accelerated differentiation and diversification of the branch, the development of the social combination of the production process i.e. the social organisation of the production together with the forms of concentration, specialization, co-operation, combination, integration with research and;

- the development of the economic mechanism - first of all in seeking for an effective measure (different for the various stages of industrial development) between the centralized planning and the utilisation of the relative economic independence, including here the economic accounting, financial stimulation a.o.

These two tendencies have determined the present organisation of this branch.

According to the decisions in the "General scheme of concentration and specialization of the productive forces" in the Machinebuilding industry branch, worked out on a sectorial level within the framework of the Ministry of Machinebuilding the following economic organisations have been differentiated, approved (with regard to their status and legal rights) by the Council of Ministers:

1. Committee for Casting and Plastic Processing of the Materials (CCPPM) including a scientific-industrial association

(SIA) with 6 plants, one scientific-industrial combine with 2 plants and another 4 combines including 12 plants. Appart from these independently functioning in the range of CCPPM are 10 more plants.

2. Committee for Transport Machinebuilding (CTM) including 8 large combines and 20 single plants.

3. Committee for Heavy Investment Machinebuilding (CHIM) including 13 large combines, one scientific-productive association and 9 single plants.

4. SIA "Metal Cutting Machines Works" which includes 2 scientific-production combines, 5 combines and 7 more plants.

5. SIA "Hydraulics" with 3 combines and 5 plants.

6. SIA "Shipbuilding" with 2 combines and 7 independent plants.

The management systems of the type "Committee" and State economic association are a medium link of management positioned between the Ministry and the enterprise (combine, plant etc.). The difference between the "Committee" and the SIA consists mainly in the production scope and the centralization of some strategic functions of management.

A tendency has been outlined towards attachment of the subject to the accounting relations (the subject at the present organisation of the branch is of the "matrioshka" type, i.e. economic organisation is the Committee and the SIA and the combine) plant when not included in the structure of a combine, but exists independently in the structure of a Committee or a SIA) together with the principal production system, developed in the period 1976-1980 - the combine. The idea for the combine to become real and full bearer of the accounting relations in

Bulgarian economy or to have only one-(or to be more precise - unified) type of economic organisation.

Thus an adequate covering of the productive - economic form would be achieved which has already developed on larger scales and structure with its increased significance for the national economy. On its part the Ministry as planning and regulating centre of the branch system and as a state authority body should dispense with taking decision of executive economic character. It has to work out the strategic guide lines of the technological and production policy of the economic organizations, to control and to co-ordinate their activities.

4. GENERAL CONCLUSIONS ABOUT THE ORGANIZATIONAL AND STRUCTURAL DEVELOPMENT OF THE CAPITAL GOODS INDUSTRY

First of all we should have in mind that under the conditions of the socialist economies, characterized by the organization of labour on socialized foundation, the prevailing of the socialist ownership of the means of production, the growth of the economy of the country to an uniform national economic complex and the whole way of organizational and structural development even of one separate sector and its element, the problems should be treated from the viewpoint of the production-economic organizational structure of the social production. The strong orientation towards the development of the productive forces, including the acceleration of the contemporary scientific - technological progress, the development of ripe production relations and the growth of the economic efficiency should also be taken into consideration.

In other words, the treatment of the theoretical and

practical problems of development of the organization structure of the capital goods industry as well as of the separate production systems in its structure, has been and will be accomplished in our country, first of all, in a national economic aspect, as a macroeconomic problem, which of course does not leave out from the agenda the decisions of the local, inner problems of development of the organizational structures of the individual enterprises of the sector.

The development of the structure of management of industry and especially of the Machine building sector (as an existing in reality distinct system of the planned management of the Bulgarian industry) should be treated from the viewpoint of the realization of the basic principle of management organization - the democratic centralism. The tasks of development and improvement of the structure have consisted in pursuing the realization of two tendencies: First, strengthening of the role of the centralized planned management and widening of the fuctions of the state organs and the sector organs; Second, in developing the forms of the economic independence of the basic production systems.

All this means that during the past years the improvement of the socialist centralism has had a complex, many - sided character. It should not be considered in a simplified mechanical manner only substituting the principles of decentralization with principles of centralization. In fact a complex transformation of different functions and forms of management was taking place.

If we follow the inner guide lines of the historical organizational structural development of the managerial structure of the machine-manufacturing, we could differentiate between two

different and at the same time interconnected processes, which show a raising curve of this development in their contradictory unity.

- The first process consists in a continuous effort to a concentration on the level of the centralized management of the system (national or sectorial) in the sense of strategic management. It consists also in expanding the circle of most important and decisive problems, which this centre has to solve and in a more complete and broader carrying out of an uniform policy of scientific-technological, economic and social development. Such strengthening of the centralism is accomplished in order to ensure the planned uniformity in the functioning of all economic production units within the system. But it must be stressed that this is combined with a relative economic independence of the basic units in the frames of the state plan, with a decentralization of the decisions of local problems, including those pertaining to the assortment production structure. The economic functions of these units are steadily growing. In which way can one realize such a combination, which seems at first glance impossible?

- The second process gives an answer to the question. First of all, this process consists of the efforts to concentrate on the level of the central management a medium form of organizational, economic and business individualisation (an intermediary form, between the Ministry and the enterprise/plant). Through this form other, operational functions, which have been carried out till now by the lower units are shifted to the intermediary level. This diminishes the centralization on the level of the Ministry since greater rights are given to the new form - the Combine. On the other hand, the economic independence of the basic economic unit is being strengthened (of course now on a higher

level of concentration of the production and centralization of the management - the Combine). Such a new centralization, but on lower level of management, also leads to one more or less greater limitation of the economic independence of the present parts of the Combine - the former plants (one-plant enterprises).

It becomes clearer that the results of the development of these two processes have found distinct manifestation and now continue to be expressed in the most important transformation of the organizational stucture of the social production - the creation and the functioning of the multi-plant enterprises (the Combines), as a basic economic organization in our national economy.

When we study the influence of the processes of concentration and specialization on the development of the production structures of the basic production systems in this sector and when we seek to understand the sense, the meaning and the future trends of development of the process of "echelonization" (Lining) of the sectorial production structure, as well as when we speak of diversification as a factor for the development of these structures, we should always have in mind that under the conditions of our national economy the processes of improvement of the production structures have an extraordinary great impact over the reorientation of the structure of the whole economy and vice versa. The creation of a new enterprise in our country is done not with a decision of the relevant sector Ministry, but only with a decision of the Council of Ministers. This is so, because the improvement of the production structures of the enterprises (as well as of the sector) is always realized under given national-economic limitations (demographic situation, raw material and energy resources, etc.), under which the change of the structure of a

given system leads to a redistribution of resources and to a change in the production programmes of the connected industries. Or (from this point of view) a substancial change of a given production structure may be realized only under strong coordination with the national economic interests.

The limiting conditions of the national economy create also objective preconditions for the formation of bilateral and multilateral international production enterprises with the countries of COMECON as well as with other countries. These enterprises will not only satisfy our needs of missing raw materials, etc., but will also stimulate to a greater competitive power the Bulgarian products on the international markets.

When we evaluate the Bulgarian way of organizational - structural develpment in the context of factors, which are forming the structure, such as: concentration and specialization, diversification, echelonization, etc., it is necessary to make a number of remarks, which in fact will delineate the specifics of the Bulgarian way and will define its future.

One of the most important and at the same time least developed problems is the problem of the scientific foundations of management of the processes of creation, formation and individualization of the sectors of the socialistic industry, i.e. the management of the forming of sectorial structure of the industry, respectively of the subsectorial structures of the separate sectors. This problem has not been solved practically. It is even not clarified also in a theoretical aspect. Here we shall try to give some of our evaluations and considerations.

The Bulgarian way is different from the historical way of development of the structures of the industrial enterprises

in the West and especially in the USA, where it developed under the main impact of the process of "diversification" (but there were organizationally no separate sec ›rs). In the Bulgarian economy and especially during the creation of the machine-manufacturing sector (whose creation coincides with the birthday of establishing of socialist order in Bulgaria and in this differs from the other socialist countries) another process has initially a basic impact on the structure of the sector. This process (which is different from the diversification, whose object is the enterprise) has as an object the differentiated sector and the name of this process is "sectorial differentiation". The process of sectorial differentiation is in fact a form of the specific division of labour and is expressed in the division of the production into separate economically differentiated sectors. In this way this process serves mainly for the satisfaction of various needs of the national economy. A moving force of the sectorial differentiation is the technological progress as well as the ripe needs of various products or services of the national economy.

A product of the sectorial differentiation is the one-plant enterprise with universal production structure. And it is natural that after the initial long term phase of sectorial differentiation and after the formation of the sectorial and subsectorial structure of the machine manufacturing has begun (even parallel with the above processes) the process of concentration and specialization. And here we can establish some connections with the remaining processes. A product of the specialization ‹ (a final product) is the echelonized specialized one-plant enterprise (on one of the three echelons). But the development does not end here. The creation of the Combine's production structures,

the improvement of the economic mechanism towards giving of the combines greater economic independence, etc. open the doors for diversification (conceived now as penetrating of the process of sectorial differentiation in the very enterprise, the reverse side of this process being the improvement of the specialization, but on the level of inner echelonization).

In fact, it is only now that a certain transition is taking place towards some forms of diversified production structure of the Combines expressed in these directions of the diversification, which are known as enriching the technological or the production "Family". There are still no Bulgarian enterprises, that have developed a diversification structure as regards certain functional servicing of the user. That is why, when speaking about echelonization and about creating of future multi-echelon enterprises, we should bear in mind that they will be created mainly under the impact of the diversification and that the raising of the specialization of the production units of those big enterprises will be accomplished chiefly by means of differentiation of inner echelons of specialized plants.

It is well known, that all this will break the "purity" of the sectorial and subsectorial structure of the machine manufacturing. This will impose a change in the very management of the national economy, will change fundamentally the different functions, goals and possibilities of the existing sectorial Ministries (because of the formation intersectorial enterprises).

Therefore, the necessity is gradually ripening towards formation of organs for intersectorial management, including associations, joint-stock companies, commercial - production organizations, etc. According to our opinion, it will be purposeful

that these organs be of two main kinds:

- organs, which ensure the realization of uniform centralized long-term and medium term programmes - social-economic, scientific technological, construction, etc., that will coordinate the activities of the participants in the relevant programmes and carry the full responsibilitis. These organs may be permanent or may be created ad hoc for the realization of a given programme;

- organs of management of groups of homogenous and interconnected sectors, which could even represent levels of managerial structure, which are superior to the Ministry.

5. ORGANIZATION OF THE SYSTEM FOR PROFESSIONAL TRAINING OF PERSONNEL EMPLOYED IN THE CAPITAL GOODS INDUSTRIAL UNITS IN BULGARIA

Very important for the professional training of skilled workers is the systematic study of the regularities of the proffesional division of labour. The action of the law of labour division involves also the action of the change of labour law, as a law reflecting the interrelation between labour force and the means of labour at a higher stage of development. The requirement for an all-sided development of the workers in the industrialized society has an imperative character. Applied to the contemporary character of production this requirement imposes important changes on the character and level of professional training. These changes have to be of such an orientation and contents so that they can contribute to the acquiring of sound knowledge of the scientific and technological principles of production which would favour a comparatively rapid and durable understanding of the prin-

ciples of the different kinds of equipment, technologies, products and when necessary to make possible a quick and efficient reorientation.

One of the indicators which are generally characterizing the changes that have taken place within the level of qualification of the labour force is the relative share of qualified labour. Some markedly progressive trends in the qualification structure of labour in the sphere of the machine building are noticeable in the period 1965 - 1975. While the average growth rate of production personnel amounts to 8,5%, the growth rate of the number of specialists with higher education for the same period amounts to 13,3% and that of qualified labour - to 10,6%.

Due to the reform carried out in the educational system the number of workers with higher, college and secondary professional education increased considerably over the last few years. This development has been infuenced by the facts that the scientific and technological progress has been coming in strong, the production processes have been subjected to mechanization and automation and the production capacities have been modernized and re-constructed. It is worthwhile to mention that by November 1, 1978, 8,4% of the personnel engaged within the system of the Ministry of machine building were with higher education; 0,8% - with college education and 31,3% - with secondary professional education.

The grown demands toward the professional training of the workers necessitated the application of a unified system of professional training established in 1972 in Bulgaria. Some difficulties connected with its application required the improvement of a part of the indicators of the system. A result of this are

also some of the additionally released enactments aiming at improving of the training mechanism, of the ditribution and use of the workers in the sectrorial systems.

The tasks that have to be solved by our economy are placing greater emphasis on the personal factor of the production. The requirements for independent and creative activities of the workers are growing so as to a quick adaptation to the dynamic changes in the character and content of labour. This fact is once more raising the problem of the professional training and workers' qualification.

Nation-wide discussion of the new educational system reform in Bulgaria was carred out. Now the educational policy is swithching over from revealing and developing particular features and talants of the individual to revealing and developing his manifold talents, qualities, i.e. it aims at the formation of versatile all round personality, capable of complete selfrealization in life.

There is no doubt that the whole educational system will affect the activities of the sectorial and administrative systems of professional training, but they will not cease to be elements of the national educational system, they will only change their place and importance.

5.1. Objectives and Structure of the National System for Professional Training

The main purpose of the national system for professional training is the planned elevation of the intellectual level of the workers and their formation as versatile and harmonious personalities.

The model and the programme of the presently functio-

ning national system for professional training (components of which are also the systems of professional training within the system of the Ministry of machinebuilding, the Ministry of Electronics, some SIAs, the NAIU, respectively all organisationally differentiated branches belonging to the capital goods industry) have been, approved by the Coucil of Ministers at the beginning of 1972. The ministries, the State Industrial Associations and the executive committees of the district people's councils are responsible for the realisation of the programme while the functions of of realisation of the united state policy and the co-ordination of the activities of the branch ministries and SIA for the training and qualification of the worker have been entrusted to the Ministry of Labour and Social Welfare (MLSW) - presently the Committee for Labour and Wages. In the structure of the SIA "Training of Personnel" offices were created, which execute all management functions connected with forcasting the needs of personnel and their development, approbation of the professional training evaluation of these, organisation and accounting for the training and qualification of the workers by means of creating qualification files of the personnel of the State Economic Organisations.

The structure of the national system for professional training has five hierarchical levels:

The top-level is composed of the higher (central) organs of management. They give directions, define the trends of the further development of the process of elevation of the cultural-technological level of the workers.

The second level includes the State Planning Committee, the Ministry of Education, the Committee for Labour and Wages and is focussing the socio-economic and training-methodological

aspects in the system. The main tasks and conditions are determined at this level, which have to be followed in their realisation. The links between the above organs are of functional competence with no whatsoever linear subordination.

The third level reflects the branch and territorial principles of the system. The branch Ministries and country councils with their respective structural elements are included here.

The subordination link between the second and the third levels is a functional one. There exists a relative linear subordination.

Links of co-ordination exist between the Committee for Labour and Wages and the country councils expressed in the exchange of information and co-ordination of the planning activities of the workers' training.

The fourth level composed by the State Economic Organisations which are in linear subordination to the respective branch ministries and there exists a functional relationship between them and the country councils.

The fifth level includes the individual enterprises. Links of linear and functional subordination are existing between them and the higher levels.

The system of professional training and qualification of the workers from the capital goods industry is interrelated to all hierarchic levels and being subordinated to the first two represents the third in its specialized aspect and is superior to the fourth and fifth levels.

5.2. Organisational Structure, Goals and Objectives of the System for Professional Training for the Capital Goods Industry

The purpose of the system for professional training of the capital goods industry personnel is to continuously organize the training and retraining of the workers, so as to ensure such a professionally qualified manpower which could best meet the requirements of production.

This general objective is determining the tasks which the system has to solve. The major tasks are the following:

- training of new workers;
- additional training of the workers (incl. learning a second and more professions);
- improving the qualification of the workers;
- elevation of the educational level of the workers.

Besides these tasks the educational system has to solve problems connected with the planning, organization, distribution, co-ordination and control of the professional qualification of the workers and their movement within the framework of the system - from one sub-sector to another and from settlement to settlement. Decisions have to be taken continuously on problems related to the cultural and technological level of the man-power.

The organizational structure of the system within the sector is reflected in the number and types of educational units and their structural ratio.

The elevation of the educational and qualification levels of the workers within the capital goods industry system, as well as their professional training is presently carried out in two basic types of educational establishments: SPS (secondary po-

lytechnical schools) and PTC (professional training centres), the larger of which have branches of their own.

The professional training in our country has passed different stages of development. It began with handicraft schools, followed by factory schools, schools for skilled labour reserves and vocational schools, the last stage being the secondary polytechnical schools. This continuous improvement of organization, forms and methods of the training of personnel is a result of the social development, as well as of the scientific and technological revolution which set high standards for the professional qualification and educational level of the workers.

The SPS organized within the framework of the capital goods industry some 15 years ago, have already proved that they are the main source of manpower reinforcement supplying the machine building industry with highly qualified workers with secondary education.

During the 1973-1979 period the number of SPS related to the system of the Ministry of Machine Building increased at rather slow rates (from 42 to 48). The Committee for Transport Machine Building has the greatest number of SPS - 16, followed by the Committee for Heavy Investment Machine Building - 14. The State Economic Association "Shipbuilding" has the lowest number of schools - only 2. This is explained by the fact that the professions connected with shipbuilding have a rather limited field of application in this country.

The PTC (Centres for Professional Training) represent another organizational form of professional qualification for machine building workers. They are set up on the basis of specializational or functional principles and are included in the units

of the economic organizations. Branch PTCs are established in cases where the establishing of a PTC is not expedient. The PTC are establishments for educational pedagogical, methodological and organizational guidance of the extension courses organized in enterprises which have no PTC or branch PTC.

The number of PTCs in the system of the Ministry of Machine Building was also increased insignificantly over the same period, i.e. 1974-1979 (from 59 in 1974 to 63 in 1979), which means that their number is sufficient to meet the existing requirements. To a certain extent this is due to the fact that there are some particular regulations which have to be observed in the setting up of a PTC. One of them is that the related industrial unit should have more than 1000 workers. Here also as in the case of the SPS the Committee for Transport Machine Building and the Committee for Heavy Investment Machine Building have the larger number of PTCs. 34 PTC extensions are established within the system of the machine building industry.

The extension courses kept an almost stable number over the last 6-7 years: they were 102 in 1973; 104 - in 1979. They have the highest relative share in the system of professional training establishments. The unequal financial and organizational conditions and the methods of teaching in these courses are connected with the level of professional qualification of this form of training.

The educational programmes of the SPS comprise two equally important curricula - theoretical and practical training. The SPS in the system of the machine building industry have an annual production output amounting to over 5 million leva. This production is accepted by the quality control organs on equal terms

with the plants' regular production. The annual growth rates of SPS production are close to those adopted by the base plant. Thus the professional and eductional training of workers are complementary to each other.

In the PTC and the extension courses of the plants the workers are given the opportunity to excersise their first, second or other profession and to increase their qualification. The elevation of the educational level of workers is not the task of extension courses and other training cources, while in the PTC it is achieved to a very moderate degree.

The new educational reform which is attaching great importance to the general education basis of the professional training will lead to some essential qualitative changes not only in the forms and methods of education, but to changes in the structure of the educational system in general, by strengtheining the role of the Unified Secondary Politechnical School for the professional training of the young generation. This tendency is observed also in the Plan for admission of students to the SPS in the system of the Ministry of Machine Building for the years 1978/1979 and 1979/1980. Irrespective of the fact that some new professions are included in the curricula of these schools - rolling production, metal cutting machines engineering, metal paintion, etc. a considerable drop is envisaged in the addmission number, when compared to previous years. It comes to about 20-23%. Similar decrease of admission number is also observed for wide spread professions like turners-millers (by 27-28%), fitters (about 26%), welders (31%), casters (37%), etc. The reason for this is that all of them are very popular and for the time being there are too many workers trained for them. The main bodies for pro-

fessional training will be the PTCs which will have the additional task of raising the cultural and technological training and level of the workers.

5.3. Programmes for Training of Personnel Employed in the Capital Goods Industry

The forms of training are determined in accordance with the main problems the system has to solve. They are:

- Training of newly employed workers. This is a basic form which gives the worker the right of excercising his profession (the right of labour). The training is taking place in the SPTS and the extension courses in the plants and enterprises. The training of newly employed workers in the PTCs is gradually falling away and is being replaced by other forms of training. Usually within the plants and enterprises the workers are trained so as to meet the current needs of production, while the training in the other educational establishments is directed to meeting prospective needs.

- Re-training of workers (learning of a second or more professions). Three main reasons predetermine the necessity of acquiring a second profession: changes in the production programme of the respective industrial unit, replacement of obsolete equipments, rational use of the personnel. Over the whole of the period until 1979 there was a continuous upward tendency for acquiring a second profession in the system of the machine building industry, but the number of workers with two professions is still comparatively insufficient. They account for only 6 percent of the total number of workers trained in 1979.

- Qualification improvement. This form of training takes

place in the numerous various courses and is not necessarily connected with the obtaining of a higher degree of qualification. There are different courses for extending the professional qualification, for familiarization with leading experience. Recently the so called tutorial courses are widely spreading.

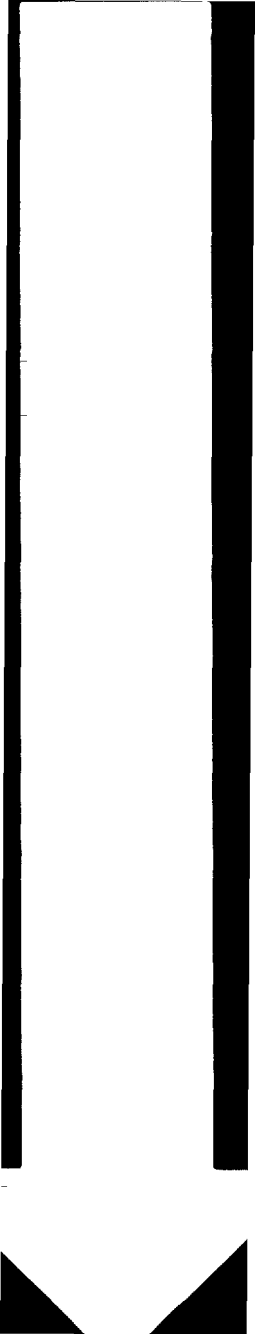
- Elevation of the educational level of the personnel. A new form has been introduced in order to improve the education and qualification of the workers without interrupting their regular work - the so called factory classes. The main purpose of this form is to improve the educational and professional training of the workers by special crack courses. The duration of the school year is 40 school weeks, each consisting of 12 hours. Organizationally and administratively the factory classes are controlled by the plant itself or by the respective PTC, if there is such a centre; while methodologically they are supervised by a corresponding educational establisment, especially designated for the purpose by the local country council's education department.

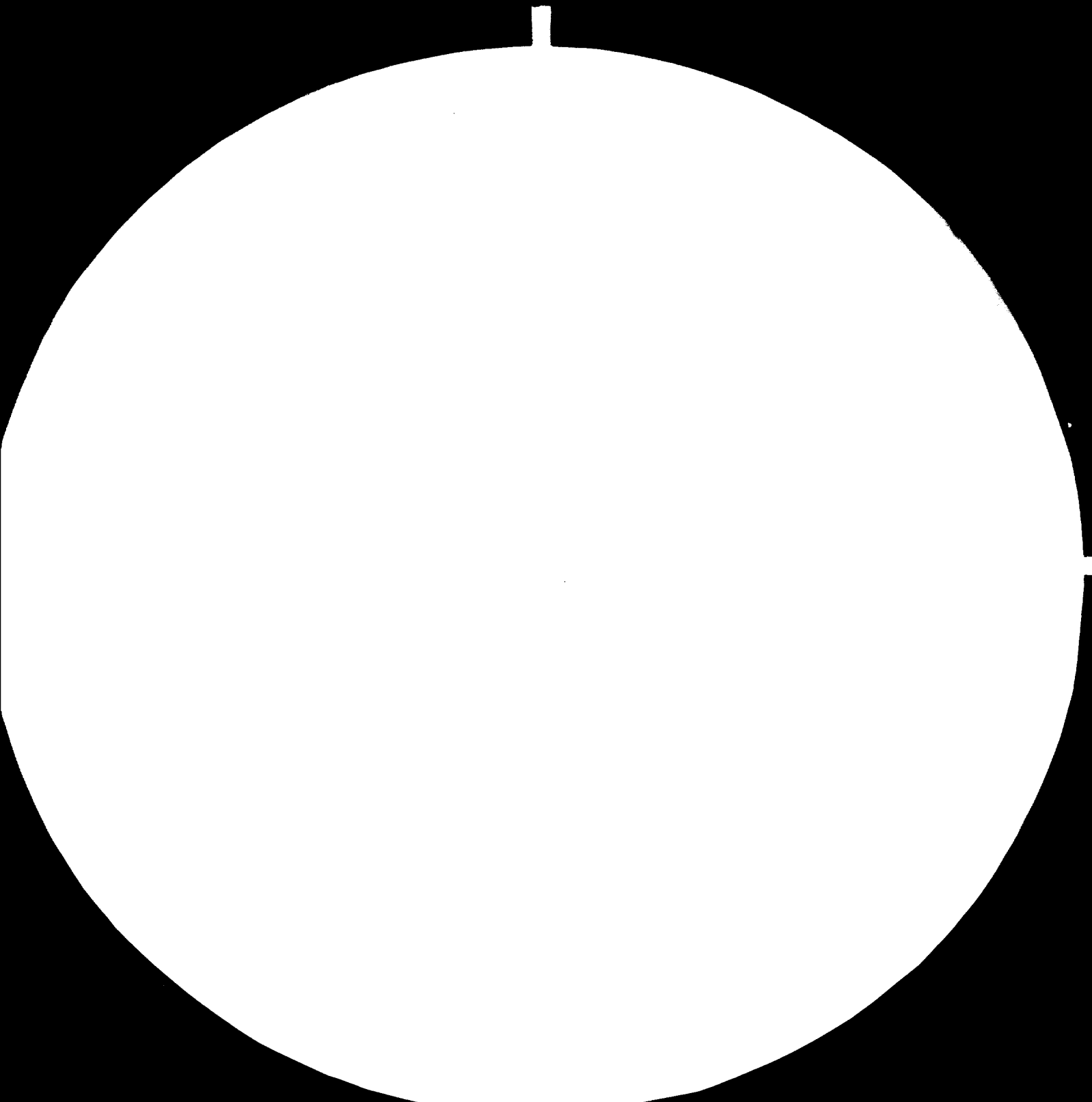
The advance of the science and technology in the sphere of the machine manufacturing production has given rise to a continuous growth of the relative share of workers with higher and secondary professional education in a number of entirely new subjects, due to the demand for new professions. The ratio between engineers and mechanics comes to 1:5,0, that between specialists with higher and college education comes to 1:3,7 and the ratio between economists with higher and college education is 1:2,5.

The trends of the changes in the professional structure of the personnel engaged in the production sphere of the capital goods industry called forth by the technological progress could

be enclosed with a relatively satisfactory precision by studying the use made of different groups of workers according to the level of mechanization of labour processes and according to the functional purpose of the work put in by them. These changes are shown on Tables 22 and 23:

The changes of the professional structure of the labour engaged in production are determining the guidelines for the planning of this structure in perspective and hence they are contributing to the improving of the educational training in new subjects in the higher educational establishments and the technical schools. In view of the world wide trends of establishing new professions and in conformity with the peculiarities of the capital goods industry, a number of new professions are and will be appearing in our country, such as operators of metal cutting machines with programmed operation, operators of automated machines and devices, of particular shipbuilding machines, of shelving machines and machines for mechanized storages; mechanics and electrical mechanics for keeping aggregate machines and automated machines with central programming operation in repair, service specialists in hydraulics and pneumatics. All these development necessitate the appearence of new subjects in the curricula of the higher educational establishments and the technical/vocational schools.





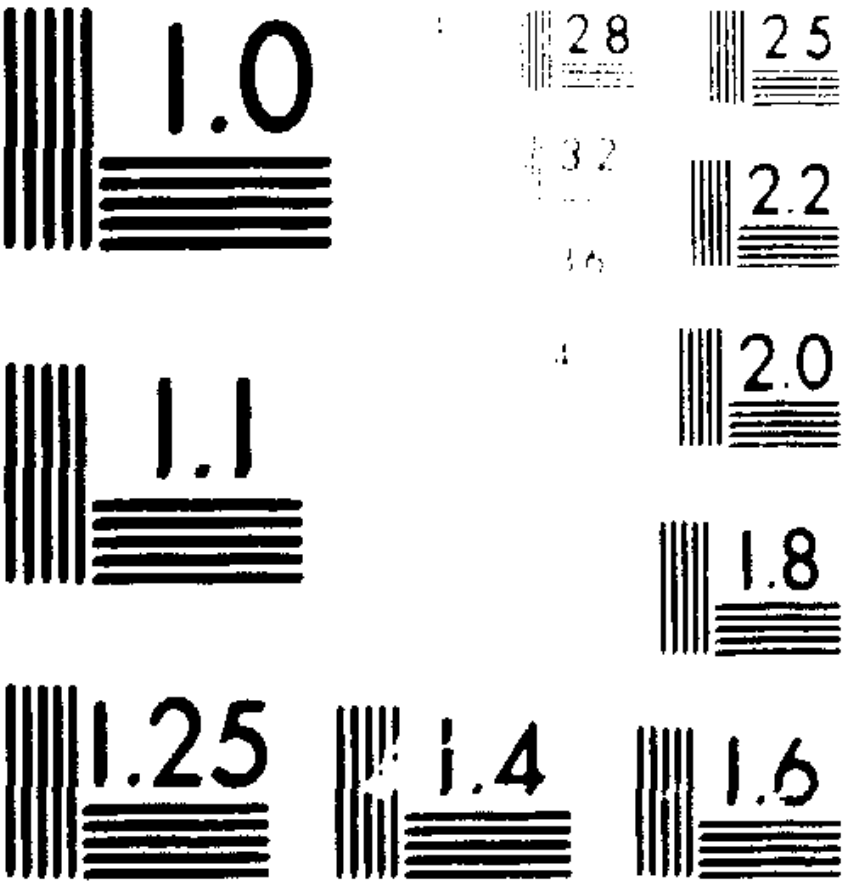

1.0
2.8
2.5
3.2
2.2
2.0
1.1
1.8
1.25
1.4
1.6

Table 22

Structure of the Personnel Engaged in the Production Sphere of the Capital Goods Industry according to the Extent of Mechanisation of Labour

(in %)

Groups of workers	Relative share				Index	
	1965	1968	1971	1975	1975/65	1975/71
1. Workers operating with automatic and semi automatic devices and apparatuses	1,6	1,6	1,8	1,95	229,98	188,09
2. Workers operating with non automatic machines	25,0	22,0	22,8	22,8	181,64	183,26
3. Workers engaged with hand operated machines and equipment	23,7	15,7	26,0	27,3	229,46	192,44
4. Workers engages with manual labour	43,8	41,8	39,8	38,3	173,79	175,98
5. Workers keeping the machines and devices in repair	5,9	8,9	9,6	9,7	317,36	185,11
TOTAL	100,0	100,0	100,0	100,0	198,90	183,03

Table 23

Structure of the Personnel Engaged in the Production Sphere of the Capital Goods Industry according to the Functional Purpose of their Labour

(in %)

Groups of workers	Relative share				Index	
	1965	1968	1971	1975	1975/65	1975/71
1. Workers engaged with objects of labour	94,1	91,1	90,4	90,29	190,85	182,79
a) Preparation of the objects of labour	7,6	7,1	5,6	5,48	143,42	179,09
b) Processing of the objects of labour	67,4	65,9	66,9	67,32	222,21	205,99
c) Preparation of manufactured goods	19,1	18,1	17,9	17,49	182,14	178,82
2. Workers engaged with the means of labour	5,9	8,9	9,6	9,71	327,36	158,11
a) Workers adjusting and regulating the machines and devices	1,7	2,7	2,2	2,24	251,62	186,35
b) Workers keeping the machines and devices in repair	4,2	6,2	7,4	7,47	349,58	183,72
TOTAL	100,0	100,0	100,0	100,0	198,90	183,04

C) Development Problems of the Capital Goods Industry

The results of the development of the capital goods industry in Bulgaria over the last 30 to 35 years present an opportunity for some generalizing evaluations and for footlighting of the particular instances which have had an impact on this development. It should be emphasized that the accelerated development of the capital goods industry has been a strategically justified line which has stood up the test of time. However there were a number of constraining factors of historically objective character, the necessity of overcoming of which served as an additional driving force for the speeded development of this sector. It is possible to identify some of them and to present them in the following way (not observing any order of priority):

First. Once the post war period of restoring the country's economy was over, it was generally believed that the speeding of the economical growth did not imply any priority of the capital goods industry. Consequently a policy for rapid development of the consumer goods production was under way up to the beginning of the second half of the fifties, but it was soon discarded as inadequate. A new conception was gathering weight, it was realised that a lasting growth of the consumer goods industries was possible only if a priority was given to the capital goods industry, due to the simple fact that the latter was to supply all the machinery necessary to the consumer goods sectors, to the agriculture and to the other sectors of the national economy.

Second. The development of the capital goods industry in Bulgaria during the first years of the country's industrialization was in the first place interlinked with the priority de-

velopment of the national raw materials base. The rather limited production rate was directed primarily to meeting the needs of the national economy. It was characterized by an over-expanded production nomenclature, irrespective of the limited production scope. Some political and social considerations were considered more important than purely economic considerations. The active development of the country's international economic co-operation and participation in the international division of labour was also underestimated and neglected. This policy line also proved to be rather inefficient. The development of economic co-operation within the COMECON system contributed a great deal for the overcoming of this isolationist policy. The application of an economic approach to the development of the sector and the higher efficiency of production were the next problems to be solved. The improvement of the economic approach applied to the management of the sector is still on-going.

Third. The complexity of the capital goods industry was also underestimated. Almost no attempts were made at producing assemblies and aggregations and the policy line of production was directed mostly to the production of a definite number of articles with comparatively resticted processing stages. Product-oriented science was a rare phenomenon. By the end of the sixties and the beginning of the seventies, however, the national capital goods industry became increasingly oriented toward the utilization of foreign scientific and technological achievements, studying and implementing of foreign production experience and knowhow, purchasing and implementing of patent licences, scientific and technological cooperation, etc. The country's scientific potential is increasingly industry oriented.

Fourth. The early development of the sector was mostly extensive. This policy was determined by the inadequacy of the technical and technological level, by the small scale and limited range production, by the lack of production and organizational experience and - especially in the very beginning, by the exceptional dependency on political values, which nevertheless played a positive role in that period. The last 10-15 years were years of accumulating experience, of improved structures, systems of management and constantly increasing production.

Quality characteristics and some specific indicators complying with the consumer's requirements were becoming increasingly important. The efficiency and complexity of production have become one of the cardinal issues of the Bulgarian capital goods industry, with respect to the requirements of the home and world market.

Fifth. The development prospects of the capital goods industry were rather vague during the first few years. During this period there was lack of long-term evaluations and forecasts which to take into concideration the achievements of the scientific and technological progress, the country's resources and their reproduction, the home-market demand and the capacities of the foreign markets. A move in this direction was made in the seventies, when considerable efforts were devoted to economic forecasts and long term evaluations of the economic development and its relationship with the constantly changing external conditions. The producers, initiative for improving the production planning in the capital goods industry is receiving increased attention. The correlation of planning documents, the provision of resources and the capacities for production and realization

of finished goods is also given particular regard. Especially important for this country is the elaboration and implementation of long term target goal-oriented projects for cooperation with the system of the COMECON countries, established since 1976. Special emphasis is laid on projects for correlative development of machine building industries on the basis of accelerated specialization, concentration and co-operation. A special place is taken by the general programme for specialization and cooperation in the sphere of material production, adopted by Bulgaria and the USSR until the year 1990.

CHAPTER II.

DECISIVE FACTORS IN THE DEVELOPMENT OF THE CAPITAL GOODS INDUSTRY

A) The Industrial Policy, Main Instruments and Factors

1. CONDITIONS AND FACTORS SUPPORTING THE DEVELOPMENT OF THE CAPITAL GOODS INDUSTRY

The intensive development of production in the capital goods industry requires large scale capital investments, the extent of which should be significant in proportion to other statistical data pertaining to this country. The level of capital investments in this sector in 1960 amounted to 40 million leva, which accounted for 8,4 percent of the overall capital investment in industry and for 2,9% of the overall capital investments in the national economy. In 1978 the investments in the capital goods industry amounted to 503 million leva, while their share in the overall investments in industry was 19,5% and their share in the country's total investments amounted to 8,1. This was 12,6 times the amount invested in 1960.

The significantly large amount of 4,1 billion leva was invested with the purpose of providing the material production foundation of the machine building industry over the whole of the period 1961-1978.

In 1960 the fixed production capital of the capital goods industrial units came to 296 million leva, which was 10,8 percent of the overall fixed capital in industry. In 1978 the sector's fixed production capital ran up to about 3 billion leva, constituting 12 percent of the overall fixed capital in industry.

In 1977 the capital goods industry exceeded ten times the fixed production capital of 1960. It amounted to about 12,6 times that of 1970.

Along with the extension of the sector's material production foundation some important changes in the composition of its fixed production capital took place over the last few years. Due to the consistently pursued policy of rapid implementation of the achievements of science and technology, the continuously furthered machanization and automation of production processes and labour activities, the number of machines produced, as well as that of industrial equipment and measuring and controlling equipment has been constantly on the rise. In 1978 they came to about 56 percent of the sector's fixed production capital, the share of machines and equipment comprising about 50% of them.

Table 24

Relative share of machinery, equipment, and measuring and controlling equipment in the overall capital stock

(in %)

	1960	1970	1978
Total	100,0	100,0	100,0
Machinery and equipment	40,0	47,5	48,7
Measuring and controlling equipment	6,1	6,3	7,0

The overall rapid formation of the material production foundation of the capital goods industry in Bulgaria would have been impossible if additional labour force was not drawn in. The accelerated growth of this sector is greatly contributing to the full employment policy of our country which is accompanied by a

relatively limited migration. At the same time the setting up of industrial units in small towns and settlements contributes to the slowing down of urbanization processes and reduces the excessive concentration of labour force in larger towns.

90 thousand were employed in the capital goods industry in 1960, which represented 14% of the labour force and other personnel engaged in all branches of the capital goods industry (CGI). In 1970 their number came to 195 thousand, while in 1978 it ran up to 284 thousand. The capital goods industry accounted for 44% of the rise of the number of employees in industry over the whole of the period 1960 - 1978.

These data are once more displaying the important role, significance and place of the rapidly growing capital goods industry for the overall development of the national economy.

Along with the rise of employment in the capital goods industry in Bulgaria, there is a significant change of the quality and qualifications of those employed. The most nutshell expression of the results of this objectively taking place process is represented by the increased productivity of labour in industry. In 1978 it exceeded 5,4 times that of 1960 and 2,2 times that of 1970.

An important factor for this rapid process of raising the labour efficiency is the implementation of scientific and technological achievements. No less important is the raise of fixed capital per worker. The mechanization and automation introduced to manufacturing processes and the improved energy labour ratio have also been factors of paramount importance to the accelerated increase of labour productivity.

In 1978 some 700 new or improved articles were intro-

duced to the machine building industry. Some 470 innovatory or improved technologies were implemented in production. All this resulted in raising the technical levels of machinery and equipment and in an increase of production volume and efficiency observable for the whole of our national economy.

The fixed capital per worker in the machine building industry has grown considerably which is also contributing to the increase of labour productivity.

The higher level of technical development of our capital goods industry is to a great degree dependent on the energy/labour ratio and especially on the electricity labour ratio. This is shown on the following table:

Table 25

Energy supply, energy/labour ratio and electricity/labour ratio

(in kW)

	1960	1970	1978
Capacity of energy generating engines and motors (thousands)	26	196	476
Capacity of electric equipment/ electric motors (thousands)	180	653	1234
Capacity of electric equipment (thousands)	89	395	781
Installed capacity per worker	3,0	6,4	8,5
Capacity of electric engines and motors per worker	1,9	3,3	4,2
Total energy input (in kwh):			
- per worker	2956	4434	6158
- per man-hour worked	1,5	2,3	3,5

In 1978 the capacity of electric engines of decisive importance to raising the energy/labour ratio was 6,9 times that of 1960. The total capacity installed per worker was 2,8 times the level of 1960; while the level of electric energy utilized as motive power and in electro-technological processes estimated per worker was 2,1 times the level of 1960 and 2,3 times the level of the same year when calculated per one man hour worked.

An important aspect of the implementation of the achievements of the technological progress is the consistently applied specialization and echelon formation of production in the machine building industry, which is a prerequisite for increasing the batch production and the total production volume. This activity has been under way since the last few years. It has served as a basis for a continuous extending of manufacturing co-operation among separate industrial units of the machine building industry, which in turn is contributing to the raising of the technological level and to the better organization of this basic sector of our national economy.

Table 26

Coefficient of specialization (object and linkages specialization) and cooperation of production in the machine building industry

Indicators	1974	1975	1978
Coefficient of specialization	0,90	0,88	0,91
Coefficient of cooperation	0,19	0,19	0,21

An important and lasting trend characterizing the development of the capital goods industry is the trend of constant

renovation of production, 22 percent of the section's production total was renovated in 1978. This was a prerequisite for the following:

- the continuous extending of the sector's production, while taking into account the necessity of flexibility and adaptability to the requirements of the other industrial sectors, i.e. those using the machinery and equipment produced and complying with the requirements of the export.

- the application of the production renovation for furthering the accelerated implementation of the achievements of science and technology in the remaining sectors of the national economy, for increasing the quantity and improving the quantity of the latter's production. Thus the capital goods industry is playing an important role for providing the prerequisites for the country's accelerated industrialization, as well as for the development of the overall national economic complex.

An important aspect of the development of the capital goods industry is the continuously growing efficiency of production. This fact is reflecting in a most synthesized form the importance of this industrial sector for the overall development of the national economy of the country.

The economic effectiveness of the sector is growing parallelly with its rapid development. An immediate result of the development of the total industrial production, the mean annual employment rate and the mean annual value of the fixed capital, is the rapidly changing indices characterizing the efficiency of the social production output of this sector.

An already mentioned the labour productivity of workers and employees engaged in industry is growing at accelerated rates

thus providing for most of the production output increase. As one might expect the labour intensity of production is systematically being reduced.

Up to 1970 the fixed capital per worker was developing at highly fluctuating rates, ranging from -2,25% to 9,25%. This year, however marked a boundary line, followed by a lasting trend of growth.

The capital intensity of production also showed fluctuations in its development prior to 1970, ranging from -0,10% to 11,50%, and has even since been on the decrease.

Up to 1965 the productivity of capital was growing by fluctuating rates. It has been lastingly, though slowly growing since 1966. The material intensity of production has been on the decrease since 1970.

The total value of industrial production is a dynamic value which changes under the influence of three main groups of interlinked factors: the living labour force (the industrial employees); the means of labour (fixed capital) and the objects of labour (raw materials, materials in general, fuel, energy). It is understood, however, that in turn the growth of all these indices is dependent on other factors and activities, such as the scientific and technological progress.

The efficiency of labour is being measured by the increase of the total industrial production at the expence of changes of the number of industrial employees and of labour efficiency. It is expected that over the period 1975-1980 about 3 percent of the production growth would be accounted for by the increase of the number of people employed in industry, while 97% would be accounted for by the increased productivity of labour.

The intensive development of the capital goods industry and the increase of the productivity of labour is based on the modernization and reconstruction of the material and technological foundation and on the modernization and renovation of its production nomenclature, taking into account the latest achievement of science and technology.

The effective use of the fixed capital in the capital goods industry is differentially evaluated by its components: a) first, by the increase of the number of employees and the increase of the labour efficiency and second, b) by the productivity of capital. It is expected that about 55% of the production growth rate would be due to the latter component.

The increased productivity of capital is due to the modernization and reconstruction of the fixed capital and the capital stock and to the increased labour productivity.

The increase of the production volume at the expence of the objects of labour (i.e. materials, fuel and energy) is estimated by the increase of the output/material ratio and by the increase of material consumption (which is an extensive factor). It is expected that the relative share of the first factor would be as high as 15%, while that of the second would be 85%.

The integrated influence of the above mentioned factors (living labour, means of labour and objects of labour) is shown by the integral efficiency of production.

The analysis of the structure of the integral efficiency has shown that the productivity of labour has the biggest relative share, which is followed by the output/material ratio and the productivity of capital. In a structural aspect these results could be presented by a ratio of 85: 10: 5, which has been valid

for the capital goods industry in Bulgaria over the period 1975-1980.

2. NATIONAL RESOURCES FOR THE DEVELOPMENT OF THE CAPITAL GOODS INDUSTRY AND THEIR UTILIZATION

Under particular social needs the development of the capital goods industry is determined by the inner resources of the country. An object of primary importance is the providing of unity and interrelation among the three basic components of the production process, i.e. means of labour, object of labour and living labour. Moreover the country's resources are determined not only by the sum total of the production capacities available at a particular moment, i.e. energy, raw materials, labour force, etc., but also by their quality and by the extent and level of their utilization. Therefore the extent of utilization of resources which is largely dependent on the advancement of scientific knowledge and technology is no less important a prerequisite for the development of one or another branch of the capital goods industry, than the availability of natural wealth, material, labour and financial resources.

The future prospects for meeting the cumulative requirements of the capital goods industry for raw materials, fuel and energy are by no means reassuring. The further development of production is connected with meeting of requirements that would be immense in proportion to the country's potential. The future scarcity and limitations of natural resources is a fact which our country is facing in the same way as the whole of the world. The production and manufacturing of poorer resources of deteriorating quality would necessitate increasingly larger capital invest-

ment. Therefore the economical use of materials and energy is a prerequisite for counterbalancing production programmes and raw material resources under the prospect of the inevitable deffi-ciency of the latter in the country and the raw materials and energy crisis in the world.

A significant portion of the metals necessary for our capital goods industry are being imported. The fact that materials consumption accounts for 3/4 of the cost of production explains the importance of the economical and efficient use of raw materials, energy and fuel. The high rates of development of our capital goods industry which will be kept up in the future are necessitating the increasing requirements for raw materials and materials in general. This involves a constrnt awareness of the extent of materials consumption in a given line of production as well as of any deviation from the mean socially necessitated consumption and from the consumption incurred in other countries for analogous production.

The economical and efficient use of raw materials in the capital goods industry pertains to the overall production processes - i.e. it includes design, production and exploitation. This necessitates a complexity approach to the solving of problems connected with the lowering of the materials intensity of production.

The solving of the problem would imply the following:

First: lowering of the gross and net materials consumption per production unit, by means of improving the design and the existing technological process, as well as by introducing innovatory technological processes,, by using new approaches for pre-production treatment, by rhytmic and complex supply,

quality improvement and improving the conditions for transportation and storage, etc.

Second: The use of new materials as substitutes for materials in short supply or materials which are expensive. A considerable move has been made to improving the structure of construction materials used and the increasing share of non-ferrous material (especially that of aluminium) and plastics, while reducing the share of ferrous metals.

Third: Improvement of the manufacturing structure of end products with the purpose of reducing the materials consumption per output unit and increasing the extent of manufacturing of input materials.

Fourth: To economize on all scraps, i.e. collecting, sorting out and utilization of all scraps and applying of modern specialized technologies.

The metal consumption of manufactured production is to a large extent dependent on the technological structure of the machine stock available. The latter is such that about 80 percent of the metal working technologies are accompanied by waste turnings and only a small portion of them make use of shaping processes. Therefore special attention has been drawn over the last few years to problems connected with improving the technological structure of the machine stock in the capital goods industrial units.

Highly productive modern technologies are being introduced with the purpose of reducing the metal consumption per manufactured output and thus relatively lowering the requirements for material resources.

Another problem of cardinal importance is the availabili-

ty of labour force. Due to the shortage of labour resources in the country the further input of labour in the capital goods industry is more and more problematic. This shortage is due to the rather low running input of additional labour force, the increase of labour force being considerably lower than the development rates of production. Another reason is that a considerable part of the labour resources are directed to the non-material production and this trend will be even increased in the future. It is expected that a further shortening of the working time will be introduced to all the spheres of our national economy with a view to providing more free time to be used for recreation, sports, cultural life, further studying and training and for evaluating of accumulated production experience.

The input of labour force for the capital goods industry is dependent on the demographic processes characteristic for our country and on the future population reproduction. It is conditioned by a host of complex economic and social factors and is naturally dependent on the sex and age structure of the population.

The ageing of population is inherent to all developed countries. Taking into consideration the factors determining the lengthening of the average life expectancy we might expect that this process will continue in the future. A pronounced stagnation trend is characteristic for the active population of our country.

While in the not too remote past the extending of production volume was achieved by drawing in additional labour from the sphere of agriculture and by structural changes of the industrial sectors, the future requirements for labour resources

should be met by raising the efficiency of the labour engaged in production.

The increasing shortage of labour resources and the demographic ageing of the population are factors which are necessitating the alternative increase of the production volume of the capital goods industry by the use of up-dated means of labour. Thus we are encountering the problem presented by compensation resources, i.e. the labour shortage should be compensated by the speeded renovation of fixed capital and by introducing of highly productive machines and equipment.

The dynamic renovation of the means of labour presupposes some considerable changes of the professional qualification of labour.

The implementation of the programme for modernization and reconstruction involves improvement of the professional qualification along with the improvement of the technological structure of machinery, the implementation of innovatory technologies and the renovation of manufactured products. It is envisaged for the relative quota of professions connected with automation devices to be markedly increased at the expence of reducing unskilled manual labour. Therefore adequate provisions are made for the education and training of young specialists with a view to meeting the requirements of present day technological advance. The situation and development prospects of the qualificational structure of labour are taken into consideration and thus a continuous improvement of the quality and forms of training and retraining of industrial personnel is under way.

Considerable labour reserves can be ensured by changing the personnel composition (reducing the number of administrative

and managerial personnel, changing the ratio of standing full time labour/auxiliary labour), by improving the organization of labour and production, by increasing the manufacturing and servicing production quota, by reducing losses of working time, etc.

Another significant factor is the relative economizing on auxiliary workers and administrative personnel brought about by the increased production volume and changed production structure.

Under these conditions the further development of the capital goods industry will be effected exceptionally on the basis of increasing the social productivity of labour. It is expected that the increased productivity of labour would be the only source of growth of the capital goods sector's output, which means that the further development of this sector will be completely intensive.

3. THE PROGRESS OF SCIENCE AND TECHNOLOGY AND THE DEVELOPMENT OF THE CAPITAL GOODS INDUSTRY

The extremely diverse and complex impact of the scientific and technological progress on the development of the capital goods industry falls into two broad domains. The first of them pertains to the influence of the scientific and technological progress on the final products of the capital goods industry, while the second is expressed by the former's influence on the technical level of the sector's manufacturing activities. Of course there is no marked boundary line between these two domains because part of the sector's final products are utilized within the sector itself and thus are immediately influencing the technic level of production.

A basic trend of the scientific and technological revolution which has a direct bearing on the prospective development of the capital goods industry is the regular transfer of operational and intellectual functions from man to qualitatively new technical devices, machines and technologies. Therefore the main object of the capital goods industrial development is the provision of the technical means, machinery and technologies necessary for the implementation of a complex mechanization of production processes, for the electronization of the national economy, for the complex automation of production (which is a higher form of automation providing for the bionization of production, i.e. a level at which every production system is functioning as a living organism.

The orientation toward these strategic guidelines of the scientific and technological progress in the domain of the capital goods industry has been predetermined by some objective prerequisites and conditions:

In the first place Bulgaria is a contemporary socialist state with a considerable for its size production and economic potential. The already available fixed capital, capital stock and the accumulated manufacturing and technological experience are a solid foundation for the further speeded intensive development of the country's economy.

In the second place Bulgaria has built up an indigenous scientific and technological capacity, the level of which is corresponding to the country's needs and possibilities. Scientific and technological research carried out in this country contributes a great deal to the development of the strategic guidelines of the scientific and technological advance.

In the third place the scientific front of Bulgaria is developing in close co-operation and integration with the science of the other socialist countries. Of exceptionally great importance to the successful tackling of the country's problems is "The General Programme for specialization and cooperation in the sphere of material production until the year 1990" adopted by Bulgaria and the USSR. Most of the key problems of the dynamic development of the scientific and technological progress are incorporated in the joint projects and programmes of the counterpart ministries and establishments of the two countries. The division of labour and the specialization in the field of science and technology are objectively necessitated processes effected on the basis of a selective strategy of development of the scientific front. The basic guidelines are framed by scientific research on the international specialization of production, making full use of accumulated experience, facilities and traditions and rapidly and efficienty introducing progressive foreign experience.

One of the basic development objectives of the capital goods industry is extending the scope of application of machinery to material production, i.e. the mechanization and automation of auxiliary and other operations, which have been so far hand operated: delivery of the objects of labour to the manufacturing premises, fastening of different pieces and parts to machines, inter-operational travelling, assemblage, production control, retrieval of information, etc. A significant fault of present day mechanization and automation is its incompleteness.

Due to this many manually operated processes are performed along the automated production lines, both skilled (those

connected with maintenance and repair) and unskilled (those applied to a number of trifle operations). Therefore important desiderata of the capital goods industry would be the building up and use of systems of machinery for complexity mechanization and automation of production. The reducing of expenditure for repairs would be achieved by specialization and centralization of repair, centralized production of spare parts and links for the machine building industrial units, by improving the wear resistance of the most important pieces and connecting parts with a view to preventing and eliminating any failure and average in the periods between overhauls.

An important development objective of the capital goods industry is devising and implementing of innovatory technology, including new approaches for treatment of the objects of labour: both non- mechanical (atomic, chemical, electro-chemical, electrophysical) and mechanical (magnetic, explosive, vibrational, pneutatic, hydraulic); improving the production capacity of machines, aggregates and equipments by enlarging their dimensions, increasing their speed limit, output capacity, temperature, pressure, etc.; by replacing discrete with continuous processes, by the application of new technologies and complex mechanization, including the use of aggregations of machinery, mechanization and automation of inter-operational travel, auxiliary operations and elimination of failure.

The vigorous growth of the technological equipment efficiency and the higher level of basic technological processes are necessitating the improval of all the links and units of the overall production line. Therefore the structure of the means of labour would be continuously changed, while the quota of machi-

nery and technological equipment would be reduced at the expence of the increased introducing of equipment with multiple performance, incl. computers, means for internal travel, controlling and measuring equipment, environmental protection equipment, etc.

The development of robotics as a means for complexity automation of production and for increasing the social efficiency of labour is opening up new vistas for the future. Robots are to replace labour in many processes, such as casting, forging, welding, pressing, protective covering, painting, supplying of machine tools and plastics processing machinery, etc. It is expected that during the next ten years the capacity of the robots would be significantly raised due to the development of microelectronics. This sets out the problem of choosing an appropriate policy for robots development in accordance with the country's scientific and production capacities.

Exceptionally important for the development of the capital goods industry is the accelerated electronization of material production sectors, the production and implementation of completely electronized systems and complex units, automated systems for management of technological processes, for control management, for automation and designing of technological projects, for automated management carried out at different levels of the national economy. A leading role for the improvement and automation of the production process is to be played by computers. The development of the latter would involve an increase of their operational speed, extension of their memory units, providing of automated distribution of computer time by the consumers and a significant price reduction of computer operations. The outer lay-out of computers will also be subjected to improvements (input and

output devices, memory units, units for transmitting and retrieval of information, etc.).

A number of related problems are also to be solved by the introduction of electronization into the capital goods industry, e.g. the timely renovation and diversification of nomenclature conforming with the requirements of the home and foreign markets; the development of microelectronics and a proportional growth of the elements stock; development of the instrument building industry and devising of computer based mechanical, hydraulic and pneumatic devices; software development with a view to attaining the status of a software industry.

The impact of the scientific and technological progress on the final products of the capital goods industry is contributing to a considerable extent to the raising of the technical level of the sector's output, because the sector is at the same time consumer of its own products. Therefore a problem of cardinal importance is the further development and improvement of the technical base of the capital goods industry production; and first of all the improvement of the stock/labour ratio and the electricity/labour ratio. Taking into consideration the already described distinct impacts of the scientific and technological progress on the means of labour, one might expect that the increased technology/labour ratio will be effected not so much in a quantitative aspect than in a qualitative aspect (implementation of systems of machines, robotization, electronization, etc.). Extremely important is for the productivity of labour rates to exceed the rates of increase of the technology/labour ratio. This means that the further implementation of technology should result in an increased labour efficiency, which makes the technological

level and the extent of utilization of existing technology problems of critical importance.

With a view to the same objective special attention is being drawn to maintaining appropriate age structure and to the timely renovation of capital stock in the capital goods industry. Therefore it is necessary to speed up the renovation of the machinery and to shorten the wear tolerance of machines and equipment.

The scientific and technical progress sets out important requirements with respect to the timely renovation of the capital goods industrial output. Not less than 20% of the sector's production total is regularly renovated per annum, and the whole of production nomenclature is substituted every 4-5 years, thus creating an opportunity for a rapid adaptability of production to the changing needs and requirements of the home and foreign markets. To maintain a high technological level and quality of the capital goods industrial output is a task of paramount importance. Quality along with social requirements is an important prerequisite for determining the sector's development. An article could be considered prospective from an economical point of view only if the three following conditions are satisfied: if the good in question is socially required; if it can be subjected to the influence to all the factors ensuring its optimal quality; and if it is contributing to the economic efficiency of production and export.

4. INVESTMENT POLICY FOR CONSTRUCTION AND DEVELOPMENT OF PRODUCTION CAPACITIES FOR THE CAPITAL GOODS INDUSTRY

The most characteristic feature of the sub-sectorial

development of the capital goods industry under the conditions prevailing hitherto was that it was first of all dependent on new construction. The reproduction of fixed capital was effected mainly by setting up of new industrial capacities and to a considerably lesser extent on extending of existing capacities or installment of new machinery and equipment. This accounts for the big relative quota of new construction and expanding of existing capacities in the total volume of capital investments. The material and technological base established in this sector made it possible for the further development of production capacities to be accomplished mainly by modernizing and reconstructing of capital stock and by improving the technological and reproduction structure of capital investments.

A concurrent process is the continuous renovation of the nomenclature of manufactured products and the introduction of new products preconditioned by the impact of the scientific and technological progress and the further extension of integration within the framework of the COMECON. In such cases the adjustment and reconstruction of existing production capacities has proved to be inefficient. Provisions are therefore made for new construction if the product in question has proved to be effective enough. Characteristic case histories are several large scale works in Bulgaria, the construction of which was necessitated by the requirements of our chemical, energy and metallurgical industries.

The capital investment efficiency is directly dependent on the development rates and proportions taken on by expanded reproduction, on an appropriate policy for the development rates of the individual sub-sectors and on optimizing the sectorial

and territorial structures of production capacities in the capital goods industry. This accounts for some qualitatively new requirements to designing pertaining to extending the planning and designing of single units to designing based on complex target-projects for simultaneous development of the capacities of groups and types of industries connected by common specialization or co-operation within the frameworks of individual amalgamations, echelon formations or economic units.

The present day development of production is a multilateral process connected with the improval of technique, technology and the organization of labour. This necessitates a continuous renovation of machinery and equipment and the replacement of worn out machinery by reconstruction and modernization. The renovation of capital stock and the introduction of new technology is effected in the following ways:

- by optimal expanding of the capacity of machinery and increasing their operational rate;
- by a transition from mechanical methods of production to chemical, electrochemical and other methods;
- by the continuous implementation of new technological processes;
- by complexity mechanization and automation of production processes;
- by a transition from a three unit machine system to a four unit system.

The modernization of machinery is one of the forms applied for preventing and eliminating the wear of the machine stock. It makes possible the adjustment of existing machinery to the technical and economic indices of new machinery with mi-

nimum expenditure and the shortest possible terms. The adjustment of the technical and economic indicators of existing machinery and equipment to the most up-dated requirements prevents premature removal from production and leads to an increase of output rates.

Bulgaria has considerable reserves for increasing the production efficiency in the capital goods industry by modernization of machinery, thus raising 1,5 times the labour productivity. The modernization of more than 3000 machines has been carried out in the machine building industry over the period 1976-1980, which would result in an economic effect amounting to 5,2 million leva.

The reconstruction of production capacities in the subsequent period is another form of extended reproduction of the capital stock and renovation of existing machinery and equipment.

It is envisaged that the renovation of capital stock by reconstruction will be carried out along two main lines:

- additional installing of new machinery and equipment to the already existing machine stock;
- replacement of obsolete machines and equipment.

At the same time each of these two approaches for renovation could be accomplished by the use of machines and equipment with technico-economic indices equal to or higher than those of the existing machinery. Under the conditions of intensification of the capital goods industry, the renovation of the capital stock should be effected by introducing machines and equipment with higher technico-economic indices.

On principle a larger relative quota of the means for modernization, reconstruction and extension conditions a smaller volume of capital investment per capacity unit. It is envisaged that the quota of capital investment in modernization, reconstruction

and extension would account for 70% of the capital investments total in the capital goods industry.

The improvement of the capital investment structure is no less important. It pertains to the proportion between construction and assembly investments and the expenditure for machinery, equipment, etc, included in the overall volume of capital investment. The relative quota of machines and equipment amounts to abou 2/3 of the capital investments and can be compared with quotas as high as these of the German Democratic Republic and Poland within the framework of the COMECON countries.

The increase of the relative quota of machinery is not unlimited, however. The advance of science and technology has set definite requirements for anti-dust ventilation, for certain appropriate levels of temperature and humidity on the working premises, fro appropriate lighting, etc., which are naturally raising the cost of construction.

Special emphasis is played now on sustaining a considerable quantity of unfinished construction. The concentration of capital investment on a smaller number of objects of great economic importance ensures the most rapid construction of production capacities and shortening of the lacking up period when the national economy has no return from the capacities under construction. Therefore a narrowing of the construction front and diminishing of the unfinished production is being accomplished and envisaged and it is expected that the speeded modernization and reconstruction would have a positive impact.

The policy towards shortening the terms for puting into operation capacities has the same objective, i.e. acceleration of the economical effect of these capacities for the benefit of the

national economy. Thus tion programme is bound with the
production capacities er a reduced volume of capital in-
vestment which has an fficiency.

The acceler renovation rates of the capital
stock is connected wi ng the optimal quantity of machi-
nery to be taken out n. Under the present day rates of
scientific and techn nce it is the economic factor, i.e.
the wear tolerance of hat is determining the exploita-
tion term of machiner ent.

Presently, the extent of machinery and equip-
ment taken out of pr to wearing out is rather low.

The keeping xisting trend for renovation
mainly by introducing s would reduce the coefficient
of replacement and b ortage of labour. The current rep-
lacement rates of the pital stock would soon call forth
a doubling of the nu ting machinery. This would lead
to a proportionate de our and thus- to labour shortage,
because the rate of l ces increase is much lower.

To ensure a h of the intensive production fac-
tors in the capital g it is envisaged for a timely rep-
lacement of obsolate r equipment to be regularly carried
out, the replacement amounting to 2-3% of the overall
volume of the capital objective should be attained by
introducing of high p utomated machinery suited for multi-
machine operation.

The role of of science and technology is ex-
pressed by the applica ern technological processes, which
are shortening the pro tes, reducing the labour intensity
of the goods and incr roduction efficiency. Therefore

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the modernization and reconstruction of the capital stock is preconditioning the following:

- implementation of partial and complexity mechanization and automation of manufacturing processes;

- improvement of existing technological processes on subsectorial basis;

- improvement of the organization of existing production units;

- improvement of the forms of specialization and raising of the relative quota of parts and links specialization, as well as that of technological and functional specializations;

- technical and organizational improvement of inner inter workshop travel;

- improvement of the technology and organization of auxiliary operations;

- continuous increase of the relative quota of standardized technological processes;

- improvement of the complexity of production capacities with a view to providing optimal correlation between the output capacities of individual units.

On the whole the country's investment policy is guided by the principle that the continuously increasing economical and efficient use of capital investment is the one and only way for accelerated development of the capital goods sector, given the limitations of resources and especially of the part of the GNP earmarked for accumulation.

5. USE OF THE PRODUCTION CAPACITIES AND THE FIXED CAPITAL OF THE CAPITAL GOODS INDUSTRY

The use of the sector's production capacities and fixed capital is immediately connected with investment policy and the appropriate allocation of capital investments. This connection is twofold. On the one hand the capital investments are determined by the volume, structure and extent of exploitation of capacities and stocks, while on the other hand the efficiency of capacities and of existing and newly introduced capital stock is dependent on the allocation of capital investment.

The intensive development of the capital goods industry is executed along two lines- capital intensity of production and capital saving production. By the first the increase of labour productivity is accomplished by an increase of the capital/labour ratio, resulting in a trend of increasing the capital intensity of production. By the second, the increase of labour productivity outruns the increase of fixed capital per worker, thus reducing the capital intensity of production. Here a most important task would be the transition from capital intensive production to the higher capital saving form. The successful solution of this problem is dependent in the first place on the technique and technology implemented and the extent of its utilization. This preconditions the gradual transition from lower to higher form of production in the capital goods sector.

The extensive factors are of paramount importance to the better utilization of production capacities and capital stock attained by lengthening the exploitation period of machinery within their fixed working regime. This is achieved in the following ways:

- by extending workdays, i.e. including saturdays and sundays, while preserving the five workdays week by manouvering shifts and shortening the time used for overhauls and regular current repairs, by improving the repairs efficiency, so as to extend periods in between overhauls;

- by increasing the shift coefficient, which reflects the average number of machine shifts within a given industrial units, sub-sector or sector. The coefficient is increased by increasing the average number of shifts to 2-2,5. The fuller exploitation of machinery is attained by improved complexity deliverance and surmounting some repairs difficulties; by loaning or selling part of the capital stock to other industrial units when this is necessitated by changes in the specialization of production and by economic motivation for a better utilization of fixed capital;

- by increasing the work efficiency of machinery, reducing idle time due to different reasons: delayed delivery of materials and defficiencies of energy supply, shortcomings of the organization of labour and production processes, averages, etc., which are still taking up about 20% of the machinery working time.

The improved extensive use of production capacities and fixed capital is reducing the necessity of additional capital investments and makes for the shortening of the time necessary for receiving of economic return, as well as for the maintenance of up-to-date technological level and for reducing the wear of ca-

pital stock.

The increased extensive use of production capacities and capital stock necessitates the drawing in of additional labour. This problem can be solved by introducing complexity machanization in the auxilliary and servicing units and by reducing the number of administrative and managerial personnel at all levels.

The extensive use of production capacities has its own natural limits. In contrast to extensive use, the intensive use of production capacities has unlimited possibilities, because it is science and technology based.

The intensive factors are making for improved utilization of production capacities and capital stock by increasing the work load of machinery per time units and raising their efficiency.

The following factors are to be given particular regards:

- the technological improvement of the means of labour and labour processes by modernization and reconstruction, by introdicing of perpetual methods and technologies, by attaining higher parameters (such as speed, pressure, temperature, etc.) of the operation of machinery and equipment, by reducing the labour intensity of production by improving the design and the technological process of the goods;

- raising the qualification level of personnel and constant re-training with a view to mastering most skilled use of existing technology;

- observing and shortening the terms determined for utilization of the production capacities of machinery;

- raising the levels of specialization and cooperation of production in accordance with the production range and the machine stocks composition;

- reducing the prices of capital stock by increasing labour efficiency;

- improvement of the fixed capital structure with a view to increasing the relative share of its active components, i.e. machinery, devices, equipment, etc.

The efficient and rational use of production capacities will assume increasing importance with a view to the necessity of allocating more funds for environmental purposes and for the development of production and social infrastructure, for improving the working conditions and living standards.

6. CONCENTRATION AND SPECIALIZATION OF PRODUCTION IN THE CAPITAL GOODS INDUSTRY

The further development and improvement of the social character of production is related to the concentration and specialization at all levels of the capital goods indutry, i.e. in all systems of shops, works, units, associations, etc. Given the advantages of scientific and technological progress the cooperation (i.e. an organizational form of social production) is one of the factors determining the accelerated and efficient development of this sector.

Over the whole of the period 1960-1975 the level and extent of concentration in the capital goods industry in Bulgaria was increasingly furthered and promoted. The speeded growth of the overall industrial output volume, the increased use of fixed capital and the number of people employed in industry are indicators serving as a proof of this development. An index of equal importance is the capital goods industry/other industries ratio.

The increasing concentration process is reflected by the

growth and expansion of industrial units and state economic associations. The medium size of industrial units estimated on the basis of the number of labour employed has extended most rapidly. The same holds good for estimations done on the basis of fixed capital.

The increase of the number of industrial units exceeds that of labour employed. Therefore, on the average, the number of employees at a given industrial units has shown a reduction bound tendency.

For the purpose of studying the development of concentration, the industrial units have been subdivided into four groups. The medium size units are prevailing, which is shown on the following table, valid for 1975:

Table 27

Structure according to Extent of Concentration

(in %)

Groups of units according to extent of concentration	Production output volume (Gross Output)	Fixed capital	Number of employees
Small scale units	2,0	4,1	1,9
Medium size units	55,0	69,5	67,0
Big units	19,0	17,9	28,4
Big scale units	24,0	8,5	2,7
TOTAL	100,0	100,0	100,0

Prospective evaluations about the average size of a capital goods unit in Bulgaria with respect to its production output volume are making use of four types of functions depending on

the trends prevailing in the period under consideration. On the basis of calculations made by these functions, four variants have been distinguished for the average size of an industrial unit with respect to its output volume. The first of them has been obtained by means of a parabolic function, while the second has been deduced by a linear function. The third has been based on the assumption that the average size would grow at accelerated rates under the influence of the intensive factors. A hyperbolic function has been used to this end. The fourth and last variant has been based on the assumption that a rather wide range of changes would be admissable with respect to the content and structure of units and their grouping.

The forecasted growth rates of the individual variants estimated for 1980 and for 1985 are shown on the following table:

Table 28

Forecast for the growth of the average size of the capital goods units

(in %)

Year	Growth variants according to production volume (1970 = 100)			
	Variant I	Variant II	Variant III	Variant IV
1980	150	160	177	214
1985	175	198	240	310

Considerable changes are envisaged in the proportion between the different groups of units on the basis of analyses and forecasts related to average size. There is a noticeable trend of a prevailing development of large scale units, shown on the next table:

Table 29

Unit structure according to extent of concentration

(in %)

Groups of units according to extent of concentration	Reported		Envisaged	
	1970	1975	1980	1985
Small scale units	3,5	2,0	1,5	0,7
Medium size units	57,4	55,0	47,5	38,0
Big units	15,6	19,0	24,0	29,0
Large scale units	23,5	24,0	27,0	32,3
TOTAL	100,0	100,0	100,0	100,0

The promotion of concentration on the basis of the optimal size of production capacities and of the improvement of the specialization of components and technologies has an immediate impact on the capital goods industry. Specialization processes in the capital goods industry in a broad sense includes differentiation processes and the further profilization of machine building industries. A characteristic feature of the capital goods industry is the increase of the individual and mean extent of serial production, which accompanies the accelerated growth rates of production.

The differentiation within the machine-building branch has already been completed. The machine building units are manufacturing 99,2% of the total machine building output.

A basic trend of differentiation within the machine building units is the establishment of different sub-branches and units for linkages, components, partial processes and functional activities.

The relative share of the individual forms of differentia-

tion of manufactured products in industrial units is shown on the table below:

Table 30

Structure according to forms of specialization

(in %)

Form of specialization	According to number of units			According to production output volume		
	1965	1970	1975	1965	1970	1975
Object	53,9	53,9	56,4	87,1	63,2	60,4
Component	26,1	16,9	26,0	5,8	27,4	30,2
Technological	3,7	3,5	3,7	2,1	2,8	2,9
Functional	16,2	15,7	13,9	5,0	6,6	6,5
TOTAL	100,0	100,0	100,0	100,0	100,0	100,0

The share of partial products industries is not relatively small, because they are developing under the impact of the integration carried out within the framework of the COMECON. They comprise assemblage of cars, automobile linkages and components, hydraulics, bearing, printing plates, etc. Due to the increasing requirement of object specialization, the country is developing a number of partially specialized industries, mainly on a sub-sectorial basis (production of assembly parts and components for electric trucks and motor trucks, electric hoists, silage combines, tractors, tools, appliances, wrought parts, meltings, instruments, etc.).

The growth rates of this progressive form of specialization are considerably higher, which is shown by statistical data for 1975 (1970 = 100):

Object specialization - 184,3%

Partially specialized industries - 271,5%

This differentiation is mainly internal, i.e. it concerns only the sector's units and associations. Only some 5,7% of the machine building output has an inter-branch character. The most general indicator of the level of specialization is the coefficient of profilization. The sector's specialization took place mainly during the period 1960-1970, which is shown on the following table:

Table 31

Extent of Specializiation in the Capital Goods Industry

(in %)

Indicator	1960	1965	1970	1975
Coefficient of specialization	62,9	73,7	85,2	88,9

The coefficient of specialization reflects the qualitative aspect of the specialization and the reserves related to production efficiency. It is lower than the coefficient of profilization, because most of the profile production is manufactured by standardized methods.

The efficiency of specialized production is considerably higher than that of standardized production; it exceeds by 98% the latter's production efficiency and by 49,6% the latter's profitableness.

The main thrust of the intensive development of concentration and specialization is the establishment of large scale echelon lines and economic units for semi-finished products, aggregates, linkages, components, assembly of final products, etc. The envisaged extension on the automation and mechanization of manu-

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The main thrust of the intensive development of concentration and specialization is the establishment of large scale echelon lines and economic units for semi-finished products, aggregates, linkages, components, assembly of final products, etc. The envisaged extension on the automation and mechanization of manu-

facturing processes and the related increase of the relative share of high-performance and automated machinery is necessitating a further fostering of concentration and specialization on a principally new basis.

One of the basic prospects is the setting up of capacities with optimal size and optimal specialization, e.g. units, economic organizations, associations, etc. Expedient echelon formations of the manufacturing process are being established on the basis of complexity standardizations, unification and typization of the production of linkages, components and final products.

An immediate result of the implementation of this line would be the gradual incorporation of the established industrial and territorial manufacturing complexes into an unified production system.

7. PLANNING - A BASIC INSTRUMENT FOR THE REALIZATION OF THE ECONOMIC POLICY OF THE STATE AND FOR ACHIEVINC OF THE DEFINED GOALS

The long experience and practice of planning of the National economy in Bulgaria and in the other socialist countries have confirmed that the planning activity is one of the most important conditions for a rapid and purposeful development of the social production, for the realization of the economic policy of the state and for achieving the goals, determined on the basis of an integral plan, which includes the planning of the separate economic enterprises as well as the overall economic planning and the realization of coordination of plans within the framework of the socialist community.

The material base of the planning is the public property

of the capital means of production. The knowledge of the economic laws and their creative application make possible the planned development of the economy and the efficient use of the production resources. The planning is effected by means of the economic and organizational activities of the state, based on the purposeful use of the economic laws in economic practice. In accordance with the objective operation of the economic laws, all the important structural changes in the economy, the rates of growth and the proportions of the overall economy and its sectors are consciously and purposefully outlined in the national economy plans. In accordance with the stages of development and the tasks, which have been set up, different forms and methods are used, different means of economic management and material incentives, are applied, which (under given conditions and a certain level of development of the productive forces), would provide best opportunities for an efficient and purposeful use of the economic laws.

The industrial production plan has always taken a central place in the national economic plan of the country and this plan has always defined the rates and the proportions of the reproduction process as a whole. The capital goods industry is a substantial part of the industrial production, which defines to a great extent the level of labour productivity and the use of the achievements of the scientific-technological progress. For the Bulgarian economy it is of great importance that the capital funds for the production be ensured through extermal economic connections, which constitute a specific part of the national plan. The balancing of the production programme with the needs of the country and the interconnections with the other countries within the frames of the yearly and five-yearly plans, as well as the connection of the ca-

pital goods industry with the other sectors of the economy, is a basic task of planning activities.

The objects of planning are not only indicators of the volume, but also qualitative characteristics of development, which have a specific technical economic character as well as some social and regional aspects. Relevant interrelations between the current, the concrete and the general, the perspective, etc. are sought in the planning process. There are also solved the problems of the organization and management of the economy by means of relevant forms and methods, as well as of purposeful relations between the centralization and decentralization in the management and the planning, in the disclosing and use of inner-factors and possibilities and in the consideration of the conditions existing abroad, their probable changes, etc.

8. THE EVOLUTION OF THE CAPITAL GOODS INDUSTRY IN BULGARIA AND SOME PROBLEMS OF INFRASTRUCTURAL DECISIONS

The strategy of regional balancing, which was adopted in Bulgaria soon after 1944, has had a great impact on the whole industry and on the machine-building industry and its territorial distribution. Its objective was to eliminate the economic depression existing in some regional parts of the country, which had valuable raw materials and labour force, as well as to improve the conditions of the underdeveloped territorial units of Bulgaria. In this sense, in almost every settlement of urban type there has been constructed a machine manufacturing enterprise, which (according the sectorial specialization at that time) had an universal production structure with various assortment of the production, without making a substantial difference between the local and national im-

portance of the relevant enterprise.

At the same time, the processes of expanding industrialization and urbanization are giving rise to some changes in the existing regional structure of the country - significant migration of the population of working-age from villages to towns, which in some parts is rather strongly expressed in concentrating in separate bigger settlements a substantial number of work - capable population. The influence of the balancing regional strategy continued during a considerably long period and has led to results, which to a certain extent may have a contradictory interpretation. On the one hand, the creation of professional employment of the population in the different regions of the country has raised the industrialization level of the whole country, has changed the existing economic organization (which was predominately agricultural) and to a certain extent has harmonized the professional, social and cultural development of the population in the different parts of the country. The realized regional balancing leads to an improved construction and reconstruction of the main infrastructure (transport facilities and engineering communications) of the whole country, the infrastructural heritage of which was insignificant and obsolate. Actually an almost new infrastructural base was built up in Bulgaria in a functional as well as in a territorial aspect. The listing of the positive effects of the described strategy of regional balancing may be continued, but it is necessary to stress that this strategy played a really important role for a given historical phase and was objectively a kind of regular tendency of the industrial and territorial development of Bulgaria.

However, in the present phase, the development of the industry on a world wide scale, as well as of the industry of the

COMECON countries and Bulgaria, has reached such an advanced development, that it is necessary to change the existing strategic conceptions as regards the relation: enterprise - settlement. The territorial dislocation of the Machine building sector has covered the whole country. Undoubtedly the short distances in Bulgaria do not create any problems with regard to transport costs (as is the situation in big countries, for example the USSR), but, nevertheless, in the process of transition towards big multi-plant copmlexes, the scattering of the machine manufacturing enterprises over the whole country would create difficulties (even under the conditions of dinnerplant cooperation and interplant cooperation) of the future multi-plant enterprises.

Almost all machine-manufacturing enterprises in Bulgaria have a number of small repair, instrumental and service economic units of their own, which complicate and make heavy the structural balance of the enterprises. The broad territorial dislocation of the machine-building enterprises over the whole territory of the country has created the necessity for each establishment to ensure the conditions of its own functioning. This territorial dislocation is not facilitating the forming of multi-plant enterprises in a given area at the present stage of development. This has an impact not only on transport expenses but makes impossible the use of an integrated infrastructural base of several machine-manufacturing enterprises or plants.

Recently it is felt more sharply that the acievements of the machine manufacturing are beginning to give also negative results, which necessitate some cardinal changes in the future structure of the industry.

The successful development of purpose-oriented directions

of development of the machine manufacturing and the production structures of the big multi-plant complexes should in greater extent be based on the understanding of the principles of the material natural balance and the ecology. The dislocation of machine-building enterprises over the territory of the whale country will on lack of would lessen the limitations, restricting industrial activities, such as energy and space deficiency depletion of resources, etc.

B) Analysis of the International Cooperation, the Transfer of Technology, the Industrial Research and the Scientific and Technological Cooperation

The increasingly complex, long- term and multi-sided character of the relations of specialization and co-operation in the spheres of production and of science and technology is further strengthening their role of main factors of the dynamic and effective development of the country and particularly of the capital goods industry.

The results of this impact are rather diverse. Even their most generalized presentation indicates that as far as efficiency, terms and dimensions are concerned Bulgaria had and has no other alternative than the already adopted line of building up and developing the sector of the capital goods industry, which is being implemented on the basis of integration. The comparative analysis of the industrial development and the export of the economically developed countries has indicated that Bulgaria represents an exceptional case and has created a precedent - no other country has attained the following results: while in 1952 machines and equipment did not have a place in the export structure of the country, in 1979 they constituted half of the export resources of Bulgaria, more than 45% of which being products of the capital goods industry.

The development of production of the capital goods industry is taking place under the direct and continuously increasing impact of integration processes and especially of the international specialization and cooperation effected within the system of the COMECON. Due to the decisive role of this sector in

the national economy, it is through this particular sector that the basic relations between the national economic complex and the integration system are formed and it is through this sector that the impact of the integration factors on the economic growth and the development of the structure of the Bulgarian economy is mainly manifested.

What are the gains of our country from its continuously extending participation in the international specialization and cooperation of production in the frames of the integration-community of the COMECON? The basic dimensions of this decisive impact and of the related possibilities for accelerated development may be presented by the following instances:

- the building up of a developed industrial structure of the economy in a comparatively short period and the basic change of the export potential of the country;

- attaining through specialization and cooperation an economically justified concentration of production and an optimal scale of production, which is one of the decisive conditions for raising of efficiency;

- acceleration of the scientific-technological progress in the capital goods industry through the expansion and intensification of the scientific-technological cooperation in its different forms and especially through cooperation of the forces in the production and scientific-technological field for a coordinated realization of the cycle "research - development - production - realization (sales)";

- long-term market realization of the new structures, which for a country like Bulgaria was no less important than ensuring of economic and technical conditions for the development of

the capital goods industry;

- expanding possibilities for cooperation through common participation on a third market together with other COMECON member countries, as participants in the realization of complet delieveries, investment projects, etc.

1. BULGARIA'S PARTICIPATION IN THE SPECIALIZATION AND COOPERATION RELATED TO THE CAPITAL GOODS INDUSTRY WITHIN THE FRAMEWORK OF COMECON

The open character of the national economy of Bulgaria is a precondition for the realization of a broad economic and scientific-technological cooperation with all countries. Due to a number of circumstances and factors, the national economy is being developed mainly within the frames of the COMECON. This is explained with Bulgaria's affiliation to the community of the COMECON member-countries. This community is characterized with the establishment and the maintainance of international relations of a principally new type, the basic features of which are equality, mutual respect and mutual friendly help. The strength and the unity of the community are constructed on a solid base - uniformity of the economic base, identity of state structures and unity of the ideology. The relations between the COMECON member-countries are based on a general common final objective, for the attainment of which they have dedicated their efforts and energy.

Of exceptionally great importance is the fact, that along with the general common practical goal set up by COMECON - the continuous strengthening and inreasing of economic and scientific-technological cooperation and the development of the socialist economic integration; there is also the task of supporting

in all respects of the countries with less developed economy so that they may realize their industrialization with higher growth rates. Different methods and means are used for the solution of this task, most substantial of which are the international specialization and cooperation of production and the realization of an intensive and extended scientific-technological cooperation with respect to rates and scale.

The many sided international specialization and cooperation in the sphere of the material production, carried out within the frames of COMECON has a history of an almost one quarter of a century and is rich in experience. It comprises to a considerable extent the production of the machine builing sector. Till now more than ten thousand kinds and types of machines, equipment, technological lines, etc., have been subjected to COMECON international specialization and cooperation. To meet the objective needs of the COMECON member-countries, the bulk of these products has an investment destination, i.e. they are fixed capital means of production.

The steady and active participation of Bulgaria in the multi-national specialization and cooperation in the machine-building industry and the positive attitudes of the more advanced COMECON member-countries towards the problems of our economic development, are factors, which have played an exceptionally great, and in a number of cases-exclusive role in the formation of the contemporary Bulgarian machine-building.

The fact that now Bulgaria is fulfilling its obligations emanating from more than 190 international contracts and agreements and that in 1980 its exports of specialized machine-building production will be about two times those of 1976 indicates the large

scale of our participation in the socialist international division of labour in the sector of the machine-building. The relative weight of the specialized machine-building production in the total export of machines for the COMECON members-countries of is 64,2% for 1979 (while in 1976 it was 48,2%). This proves the fast growth of production as a result of the deliberately conducted policy lines of these countries. The rather small scale the needs of our country for different kinds of machine-building production requires the organization of mainly export-oriented machine-building production, predominately for the other COMECON member countries. This is the reason why Bulgaria presently takes the second place among the COMECON member countries with respect to volume of export of machine-building production per person of the population.

A substantial peculiarity of the efficient participation of the country in the international specialization and cooperation of production is the goal-orientation and the planning character of this process. In the first place Bulgaria is given the assigment to specialize on such production, for which favourable conditions are already existing in the country and at the same time conditions are created for the realization of the main part of the expected production on the markets of the other COMECON member-countries. As a rule, the greatest help in this respect is provided by the Soviet Union. On the other hand efforts are made during each successive planing-period (as a rule five-year plans) for the already specialized production to be innovated (by technological - economic and production-running indicators) and to increase the volume of production. In such cases the strengthening of the cooperation is carried out along different lines, the most important of which is the cooperation in the production

of assemblies (units) and details. This is contributing for the raising of the concentration of production and labour prod.

The first and the most-substantial advantage, which was given to the country, was the orientation and the specialization of Bulgaria in 1956 in the production of electric trucks and electric hoists which are important for the inner transport and the mechanization of the loading-unloading operations. In fulfillment of its obligations towards the other COMECON member-countries, Bulgaria steadily improves its production, expands the nomenclature of production and since a number of years has established itself as one of the biggest producers in the world and as practically the sole exporter within the framework of COMECON. It now competes with most of the well-known firms in the world. On the basis of the great experience already accumulated and of the built up productive and development base, the production was oriented towards the building of the electric tricks and the electric hoists in highly mechanized and automated systems for inner - plant and storage transport. Presently the production of the lifting-transport technique (in this number of electic trucks, motorcars, electric hoists, highly mechanized and automated systems and technological lines) is a main direction in the development of Bulgarian machine-building.

A further development of the specialization in this field is the setting up and the mastering of the production of robots and transmanipulators with the purpose of satisfying also the needs of the other COMECON member-countries. This is a new, modern direction in the development of the Bulgarian machine-building industry, which coincides with the basic directives for the de-

velopment of this sector in the country. It includes a number of basic industries - mechanics, hydraulics, pneumatics, electrical engineering, electronics, etc. At the same time, the introduction of the robots and transmanipulators into the technological processes leads to their automation, to the raising of labour productivity, to a substantial improvement of the quality of the products.

Our country has a well-developed agriculture and food processing industry. The mechanization and automation of these sectors requires a large volume of multi purpose technology, which has long ago brought about the introduction of the production of particular machines and equipment in Bulgaria. Under the conditions of the consistent and purpose-oriented carrying out of the socialist international division of labour in this field the necessary conditions were created in our country for the production of this technology be rationalized and improved from the point of view not only of our national interest, but also from the international viewpoint of the whole socialistic community. In result of its participation in the international specialization and cooperation of production Bulgaria is now a big producer and exporter of such important kinds of agricultural technology and food-processing machines as: vine-growing tractors type T-54 B, soilcultivating machines, transplanting machines, facilities for gathering of sunflowers, combines for picking of grapes, electronic appliances for agricultural machines, sets of machines for primary processing of tobacco, rotor mowing machines, sets of pneumatic installations for livestock, sets of technological lines for the milkprocessing, wine and canning industry, lines for distribution and packing of liquid foods, automatic machines for

sorting out and packing of various kinds of foodstuffs. In this case, the improvement of the technological-economic indicators of a substantial part of the production is realized by the implementation of most up-todate means for mechanisation and automation in machines and technological lines. The requirements in this respect are worked out by the COMECON member-countries and are implemented within co-ordinated terms, which leads to a total unification of the machines and the equipment, produced in the different countries which are complementary to one another. On this basis the agricultural machine building is stabilized as one of the basic directions of the capital goods industry in Bulgaria.

The geographic and climatic conditions in Bulgaria are favourable for the development of the shipbuilding industry.

The COMECON member-countries have taken into consideration this specific feature and have enthrusted Bulgaria with the task of developing a medium weight shipbuilding industry. This decision is reckoning with a number of factors; one of them is that the Black Sea is an inner sea with limited possibilities of receiving and sending out large ships to the other seas and the oceans; another is that the country is not yet in a position to master the production of the main ship engines and is still importing them from the other COMECON member countries on the basis of the specialization established. At the same time the production of ship engines is gradually introduced in our country, mostly by means of the cooperation mentioned. The furnishing of ships with appliances, apparatuses, automated devices, etc., is realized on the basis of the socialist international division of labour. Now the profile of the Bulgarian ship-building is formed by the specialized (on multi-national basis) vessels such as: 25000 t. ships

for goods in bulk: ships for dry loads, suitable for rivers and seas; small-tonnage ships (tankers); container-ships; swimming ferro-concrete workshops, etc. Conditions have been created for an efficient and accelerated development of the shipbuilding in Bulgaria as an important sector of the capital goods industry.

The metal-cutting machines are produced in a great variety of kinds, types and size. This fact made it necessary to carry out in time a distribution of the production in the frames of COMECON. During the last years, parallel with the classical kinds of machines, a large place is taken by the production of machines with programmed control. There was a substantial development in the division of labour by assemblies (component parts), aggragates and equipment. True to the principles of supporting the development of the capital goods industry in all socialist countries, these countries carried out a well-grounded international division of labour, with which they created favourable conditions for the organization of the production in Bulgaria (while taking into consideration the needs of the other countries as well). Through carring out of coordinated intensive research and development activities in each of the countries, the CMEA is able to ensure with common efforts a steadily maintained comparatively high level of the technical-economic characteristics of the machines produced and especially of those having numerical programmed control and those for mass-production. Special recard is given in Bulgaria to the production of purpose-oriented semi-automated machines, to special devices, to automated lines, to complect machines for casting under counter-pressure (the latteris a field in which we have some exceptional achievements). The production of the metal-processing machines has been already stabi-

lized as one of the main sectors in the production, which is determining the entire industrial structure.

It is well known that the energy problem is worrying the whole of the mankind and that immense efforts are directed toward attempts to find a lasting and efficient solution of this problem. One of the basic lines of inquiry is the development of nuclear energy. Since this is a comparatively new energy source and since the COMECON member-countries (with the exception of the USSR) have not got the necessary capacities and expertise to solve this problem independently, it has been agreed upon that the production of atomic equipment will be subjected to international specialization. In accordance with its potentials our country is also participating in the solution of this problem and has started production with the purpose to supply various kinds of machines and equipment to the other COMECON member-countries. The conditions necessary for the expansion of this line of production during the next 5 to 10 years have already been created.

The electrotechnical industry is developed in each country with a contemporary industrial structure. Since the products of this industry include a very broad nomenclature and since almost no country is in the position to master all products fully, a distribution of production among countries is being carried out since the initial stage of the international specialization and this distribution is constantly being improved. On this base Bulgaria presently is a large producer and exporter (to the other COMECON member-countries) of different kinds of electro-motors, including micro-motors for recording of sound devices, sets of electric motors for metal-cutting machines with numerical programmed control, sets of transformer substations, sets of distri-

buting equipment, equipment with low and hig voltage, step-regulators, hand-electrical instruments, different kinds of non-standard technological equipment, etc. A policy of constant increasing of the concentration of the production is consistenly conducted, of introduction of new products and of ensuring a greater mutual supplementing of national nomenclatures with the purpose of satisfying the needs of the community with all kinds of electrical products. Bulgaria takes part actively in the decision making and is now a country with a developed electrical machinery and equipment industry, which is developed within adequate scales and structure.

The very fast development rate of the chemical industry on the basis of the great and steadily increasing achievements of science and technology requires the ensuring of various technological lines which differ by principles of operation, construction, capacity and completness. This has set to machine-building industry of the whole community the big task of ensuring the necessary great variety of technology and automation in due time. The solving of this problem on the basis of the division of labour in the framework of COMECON is a continuous process, which is developing in two directions: according to complet technological lines and according to different kinds, types and sizes of machines and installations for the chemical industry. Bulgaria has specialized on this basis and developes the production of lines for sulphuric acid, machines for processing of plastics, equipments for the chemical industry, etc. The chemical machinebuilding will be rapidly developed and presently the conditions necessary for increasing the possibilities for export of complect objects are created.

During the sixties the problem of the broad application of computer technology to the management of the production, in the engineering activities and in solving of a great number of practical problems and tasks was put sharply on the agenda. This made necessary the fast mobilization of existing resourses and the creation of new resourses in order to find a solution of the problem. A special intergovernment commission of the COMECON member-countries was established in 1969, with the task of organizing and implementing the multilateral cooperation in the field of the computer technology. A large - scale socialist international division of labour has been carried out since a number of years. On its basis Bulgaria has organized the production and a substantial export of such important products of the computer technology as: central processors, various kinds of periphery memory devices (units), equpment for data processing, etc. The scale of our participation can be illustrated by the fact that in the framework of COMECON our country is the biggest exporter of such production. Now the production of calculating means is one of the basic directions in the development of the Bulgarian machine-building industry and in the next 10 years it will continue to take one of the first places in the structure of the capital goods industry.

In all the COMECON member-countries (as in many other countries), the communication technology is characterized by a rapid development not only in quantitative aspect, but also in a qualitative aspect. This important task is being solved in the frames of COMECON with the participation of all countries on the basis of the specialization and cooperation of production. On this basis Bulgaria has organized a number of specilized industries

and is satisfying a part of the needs of other countries with: automatic telephone stations (centrals) - for establishments and administrative units, for regional communities, for the railway transport; some kinds of congestion technology; sets of radio-relay equipment with 60 to 960 channels, Ultra-short-wave radio stations, telephone apparatuses, etc.

An unseparable part of the international socialistic division of labour in the field of the capital goods industry is the specialization and the cooperation of production in the frames of COMECON in many different sets of products - devices and instruments, aggregates, component parts with all-sectors purpose, radio-components, integrated circuits, etc. In this respect our country has its proper place - in addition to the production for covering its own needs, it is an exporter of such products as the following: rear bridges for the heavy - load trucks, assemblies (units) for the motor-car "Lada", units for the weaving machines, roll-bearings, reductors for general purposes, devices as a part of the uniform system for management and control of technological processes, radio-parts, etc.

A number of bilateral documents have been signed with USSR and the other socialist countries. New and favourable conditions are created for strengthening and expanding of economic relations mostly in the field of machine-building industry and especially in the capital goods industry. Parallel with a specialization on a multi-national basis, specialization is being developed also on a bilateral basis among the COMECON member-countries. These two directions are complementary to one another.

We should emphasize in conclusion that the multilateral and the bilateral international specialization and cooperation

of production in the capital goods industry in the frames of COMECON is a steadily expanding and strengthening process, in which the participation of Bulgaria is becoming more active and substantial, which corresponds to the requirements for an accelerated development of our economy, for a continuous improvement of its structure, for a steady improvement of its efficiency. In this respect there is a complete harmony between national and international interests and this is the fundamental precondition for the achievement of greater success in this field.

2. BULGARIA'S PARTICIPATION IN INTERNATIONAL COOPERATION IN THE FIELD OF THE CAPITAL GOODS INDUSTRY WITH NON-SOCIALIST COUNTRIES

Bulgaria carries out a policy, which is directed towards expanding of the economic relations with all countries, independently of their social order. In this respect the country has established relations of international cooperation with non-socialist countries in different fields of production, in the field of science and technology, patents, licences, engineering services, leasing and others.

An expression of the policy of the Bulgarian state for expanding of the economic connections with other countries are a number of laws, regulations, etc. With those the international cooperation has received its legal foundation. Parallel with these there are a number of measures for overcoming the difficulties and the formalities in making agreements for cooperation and for the stimulation of the Bulgarian enterprises towards the establishment of long-term and lasting relations with the firms of the other countries.

The main legal document underlaying the contracts for international cooperation between Bulgarian and foreign enterprises, is the Foreign Trade Law. Acoording to this law, all transactions in the sphere of international economic relations, signed between Bulgarian economic organizations and foreign firms, are considered foreign trade activities, which are realized by the state monopoly on foreign trade.

A regulation for the industrial cooperation of the Bulgarian economic organizations with enterprises and firms of the non-socialist countries was released in Bulgaria in 1971. It made provisions for the order, the means of study, the planning, the financing, the estimations of the economic efficiency, the contract-making and the material interest of the Bulgarian economic organizations in the cooperation with non-socialist firms.

Other laws and regulations are directed towards the different forms of incentives, the specific regulations for giving of premiums, the sanctions for the economic assosiation and their sections and for the foreign trade organizations and their personnel depending on the fulfillment of instances of industrial cooperation.

Since the middle of 1974 the legal regulation of the international cooperation between Bulgarian economic organizations and foreign firms is carried out on the basis of a special document for the economic, production and technical cooperation with foreign juridical and physical persons. This document contains the basic legal principles for establishing, continuing and strengthening of the economic, production and technical cooperation. It is also outlining the objectives, which such a cooperation might persue. They are the following: the first goal is to

construct new and to modernize the existing production capacities and to introduce new products, using the most advanced technology and the contemporary scientific-technological achievements; the second goal is to improve the efficiency and the organization of production and to increase the productivity and the quality of production; the third goal is a better satisfying the needs of the country and expanding its possibilities for export; the fourth goal is a more rational use of the material and labour resources of the sides of the contracts. The forms are also determined which for conducting economic, production and technological cooperation with foreign firms. They are the following:

a) Common activity for creation of production capacities or for reconstruction and modernization of the existing capacities on the basis of the contemporary scientific-technological achievements.

b) Joint research, projects designing and other activities.

c) Organization of contemporary production of finished and semi-finished products and of documentation of the countries or of the relevant organization, exchange of products, documentation, licences, technical experience, etc.

d) Common participation in the delivery or the construction of comlex objects on the territory of the country and in third countries, common assembly or control of the assembly.

e) Organizing of joint enterprises outside of the territory of Bulgaria for economic or for other business activities, etc.

During the last years Bulgaria realized a significant number of agreements for international cooperation. In this res-

pect one can mention the following:

- a contract for cooperation with a Dutch firm for the construction of greenhouses;

- a contract with an Italian firm for the construction of a colliery and of a plant for the production and processing of "betonite";

- a joint enterprise between a Bulgarian machine manufacturing enterprise and an Italian firm for the construction of petrol refineries in Lybia;

- a contract between Bulgarian machine-building enterprises and West German enterprises for the production and marketing of certain types of metal-cutting machines and machines for the wood-processing industry;

- a contract between "Balkancar" with Danish firms for the production and marketing of some types of motortrucks;

- a contract between Bulgarian machine-building enterprises and Austrian enterprises for the production of installations and the construction of purifying station for waste waters; for pneumatic installations and for other products;

- a contract with the Italian firm "Technopetrol" for the delievery of the machines and installations and for technical assistance in building of a plant for the production of ethylene in Bulgaria;

- a contract between the Danish firm "Je-Lau" and the Bulgarian firm "Balkancar" for the production of some types of motortrucks and engines, working with petrol;

- a contract between "Balkancar" and the Austrian firm "Kommayer" for the production of chains;

The Bulgarian machine-building plants have concluded

contracts for cooperation with the following Western firms: "Süsemil" - FRG - for woodprocessing machines; "Jepla" - FRG - for the production and sale of a given type of band and belt-cutting machines; "Kuka" - France and "Jilli" - for typing machines; "Siemens" - FRG - for the production of telephone stations; "Festo" - Austria - for the improvement and the automation of the production of forging-and-pressing machines; "Placy" - England - for the production of machines with programmed control; "AEG - Telefunken" - FRG - for the production of manual electric instruments, mainly - boring machines, etc.

The Bulgaria "State economic associations" (SEA) have also opportunities to cooperate with foreign firms in the field of the projecting - designing activities and to carry out joint work with foreign firms on the projecting and construction ofnew or on the improvement of the existing aggragates of lifting and transporting machines as well as on other machines for concrete objects. They can also exchange technological and other documentation about such machines, as well as to consign patents, licences and technical assistance for their production, assembly, introduction into exploitation, etc.

The development of international cooperation, as a new form of international relations between countries with different social systems is called forth by the regularities and laws of the development of the world economy, which are emanating from the scientific - technical revolution. This process leads to the internationalization of production and productive forces, as well as to the intensification of economic relations between the countries, and especially to the technological and detail (unit) specialization of the production of the enterprises of the two sys-

tems and mostly with the developing countries.

The scienctific-technological progress has caused the appearance of a new structure of the international trade, of new forms of economic cooperation. There is a great increase of the trading with patents, licences, technologies, etc. Many firms have been established for technical assistance, for engineering activities, etc. This very process leads to expanding and strengthening of the economic and scientific-technical cooperation between the two systems and to their further development. These new forms of the economic cooperation are penetrating into an increasing number of sectors. They involve an increasing part of the economic activities of the COMECON member-countries, as well as of other countries and especially of the developing countries.

3. INDUSTRIAL RESEARCH AND SCIENTIFIC, TECHNOLOGICAL AND ECONOMIC COOPERATION

Independently from the international scientific-technological cooperation, the buying of patents and licenses and the cooperation in the field of the capital goods industry an active policy is carried out in Bulgaria for the development of industrial research especially in those fields, which take a great share and have great importance in the economy of the country and in which Bulgaria specializes within the frames of COMECON.

The contemporary scientific-technological revolution has set high requirements to the development of research, to its more direct connection with practice and to the rapid implementation of the achieved scientific results. However this does not exclude the possibilities of developing of some fundamental branches of the contemporary science, whose development is con-

centrated mainly in the Bulgarian Academy of Sciences.

The industrial research in the field of the capital goods industry is concentrated in the sector scientific organizations, which work jointly with the production units form scientific-industrial organizations and combines, or work independently. The organizational linking of the research to production has a number of advantages not only from the viewpoint of the problematics and the purposeful orientation, but also from point of view of the personnel potential, the training of personnel, the better use of the technical base, etc.

The increase of the labour productivity and the raising of the efficiency of production in the country are directly connected with the achievements of the scientific-technological progress and ensuring of higher quality of the produced capital means of production. In this respect one relies on the following:

1. Ensuring of the necessary scientific potential and on this base increasing substantially of the scientific-intensity of the production and raising the science/labour ratio. As a result of the realized policy during the period 1965-1978 the number of research workers has increased 2,2 fold, of them about 16,14% being engaged in the branches of science, which serve directly the capital goods industry. The personnel engaged in science and in serving of the science in our country reached in 1977 1,51% of the total number of the workers and employees. The persons engaged in science as research staff and auxilliary personnel during 1977 are distributed by categories as follows: research personnel - 16,6%; auxilliary personnel - 46,0%; workers - 23,3%; others - 14,1%.

2. The creation of a substantial body of scientific so-

lutions and results, which would ensure the continuous innovation of the production and a constant high technical level of the production.

3. The creation and the implementation in the production processes of principly new highly productive means of labour - machines, equipment, machine-systems with programmed control, robots, etc., based on the broad use of electronics, microprocessors and highly efficient systems of labour management in the production.

A main characteristics in the development of the fixed capital goods industry is that, if up to now the increase of productivity was ensured mainly through the increase of the production means and the capital goods/labour ratio, during the following years the main attention is to be concentrated on those sides of the development of the material-technical base, of the productive forces, on which depends the full use of the advantages of the contemporary scientific-technological revolution.

First of all, this is the maximum most-rational use of the existing scientific potential, of the most rapid and fruitful implementation in the practice of the scientific-technological achievements and the most advanced experience.

The use of science as a direct productive force requires also a maximum degree of the introduction into the production of the achievements of the contemporary world science. On the basis of the "Long-term objective programme for cooperation between the COMECON member-countries in the field of machine-building" it is a complex and efficient integration in the research field envi- envisaged for a complex and efficient integration in the research field to be effected in order to attain a maximum utilization

cially of the soviet science.

The international scientific and technological cooperation has been considerably developed over the last decades.

The more important elements of the international scientific-technological cooperation are the following:

- coordinating of particular research units of the participating countries;
- carrying out of joint fundamental research projects;
- exchange of experience and joint activity in the field of the invention and patent work;
- cooperation in the education and training of highly qualified personnel.

Commissions are set up on a bilateral basis as organs of the scientific-technological cooperation. The first commission of this kind was created in Bulgaria in 1950 for cooperation with the USSR. Similar commission for cooperation with the other socialist countries were established further on. Today Bulgaria has signed payment and trade agreements with over 50 countries. A number of these agreements include partucular agreements for scientific-technological cooperation.

The economic cooperation includes the cooperation between the contracting countries in the following fields:

- commerce;
- state and firm credit;
- cooperation activities;
- creating joint firms abroad;
- construction activities;
- geological prospecting activities, etc.

The economic cooperation is almost always accompanied

also by scientific-technological cooperation.

The scientific-technological and economic cooperation carried out within the COMECON framework is now in ful swing and has reached an unprecedented level and scope.

The COMECON member-countries realize a many-sided and highly efficient cooperation. It is expressed in the coordination of research and development activities, in the common realization of constructions, standards, technologies and other documentations, in the common buying of licences, in the exchange of a considerable amount of scientific-technological, construction, technological and other documentation, in giving technical assistance and in exchanging for training and the raising of the qualification of workers and specialists, etc.

We may indicate the extent of the participation of Bulgaria in the scientific-technological cooperation, which is realized in the frames of COMECON, when we quote some total data for the year 1979. Bulgaria has taken part in the development of about 2900 projects with practical-application character. About 300 projects have been completed. Out of them about 140 projects are on the development of new products, mainly capital means of production, new and more progressive technologies (predominately in the machine manufacturing). The development of standards, in which the experience and the achievements of all sister-countries is accumulated, has given good results: there were accepted about 700 standards of COMECON, 590 of which were introduced in production. During the year have been received 250 sets of documents - mainly on problems of the machine manufacturing. About 2400 persons were sent abroad in order to master the production experience of the more developed socialist countries. At the same time 630

highly qualified specialists of these countries have visited Bulgaria as consultants and advisers with the purpose of improving the production of basic products.

On the basis of the already created scientific-technical base of the electronic industry it is also planned to realize a complex and large-scale introduction of sector-automated systems and automated systems for production-management, of machines and machine systems with numerical-programmed control and of creating whole automated lines, establishments and plants. Considerable attention is paid to the development of new areas of electronics - microelectronics and micro-processors, and accordingly to the robotics, the pneumatics and the hydraulics.

In accordance with the general line for development of the economic potential of the country, it is planned that the basic sectors of the heavy industry - chemistry, energetics, metallurgy, machine-bulding and food-processing industry continue to develop with high rates. In order to answer to the increasing needs for capital goods for the production of the above sectors, there will continue the process of building of big (for the scales of the country) capacities of the heavy-investment machine-building. During the coming periods the development of the following directions of the production of the capital goods industry in the field of the heavy-investment machine-building will continue:

1. The mastering of the production of large aggregates and lines with big capacities and high technical-economic indicators. On this basis there will be increased the export of complect objects.

2. Mastering of the production of separate kinds of machines and equipment for the energetics, the mining and quarring

industry, the metallurgy, etc.

The main task of the development of the production of fixed capital goods industry is the satisfying of the needs of the national economy and the greater share in the export of complete objects.

The implementation of the scientific-technological achievements, the accomplishment of well-grounded and efficient work on the innovation of the nomenclature of the products, etc. is a line, which has a complex impact on the development of the capital goods industry. A substantial growth of the new production and the expanding of the nomenclature of the production is planned for the following periods. The envisaged average annual renovation of the production, which is about 20%, is directed to:

- development of new directions in the nomenclature through the mastering of the production of new, highly productive, automated machines and systems of machines, which have not been produced in Bulgaria till now;

- improvement of the traditional nomenclature of the production of electric trucks and motor-cars, metal-cutting machines, electric hoists, transport and storing technology etc;

- implementation into production of machines and equipment with investment destination for the chemistry, metallurgy, energetics and other sectors of the national economy;

- strong development of the engines manufacturing.

The renovation of the production will be carried out on the basis of Bulgarien projects, foreign documantation, licences and samples. The main form of renovation would be development of new Bulgarian products and technologies which would account for 60% of the renovation.

C) The Technical and Technological Levels of Complexity Development in the Sector and in its Sub-groups

Problems related to the technical and technological levels of development and their quantitative definition, comparison and evaluation are very important, but at the same time very difficult to solve because of their complex character and their specific features in the different countries. The evaluation of the complex development of such a complicated sector as the machine manufacturing, and respectively the capital goods industry, should take into consideration a number of technical, technological and organizational-economic characteristics, which are often heterogeneous and incomparable. This fact makes it necessary first of all to list the aspects in which the complex development of the sector is to be studied and, after that, to choose the methods and the indicators for measuring the relevant levels and for carrying out of analysis and decision making.

1. SYSTEM AND INDICES USED IN DETERMINING THE TECHNICAL AND TECHNOLOGICAL DEVELOPMENT OF THE CAPITAL GOODS INDUSTRY IN BULGARIA

The technical and technological development of the machine manufacturing is generally analized and evaluated with respect to the following basic criteria:

Nomenclature - the produced groups of final and component products, the range of their typical lines of products, the share of the produced positions in the totality of positions of the world machine manufacturing (according to relevant classifications).

. Quality of the products - in the broad sense of the word this includes: functionality, productivity, reliability, design, etc.

. Technology of production - the implementation of progressive methods of processing, economy of resources, protection of labour and of the environment.

. Material base - the introduction, modernization and efficient use of highly productive technology and instruments, contemporary plant installations, machinery, communications, production and residential building.

. Division of labour - international, sectorial and subsectorial optimal echelon (lines) formation within the machine-building production, concentration of the general-sector products and product groups on the basis of new technologies and standardization of the component products.

Each of these directions have been developed by means of a systems of indicators and means for measuring, planning and comparing of the planned or actual levels. These are regulated by state normative documents, connected with the economic mechanism of the national economy. All this is coordinated with the existing systems for evaluation in the countries - members of COMECON. The combination of the analytical materials on the development in technical and technological direction with the analysis of the economic characteristics as: level of the production costs and of the prices, level of the investment, the proportions between the product of the group "A" and group "B", etc. All these analytical data allow to follow and to regulate the complex development of the sector in accordance with the general goals.

A complex evaluation, which can be derived from the evaluations of the levels of the separate factors, is usually not practiced in Bulgaria, because of the conditional character of such a complex evaluation of heterogeneous values. For example, a complex evaluation implies a mixture of the negative results and the low levels of some factors with the positive results and the successes of other factors. It does not allow to see clearly that low level, which should be raised. It does not present any possibility for international comparisons, because the complexity of the evaluations is different with respect to scale and is formed on the basis of the different methodologies used in the different countries.

Methodologically we avoid the application of different values (balling) for the different indicators, but use broadly the absolute values, the percentages and the arrangement according quantities and values for the different indicators. In this way the sistem becomes more flexible and adoptable to the dynamic changes in the technical and technological level of the world production of means of production. Under the contemporary conditions, the information about a particular indicator becomes quickly out of date. Therefore, it is more rational to follow the absolute values for short periods. By the "balling" (general evaluation by giving relative weights of the factors), where we use an interval for the relevant values of the indicators (indices), we cannot trace the changes and the tendencies of their development.

1.1. Nomenclature

A characteristic indicator about the development of the

production of means of production is the relative weight (share) of the produced positions of machines to the total positions of such machines produced in the world, i.e. the establishing of the diversification of the production. The quantitative measurement of this indicator is, however, in dependence of the completness and the degree of differentiation of the classifier on the bases of which the comparison is made. Different classifiers may be used: the uniform classifier of the production (ЕКП) - Bulgaria; the soviet classifier (МСПК), the classifier of foreign trade of COMECON (ETHBT); the classifier of UN (SITC, ISIC), etc.

One of our studies about the mastered nomenclature in Bulgaria, according the classification of SITC, has given the following results:

Table 32

Mastered nomenclature in Bulgaria

(in numbers)

Group	Designation	Groups	Subgroups	Positions
71	Non-electrical machines and equipment	7	36	60
72	Electrical machines and equipment	6	18	25
73	Transport means	5	25	14
	Total:	18	79	99
	Of them mastered in Bulgaria:			
71	Non-electrical machines and equipment	7	26	34
72	Electrical machines and equipment	6	16	23
73	Transport means	4	14	9
	Total mastered:	17	56	66
	Relative weight of mastering (in %):	94,4	70,9	66,7

As seen from the table, the degree of mastering is different for the levels of disaggregation. It is more conditional for the aggregated groups, where under "mastered group" should be understood partial mastering.

These data show that independently from the different base, the degree of diversification of the sector is established in the frames 60-70% of the world nomenclature, which (when we take into consideration the above remark about the partiality of mastering) is an indicator for comparatively good scope of the produced assortment of means of production in Bulgaria.

It should be noted here that the aim of the study of this level is not the mastering of the full nomenclature, but the directing of the production to some groups, which are favourable and perspective for the country and for the complex development of the sector. The scales in our country and the existing resources require the diversification within the frames of the mastered groups (production of typical lines of defined products), while for the assortment of the different groups the efforts are directed towards the specialization in COMECON and the increase of the scale of production of the specialized groups. At the same time the production of some groups has been discontinued. This refers to products for the production of which other countries - members of COMECON have been specialized as: personal cars, agricultural aircrafts, textile machines, steam - locomotives, motorcycles and mopeds, etc.

1.2. The Quality of Goods

For the comparison of the quality of the products to the world levels there have been introduced three evaluations:

"K" - over the average world level;

"1" - on the average world level;

"2" - under the average world level.

The world level is established according to parameters of the products of different countries and firms. There is a permanent actualization of the information, in which process are selected the leading firms for the given product. The evaluation "K" is given to products, which are produced on the basis of original own developments, which represent innovations in the world practice, patented decisions and solutions or are produced under licence of a leading firm, whose production sharply exeeds the quality indicators of the other firms.

Since the renovation of the means of production is very intensive, the products are evaluated for a period of two years, after which they are again evaluated according the changes in the relevant level, the construction and the new requirements.

The relative weights to the total production in value terms of the accepted evaluations of the quality, as well as of the different kinds of projects, are shown on the following table:

The relative ahare of the non-evaluated production is rather big because single products as well as component products of the innerplant and inner-sector turnover are included under this item.

The data show that products on the average world level are prevailing. The system for raising the quality level of the whole production is actually more complex with the purpose to cover the whole complexity of main factors. There have been introduced: "step-prices"; premiums (resp. sanctions) for the evaluation "K" and "2"; strict requirement for the parametrical

Table 33

Quality indicators and kinds of projects

(in %)

Indicators	1978
Quality evaluation "K"	5,1
Quality evaluation "1"	40,8
Quality evaluation "2" and non-evaluated production	54,1
New and improved products	40,4
Structure of the developments:	
Own projects	70,0
Using of foreign experience	8,3
Licences	0,7
Documentation	15,2
Models and samples	2,3
Other projects	3,5

international analysis of the products; a system of state control and acceptance, etc., which aim the attainment of coincidence of the interests for reaching of high level of the quality. Particular tasks are annualy assigned to each industry and production unit involving the development of new products and their mastering and the modernization of the serial production of final and component products. The development of the indicator "degree of renovation", is being traced which characterizes the share of the renovated production in the total value of production, as well as the final dates set for the mastering of each product planned for renovation. Over a one year period, the coefficient of renovation by economic organizations is varying within the range: 0,15-0,30 depending of the up-datedness of renovation and the structure of

the volume of production. A complete renovation of the main production-nomenclature averagely for a period of 4-5 years is ensured within this range.

1.3. Production Technology

The level and the development of technology (in the broad sense of the word) is to be planned and reported. The difference in the quality of the products is conditioned by the grounding of the tasks for the raising the technological level, since the introduction of more progressive technology is economically purposeful under certain conditions. Studies and pre-project investigations are periodically carried out for this purpose, as a preliminary stage for setting the technological tasks.

A system of indicators is used in this analysis, which characterize the different technological aspects:

- number and professional structure of the basic workers as a starting point for the establishment of technological processes;

- relation betwen the interchangeable progressive and conventional technological methods, quantitative establishment of the indicators and their comparison with those of the developed countries;

- structural studies of the detailed assortment by means of computers, by functional groups, by configuration, by size, by basic technological processes in the production (with the purpose of production reorientation);

- establishing of the minimum series with the purpose of transfer to more progressive technological process for the different delievery and processing operations;

- study of the applicability of the special, highly pro-

ductive and expensive technique;

- study of the preconditions for the introduction of new efficient materials, waste eliminatin , processes and equipment for the protection of the environment, etc.

Of the total number of tasks, about 25% annually are for technological studies, new and improved technologies, new and improved raw materials, etc. Analogically to the problems of quality, the quantitative establishment of the level of technology is less important compared to the problem of selecting of those tasks, which will give periodically technological and economic effect in the sector and the sub-sectors of the production of means of production.

1.4. Material Foundation

The material foundation is one of the decisive factors for the development of the sector and the sub-sectors and is accordingly subjected to analyses of its level.

The main indicators of this evaluation are: fixed capital per person of the industrial-production personnel, energy/labour ratio, production per unit of fixed capital, structure of the fixed capital production means (funds). These indicators serve to carry out a comparative analysis with world known firms by analogical products or with enterprises of different subsectors with a similar profile of the production process.

Paralell with the quantitative investigations of the material foundation there are carried out analytical studies about the extent of its use. The following indicators are applied: coefficient of shifts, coefficient of the utilization of the inner-shift time, the utilization of the machines by time and the structure of the standstills by groups of machines, the uti-

lization of the expensive machines by time, the utilization of the technological lines by capacity, etc.

As a result of the investigations and the evaluations of the qualitative and quantitative indicators, which form the general level of the material foundation, the guidelines are worked out for the investment policy, for five-year and one year periods, for the distribution of the capital investments by subsectors and products, the structure of the means for new projects and for modernisation and reconstruction. There is also applied a system of indicators for reporting the actual fulfillment of planned undertakings.

1.5. Division of Labour

The participation of Bulgaria in the international division of labour has a very great impact on the technical and technological level of specialized productions, because of the sharp increase of the big series and the possibilities for application of highly productive technique and technology. The relative share of the export of the total production of given groups of machines, as well as the absolute number of the exported products are indications of the necessity for raising of the technical and technological level of the production.

The preconditions for the sector and subsector concentration of products and assembly-parts (components, units) assortment are constantly analyzed. The main indicators for the study of the concentration and the specialization in the sector are: coefficient of object specialization, coefficient of unit-assembly specialization (by components and groups of components), coefficient of technological specialization, average size of the enterprises by volume of production, by fixed capital means of produc-

tion and by personnel, grouping of the enterprises in intervals by the three indicators, production capacity in physical units for particular delivery products.

A characteristic feature of the sector for the production of means of production in Bulgaria is that there are no small enterprises. There are no enterprizes with less than 150 workers. This fact has influenced the results in § 2.

As a result of systematic investigations there have been formed enterprises for the production of delivery parts (intermediate products), components, assemblies, etc. with general - sector purpose, concentrated in a homogeneous assortment. This process is basic for the improvement of the production rear and it is planned to be developed intensively in the future.

In conclusion of the analysis of the Bulgarian experience and practice of establishing the technical and technological development of the sector there should be noted, that the complex development depends on many factors, which are difficult to investigate a complex system and of indicators in necessary, which would allow a comparative in-depth comprehensive analysis. The incomparability of the factors and their values are an obstacle for a global and general evaluation, but the analysis in given directions allows to establish with satisfactory exactness the attained results - positive and negative, and in this way makes it possible to react in time and in accordance with the changing economic and production situations.

2. RESULTS AND ANALYSIS OF THE STUDIES ON THE TECHNICAL AND TECHNOLOGICAL LEVEL OF THIS SECTOR ACCORDING TO UNIDO METHODOLOGY*

2.1. Scope

The technical analysis includes products belonging to the group "Manufactured metal products, machines and equipment" which form Class 38 of the international classification ISIC.

The structure of the products examinded, confirmed to the categorization of the products according to Class 38 of the ISIC nomenclature, is presented in the following table (Table 34).

Table 34

Scope of the nomenclature studied

Class 38 Groups	Determination of the product Metal products machines, equipment	Number of products (UNIDO methodology) Total	(%)	Number of examined products Total	(%)
381	Manufacture of metal products, except machines and equipment	23	7,0	5	3,0
382	Machines, except electric	203	65,0	120	71,8
383	Electric machines and apparatuses	28	10,0	16	9,6
384	Transport equipment	45	14,0	17	10,2
385	Professional and scientific measuring and control devices	14	4,0	9	5,4
	T o t a l	313	100,0	167	100,0

Table 35 contains indices A, B, C, D, E and F (see

* The following materials have been used: "Paper prepared by UNIDO for the seminar in Algiers, held December 1979"

Table 35

Nomenclature examined according to the classificator

Groups	Denomination	Measure	Groups examined			Groups not examined			Total for the groups
			A	B	C	D	E	F	
381	Metal products except machines and equipment	Number of Positions	5	1	10	1	-	6	23
		(%)	21,7	4,3	43,5	4,3		26,2	100,0
382	Machines and equipment except electric	Number of Positions	120	63	8	8	7	2	208
		(%)	57,7	30,3	3,8	3,8	3,3	1,1	100,0
383	Electric machines and equipment	Number of Positions	16	8	9	-	-	-	33
		(%)	48,5	24,2	27,3	-	-	-	100,0
384	Transport equipment	Number of Positions	17	22	3	5	-	2	49
		(%)	34,7	44,9	6,1	10,2	-	4,1	100,0
385	Apparatuses and control devices	Number of Positions	9	2	4	-	-	-	15
		(%)	60,0	13,3	26,7	-	-	-	100,0
	T o t a l from the classificator	Number of Positions	167	96	34	14	7	10	328
		(%)	50,9	29,3	10,4	4,3	2,1	3,0	100,0

Annex I). They are used to indicate the following: "A" indicates products manufactured in Bulgaria ("A" indices respond to the consecutive number on the technical list); "B" indicates products which are not manufactured; "C" indicates products which are manufactured in this country, but are not examined, "D" indicated products which have fallen out of manufacture; "E" indicates products which are being adopted by the industry at present and for which there is no available data on the assessment of the indices contained in the methods for analysing the production process and on the complexity of the products; "F" indicates products designed to be used in everyday life; they are not included in the scope of this study. Table 35 shows the examined and not examined groups of Annex I by their numbers and structure. In is evident from Table 35 that 83 per cent of the nomenclature manufactured in this country has been examined.

The products examined are characterized by the fact that they are entirely capital goods, machines and equipment for end products. They represent actual groups of products with homogenous parameters. They are indicative of the manufacture of a number of products and do not characterize the production of single, individual products.

The products examined are directly involved in and guaranteing the production of capital goods, with the exception of the products of Groups 381 and 383. Group 383 products do not represent entire electric machines, most cases they are only individual components of these machines. Electronics is excluded from the present study, being an integral industrial branch.

Two parameters - α and β, are used for determining the complexity of the products. The first coefficient denotes the

value of 1 kg of a certain product in US dollars. The β coefficient is an assessment of the renovation rate of the products examined. The values of the two coefficients are assessed in 6 classes, and the scope of variation of the parameters of these classes is as follows:

For α - up to 2,5; 2,5 to 5,0; 5 to 10; 10 to 20; 20 to 40; over 40 (value of 1 kg of the product in US dollars)

For β - this being the measure of the renovation rate of the producty - over 50 years; 50 to 35 years; 35 to 25 years; 25 to 15 years; 15 to 10 years, and less than 10 years.

A certain interdependance exists between the values of α and β. However, the price of a certain product does not always respond to its technical complexity. This is the case with old products having a low β coefficient (otherwise technically stable) whose market price does not respond to their technical complexity. On the other hand, the economy of raw materials and its effect on the weight of the machines, leads to an increase in the value of coefficient α, without any modification in the complexity of the respective products.

Thus, prices do not present possibilities for evaluating the technical complexity of the products.

Another approach for evaluating the products is to consider the length of time spent for their production. This, however, leads to other problems. They are created by the fact that additional labour spent on the production has to be added to the direct labour, and in many cases these two expenditures do not correspond by time of execution. As a result, standard values have to be calculated. Often, the average labour costs are used as

measures of complexity. However, being approximate, they are not precise enough.

Basic purpose of coefficient α is to assess the complexity of the product and to compare it to the complexity of the production process. Besides, it has to determine if there is any interdependence between them.

The β coefficient is used for the classification of equipment in accordance with its technological age. The old and stable production could not be spotted out without the application of this coefficient and hence the evaluation of the well known and rapidly falling out of use technology is also dependent on this coefficient.

2.2. Technical Characteristics of Production

It is being drafted on the basis of the 44 factors, described in Annex II. These factors are presented in the following order:

- for central production units (see Annex IIa) - 6 factors
- requirements of the semi-finished products - 8 factors
- requirements of the technological processes - 15 factors
- components assembled into finished capital goods - 15 factors.

The arrangement of the factors needed for the technical characteristics of the products is shown on Diagram 1 (see Annex IV). These factors are arranged in four groups.

They express only one single production function (mounting-assembly, less the time spent on "know-how") and the most important characteristics of the production apparatuses and their management.

The other production processes are only a part of the

items of the semi-finished products, as well as the technological servicing of the process of mounting.

This part includes the most important item of the mounting process namely, designing and control, marketing being excluded.

The "infrastructural" grouping includes the semi-finished products and the technological servicing of the sub-mounting process.

The sub-mounting of the semi-finished products includes the casting, forging and stamping processes.

The sub-mounting technological servicing does not include processes related to tempering, thermal treatment, metallisation, supply of production instruments - tools, matrices, moulds, measuring devices, etc. production processes for the chemical and mechanical processing and stamping.

With the differentiation of grouping by "mounting and sub-mounting groups", the production is classified in "central production units" and an "infrastructure", which contains the semi-finished and semi-mounted products and the technological servicing.

The basic content of the industrial production needed for the manufacture of capital goods is determined by means of the technical factors.

Six levels of development and complexity of the products for the equipment have been used. These levels respond to the historic and technical development of the industry producing capital goods. The information obtained thus, which allows an assessment of the possibilities of industrial production growth, denotes its homogeneity.

The use of data on the direct time expenditure for production and for the needed "know-how" discloses the qualification of labour spent on the production groups.

2.3. Quantitative Evaluations of Complexity

The standard build-up system is being applied because of lack of criteria or methodology for determining the weight of the variants examined.

Thus, the initial level of each factor is evaluated with the starting value "one". The growth that follows with the transition of one level to the next one is done by a geometrical progression with the rate changing for each one of the factors. The rate has three values: 2, 1,68 and 1,41. The values determined for the individual factors are, as follows:

Central production unit (6 factors) A

1. P Type of industry (heavy, etc.) - 1,68
2. Hs Hours of know-how (per 1000 US dollars) - 2
3. Hd Direct hours (per tonne produced) - 2
4. S Production run - 1,41
5. T Size of company - 1,68
6. M Assembly and erection - 1,68

Semi-finished inputs (8 factors) B1

7. Cast iron foundry - 1,41
8. Steel foundry - 1,68
9. Non-ferrous foundry - 1,41
10. Strategic foundry - 2
11. Pressure casting - 1,41
12. Other types of foundry work - 1,41
13. Forging - 1,41

14. Stamping - 1,41

Technical services (15 factors) B2

15. Annealing - 1,41
16. Heat treatment - 1,41
17. Metallisation - 1,41
18. Tool manufacture - 1,68
19. Matrices for stamping - 1,41
20. Moulds and models - 1,68
21. Gauges and calibres - 1,41
22. Light boiler work - 1,41
23. Medium boiler work - 1,41
24. Heavy boiler work - 1,41
25. Production of gears - 1,41
26. Special light machining - 1,41
27. Special medium machining - 1,41
28. Special heavy machining - 1,68
29. Cold stamping - 1,41

Use of components (15 factors) C

1. Mechanical simple machine components consisting of very few parts - 1,41
2. Mechanical: compound machine components up to medium complexity and weight - 1,68
3. Mechanical: compound machine components up to heavy, complex and special - 2
4. Hydraulics - 1,41
5. Pneumatics - 1,68
6. For vacuum circuits - 1,41
7. Electrics: control and monitoring - 1,68
8. Electrics: for power circuits - 1,68

9. Electronics: - 1,41
10. Linear and angular measurement - 1,41
11. Lubrication - 1,41
12. Refrigeration (including compressors) - 1,68
13. Temperature, flow, pressure measurement, etc. - 2
14. Optical - 2
15. Others - 2

A "Technical sheet" has been composed for each one of the products examined in Annex I. A specific weight is given in each one of the sections of this sheet, relative to the above denoted value. Two levels are given for some of the indices of the individual factors - minimum and maximum; they depend to a different degree upon the process of treatment of the diverse kinds of goods of this product, as well as upon the possibility of manufacturing a certain product in a number of works.

The total value of the index of complexity of a certain product of the capital goods is the arithmetical sum of the weights of the different sectors of the 44 factors, i.e., it is obtained by adding the values responding to the factors of the central production unit, of the sub-mounting of the semi-finished products, the technical servicing and the components. The two factors α and β are not considered when summing the other values because of the above mentioned reasons.

A minumum and a maximum value for complexity of the products is also obtained. As a result, an average complexity value is calculated. It represents the common, combined meaning of the index of compexity.

The factors of the components may not be considered when determining the index of complexity, thus this index is obtained

without the effect of the components. This is needed only during the initial development of the production of capital goods in case when they are not produced at home, but are imported from abroad.

In these calculations the complexity is obtained for all 44 factors and they possess levels of complexity in the limits 20 to 240. These groups of products are divided into 6 classes according to the following values:

Table 36

Level of complexity

Index of complexity	N 1	N 2	N 3	N 4	N 5	N 6
Groups of complexity	of 5 to 15	16 to 30	31 to 60	61 to 120	121 to 240	over 240

The examined 167 products are classified as dependent on the above classes. In table 37 is given the division of the products by groups and their relative part in the group and a combined value, as dependent on their complexity. It must be born in mind that their average complexity is being denoted.

The data analysis of this table shows that dominating classes of complexity are III and IV, representing 49,1 and 35,3 per cent, resp., of all products examined. The first and sixth classes are empty. The second and the fifth classes have similar importance, this being 9,6 and 6,0 per cent, resp., of the total number of examined products.

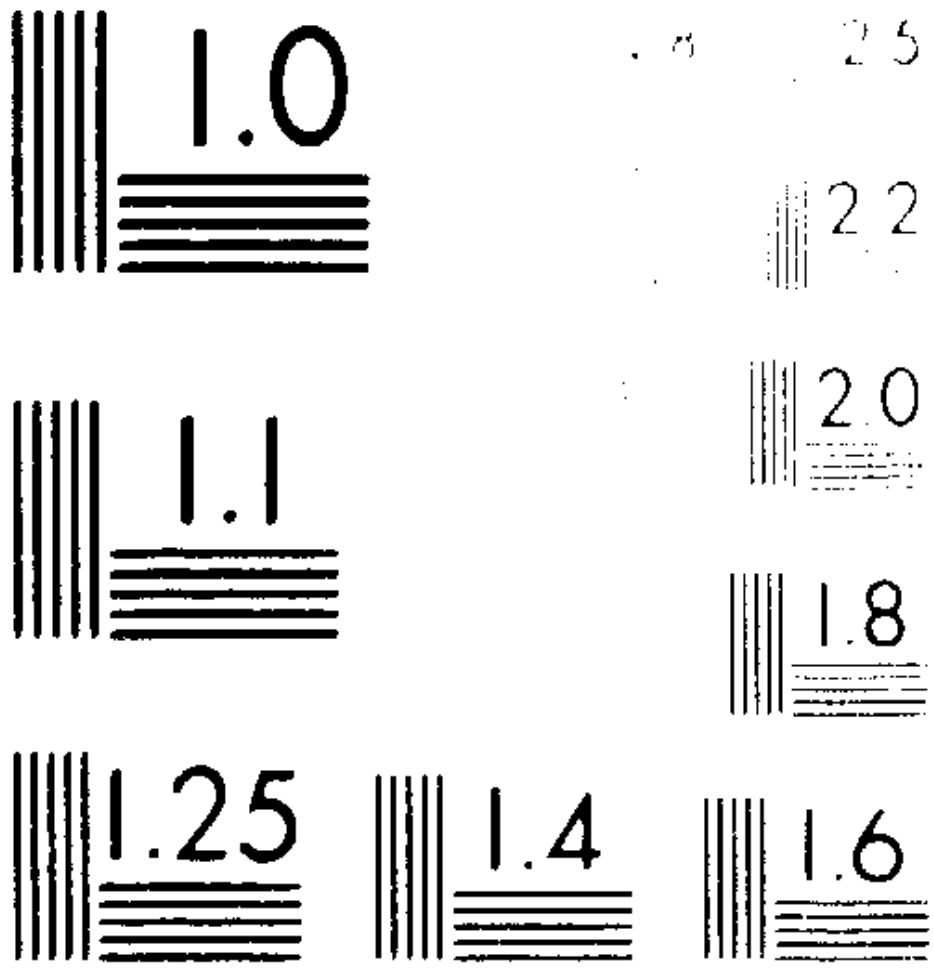
For the diverse groups 381, 382, 383, 384 and 385 these ratios are, as follows:

1. For group 381, the only complexity class is the second

Table 37

Index of complexity by groups and for the whole examined nomenclature

Group	Denomination	Measure	Index of complexity						Number of positions in Total
			N 1	N 2	N 3	N 4	N 5	N 6	
381	Metal products less machines and equipment	Number of positions	5						5
		(%)	100,0	-	-	-	-	-	100,0
382	Machines and equipment less the electric ones	Number of positions	-	7	59		7	-	120
		(%)		5,8	49,2	39,2	5,8	-	100,0
383	Electric machines and equipment	Number of positions	-	3	13	-	-	-	16
		(%)	-	18,7	81,3	-	-	-	100,0
384	Transporting equipment	Number of positions	-	-	6	8	3	-	17
		(%)	-	-	35,3	47,0	17,7	-	100,0
385	Apparatuses and control instruments	Number of positions	-	1	4	4	-	-	9
		(%)	-	11,0	44,5	44,5	-	-	100,0
	For the whole examined nomenclature	Number of positions	-	16	82	59	10	-	167
		(%)	-	9,6	49,1	35,3	6,0	-	100,0


1.0
2.5
2.2
1.1
2.0
1.8
1.25
1.4
1.6

one. It represents 100 per cent of all the examined products of the sub-group. The other classes have zero contents.

2. For group 382, the third class is the dominating one, containing 49,2 per cent of all products of this sub-group. With almost similar importance is the fourth class. Its relative part from the total number of products in the sub-group is 39,2 per cent. The second and the fifth classes claim 5,8 per cent each of the products of this group.

3. Characteristic feature for group 383 is the division of the products into two classes - the second and the third, the latter being the dominating one. It represents 81,3 per cent of all the products in this group.

4. The fourth group 384 is divided into three classes. Dominating is the fourth class with 47,0 per cent of all the products. Second ranks the trird class. Its relative part is 35,3 per cent. This, as well as group 382 contain products with complexity much higher than fourth. Their relative part increases and reaches 17,7 per cent.

5. The products of the last 385 group are refered to three classes, namely the second, the third and the fourth. Greatest relative parts are claimed by the fourth and third classes with 44,5 per cent of the total number of products each. The second class contains a small number of products, their relative part amounting only to 11,0 per cent. There are no products belonging to the first and to the last two classes. The fourth and the third classes are dominating. This feature is characteristic for the whole class 38.

It must be considered that these ratios change for the different groups. They depend on the degree of categorisation of

the products. It is quite natural that the simple metal products (group 381) will have second class of complexity.

The group of non-electric machines, and the group of electric machines and transporting equipment require higher qualification of the labour power. In this case the complexity level increases substantially. Complexity classes three, four and five are dominating. These classes claim 143 out of a total of 167 examined products. Higher complexity class possess the products of groups 384 and 382.

Table 37 data give opportunities for assessment of the manufactured products on the basis of similar indices used in other developed countries, and to denote measures for an increase in their complexity by raising the level of the factors included or not included in the present study.

Table 38 data present the average weighed value by classes and by factors "A", "B1", "B2" and "C" of the levels of the infrastructure of products from different groups:

Highest average weighed value of factors "A" possess groups 385, 384 and 382, this being explained by the great concentration of production and specialisation of these products.

Moreover, these products are characterised by the great dynamics of their technical development and the rate of their renovation (indice 8). This denotes the high value of the factor "know-how".

The "A" factors of almost all groups have a relatively biggest share as compared to the other factors "B1", "B2" and "C". This is specially indicative for groups 385 and 383 and depends largely on the structure of the products.

Table 38

Weighed value by groups and factors

Group	Denomination		Factors "A"	"B1"	"B2"	"C"	Mean group index
381	Metal products less machines and equipment	Weighed units	11,4	2,4	6,4	1,0	21,2
		(%)	53,9	11,4	30,0	4,7	100,0
382	Machines and equipment less the electric ones	W.U.	25,3	7,1	13,8	15,1	61,3
		(%)	41,3	11,6	22,5	24,6	100,0
383	Electric machines and equipment	W.U.	18,3	6,2	15,5	3,7	43,7
		(%)	42,0	14,0	35,5	8,5	100,0
384	Transporting equipment	W.U.	28,5	9,2	22,2	36,4	96,3
		(%)	29,6	9,6	23,0	37,8	100,0
385	Apparatuses and control instruments	W.U.	33,9	3,4	11,6	1,0	49,9
		(%)	68,0	6,8	23,2	2,0	100,0
	Examined nomenclature mean	W.U.	29,4	7,1	17,4	14,3	68,2
		(%)	43,0	10,4	25,6	21,0	100,0

"B2" is the second important factor. Obviously, the manufacture of these products requires more and quite complex technological processes. Highest value of this factor possess groups 383, 385 and 384.

Factor "C" is at its highest with the transporting equipment, due to the use of a greater number and more complex composite machine parts and systems. Similar conditions for this factor exist in group 382. For all the rest of the groups the value of this factor is in the limits 2 to 8,5 per cent.

Table 39 shows the numerical values of coefficient α for the examined products. These data show that coefficinet α reaches a maximum of class 3 for groups 383, 384, 382 and 381. The only exceptions are about 25 per cent of the products of group 382 and the examined products of group 385, which possess a higher class for coefficient α. These results show that the manufacture of these products has low prime cost per 1 kg. This is highly indicative for the transporting equipment.

In general, for all examined groups, coefficient α is at its maximum for classes 2 and 3 which indicates that their production has a value of 2,5 to 5,0 dollars per kg and 5 to 10 dollars per kg, resp. Insignificant is the relative share of products, whose coefficient α is from class 1-3 per cent, and classes 4, 5 and 6-23 per cent.

The calculated values of coefficient β for the examined products shown on Table 40 indicate a speedy renovation of these products. This is especially true and indicative for the products of groups "apparatuses and control devices", "electric machines and equipment" and "Transporting equipment". Only two of the products belong to classes 3, 4 and 5, which shows that the structure of the products and the technology of their manufacture are continuously improving.

Tables 41 and 42 show the average weighed values of the technological processes by groups and levels, displaying a relative high level of the technological processes (see Annex III). Level 3 is for almost all technological processes of the products. The relative weight of levels 2 and 4 is almost equal. With lowest level are the processes of painting and assembly line for group 382. In very rare cases level one can be met with for

Table 39

Weighed value of coefficient α by groups and for the whole examined nomenclature

Group	Denomination	Measure	Weighed value (dollars per kg)						Total of number positions
			1 to 2,5	2 2,5-5	3 5-10	4 10-20	5 20-40	6 over 40	
381	Metal products less machines	Number of positions	-	2	3	-	-	-	5
		(%)	-	40,0	60,0	-	-	-	100,0
382	Machines and equipment except electric ones	Number of positions	3	39	47	19	7	5	120
		(%)	2,5	32,5	39,2	15,8	5,8	4,2	100,0
383	Electric machines and equipment	Number of positions	1	2	13	-	-	-	16
		(%)	6,2	12,4	81,4	-	-	-	100,0
384	Transporting equipment	Number of positions	1	8	8	-	-	-	17
		(%)	6,0	47,0	47,0	-	-	-	100,0
385	Apparatuses and control instruments	Number of positions	-	-	1	4	2	2	9
		(%)	-	-	12,0	44,0	22,0	22,0	100,0
	For all the examined groups	Number of positions	5	51	72	23	9	7	167
		(%)	3,0	30,5	43,1	13,8	5,4	4,2	100,0

Table 40

Weighed value of coefficient β by groups and for the whole examined nomenclature

Group	Denomination	Measure	Weighed value 1	2	3	4	5	6	Total of number positions
381	Metal products less machines and equipment	Number of positions	-	3-	-	2	-	-	5
		(%)	-	40,0	-	60,0	-	-	100,0
382	Machines and equipments less electric ones	Number of positions	2	22	39	31	14	12	120
		(%)	1,7	18,3	32,5	25,8	11,7	10,0	100,0
383	Electric machines and equipment	Number of positions	-	2	2	9	3	-	16
		(%)	-	12,5	12,5	56,3	18,7	-	100,0
384	Transporting equipment	Number of positions	-	2	7	4	4	-	17
		(%)	-	11,8	41,2	23,5	23,5	-	100,0
	For all the examined groups	Number of positions	2	29	50	49	24	13	167
		(%)	1,2	17,4	29,9	29,3	14,4	7,8	100,0

Table 41

Technical characterization of the four levels of complexity (average weighed value) of the technological processes

Group	Foundry	Forging	Sheet, tube, profile working	Heat treatment	Assembling	Machining	Assembly line	Painting	Testing and inspection
381	4,0	2,7	2,2	3,0	2,7	3,3	1,3	1,5	2,0
382	2,5	2,7	3,1	2,5	2,7	2,8	2,3	2,1	2,7
383	2,5	3,0	3,0	2,0	2,0	2,6	2,6	2,6	2,6
384	2,3	2,5	2,7	2,4	3,1	3,2	2,2	1,7	2,6
385	2,2	2,2	3,0	2,2	2,0	3,1	2,2	2,8	2,9
Mean	2,54	2,74	2,80	2,45	2,75	3,00	2,34	2,10	2,67

Table 42

Relative share of the average weighed value of the technological processes by groups and levels

(in %)

Group	Technological processes																	
	Foundry		Forging		Sheet, tube, profile, working		Heat treatment		Assembling		Machining		Assembly line		Painting		Testing and inspection	
381	1	-	1	-	1	-	1	-	1	-	1	-	1	50,0	1	50,0	1	-
	2	-	2	33,0	2	75,0	2	-	2	33,0	2	25,0	2	50,0	2	50,0	2	100,0
	3	-	3	67,0	3	25,0	3	100,0	3	67,0	3	25,0	3	-	3	-	3	-
	4	100,0	4	-	4	-	4	-	4	-	4	50,0	4	-	4	-	4	-
382	1	-	1	-	1	-	1	-	1	-	1	1,7	1	11,3	1	16,1	1	1,7
	2	57,8	2	36,7	2	12,5	2	66,7	2	40,2	2	41,3	2	54,7	2	51,5	2	38,7
	3	28,9	3	53,1	3	73,3	3	25,6	3	55,9	3	33,6	3	21,7	3	27,3	3	46,6
	4	13,3	4	10,2	4	13,6	4	7,7	4	3,9	4	23,4	4	12,3	4	5,1	4	13,0
383	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-
	2	50,0	2	-	2	8,3	2	100,0	2	91,7	2	37,5	2	45,7	2	35,7	2	37,5
	3	50,0	3	100,0	3	83,3	3	-	3	8,3	3	62,5	3	54,3	3	64,3	3	62,5
	4	-	4	-	4	8,3	4	-	4	-	4	-	4	-	4	-	4	-
384	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-
	2	73,3	2	53,3	2	58,4	2	66,6	2	21,4	2	-	2	90,9	2	35,7	2	41,1
	3	20,0	3	40,0	3	16,6	3	26,6	3	42,9	3	76,4	3	-	3	-	3	52,9
	4	6,7	4	6,7	4	25,0	4	6,8	4	35,7	4	23,6	4	9,1	4	7,2	4	6,0
385	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	-	1	11,1
	2	83,3	2	80,0	2	-	2	83,3	2	100,0	2	25,0	2	77,8	2	16,7	2	11,1
	3	16,7	3	20,0	3	100,0	3	16,7	3	-	3	37,5	3	22,2	3	83,3	3	55,5
	4	-	4	-	4	-	4	-	4	-	4	-	4	-	4	-	4	22,3

individual processes of single products. Characteristic levels of the technological processes are three and two, which reflects the mechanization applied, responding to the modern requirements on the manufacture of products for capital goods.

The four levels of complexity of the technological processes are shown on the Table in Annex V.

The present study analyses the technical and technological levels of the manufacture of capital goods in Bulgaria. Two different approaches have been applied for the purpose: according to the system of factors and indices used in this country, and according to UNIDO methodology. In both cases have been obtained similar and complementary results, deductions and conclusions.

The methodology applied in our study for establishing the technical complexity of the capital means of production, which was developed by UNIDO, may be of actual importance in the several comming years, since the basic factors of the methodology are not likely to undergo any fundamental change.

However, it would be necessary to continuously reflect the newly created technologies and also the increase the number of factors.

The coefficient α should be stabilized in the course of time or be substituted by another coefficient, which should give a more exact notion for the complexity of the machines and equipment.

The six factors of the central production unit should be made more precise in order to avoid the influence of the subjective factor.

The applied nomenclature of the groups of products in classes should be supplemented for longer periods. One should take

vity, which has different intensity in the course of time and in respect to different groups of products.

The development of the capital goods industry in Bulgaria during the last 20 years is characterized with a dynamic increase of the technical and the technological level of those groups of products, which define the structure of industry. Most of these groups of products are objects of specialization of our country in the frames of COMECON. Such groups of products are e.g.: electric trucks, moto-cars (special nonelectric trucks), electric hoists (telphers), shelving machines, special cranes, machines for processing of plastics, machines for the food processing industry, units for computers, electronic apparatuses, automatic telephone centrals, special regulators, etc. For the production of those machines there have been set apart resources for research and development activity: qualified engineering personnel, means and apparatuses for research, capital investment for development of production capacities.

It should be noted, that the intensive development of the decisive (for the structure) groups of products leads to the raising of the level and the intensive development of the production of the component aggregates, units and elements. An example of those in Bulgaria are the following: Hydraulic elements, diesel motors, batteries, semiconductors, integral schemes, etc. In this way there is a parallel development of the finished products as well as of the base of elements, which is a prerequisite for a sound production rear and for diversification of the sector.

The basic share of the renovation activity have the projects worked out in the specialized institutes and development bases, a number of products are being improved through free of

charge exchange of documentation and samples between the socialist countries or through buying of licenses from firms in the developed capitalist countries. By this adoptation of foreign experience, the level of the products reaches the level of the leading firms in short terms.

A notion for the qualitative evolution of the products in the course of time can be received by the analysis of different indicators, which characterize the specific features of the development. Such an indicator is, for example, the unit weight of the product. With the improvement of the constructions it is usual that the weight per unit of product is decreased, despite the increase of the parameters, the complexity and the functional possibilities.

Some of the typical examples of the evolution of concrete products of the hoisting (lifting) and transporting machine building are shown on the following table.

The dynamic evolution may be evaluated also by means of other indicators: the change in given parameters, the productivity, the installed capacity, etc. For the motors with internal combustion, for example, is characteristic as an indicator the mass related to 1 horse-power, which for the given period is decreased in Bulgaria from 4,2 kg/hp in 1970 to 3,55 kg/hp in 1978.

The dynamic analysis shows changes also in the use of materials in the production. The relative weight of the highly efficient materials is growing. Thus e.g. special profiles of hot-rolled high-tensile steel are now applied in the lifting units of the trucks. Plastics are widely applied in the production of accumulators. There are substantial changes in the component ele-

into consideration the electronics, which is increasingly penetrating in a number of classes and it should be differentiated in a separate class. Obviously, without an analysis of the electronics one cannot have an exact idea about the technological level of a given country. With the same purpose it is necessary that the class 385 be expanded by new groups of products from the field of the accessories and instruments, means of automation and control-measuring apparatuses. The group 385 does not exhaust all groups of products in the relevant field. Besides, in this group may be traced groups of products, which do not correspond to the investigated direction. For example, from this class may be excluded the parking meters, the taxi-meters, the drawing machines and other similar equipment, since they are not characteristic for the given class. In the same sense there may be made a more precise defining of the groups of products with the purpose of their classification into the relevant class, which corresponds to the given direction. After a more comlete forming of the classes groups of products, the nomenclature may become universal and applicable for all countries.

2.4. Evaluation of the Dynamics of the Technical and Technological Levels of Different Industries (Productions) of the Capital Goods Industry in Bulgaria

The investigations, which were carried out for defining of the complexity of the products, on the basis of the methodology of UNIDO can establish this statically (for a given moment of time). However, this complexity and technical level have been attained as a result of long-term research and development acti-

Table 43

Diminishing of the weight per unit of product for the period 1970-1978

Products	Type and weight per unit: 1970	1978	Decrease (kg.)	(%)
1. Electric truck-highlifter, with capacity of 1 ton and with H = 3200 mm.	EB 676-4 2500 kg.	EB 687.32 2250 kg.	250	10
2. The same, but with H = 2240 mm.	EB 667.22-4 2600 kg.	EB 687.22 2160 kg.	440	17
3. The same, but with H = 4500 mm.	EB 677.45-4 2680 kg.	EB 687.45 2225 kg.	445	17
4. The same, but with H = 2500 mm.	EB 638-4 2500 kg.	EB 687.25 2170 kg.	330	13
5. Motor-car (spec. nonel. truck) - highlifter with capacity of 3,2 tons, with H = 3300 mm.	DB 1733-1 4900 kg.	DB 1733.33 4600 kg.	300	6
6. The same, but with H = 4500 mm.	DB 1733.45-1 5000 kg.	DB 1733-45 4700 kg.	300	6
7. Electric truck platform - 1 ton	EP001 900 kg.	EP001 850 kg.	50	5
8. The same, but with, 2 tons	EP006 1420 kg.	EP006 1350 kg.	70	5
9. Electric truck, dumper, 2 tons	EC301 2250 kg.	EC301 1950 kg.	300	13

ments of the different generations of electronic apparatuses and of the computers.

All this shows that the analysis of the technical and technological level of the products gives a picture of a complex and dynamic process of improvement.

D) Long-term Forecasts for the Capital Goods Industry in Bulgaria, Importance and Problems of this Industry in the Country's overall Social and Economic Development

1. BASIC GUIDELINES OF THE DEVELOPMENT OF BULGARIAN ECONOMY UNTIL THE YEAR 1990 AND FORECASTS FOR THE DEVELOPMENT OF PRODUCTION AND RESOURCES IN THE CAPITAL GOODS INDUSTRY

It is expected that the economy of the country will develop along the following main lines during the next decade:

First. Accelerated introduction of most modern achievements of science and technology, attained in this country and abroad, into all branches of the national economy; integration of science and production aimed at a speedied up implementation of the scientific-technological achievements in practice, thus ensuring a further development of the material-technological basis of socialism.

Second. Expanding and intensifying the economic development on the basis of the best achievements of the contemporary scientific-technological revolution, which will guarantee catching-up, with the highly developed countries with respect to productivity.

Third. Improving the structure of the national economy, the concentration of material and labour resources and the scientific potential of the country upon the development of these production branches, which would play a crucial role in the further accelerated building-up of the economy of the developed socialism.

Fourth. A further expanding and strengthening the integration links between Bulgaria and the other countries, and espe-

cially the socialist countries; a close integration with the economy of the Soviet Union, which will guarantee a dynamic and effective development of the Bulgarian economy.

Fifth. Further resolving, on a complex basis, problems pertaining to the living standard of the people and establishing the socialist way of life.

The quoted main guidelines are starting moments for the perspective development of the production of capital goods as well. In the structure of the national economy the production of capital goods occupies an important place and plays a leading role in the fulfilment of the plan for social and economic development of the country. The production of capital goods is the basis for building-up material-technical foundations of its own, as well as the material-technical foundations of all the other branches of the national economy. As a carrier and promoter of the technical progress, it ensures materially the increase in the social labour productivity, it assists in the development of the structure of the national economy and in the increase in efficiency of the production, it reveals possibilities for an expanded and effective participation in the international division of labour and in the international socialist economic integration, it promotes the development and establishment of the socialist production relations.

According to preliminary perspective data, a more rapid increase in the volume of production is expected, as compared to the increase in the quantity of the production resources. In other words, there will be a substantial increase in the utilisation of these resources (See Tables 44 and 45):

Table 44

Indices of the gross output and of the basic resources for the development of the capital goods production in Bulgaria 1980 = 100*

(in %)

	1985	1990
1. Brutto-production	163,6	241,4
2. Capital investments	148,8	179,0
3. Basic production funds	142,6	236,4
4. Industrial production personnel	104,6	107,8
5. Production of shaped ferrous metals	125,5	163,1

*Preliminary forecasting data

Table 45

Indices on the parameters for the use of the production resources in the production of capital goods in Bulgaria, base 1980 = 100*

(in %)

Parameters	1985	1990
1. Capital intensivity of the gross (brutto) production	91,0	74,2
2. Fixed capital intensivity of the gross production	87,2	97,9
3. Labour productivity (total productivity per 1 person from the labour force)	156,4	223,9
4. Fixed capital means per 1 person from the labour force	136,3	219,3
5. Metal intensivity of the general production (on the basis of shaped ferrous metals)	76,7	67,6

*Calculated from Table 44

2. FORECASTS FOR THE DEVELOPMENT OF THE CAPITAL GOODS INDUSTRY IN BULGARIA UP TO 1990

The accelerated development of the production of new technical means, machine systems, technological lines and complete sites, complying with the requirements of the scientific-technical progress and the adopted directions for the international specialisation of this country will constitute the main problem of the production of capital goods to be solved in the 1981-1990 period. During this period the production of the capital goods branch will grow over 2,4 times.

The accelerated development of this industrial branch will be achieved on the basis of continuous development and improvement of the inter-sectional structure. A characteristic aspect of this development is the fact that the achievements to date of the industry for the production of capital goods which dispose of a substantial material basis, are preserved for the future development. Simultaneously an accelerated development of some products and at the same time a delayed development of others can be observed in almost every production group. All this comes to underline, that there is good reason to expect that in perspective the basic production groups (non-electric, electric, transport machines building and metal processing) will not differ substantially in development rates. Thus, they will not substantially change their share of the total production volume of this industrial branch.

In this sense, it is further needed to say that the improvement of the internal sectional structure of the capital goods production will be realized entirely on account of the production types, the assortment of products and their diverse measures, included in each group. A guideline will be the increase

in the share of these products which create the material basis for the realization of the most important aspects of the scientific-technical progress and which guarantee a high level of labour productivity in all branches of the material production. There is no other branch of the national economy with such an unstable, changeable and dynamically mobile structure as the industry for the production of capital goods. New discoveries and inventions are consistently emerging in the epoch of the scientific-technical revolution. However they acquire productive power only after being transformed into machines or machine systems. The faster they are created, and distributed, the greater their effect as promoters of progress on the national economy is. On the other hand, the capital goods industry will react very flexibly to eventual changes in the demand of its products from all other branches of the national economy, it will effect the close link between these demands and the results from the scientific-technical progress. As a result, new production capacities will be created, which will dispose of most effective production technologies, with lowest material and labour expences.

Some preliminary data from forcasts about the volume of production by groups and kinds of products and industries of the sector "Capital goods industry" in Bulgaria up to 1990 are presented on the following table 46 .

It is seen in the table that in perspective the capital goods industry in Bulgaria will develop with accelerated rates, which would be different for the different kinds and groups of products of the capital goods industry. The rates will be higher than the rates forecasted for some industrially developed countries (See: "Prognos Euro Report", Basel, Nov. 1977). This is necessitated by the needs of our national economy, by the require-

Table 46

Indices of the brutto-production (gross output) of the capital goods industry in Bulgaria (1980 = 100*)

(in %)

Groups and kinds of products and industries (subsectors)	1985	1990
1. Nonelectrical machine-building	165,7	246,0
1.1. Heavy investment machine-building	204,5	362,4
1.2. Metalcutting machines and instruments	160,0	232,7
1.3. Construction machines	113,4	181,0
1.4. Tractors and agricultural machines	166,2	233,2
1.5. Computer and organizational technology	201,9	309,7
1.6. Hoisting and transporting machines	123,8	141,8
1.7. Equipment with general purpose	138,5	188,1
2. Electric machine-building	163,9	246,2
2.1. Electric industry	148,9	218,4
2.2. Communication technology (engineering)	209,6	310,6
2.3. Instrument making, automation means and medical technology	177,6	293,9
3. Transport equipment	156,5	241,0
3.1. Railway equipment	123,7	155,1
3.2. Automobile industry	183,2	312,9
3.3. Shipbuilding	174,0	284,9
4. Metal-working	159,8	199,3
4.1. Containers and pallets	100,0	114,3
4.2. Castings and forgings	163,1	201,4
4.3. Instruments for manual use and for machines	147,0	194,4
Capital goods industry - total	163,6	241,4

*Preliminary forecasting data

ments and the achievements of the scientific-technological progress and by the participation of the country in the international division of labour and in the socialist economic integration within the frames of COMECON, with the purpose of attaining favourable economic results.

CHAPTER III.

THE SIGNIFICANCE OF THE BULGARIAN EXPERIENCE TO THE DEVELOPING COUNTRIES

A) Summing up the Achievements and Expirience gained from the Past Development of the Capital Goods Industry in Bulgaria and the Prospects for its Future Development

Bulgaria succeeded for a very short historical period, since 1944, to develop from an underdeveloped, poor, agricultural country with undeveloped industry into a developed industrial country with well developed agriculture, transport, infrastructure, with an advanced system of education, science, public health, tourism; a country well-known on the international market, a searched partner for international economic and scientific-technical cooperation. On the place of the dependent, robbed and exhausted by the war economy, after 1944 Bulgaria quickly built and developed a material-technical foundation, which ensured fast rates of economic growth, favourable economic structure, high level and socially justifiable distribution of the national income.

Two main factors played a decisive role for these attainments: the establishment of socialist production relations in the country, which are characterized first of all with the public property of the means of production in all the spheres of the economic life, and the substantial and unselfish help from abroad (first of all from the USSR and from the other more developed socialist countries, especially in the frames of the socialistic economic community - COMECON). A favourable role was played by the global economic strategy and economic policy of the country, based on the conception of the industrialization and the develop-

ment of the most important sectors of the industry, such as: production of electrical energy, mining, metallurgy, machine-manufacturing, chemical industry, etc. It has been already mentioned that a characteristic feature of the development of the industry in Bulgaria is that this process is realized under the conditions of mutual assistance and the specialization and cooperation of the socialist economic community. This has conditioned the development of those sectors, for which the conditions in the country are most favourable, for which there is an urgent need and which ensure export resources, necessary for the import of machines, raw materials, etc., with the purpose of rapid development of the remaining sectors and of the economy as a whole and meeting the needs of the people. One of the key-sectors, on which particular stress has been laid in the economic policy of the country, was the production of fixed capital means of production.

As regards the development of the Bulgarian industry, respectively of the sector of capital goods industry, the national economic policy has three basic concretely historical periods (phases). The first period begins in the first years of the socialistic reconstruction of the country, the years of its industrialization and its transition from a typically agricultural country to a country with a rapid and predominant growth of the material - technical base of the heavy industry. It can be generally characterized as a period of extensive development of the whole industry, including the capital goods industry.

What main objectives and tasks had been set up during this period?

The initial and main goal has been to reorient and to organize the national economy in accordance with the tasks of the

socialist construction of the society.

A specific feature of the industrial policy in Bulgaria is, that unlike most of the other socialist countries in Europe, which had inherited a considerable material-technical base of the machine manufacturing conditioning their socialist development, Bulgaria after the World War two had an insignificant base of the whole industry. The main accent of the industrial policy has fallen on the strong reorientation of the national economy, from an agrarian to a clearly expressed industrial character. In general, the development of the industry (and especially that of the capital goods industry) in Bulgaria has not so many common features with the development of this sector in the other socialist countries. This partly explains the contradictory at first glance influence of some social and economic factors of this development.

The task set up for the industrial development of the national economy has naturally required the priority building up and accelerated development of the capital goods industry, parallely with the building up of such sectors of the industry as: chemistry, metallurgy, production of electricity and energy, etc. This period is characterized mainly with the production of machines and equipment of a more universal type.

The industrial policy in the field of the capital goods industry during the following period is in accordance with the general economic strategy of the country. Its objective and contents is the satisfying of the needs of the national economy for capital means of production and the attainment of high quality and efficiency on the basis of the complex and massive intensification of the national economy, and of high productivity and

attaining the level of the economically advanced countries.

Preconditions for the fulfilment of the above task are the grown economic potential of the country and the big (with respect to our dimensious) material-technical base, which is not only creating opportunities, but also requires the ensuring of fast raising of the productivity. During the last phase, most rapidly developed are those capital means of production, which will lead to the fulfilment of the above strategic tasks in the near future.

For a period of about 30 years the volume of production of the capital goods industry in Bulgaria has grown 90 fold and the relative share of this industry in the total industrial production of the country has grown threefold, accounting foralmost 25%. Over 1/4 of the production of this industry was going to the remaining sectors of the industry and about 1/4 for export. About 1/3 was going to the construction industry. All this encloses the importance of the sector for the investment process in the country and for the formation of export resources in Bulgaria.

Over 1/2 milliard (billion) leva are invested annually to the capital goods industry. The fixed capital production funds of this industry are about 3 billion leva, and 56% of them are invested in the production of machines, equipment, control devices and instruments. About 300 thousand persons are engaged in this sector, which represents 27% of the total number of persons engaged in industry. The fixed capital per worker and the labour-productivity are constantly on the increase. The specialization and cooperation in this sector are high and there is a constant renovation of the production and implementation of new and improved products and technologies. A characteristic feature of

the capital goods industry is that in the process of its development the productivity is continuously increasing.

The volume of export of machines, equipment and transport means in Bulgaria has already (in 1978) reached more than 3 billion dollars and about 90% of this export is directed to the COMECON member-countries (2/3 to the Soviet Union). After equalizing the volumes of export and of import under Group 7 of SITC in the years before 1975 and during 1975, it was recognized that the volumes of export of capital goods excced those of the import (this tendency and this result are yet greater under the condition of including the remaining two groups of SITC - 69 and 861).

The general conclusion of the analysis is that in the commerce with the developing countries the volumes of the capital goods are small - the import is insignificant, while the export in 1978 is about 200-250 million dollars. The import from the developed countries is 8 times more than the export to those countries. A significant part of the foreign trade of Bulgaria with capital goods is realized in the frames of COMECON, where the specialization and cooperation are of great importance. Characteristic for the commerce within the frames of this economic group is the long-term and stable contract system, the specific system of price determination (characterized with relative stability and taking into consideration the specific features of the trade with capital goods).

The scientific-technological progress sets up a number of complicated problems to be solved by the capital goods industry. The dynamics depends very much on their solution, the structure and the efficiency of this sector. It should be added that because of the universal revolutionary role of the means of labour, the technological policy for the development of the capi-

tal goods industry influences actively the scales, the rates and the proportions of the remaining sectors of the economy of the country.

The analysis of the practice thus far in respect of the building up of production structures of the enterprises of the capital goods industry in Bulgaria shows that they are object-specialized, with a relatively closed production cycle systems. The greater part of them have an almost universal structure. The universality of the production structures, the building up of individual production infrastructure, and the construction of individual preparatory establishments are characteristic features of the development of the enterprises of the capital goods industry till now in Bulgaria. The industrial development and especially the development of the capital goods industry requires a change in some strategic concepts as regards the volumes and the scales of the production, the technical means/labour ratio, the regional dislocation, the inner structure of the enterprises and the interrelations among them, etc. In this way the transfer from "object-closed principle of specialization" of the enterprises to large open technological systems is realized.

The practical realization of the new approach for improving the structure of the social production started in the machine-building industry of the country with strengthening of the basic specialization of the enterprises and doing away with readjusting of their universality. This process of echelonization ensures the possibility for accumulating and realization of positive effects. In Bulgaria there was a transfer from one-plant machine manufacturing enterprise to the creation of multi-plant enterprises (combines) and to growth of the structural elements and the concentration of the production divisions. Parallel with these

in the country will remain to function also smaller enterprises. The building of multi-plant and multi-echelon systems is a problem of the future and will be realized by means of expanding the existing plants and by the systematic, strategic and mainly by the functional interlinking of the plants in big machine manufacturing complexes.

The basic conditions and factors, which have an impact on the development of the capital goods industry in Bulgaria, are:

- realization of a purposeful resource policy, taking into consideration the changing demographic, labour and social conditions in the country in the present stage of its development, as well as in accordance with the changed conditions of delivery of raw materials and energy, a considerable part of which our country receives from abroad. The carrying out of a technological and structural policy, aimed at systematic diminishing of the material intensity (including the energy and metall intensity) of the capital goods produced for the needs of the country and for export is very important for Bulgaria, since it has insufficient material resources of its own and since their prices on the international markets are constantly raising. Providing of energy and raw materials for the capital goods industry in Bulgaria is now and in perspective one of the main restricting factors of the growth of production of the sector and of the increasing of its efficiency;

- increasing of the importance of the "personal factor" in the production, which is characterized by the individual and creative activity of the worker and with fast adaptation of the dynamic changes to the character and contents of his labour. Di-

recting of the system for professional training towars increasing of the intellectual potential of the workers and their formation as manisided and harmoniously developed persons. Realization of an educational reform, which should bring substantial changes not only in the forms and methods of training, but also in the structure of the educational system by means of strengthening the role of the general educational foundation for professional qualification. The solving of this problem has also a broad social implications.

- the carrying out of a rational investment policy and the increase of the production capacities of the capital goods industry in Bulgaria by means of modernization and reconstruction of the existing enterprises in certain limits, as well as by new construction. The realization of a rational use of the existing production capacities and fixed capital means of production. Until now the growth of the labour productivity in the capital goods industry was ensured mainly on account of the increasing of the production of capital means of production and of the increasing of the fixed capital per worker. Now and in perspective the main stress is and will be laid on those aspects of the development of the material-technical foundation and of the productive forces, which condition the full use of the advantages of the contemporary scientific-technological revolution. This is connected with the increasing of the "scientification" of the production, the ensuring of continuous renovation of the production, the creation and the implementation of principly new highly productive means of labour, based on the use of contemporary highly efficient automated systems of management, rational use of the material, energy and labour resources of the country;

- concentration and specialization of production, expres-

sed in the increase of the scope and size of the production of fixed capital goods by means of constructing of optimal size capacities and improvement of the assembly (unit) and technological specialization. A main direction for the intensive development of the concentration and specialization is the policy of the formation of echelons and building up of economic organizations for intermedium products (semi-finished goods), aggregates assemblies (component parts of details), details and assembly of ready (finished) products;

- expanding our participation in the international specialization and cooperation of the production of capital goods and using of the foreign production experience, patents, licences, engineering services, etc. Because of the limited inner market, the production of the capital goods industry is oriented in Bulgaria to the export, mainly to the COMECON members-countries. A characteristic feature of our participation in the international specialization and cooperation of the production within the frames of COMECON is the purposefulness and the planning character of this process. The directions of specialization are defined on the basis of favourable preconditions for mastering of the production and ensuring the conditions for the realization of the prevailing part of the production within the frames of the community. Problems connected with the development, of the capital goods industry and the technical-economic and quality levels are agreed upon within the frames of COMECON. There is a coordination in the research and development activity, common work on the creation of construction, standards, technologies, etc. Parallel with this there is a trend of technical assistance and of training and re-training of workers and specialists;

- taking into consideration the requirements of the inner

and international market, of the technological progress and of the tasks for raising the efficiency of the production and of export. This is connected with the necessity of development and improvement of the structure by means of a fast priority expansion of the production of perspective, technically contemporary and efficient products and with the development of foreign trade with all countries, independantly of their social order.

On the basis of the analysis of the technical and technological level of the capital goods industry in Bulgaria (according the Methodology of UNIDO) one may come to the conclusion that this sector is characterized with an intensive development, a good nomenclature diversification of the final and component products, average complexity of the produced groups, average and high level of technology, production in series, strongly developed concentration of production and a high level of the exported products. Our scales and the existing resources predetermine the diversification within the frames of the mastered groups, while the efforts are directed to the specialization within the frames of COMECON for the assortment of the heterogeneous groups. The products of the capital goods industry in Bulgaria are on average world level and the degree of renovation is over 0,2.

The system existing in Bulgaria for analysis and evaluation of the technical and technological level of the sector includes a complicated complex of influencing factors, which allows a comparative quantitative analysis and concentration of the decisive problems of the development. The experiment and the good results of applying the Methodology of UNIDO show that it is purposeful to use this Methodology for enriching and improvement of existing methodology for defining and studying of the comple-

xity of the products and the evaluation of the level of the products and the technology on the basis of the experience of the different countries. The Methodology for defining of the level should be indeed regarded as an "open door and open system" and the Bulgarian experience described has the aim to contribute to the solving of the complex problems in this field.

The perspective development of the capital goods industry will be realized under the conditions of sharp insufficiency of all resources. Therefore the main contents of the economic strategy of the country in perspective will be the raising of the efficiency of the use of the resources. On the other hand, the necessity of an economic and efficient use of resources puts forth definite requirements as regards the volume and structure of this sector in Bulgaria for the next 10 years.

For the period up to 1990 that it is expected that the capital goods industry in Bulgaria will develop at accelerated rates with relevant changes (in some cases substantial) in the structure of the different kinds of industrial subsectors, as a result of the expected changes in the conditions and the factors (See Table 47).

The following production subsectors should be mentioned in perspective: In the first place, subestors with extraordinary industry): - heavy investment machinebuilding, automobil industry, communication technology, computer technology (hardware), device manufacturing, means for automation and medical technique (ecuipment), shipbuilding; In the second place, subsectors with a rapid development (near the average level for the capital goods industry) - (tractors and agricultural machines, metalcutting machines and instruments, electrical industry, castings, for-

Table 47

Coefficients of faster development (forstalling) by kinds of productions (subsectors) to the general development of the capital goods industry sector in Bulgaria*

Kinds of productions (subsectors)	1981-1990
1. Heavy investment machine-building	1,50
2. Automobile-industry	1,30
3. Communication technology	1,29
4. Computer and organizational technology	1,29
5. Building of devices, means for automation and medical technique	1,22
6. Shipbuilding	1,18
7. Tractors and agricultural machines	0,97
8. Metal-cutting machines and instruments	0,96
9. Electrical industry	0,91
10. Castings and forgings	0,83
11. Instruments for manual use and for machines	0,81
12. Equipment with general purpose	0,78
13. Building machines	0,75
14. Railway means of transport	0,64
15. Lifting-transport machines	0,59
16. Containers and pallets	0,47

*Data taken from preliminary forecasts

gings, instruments, equipment with general purpose, building machines); In the third place, subsectors with significantly lower rates of development than the average rates for the world capital goods industry (railway transport means, lifting - transport machines, containers and pallets).

The changes mentioned above would lead to structural changes complying with the requirements of the scientific-technological progress, the needs of the national economy and the international market, the existing material resources, the production experience and the qualification of the working force. These changes will ensure a maximum efficiency of the national economy.

B) Conclusions and Lessons from the Bulgarian Experience to the Developing Countries

The problems of the developing countries, which are connected with the goals, the prospects and the mechanisms of their economic development are presently much more complicated than those of the other countries. These countries are very heterogeneous with respect to their socio-economic status and hardly the experience of one country (socialist or capitalist) may be adopted as an "universal" standard, even as regards a limited sphere of economic activity, which is our case.

The experience of the other countries (including that of Bulgaria) in respect of the development of the capital goods industry should be connected with the goals of the economic development in the countries of the third world and should be used concretely and purposefully, taking into consideration the concrete conditions and goals, which have been set up for the particular stages of their development. At the same time the development and the interrelation between the contemporary sectors of the economy and the traditional and specific for a given country sectors should be also taken into account. Each of these two sectors has its specific place in the total development and the changes of the socio-economic structure, as well as in the interrelations with the outside world. Irrespective of the fact that the capital goods industry may be refered to the contemporary economic sectors, there should be sought conditions and factors, pertaining to the specific traditional character of the local industries and the contemporary achievements in the relevant field should be introduced so as to innovate them.

Although there is unity of the basic goals of the econo-

mic advancement of the developing countries (namely, the attainment of a maximum volume of the national income), there may exist differences as regards the goals of the different development stages, from the viewpoint of the terms and dimensions of their realization, which depend on the size of the country and the particular stage of its economic development. To the goals of the different stages one may refer: the creation of a minimum industrial complex, taken as prerequisite for a stable development, and for relatively high rates of growth; the dynamic development of agriculture and its modernization on the basis of a developed industry; ensuring foods for the population; receiving real economic results (without developing necessarily all sectors and subsectors of the economy). While in former years the discussion was: for or against the priority development of the light or the heavy industry, today the discussion covers a broader field - the different countries should develop different types of industrialization. The selection of the different sectors of industry should depend on the conditions, possibilities and the time-factor in the different countries. At the same time greater recognition should be given to the special role of agriculture in the economic development, naturally not on the basis of archaic conditions, means of production, technology and organization: the establishment of production and non-production infrastructure with the purpose of carrying out of an uniform economic and social policy.

Independently of some specific political, social and economic conditions, existing about 30-40 years ago, the economic development of Bulgaria was oriented in the right direction and for a short period the basic tasks were solved and the goals

set were attained. Countries having a population approximately equal in number to that of Bulgaria are most suited for developing a number of industrial sectors, and particularly the machine manufacturing, the chemical industry, the consumer goods industry, etc. During the initial stages of this development, the production would be oriented to satisfying the needs of the home market, while further on it would be oriented to the establishment of intensive connections with foreign countries. This is especially important for the development of contemporary industries on the basis of imported technology, which may well not be on the highest contemporary level, such as is the level of technology used in the economically developed countries, but is nevertheless contributing to raising the economical level of the country and thus leads to the realization of the goals planned.

The too big enthusiasm for the development of industry and especially of manufacturing at the expence of agriculture, may lead to distorting some of the objective proportions of the process of reproduction and to a crisis in the economy. Definite problems would be put forth by the social structure of production and the tendency of a gradual liquidation of natural and semi-natural economy. The liquidation of economic backwardness and the development of contemporary industrial sectors, such as the capital goods industry, would be impossible if pre-capitalist production relations are still existing. There are also a number of countries, the experience of which has shown that private capitalist enterprises are not in a position to efficiently develop sectors such as the capital goods industry. A good foundation for resolving this problem would be a state economic policy, capable of accumulating substantial funds, so as to ensure stable

foreign economic connections (in the English text) and to create all the conditions necessary for ensurring and developing the labour factor of production simultaneously wiht the realization of other related problems. Independently from the fact that this relates to a greater extent to the capital intensive sectors of the extractive industry, the development of a contemporary capital goods industry also requires a decisive and financially substantial intervention on the part of the state.

The role of state policy in the field treated should not have a specifically economic character only, but should establish also the long-term strategy of building up and developing the capital goods industry, which directly influences and determines the development of the other sectors of the economy. Under these conditions it would be necessary for an expedient and realistic policy to be carried out, which takes into account the conditions and the resources of the country, the latter's concrete needs and the possible ways for realization of the economic policy and strategy. Not to observe this would give rise to noxious tension and unfavourable economic, social and political results.

An important role for the development of the capital goods industry plays the creation of a state sector not only in the sphere of the economic infrastructure, but also in the sphere of bank credit activities, foreign trade, etc. The concentration of resources for realizing of the vitaly important objectives of the economy by means of state economic and financial policy is a task of paramount importance. An important instance of industrial strategy is the policy of the state as regards the enterprising activity of foreign capital. Measures should be ta-

ken so that all the possible negative implications be reduced as much as possible and the foreign capital be used in the interest of the national goals, while keeping the leading role of the state. The development of the capital goods industry may be of decisive importance with respect to overcomming of a number of inner problems and difficulties abroad.

The concentration of efforts on the creation and development of a narrow range of interrelated industries and the complex development and delivery of resources is the most advisable (goal oriented) solution for the small and underdeveloped countries. The necessity of ensuring of employment and of revenues in foreign currencies from the export by means of developing of labour-intensive subsectors, requiring several times processing in the country should also be taken into account.

The important principles of graduallity, selectivity and phase by phase development of the capital goods industry should be widely used. In some cases, the political conditions and environment do not require any active intervention as regards the solving of some problems of the social infrastructure, irrespective from the fact that the development of the transport system, communications, different energy systems, etc. is an obligatory condition for all kinds of economic and social prosperity. But such conditions do not always exist, they are restricted in time and have a limited sphere of action. That is why the development of institutions, which directly influence the reproduction of the labour force, not only have a favourable influence on the capital goods industry, the reverse is rather true - the development of this sector is directly supported by them.

Due to technological and economic requirements and

efficiency considerations the capacity of the plants to be constructed should exceed considerably the domestic needs, especially of the smaller countries. Part of the production, exceeding the needs of the domestic market, would go for export, which is not always ensured because of the growing competition on the international market. The problems of the realization of the production of the capital goods industry are difficult to solve without coordination, agreements, international contracts, specialization, international cooperation and coordination. In this respect, the principles of the international economic and scientific cooperation (opplied within the frames of COMECON) and also the cooperation with the COMECON member-countries, may be very favourable for the developing countries.

An important element of the industrial policy and strategy of the developing countries is the development of their own research and development activities, which relate not only to the direct production and to the realization of the export programme, but also to the use of the imported means of production and their adaptation to the specific conditions of the country. A timely policy for training of operative and management personnel is necessary. Every delay in this respect diminishes strongly the realization of the planned potential efficiency of production and the realization of the production of the capital goods industry.

The experience of Bulgaria as well as the experience of the other socialistic countries shows also that besides the conditions and factors for efficient development of the capital goods industry mentioned above, it is very important for the developing countries to organize a central planning as an impor-

tant political and social-institutional instrument. The existing tendency of concentration and fulfillment by the apparatus of the state power not only of political functions, but also of functions of the management of the social and economic development of the country, is already a reality with a substantial effect in the socialistic countries and is in an initial stage in the developing countries. We shall recomend (without treating this subject in detail) the book prepared and issued by UNITAR during 1978 - "Theory and methodology of the planning in the developing countries", which was published in several languages*.

No universal recommendations could be given as regards the building and the development of national production of capital goods in the developing countries. The problems are complicated and the conditions in the different countries and during the different periods of the world's history are specific and different, the goals of the national economies are not the same. Independent of the fact that the Bulgarian experience should be interpreted in accordance with the specific political and social conditions, this experience may prove expedient for countries, of analogous size, resources and needs. A number of difficulties, which Bulgaria met on its way may be avoided by the developing countries, but this does not mean that there new difficulties, cannot arise which would be not the less undesirable. However, some more specific lessons, could be kept in mind. Taking into consideration the Bulgarian experience, it will be expedient for the following preconditions for a quick progress of the developing countries in the treated field to be given particular regard:

- development of the production nomenclature on the

* The Authors of this paper/project have taken part in the preparation and the writing of the book.

basis of long-term international specialization, stable needs and realization;

- orientation towards groups of products, which use local raw materials and materials, a minimum number of semi finished goods and components and a limited completion of overall dimensions with the purpose of overcomming of communication difficulties and avoiding of capital-intensive capacities for component parts;

- initial orientation towards groups of products with low coefficients of complexity, which constitute the foundation of the production rear for the completion of future more complicated products;

- avoiding the small series and the special orders, the production of which would require a significant engineering potential;

- broad application of foreign experience for raising of the qualification of the existing labour force.

Annex I

Technical analysis of all capital goods

List of products *

381. Manufacture of fabricated metal products except machinery and equipment

F	- Hand agricultural and garden tools: axes, chisels, shovels, rakes, hoes, alfalfa cutters, etc.
F	- Simple mechanic's hand tools: wrenches, hammers, files, saws, etc.
F	- Carpenter's hand tools, without motors
F	- Mason's, plumber's and other tools
F	- Complex hand tools
F	- Hardware: locks, keys, protectors, marine vehicle hardware and the like
C	- Metal furniture for offices, restaurants, industries, etc.
A001	- Doors, screens, window frames and sashes, fixed staircases, sheet-metal components for buildings, shapes, receptacles, tanks, etc.
C	- Structural elements of medium weight and size for bridges, reservoirs, sheds, chimneys, buildings, towers, etc.
C	- Heavy and very heavy structural elements for bridges, buildings, reservoirs, sheds, etc.
C	- Metal sections for ships. barges and the like
A002	- Containers, barrels, drums, kegs, pails, safes, vaults, etc.
C	- Stamped metal parts of average size and precision
B	- Parts produced by micro-stamping
C	- Heavy stamped parts
A003	- Chains, cables and the like
A004	- Springs of all kinds
C	- Screws, nuts, washers, rivets, etc., produced in series, excluding special items
C	- Collapsible tubes and the like
A005	- Fittings
C	- Cable and wire products. Metallic mesh
D	- Stoves and heaters, non-electrical
C	- Articles plated with chrome, nickel, zinc, etc.

382. Manufacture of machinery except electrical

D	- Petrol alternating engines
A006	- Diesel engines of up to 500 HP, regarded as series-manufactured
B	- Diesel engines of more than 500 HP, regarded as made to order
B	- Gas engines and others
D	- Steam engines
B	- Steam turbines
B	- Gas turbines
A007	- Hydraulic turbines
B	- Non-conventional engines (atomic, etc.) for purposes of illustration only
A008	- Parts, components and accessories specifically for engines (except those covered under "non-conventional engines")
A009	- Parts, components and accessories specifically for turbines

* The following have been adopted in The Annex:
- A - produced and surveyed, having a number of order on The Technical Sheet
- B - not produced
- C - produced and not surveyed
- D - production cancelled
- E - products presently introduced
- F - consumer goods

A010 - Wheeled tractors of up to 25 HP (without the engine)
A011 - Wheeled tractors of more than 25 HP (without the engine)
A012 - Caterpillar (track-laying) tractors (without the engine)
A013 - Articulated tractors (without the engine)
A014 - Agricultural machinery, all without the engine; agricultural machinery for soil preparation
A015 - Agricultural machinery : implements for sowing, planting and fertilizing
A016 - Agricultural machinery : cultivators
A017 - Agricultural machinery : pesticide applicators
A018 - Agricultural machinery : harvesting, transportation and handling
A019 - Agricultural machinery : processing, metal storage areas and silos
A020 - Agricultural machinery : water supply and irrigation systems and other agricultural implements and/or installations
A021 - Parts and components for tractors
A022 - Parts and components for agricultural implements and machinery
A023 - Machine-tools, metalworking, chip-removal, simple : lathes, drilling, planing, milling machines, etc.
A024 - Machine tools, metalworking, chip-removal, medium-complexity, conventional
A025 - Machine-tools, metalworking, chip-removal, high-complexity, automatic, with numerical control; machining centres; special machines, etc.
A026 - Machine-tools, metalworking, cold-forming, simple : presses, guillotine cutters, folding machines, profiling machines, etc.
B - Machine-tools, metalworking, cold-forming, complex, high-precision, automatic or heavy
B - Machine-tools, metalworking, hot-forming
A027 - Machine-tools, woodworking, simple
A028 - Machine-tools, woodworking, advanced, automatic, high-precision, high-output, special, etc.
A029 - Machinery and equipment for the treatment of wood; integrated plants
A030 - Parts, components and accessories specifically for metalworking and woodworking machine-tools
A031 - Blast furnaces
B - Steelmaking furnaces
B - Continuous casting
B - Rolling mills
A032 - Manipulators
B - Equipment for drawing, cold rolling and extrusion
A033 - Ferrous and non-ferrous equipment for casting
A034 - Equipment for special casting : processes : pressure-die casting, shell-moulding, vacuum casting, centrifugal casting, etc.
B - Equipment for the casting of noble and/or strategic metals
B - Special equipment for the production of noble and/or strategic metals, such as Ni, Ti, Co, V, U, W, Tu, etc.
A035 - Equipment for the food industry : bakeries, including ovens (non-electrical)
B - Equipment for the food industry : biscuits, pastes and the like
A036 - Other equipment for the food industry : milk and cheese
B - Equipment for the food industry : ice-cream, juices, caramels, cakes and the like
A037 - Equipment for the fodder industry
A038 - Equipment for the beverage industry
A039 - Equipment for the breeding industry
A040 - Equipment for slaughterhouses

A041 - Equipment for dehydration, freeze-drying and deep-freezing
A042 - Refrigeration chambers
- Refrigeration balconies and the like
D - Textile machines : spinning, preparation for the spinning, winding, reeling, twisting and treatment of yarn
D - Textile machines : weaving, preparation for weaving : dying, printing and finishing
D - Textile machines : knitted fabrics
E - Machinery and equipment for the production of cement
A043 - Machinery and equipment for the ceramics, clay, asbestos and similar industries
A044 - Civil engineering (CE) : cranes and hoists
B - CE : equipment for the mixing and transport of cement (other than truck chassis). Cement pumps
B - CE : special-purpose equipment for large civil engineering projects
B - CE : immovable factories for the preparation of concrete, tubes, masts, etc. Prefabricated cement elements
B - CE : equipment for road surfacing (cement, asphalt, etc.)
B - CE : asphalt plants
B - CE : special-purpose equipment for the plate-glass industry
A045 - Mining machinery and equipment (MMe) : drilling and excavation
A046 - MMe : continuous conveyor equipment : bucket and belt conveyors
A047 - MMe : special-purpose transport equipment, special-purpose trucks
E - MMe : equipment and installations for preparation, such as crushing, trituration, etc.
B - MMe : equipment and installations for concentration, refining and pellets
B - Equipment and installations for oil prospecting and extraction on land
B - Equipment and installations for oil prospecting and extraction at sea
B - Oil and gas pipelines
B - Oil pipeline stations
A048 - Chemical and petrochemical equipment (CP) : cracking and processing towers and columns. Reactors
B - CP : heat exchangers, coolers, surface and other condensers, evaporators, reheaters and similar
B - CP : pressure vessels
B - CP : furnaces for refineries, driers, stoves, de-aerators, autoclaves
A049 - CP : spheres, storage tanks, metal silos
A050 - CP : mixers, filters and other equipment for the chemical and petrochemical industry
A051 - Equipment and installations for the vegetable oil industry
B - Special-purpose equipment for the manufacture of pulp
B - Special-purpose equipment for the manufacture of paper and cardboard
B - Machinery for typesetting shops, duplicators, binding, etc.
B - Machinery and equipment for printing and similar
A052 - Installations for refuse processing
A053 - Equipment for the collection and transport of refuse (except chassis)
D - Machinery for the leather and footwear industry
D - Machinery for the manufacture of tyres, inner tubes and rubber parts
D - Other machinery for the rubber industry
E - Machinery for cheques, mail, automatic sorting, pneumatic mail and similar
A054 - Simple individual calculators without print-out (electronic or other)
A055 - Individual calculators with print-out (electronic or mechanical)
C - Calculators for industrial, accounting and similar use

A056 – Desk computers and peripherals
A057 – Computers and peripherals
C – Card punchers, tape perforators, magnetic stores and similar
A058 – Conventional or electronic cash registers
A059 – Mechanical weighing machines, spring balances, etc.
E – Electronic weighing machines and similar
C – Copying and reproducing machines
A060 – Mechanical typewriters
B – Electric typewriters programmed or otherwise
A061 – Machinery for injecting plastic, bakelite and similar
F – Cold compressors up to 5 HP
A062 – Cold compressors over 5 HP
A063 – Air conditioners up to 5 HP (without cold compressor)
A064 – Air conditioning over 5 HP and large installations for buildings, industries, etc.
A065 – Vacuum machinery
A066 – Air compressors up to 5 HP
A067 – Air compressors over 5 HP
A068 – Ventilators, blowers, etc. up to 5 HP
A069 – Ventilators, blowers, etc. over 5 HP
B – Windmills and other wind technology machinery
A070 – Driers and similar
A071 – Simple fire-fighting equipment, portable or fixed
A072 – Automatic and/or sophisticated fixed fire-fighting equipment
A073 – Automatic pumps, specific part (except chassis), ladders and similar
A074 – Travelling cranes, gantries, pulley blocks, cranes, etc. up to 10 tons
A075 – Travelling cranes, gantries, cranes, etc. 11 – 50 tons
A076 – Travelling cranes, gantries, cranes, etc. over 50 tons
A077 – Stacking machines up to 4 tons, electric
A078 – Stacking machines up to 4 tons, with internal combustion engines (excluding engine)
A079 – Stacking machines over 4 tons, with internal combustion engines (excluding engine) or electrical
B – Mobile cranes
A080 – Lifts
A081 – Hoists
B – Mechanical garages
B – Escalators
A082 – Simple, fixed and mobile belt, bucket and other continuous conveyors
A083 – As before, medium and high powered, except conveyors used for mining classified under 3824.28
B – Cable cars, cable ferries and similar
A084 – Welding machinery and equipment
A085 – Burners and similar
A086 – Boilers for heating water, etc.
A087 – Steam boilers of rated capacity up to 20 kg/m^2h
A088 – Steam boilers of rated capacity up to 70 kg/m^2h
A089 – Steam boilers of rated capacity over 70 kg/m^2h
B – Nuclear steam generators
A090 – Steam reservoirs and similar
A091 – Evaporators
A092 – Steam condensers and similar
A093 – Heat exchangers
A094 – Small and medium-power fixed and continuous industrial furnaces up to 1,000° C
E – Small and medium-power furnaces over 1,000° C
B – Large-power furnaces, excluding those used for iron and steel

A095	- Equipment for tempering, cementation, and thermal treatment in general
B	- Ordinary equipment for electroplating
B	- Automatic electroplating equipment
A096	- Purifiers and extractors for air, smoke, dust, paint, etc. Equipment and installations
A097	- Equipment and installations for air-blasting, shot-blasting, etc.
C	- Road-construction machinery (RCM) : excavators and loaders
C	- RCM : motorized graders
B	- RCM : motorized scrapers
A098	- RCM : rollers, compactors
B	- RCM : crawler tractors
B	- RCM : ordinary and special-purpose carts
C	- Stationary and movable plants
A099	- Crushers, grinders and similar
B	- Loading terminals for ports : wheat, soya, etc. (vegetable materials)
B	- Loading terminals for ports for minerals and other
A100	- Sluice gates up to medium-heavy-duty
E	- Heavy and very heavy-duty sluice gates
A101	- Machinery for the tobacco industry
B	- Equipment and installations for sugar factories
B	- Equipment and installations for factories producing alchohol from sugar and related materials
A102	- Equipment and installations for factories producing alchohol from vegetables, babassu, cassava and derivatives
B	- Machinery and installations for the collection and processing of cotton. Includes presses
A103	- Equipment and installations for ordinary painting : spray, immersion, etc.
B	- Equipment and installations for non-conventional painting : electrostatic, automatic, etc.
B	- Equipment for service stations
B	- Equipment for motor vehicle maintenance workshops : engines
B	- Equipment for motor vehicle maintenance workshops : chassis, tyres etc
A104	- Packing and similar machinery, with or without automatic weighing
A105	- Machinery for bottling and washing bottles
B	- Industrial sewing machines
A106	- Machinery and equipment for laundries
A107	- Machinery and installations for hotel, restaurant, industrial and other kitchens
B	- Machinery for the cleaning of public places and similar
B	- Telescopic terminals for airports
B	- Orbital rockets and similar
B	- Scientific and telecommunications satellites
B	- Test benches for reciprocating engines, turbines and similar
B	- Motorized equipment for urban cleaning, snowploughs and others for towns
C	- Mechanical equipment for the transmission of electrical power
C	- Automatic merchandising machines
A108	- Motor-driven portable tools (air, electrical, other)
A109	- Centrifugal pumps up to 50 HP for non-corrosive liquids, for use at ambient temperatures
E	- Centrifugal pumps up to 50 HP for non-corrosive liquids, for use at various temperatures
A110	- Pumps for corrosives, all ratings. Motor pumps, special axial pumps, etc.

A111 - Mechanical components (MC), simple, of one or few parts, such as screws, nuts, rivets, etc.
A112 - MC : for transmission of motion, large and medium-volume products : clutches, brakes, torque and axial force limiters, elastic joints, various kinetic parts, prop shafts, etc.
A113 - MC : gears
A114 - MC : ordinary and special-purpose bearings
A115 - MC : reducers up to 10 HP (input)
A116 - MC : reducers from 11 to 50 HP (input)
A117 - MC : reducers over 50 HP (input)
A118 - MC : speed changers up to 10 HP
A119 - MC : speed changers over 10 HP
A120 - Components for oleodynamic circuits
A121 - Components for air circuits (other than manometers and compressors)
A122 - Pumps and components for lubrication circuits
A123 - Components for refrigeration circuits (other than compressors)
A124 - Valves for water and non-corrosive liquids and gases, fur use at ambient temperatures, hand operated
A125 - Valves for water and non-corrosive liquids and gases, automatic, security, programmed, etc., for use at ambient temperatures
B - Valves for corrosive liquids and gases of any type and application. Non-corrosive, at medium and high temperatures

383. Manufacture of electrical machinery, equipment, accessories and supplies

B - Fractional electric motors, DC, insulated up to 120° C
B - Fractional electric motors, AC, insulation up to 120° C
A126 - Electric motors, DC, up to 50 kW, insulation up to 120° C
A127 - Electric motors, AC, up to 50 kW, insulation up to 120° C
A128 - Electric motors, DC, up to 500 kW, insulation up to 130° C
A129 - Electric motors, AC, up to 500 kW, insulation up to 130° C
A130 - Electric motors, DC and AC, over 500 kW, insulation up to 130° C
B - Special-purpose motors up to 500 kW, AC and DC, insulation up to 180° C, of any type
A131 - Low-power transformers
A132 - Ordinary and medium-power transformers
A133 - Semi-heavy-duty and heavy-duty transformers
A134 - Relays of all types other than electronic
A135 - Low- and medium-tension breakers
A136 - High-tension breakers
B - Special-purpose electric motors for aeronautical and astronautical applications
A137 - Electric motors and dynamos for motor vehicles, road construction machinery, tractors and similar
C - Electromagnetic clutches and brakes
C - Special-purpose electrical components for machinery control circuits
C - Special-purpose electrical equipment for machinery power circuits, up to 50 kW
B - Telex equipment
B - Shared external television aerials, communal television aerials and network material. Telecopic aerials
C - Toasters, mixers, grills, etc., for industrial use (bars, restaurants, etc.)
C - Heaters for food, water, etc.
A138 - Washing machines, driers, ironing machines and other laundry machinery (same as under 382)
C - Plate washing machines, driers and similar (same as under 382)
B - Electrical and/or electronic instruments for motor vehicles

C - Special-purpose electrical and/or electronic equipment for locomotives, metros, trams, cable-cars and similar

C - Special-purpose electrical and/or electronic equipment for motor vehicles, tractors, road-construction machinery and similar, including dynamos

C - Electrical and electronic material for signalling, synchronization, control, etc. for urban traffic, highways and railways

A139 - Electrical welding units, ordinary

A140 - Electrical welding units, special and/or automatic

A141 - Electric furnaces, continuous-operation and non-continuous-operation, up to 500° C

B - Electric furnaces, for iron and steel making

384. Construction of transport equipment

A142 - Ships, barges, scows, small boats, small fishing vessels, tugs and other similar craft

A143 - Cargo and/or mixed passenger/cargo ships, up to 20,000 t

A144 - Cargo and/or mixed passenger/cargo ships, up to 100,000 t

A145 - Lake and river boats for passengers and cargo

B - Hovercraft

A146 - Floating dredges

B - Wet docks, platforms, floating docks and other similar equipment

B - Marine engines (ME), alternating-current (see 382)

B - ME, alternating current (see 382)

B - ME, alternating-current (see 383)

B - ME, steam turbines (see 382)

B - ME, parts (compare with 382)

A147 - Parts for ships (PS) : lifting, transporting, loading and unloading equipment

A148 - PS : chains, anchors, rudders, etc.; cast and forged mechanical components

A149 - PS : propellers, fixed-pitch and variable-pitch

D - Steam locomotives

B - Diesel locomotives

B - Rail-cars, for underground railways, etc. (self-propelled)

A150 - Tram cars, single and articulated

A151 - Passenger cars

A152 - Freight cars of all types, excluding Decauville cars

B - "Hovertrains" and other similar equipment. Advanced high-speed equipment

A153 - Mechanical components for convential rolling stock : boogies, couplings, axles and other forged and cast parts

A154 - Miscellaneous mechanical and other parts for rolling stock (cars and locomotives)

A155 - Parts for railway lines (excluding rails and electrical equipment), including switches

D - Locomotives, Decauville and battery

- Automobiles, utility, including taxis

B - Panel trucks, delivery vans and other similar vehicles

A156 - Trucks, up to 5 t

C - Trucks, 5.1 to 15 t

B - Trucks, more than 15 t

B - Trucks, special : articulated, heavy, extra-heavy, etc.

A157 - Bodies for buses and trolley-buses, truck cabs, etc.

B - Chassis for trolley-buses

A158 - Bodies for liquid or solid loads, ordinary or special

B - Trailers

C - Simple mechanical components consisting of one part or a few parts (wheel, pistons, stud bolts, etc.)
C - Mechanical components, others
- Bicycles and tricycles, without motors
D - Motorcycles and motor scooters with trailers
D - Motors for bicycles
D - Single-engine aeroplanes (piston)
B - Twin-engine turbo-prop aeroplanes, up to 25 t (dead weight)
B - Single-engine jet aeroplanes
B - Twin-engine jet aeroplanes, more than 25 t dead weight
B - Light helicopters
B - Piston engines
B - Propellers and helicopter blades
B - Landing gear

385. Manufacture of professional and scientific equipment and measurement and control instruments

A159 - Mechanical equipment for linear, angular and plane measurement.
A160 - Fixed and adjustable caliper gauges
A161 - Meters, gauges and flow recorders for gases
A162 - Meters, gauges and flow recorders for liquids
A163 - Meters, gauges and consumption recorders for electricity
B - Parking meters, taxi meters, r.m.p. meters, operations meters and other similar equipment
B - Drawing machines and other similar equipment
C - Complete metal design equipment
C - Mechanical drawing equipment
C - Apparatus for topography and geodetics
A164 - Mechanical instruments for surgery and general examinations and other similar equipment (composed of only a few parts)
A165 - Complete dental equipment
A166 - Equipment for hospitals, professionals, etc., of intermediate complexity, e.g. relating to inhalation, blood, sterilization, etc.
C - Veterinary instruments
A167 - Recording clocks, time-checking devices for watchmen and control of working hours and other similar devices.

Annexe II

Technical Definition of the six Levels of Complexity

for the 44 Factors

SEMI-FINISHED PRODUCTS

1. Iron castings, conventional processes

I - Elementary, primary, craft activity, without standards. Mainly manual operations. Cupola furnaces.

II - To standards. Ordinary grey and white iron. Limited weights. Mechanical moulding for smaller parts. Value of r always less than 30 kg/mm^2. Electric furnaces occasionally used.

III - Malleable, nodular cast iron alloyed with Mn, Cr, Ni and other elements. Complex parts. Semi-mechanized casting. Control of earth and sands. Very thin walls, microporosity, etc.

IV - Special alloys. Rather unusual cases. Very large parts. Very strict quality control. Automatic installations.

2. Steel casting, conventional processes

I - Elementary, no standards. Manual operations.

II - To standards. Carbon steels. Up to parts of medium weight and complexity.

III - Special steels with Cr, Ni, Mo, Mn and other alloying additions. Semi-mechanized casting. Complex parts, heavy.

IV - Special alloys. Large parts. Automatic installations. High level of quality control.

V - Highly complex or large and very large parts for military applications, highly specialized. Special alloys.

3. Casting of non-ferrous metals, conventional processes

I - Ordinary aluminium, bronze and brass castings, no standards. Manual operation.

II - Small and medium-sized parts. To standards. Bronze, brass and Al, Mg, Zn alloys with low and medium-level mechanical properties. Semi-mechanized operation. Partial quality control.

III - Bronze, brass and Al, Mg, Zn and other alloys with high-grade mechanical properties. Up to heavy parts. Systematic quality control.

IV - Very heavy parts (for example, large propellers). Special non-strategic alloys. Automatic installations.

4. Casting and forging of strategic materials: all processes

V - Small parts for aeronautical engineering, turbines, piston engines for aeronautics, space travel, satellites. Special mechanical properties. Very strict quality control. Military, naval, land and air applications, including rockets.

VI - As V with medium-sized pieces as maximum. Very special mechanical properties.

5. Pressure and centrifugal casting, etc.

I - Zamak, aluminium and other non-ferrous metals. No standards. Simple and manual equipment.

II - For ferrous and non-ferrous metals, to standards. Small and medium-sized parts. Semi-automatic equipment. Normal quality and complexity. Semi-automatic equipment.

III - For ferrous and non-ferrous metals. To standards. Up to large and complex parts. High-level quality control. Good mechanical properties.

IV - For ferrous and non-ferrous metals. Special cases with regard to shape, resistance of materials and size. Strict quality control. Highly automated installations.

6. Other casting processes: microfusion, shell moulding, chill moulding, vacuum casting, etc.

II - Simple cases for shell moulding and chill moulding. To standards. Simple equipment. Ferrous and non-ferrous metals. Limited level of mechanical properties.

III - Almost all processes for ferrous and non-ferrous metals. Medium-sized parts. Strict quality control. Semi-automatic installations or equipment. High degree of complexity. Thin walls.

IV - Special cases. Very complex or heavy parts or parts with high mechanical resistance. Maximum quality. Automatic equipment. For ferrous and non-ferrous metals.

7. Hammer forging

I - Light parts. Manual operations. Simple shapes. No standards.

II - To standards. Up to medium-weight parts. Limited guarantees.

III - Semi-heavy and heavy parts. Guarantees and standards.

IV - Special cases. Ultra-heavy parts. Strict quality control. High mechanical resistance.

V - Incorporated in 4-V.

8. Stamping, etc.

I - Light parts of simple form. No standards.

II - To standards. Normal complexity of parts. Irregular quality. Simple, conventional equipment.

III - Multi-stage forging. Upsetting. Extrusion, etc. Medium-weight parts. Semi-automatic and automatic equipment for smaller parts. Quality. Guarantee. Materials of moderate resistance.

IV - Special requirements as to shape, alloys and complexity. Large parts. Strict quality control. Automatic equipment, automated installations. Other hot-farming technologies.

V - Incorporated in 4-V

TECHNICAL SERVICES PROVIDED BY THIRD PARTIES

9. Stress relief and annealing

I - With simple installations and limited quality control. Parts of limited size. Partial guarantees.

II - To standards. Guarantees. Up to semi-heavy parts, medium thick walls. Controlled atmosphere. Conventional installations.

III - Up to semi-heavy and heavy parts. Strict quality control. Thick walls. Automatic installations. Laboratory.

IV - Ultra-heavy parts. Special cases. Complex automatic installations. Special processes. Research and development laboratory.

10. Heat treatment

I - Elementary installations. Limited weight and quality control. Normal materials. No standards.

II - To standards. Hardening, case hardening, tempering and normalizing. Moderate complexity. Conventional installation.

III - The foregoing processes for an extended range of steels. Larger parts and heavier weights, up to medium. Nitriding, carbo-nitriding and similar processes. Semi-automatic equipment. Correct quality controls. Guarantees. Laboratory.

IV - Special requirements and advanced technology. Strict quality control. Complex automatic installations. Heavy parts. Research and development laboratory.

11. Surface metal deposits, etc.

I - Semi-craft-type installations. No quality control.

II - To standards. Irregular quality control. Nickel-plating, chromium-plating, cadmium-plating, zinc-plating, phosphating, tin-plating, etc. Small and standard parts. Non-automatic installations.

III - Medium-sized parts. Normal quality controls. Laboratory. Surface deposits by powder metallurgy methods. Hard porous chromium. Other processes. Semi-automatic installations.

IV - Special requirements. Automatic and programmable installations, etc. Large parts. All advanced technological processes. Strict quality control. Research and development.

12. Manufacture and maintenance of tools

I - Maintenance of simple tools. Manufacture of simple tools. Irregular quality. Limited know-how.

II - Maintenance of tools of medium complexity. Precision expressed in 1/100 mm. Medium size. Manufacture of cutting and shaping tools and simple dies for extrusion, etc. Irregular quality. Conventional equipment. Limited guarantees. Some standards.

III - Maintenance of complex tools including broaches, gear-cutters, milling cutters etc. for tolerances up to ISO 6 and 7. Manufacture of multiple or compound tools and special tools of medium complexity. Guarantees. Standards. Metrology laboratory. Not including series production of tools.

IV - Maintenance of highly complex and/or special tools for metal and woodcutting etc. Large size. In small dimensions for tolerances up to ISO 5 and 6. Simple drills for wells, etc.; maintenance. Manufacture only of special tools of medium complexity (excluding large-scale series production). Standards, guarantees, metrology laboratory. Small-scale R and D.

V - All complex special cases for all applications in maintenance and manufacture. Maintenance of tools for well-drilling, including oil wells, and mining. R and D.

13. Construction of dies for cold stamping

I - Crafts-type construction with simple equipment. Limited quality. Small parts.

II - Moderately equipped workshops. Parts of standard dimensions and medium complexity. Limited durability. Irregular guarantee and quality.

III - Workshops with good but incomplete equipment. Up to parts of medium size. High complexity in small parts. Precision. Guarantee. Durability. Simple progressive dies. Includes own know-how.

IV - Workshops with complete and high-quality equipment. Precision, guarantee, productivity, durability. High complexity, progressive and multiple dies, etc. Micro-stamping. Large parts. Special cases. Relevant own know-how. Laboratory.

14. Construction of moulds, stamping dies, chill moulds, etc., for metals

I - Low quality. Wide tolerances. Small workshops with standard equipment. Simple parts of limited weight. No guarantee.

II - Medium-size workshops with varied standard equipment. Irregular guarantees and quality. Up to parts of medium size. Semi-complex shapes (depth, walls, ridges, etc.).

III - Well equipped workshops for parts of up to semi-heavy weight. Considerable degree of own know-how. Normal guarantees, precision and durability. Systematic quality control. Complex shapes.

IV - Very well equipped workshops. Up to large and complex parts. Special requirements. Relevant know-how. High level of guarantee, durability and precision. Solutions for large series. Quality control and other laboratories.

V - Specific solutions for naval, land and air armaments. Civil aviation, turbines, piston engines. R and D laboratories.

15. Construction of jigs, templates, etc.

II - Limited own know-how. Design by third parties. Workshops with standard and incomplete equipment. Moderate complexity. Precision expressed in 1/100 mm. Partial guarantees.

III - Highly developed own know-how. Design by third parties. Workshops with good but incomplete equipment. Air conditioning. Precision expressed in 1/1,000 mm for small parts. Guarantees. Quality. Highly developed metrology. Up to medium-sized parts.

IV - Workshops with complete and advanced equipment. Large scale parts. Special and complete solutions for large series. Advanced know-how. Guarantees. Laboratory. Very high precision.

16. Light boilermaking services, plate up to 1/2"

I - Semi-crafts-type workshops. Standard equipment. Limited precision. Design work by third parties. Low complexity. Conventional welding.

II - Well equipped workshops. Partial guarantees. Standards. Own designs and design work by third parties. Normal precision. Profiles and structures up to complex level. Manual or semi-automatic operation. Various types of welding.

III - Workshops with complete and advanced equipment. Guarantee, standards, quality controls. Own designs and design work by third parties. Complex and precision operations. Machines automated and/or with programming. Stainless steel. Special welding for various materials. Complex cases with strict quality control including pressure and similar tests.

17. Semi-heavy and medium boiler-making services, plate up to 1"

I - Small workshops with simple, incomplete equipment. Elementary quality control. Limited complexity. Design work by third parties. Conventional welding. No standards.

II - Medium-sized workshops with good but incomplete equipment. Conical, spherical and complex structures. Design work by third parties. Standards. Partial guarantees. Some simple mechanization. Adequate quality and precision.

III - Workshops with complete equipment. Technological advanced operating stations. High degree of complexity. Strict quality control including welds. Guarantees. Standards. Design work by third parties.

18. Heavy boiler-making services, plate up to 1 1/4"

II - Medium-sized workshops with incomplete, conventional equipment. Partial general quality control, including welding. Adequate hoisting gear. Manual welding and semi-automatic welding sets. Medium complexity. Plate up to 2" and related sections. Some standards. Design work by third parties.

III - Well equipped workshops with some advanced machines. Standards. Correct quality control, including welding. Guarantees. High degree of complexity. Conical, spherical parts, etc. Design work by third parties and own know-how. Plate up to 4" and related sections. Adequate hoisting and materials handling gear. Machining limited to flanges, drilling and tapping.

IV - Very well equipped workshops. High quality. Standards. Guarantees. High degree of complexity. Pressure and other tests. Conical and spherical parts. Various materials. Design work by third parties and own know-how. Machining limited to flanges, some flat work, drilling and tapping.

19. Manufacture of gear-wheels or gear-cutting alone

I - Workshops with conventional, universal equipment. Parts up to medium size. Quality class IV. Standard shapes. No guarantees.

II - Medium-sized workshops. Quality class III. Parts up to medium size. Cylindrical, conical, straight and helicoidal. Simple corrections.

III - Well equipped workshops. Quality classes II and I. Great variety of tooth shapes and corrections. Excluding more complex shapes. Guarantees. Up to medium size. Strict control. For large sizes up to 5 m in diameter. Classes IV and III.

IV - Very well equipped workshop. Advanced metrology. All the most complex shapes, corrections and sizes (excluding super-heavy gear wheels). Special surface treatment and materials of highest resistance.

20. Special machining, fine and standard

I - Automatic turning of standard complexity, precision and size. Grinding, flaring, milling services etc.

II - Screw cutting. Deep hole drilling. Broaching. Splined shafts. Internal and external superfinishing. Jig boring service. Maximum quality ISO 7 and 6.

IV - The same services as in II but with maximum quality ISO 4 and 5. Well equipped workshops, air conditioning, advanced metrology. Machining centre services.

21. Medium and semi-heavy special machining

II - Complex automatic turning. Deep hole drilling. Honing, grinding, milling, broaching, jig boring. Large flat surfaces, slotting, etc. Standard quality. Adequate metrology. Incomplete guarantees.

III - Jig boring services etc. (as II) at a level of greater precision up to classes ISO 6 and 7. Complex shapes. Materials of good mechnical resistance. Adequate metrology. Guarantees.

IV - Special cases, very complex shapes. Materials of high mechanical resistance. Up to precision of class ISO 5. Construction of special tools for the operation of the service. Grinding of threads, racks, spherical parts, etc. Guarantees. High grade metrology. Air conditioning.

22. Special heavy machining

II - Vertical and horizontal turning, grinding and superfinishing. Standard and precision flaring machines. Large flat parts. Up to 25 tonnes. Cast iron, steel and boiler-making. Standard quality. Adequate guarantees. Appropriate metrology.

IV - Same as III but workshop better equipped in variety and capacity of machines (up to 50 tonnes) and precision. Single parts for sub-assemblies. Simple test benches. Advanced metrology. Good quality. Guarantees. Standards.

V - Very well equipped workshop with capacity above 50 tonnes. Special and complex cases, with test bench. Strict quality control. Stainless steel and other special materials. Guarantees. Standards.

23. Cold stamping

I - Crafts-type workshops. Primitive quality control. Small and simple parts. Small series. Conventional machinery.

II - Medium and small workshops. Standard and medium-sized parts. Limited complexity. For non-ferrous metals and normal steels. Medium precision. Adequate quality control.

III - Well-equipped workshops. Good quality. Complex progressive stamping. Deep drawing. Conventional or automatic machines. For non-ferrous metals, normal steels, stainless and other. Possibly joining of stamped pieces. Guarantees. Tests.

IV - High precision micro-stamping. Very large parts (for example, lorry chassis). Precision line stamping. Deep drawing of large parts. High degree of complexity. Some assembly. Tests, guarantees.

METAL COMPONENTS

1. Mechanical: simple machine components consisting of one or very few parts

I - Screws, washers, nuts, pins, rivets, flywheels, pulleys, levers, knobs, springs, etc. Ferrous and non-ferrous. According to geometrical standards but without the corresponding quality.

II - Great variety of shapes and sizes, more complete than I. According to geometric and quality standards. Ferrous and non-ferrous. Tempered and ground parts.

III - Special cases with regard to shape, materials and resistance. Tempered. High precision. Guarantees. Laboratory. Own know-how in some cases.

V - Components for aeronautics, aircraft engines, satellites, rockets, etc. Strict quality control. Maximum guarantee. Research laboratory. Special materials. Creative capacity.

2. Mechanical: compound machine components up to medium complexity and weight

I - Couplings, de-couplers, power limiters, gaskets, clutches, universal joints, cams, drums, brakes, levelling devices, supports, etc. With and without standards. Limited size, power, variety, performance and quality.

II - Medium and small workshops. According to geometrical and quality standards. List I expanded as to variety, power, size etc. up to normal performance. Add to the list: small variators, simple reducers of up to 25 metric horsepower, shock absorbers, etc.

III - Medium sized and larger workshops. High performance, standards, guarantees, quality control laboratories, testing stations. Variety of models and power. Complex variators, reducers, multipliers, safety devices, simple ball-bearings up to 17 mm diameter, etc. Reference power about 50 metric horsepower.

IV - The same as III, but with a greater variety of types, models, performance, power, capacity and complexity. High quality. Testing stations. Creative capacity. Ball-bearings up to medium size and for appropriate applications. R and D.

V - Added to IV: greater variety of series manufactured ball-bearings. Special ball-bearings. Components for aeronautics and the land, naval and air arms industry. Advanced R and D.

3. Mechanical: Compound machine component up to heavy, complex and special

III - The same list as 2.III in greater size, power, performance, etc. Small series. Add: reducers, gear boxes, angular take-off devices, etc. Medium-sized workshops with conventional and advanced machines. Standard quality. Normal metrology. Partial guarantees. Some standards. Power only for reference of the order of 75-100 metric horsepower.

IV - Same list as above, with greater guarantees, power, load, size and quality. Excluding ball-bearings. Power greater than 100 metric horsepower. Testing stations. Advanced metrology. Inspection stations.

V - Includes high-power equipment. One-off heavy manufacture. Special. Special ball-bearings. Solutions for land and sea military equipment. Advanced R and D.

4. Hydraulics

II - Components for low-pressure circuits up to 70 kg/cm^2. Pumps, motors, distributors, valves, cylinders, filters, tanks, etc. Simple equipment. Little variety of types and models. Normal quality and guarantees.

III - Components for moderate pressure and power. Variety of types, models, and power, though limited. Performance tests. Guarantees. High quality.

IV - Components for high pressure up to 200 kg/cm^2. Large cylinders. Further mechanisms, fluid drive and variators, testing units, dynamometers, brakes and servo-brakes, shock absorbers, accumulators, motors, etc. Medium and high power. High degree of complexity. Quality. Guarantees. Testing laboratory. R and D.

V - Special components. One-off or small series. Normal military applications. Piston aircraft engines. Public works. High degree of complexity, large dimensions. Testing stations. Developed R and D service.

VI - Very special applications for civil and military aviation, land and sea armaments, large public works and high-power machinery. Very considerable level of testing stations and R and D.

5. Pneumatics

II - Simple components, pistons, valves, distributors. Little variety as to power, flow and characteristics. Limited guarantees.

III - Quality, guarantees, operating tests. Add: humidifiers, dosing appliances, automatic valves, brakes, clutches, accumulators, filters, large pistons, engines, etc. Greater power and variety than in II.

IV - Servo-mechanisms, automatic mechanisms. Special cases for micro-mechanics. Large-scale or high-power equipment. Laboratories. R and D.

V - Very complex and large-scale applications. Components for civil and military aviation and land and sea armaments.

6. For vacuum circuits

III - Simple pumps, preparatory. Low power. Accessories for vacuum circuits. Vacuum up to 10^{-3} mm Hg. Quality. Tests. Guarantees.

V - Medium and high capacity pumps. High vacuum of less than 10^{-3} mm Hg. Complex accessories. For special industrial applications. High quality. Guarantee. Tests. Laboratory.

7. Electrics: Control and monitoring

In this speciality, more than in others, the same description covers products with very different degrees of reliability and/or performance. Therefore, to make it possible to subdivide the equipment into I to VI, there is no other option to continue by applying the general criteria already stated. That is to say that we begin at level I with very elementary products like buttons, keys, switches, alarms, etc., without strict or

clearly defined standards, passing to material for the aeronautic and space travel industries for environment that demands high reliability of operation (for example, tests against explosions) for the armaments industry etc., all the latter being divided between V and VI.

8. Electrics: For power circuits

The same general approach is adopted as in point 7. Here also the categories go from I to VI.

9. Electronics

IV - Vacuum and gas tubes, simple series. Semi-conductors (resistances and capacitors). Printed circuits. R and D.

V - Vacuum and gas-filled tubes. Semi-conductors (resistances, capacitors, active parts, etc.). Advanced R and D.

VI - Special material. Military applications. Micro-miniaturization. Very advanced R and D.

10. Linear and angular measurement

III - Mechanical appliances that can be incorporated in machines with precision of 1/10 and 1/20 mm. Circular and linear division services.

IV - Appliances and instruments for mechanical measuring, precision 1/50 and 1/100 mm, capable of being incorporated in machines. Solex and similar appliances. Automatic gauges. Pneumatic measuring devices. Laboratory.

V - All types with visual read-out. Automatic positioners. NC and CNC. Optical and optical-electric measurement devices. Mar-Poss and similar appliances. R and D.

11. Lubrication

I - Static elements for greasing and oiling points. Pressure or gravity types. Simple seals, axial and rotary. Grease guns. Sprayers. Medium quality. Some standards.

II - To standards. Quality. Great variety of components, distributors, dosing appliances, manual and mechanized pumps, gauges, safety, etc. Guarantees.

III - Automatic lubrication circuits, small and medium power. Hydrostatic and hydrodynamic versions. Constant temperature. Filters. Laboratory and testing station. High quality. Guarantees.

V - For high-power automatic circuits. Special cases. Programmed pumps. Applications for aviation, aeroturbines, gas and steam turbines, nuclear energy, etc. High quality. Strict controls, tests, guarantees. R and D.

12. Refrigeration (excluding compressors)

II - For refrigerating liquids: pumps, distributors, dosing appliances, filters, cooling and decanting tanks, etc. Simple, manual, normal quality. Some standards. Partial guarantees.

III - For refrigerating liquids; semi-automatic circuits of up to medium flow, safety. Standards, guarantees, tests.

For refrigeration circuits: simple low-power components, manual or semi-automatic. Quality, standards, guarantees.

For refrigeration circuits: automatic components for all capacities. High complexity, precision, quality and safety. Laboratories. R and D.

IV - For refrigeration liquids: automatic circuits. Any flow. Magnetic and other purifiers. Refrigeration centres. Quality, standards, test benches.

V - For refrigerating liquids: special cases with or without contamination. Laboratory.

13. Temperature, flow, pressure, humidity, electrical metering, etc.

III - Elementary instruments for liquids, gases and electricity. Little variety. Limited precision of reading. To standards. Guarantees. Tests.

IV - Increase in variety and precision - situation intermediate between elementary and advanced. Complex instruments. Standards. Guarantees. Tests. Laboratories.

V - High precision of readings. Compound and complex recording instruments. Very large and small power. Special cases for industry. Laboratory. Considerable R and D.

VI - Application for aeronautics, space travel, satellites, rocketry. Military industry in general. Advanced R and D.

14. Optics

III - Manufacture of simple apparatus. Normal lenses. Combination with normal mechanical appliances.

IV - Optics combined with micro-electro-mechanics. Precision reading apparatus. Coated lenses. Optical assemblies. Guarantees. High quality. Laboratories.

V - Optical equipment for invisible radiation (Hertzian, infra-red, ultra-violet, etc.). Most usual applications. Advanced R and D. Optics for visible radiation with micro-mechanics. High-precision and complex optics for cine cameras, still cameras, etc. Considerable R and D.

VI - Complex and specialized military application. Advanced R and D.

Annex IIa

Definition of the six complexity levels
for factors relating to the central unit

	1	2	3	4	5	6
Hs Number of hours of know-how for $1,000 of product	< 1 hour	1 to 2	2 to 4	4 to 7	7 to 10	> 10
P Type of industry	light to medium industry	medium industry	semi-heavy industry	heavy industry	very heavy industry	high-precision industry
Hd Number of direct hours of labour per tonne of product	< 200	200 to 400	400 to 800	800 to 1600	1600 to 3200	> 3200
S Production runs	very long runs	1000 to 500 units	500 to 100	1 to 3 per month	Repetitive unit production	Special non-repetitive production
T Number of employees	50 to 100	100 to 250	250 to 500	500 to 1000	1000 to 3000	> 3000
M Erection - assembly						

Annex III

Technical characterization of the four levels of complexity

Capital goods industry of Bulgaria

SHEETS	FOUNDRY	FORGING	SHEET, TUBE AND PROFILE WORKING	HEAT TREATMENT	ASSEMBLING	MACHINING	ASSEMBLY LENE	PAINTING	TESTING AND INSPECTION
1	2	3	4	5	6	7	8	9	10
381. Manufacture of fabricated metal products except machinery and equipment									
001	-	-	3	-	2	1	1	1	-
002	-	2	3	-	3	2	2	2	2
003	-	3	3	3	3	-	-	-	2
004	-	3	3	3	-	2	-	-	2
005	4	-	-	3	-	4	-	-	2

013	4	4	4	3	3	4	3	2	3
014	2	3	3	2	2	2	3	2	2
015	2	2	3	2	2	2	3	2	3
016	2	2	3	2	2	2	3	2	2
017	2	2	3	2	2	2	2	2	3
018	2	3	3	2	2	2	2	2	3
019	-	2	3	-	2	2	1	2	2
020	-	3	3	-	4	-	3	3	2
021	3	3	-	3	-	3	-	-	3
022	2	2	-	2	-	2	-	-	3
023	2	3	2	3	3	3	2	2	3
024	2	3	2	3	3	3	2	2	3
025	3	3	2	3	3	4	2	3	3
026	2	3	3	2	3	3	2	2	3
027	2	2	3	2	2	2	2	2	2

SHEETS	FOUNDRY	FORGING	SHEET, TUBE AND PROFILE WORKING	HEAT TREATMENT	ASSEMBLING	MACHINING	ASSEMBLY LINE	PAINTING	TESTING AND INSPECTION
1	2	3	4	5	6	7	8	9	10
382. Manufacture of machinery except electrical									
006	4	3	-	2	-	4	4	2	4
007	2	3	3	2	2	3	2	2	3
008	3	3	-	3	-	4	-	-	3
009	2	3	3	2	2	3	-	2	3
010	4	4	4	3	3	4	4	3	4
011	4	4	4	3	3	4	4	3	4
012	4	4	4	3	3	4	4	3	4

1	2	3	4	5	6	7	8	9	10	
028	2	3	3	2	2	3	2	2	3	
029	2	2	3	2	2	3	2	2	3	
030	2	2	-	2	-	3	-	-	3	
031	2	2	3	-	3	2	1	2	2	
032	3	3	3	3	3	4	2	2	4	
033	2	2	-	-	2	2	-	-	1	
034	3	3	3	3	3	4	2	2	2	3
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036	-	2	3	-	2	3	2	2	3	
037	2	2	3	2	2	3	4	3	3	
038	2	2	3	2	2	2	1	1	2	
039	-	2	2	2	2	2	1	1	2	
040	2	2	3	2	2	2	2	2	2	
041	-	3	3	-	3	2	2	2	2	
042	-	-	3	-	2	2	1	1	2	
043	3	3	3	2	3	3	2	2	3	
044	2	3	3	2	3	3	2	2	3	
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047	2	2	2	2	2	1	2	2	-	
048	-	3	2	-	3	2	2	2	2	
049	-	-	3	-	3	-	1	2	2	
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079	2	3	3	3	3	3	2	3	4
080	2	3	3	3	3	3	2	1	2
081	2	3	3	2	3	3	3	2	3
082	2	3	3	-	3	2	2	2	2

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084	-	-	3	-	2	2	3	3	3
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087	2	2	4	2	3	2	2	1	3
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110	3	3	-	2	3	3	3	3	3
111	-	3	-	3	-	4	-	-	2
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139	2	-	3	-	2	2	3	3	2
140	2	-	3	2	2	3	3	3	3
141	2	-	2	-	2	2	2	2	2

SHEETS	FOUNDRY	FORGING	SHEET, TUBE AND PROFILE WORKING	HEAT TREATMENT	ASSEMBLING	MACHINING	ASSEMBLY LINE	PAINTING	TESTING AND INSPECTION
1	2	3	4	5	6	7	8	9	10
383. Manufacture of electrical machinery, equipment, accessories and supplies									
126	3	-	3	-	2	3	3	3	3
127	3	-	3	-	-	3	3	3	3
128	3	-	3	-	2	3	2	3	3

146	2	2	4	2	4	3	2	1	3
147	2	2	-	2	-	2	-	1	2
148	2	2	-	2	2	2	-	1	2
149	2	2	-	2	-	2	-	1	2
150	2	3	3	2	3	2	2	2	3
151	2	3	3	2	3	2	2	2	3
152	2	3	4	3	3	2	2	2	3
153	3	3	-	3	2	2	-	3	2
154	3	3	-	3	2	3	-	-	3
155	3	3	3	3	-	2	-	-	2
156	4	4	4	4	3	4	4	4	4
157	-	-	3	-	3	-	2	2	2
158	-	-	3	-	3	-	2	2	2

SHEETS	FOUNDRY	FORGING	SHEET, TUBE AND PROFILE WORKING	HEAT TREATMENT	ASSEMBLING	MACHINING	ASSEMBLY LINE	PAINTING	TESTING AND INSPECTION
1	2	3	4	5	6	7	8	9	10
	384. Construction of transport equipment								
142	2	2	4	2	4	3	2	1	3
143	2	2	4	2	4	3	2	1	3
144	2	2	4	2	4	3	2	1	3
145	2	2	4	2	4	3	2	1	3

and measurement and control instruments

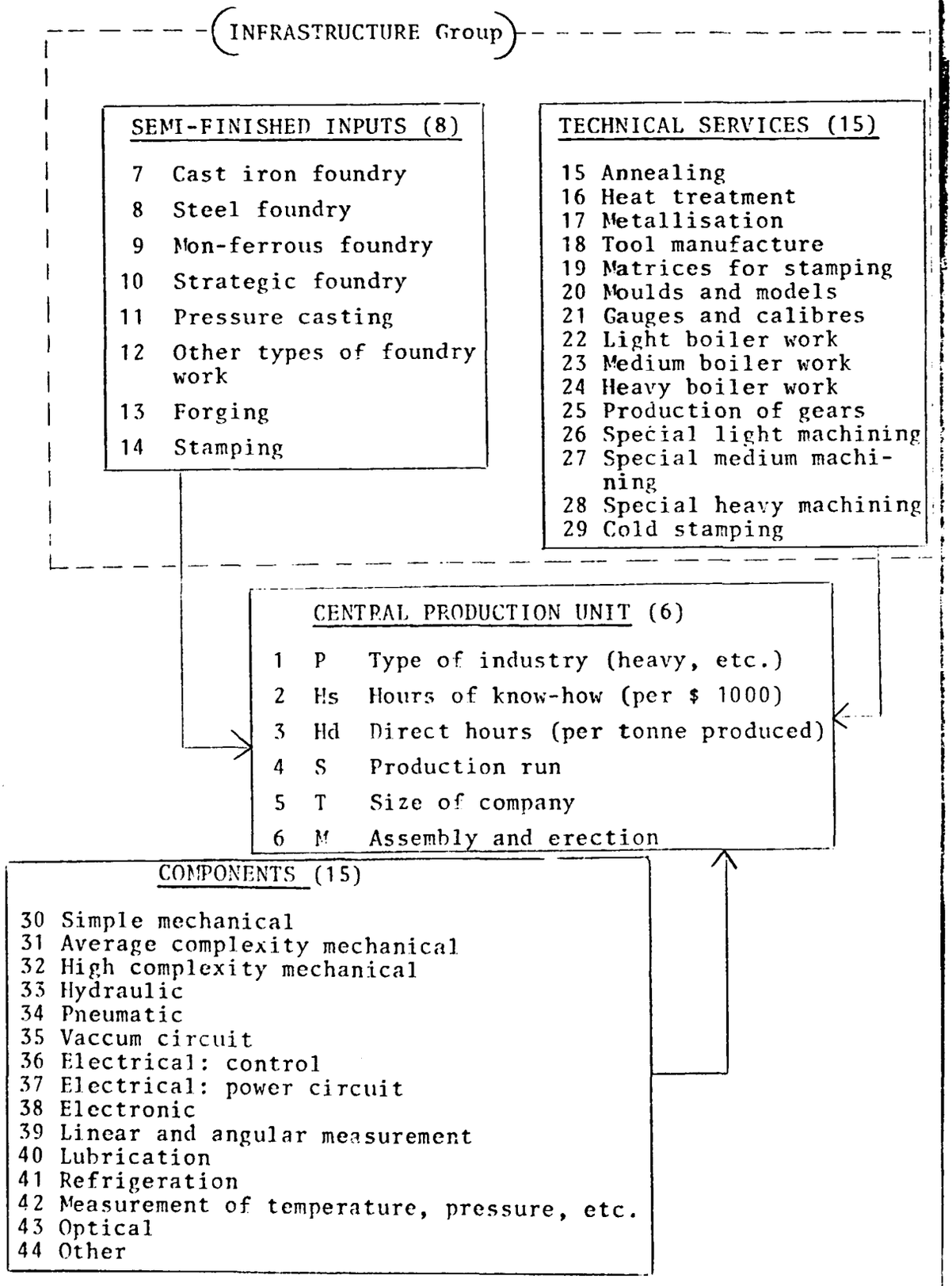
159	3	2	3	2	-	4	2	-	4
160	-	-	-	2	-	4	2	-	4
161	2	2	-	2	-	3	2	3	3
162	2	2	-	2	-	3	2	3	3
163	-	-	-	-	-	3	3	3	3
164	2	3	3	3	2	2	2	-	2
165	2	-	3	2	2	4	2	3	3
166	2	2	3	-	2	2	2	3	1
167	-	-	-	-	-	3	3	2	3

385. Manufacture of professional and scientific equipment

1	SHEETS
2	FOUNDRY
3	FORGING
4	SHEET, TUBE AND PROFILE WORKING
5	HEAT TREATMENT
6	ASSEMBLING
7	MACHINING
8	ASSEMBLY LINE
9	PAINTING
10	TESTING AND INSPECTION

Annex IV

Arragement of all the technical factors



TECHNICAL CHARACTERIZATION OF THE FOUR LEVELS OF COMPLEXITY OF FOUNDRY, FORGING, SHEET/TUBE AND PROFILE WORKING

	FOUNDRY	FORGING	SHEET, TUBE AND PROFILE WORKING
Level 1	-Manual sand preparation -Manual moulding with tools -Simple oil furnace melting -Casting with smelted-material hand transport -Hand shake-out and knock-out -Trimming with hand tools	-Simple oil- or coal-furnace heating -Loose tool forging -Hand swaging -Hand straightening	-Cutting with snips, hand hacksaw and hand torch, hand lever, shearing machine -Hand torch scribing -Hand bending -Hand 3-roller rolling
Level 2	-Sand preparation with mixing machine -Manual moulding with wooden patterns -Oil fired blast cupola melting -Casting with smelted-material crane transport -Hand shake-out and knockout -Trimming with hand-controlled sand-blasting	-Oil- or electric furnace heating -Hammer forging -Hand swaging and straightening	-S[illegible] machine and hacksaw machine cutting -Hand scribing -Use of punching, 3-roller rolling and bending machines -Limited sized machines
Level 3	-Sand preparation with mixing and proportioning machine -Machine moulding with pattern -Automatic furnace melting -Semi-automatic casting and shake-out equipment -Shot blasting and drum cleaning machines -Manual sandblasting	-Electric furnace heating -Die stamp forging -Hot-trimming machine -Straightening press	-Shearing machine and automatic sawing machine cutting -Electric etching pantograph scribing -Use of large sized punching press, 3-roller rolling, bending machines -Use of limited sized hydraulic, eccentric shaft presses
Level 4	-Fully automatic plant with machine preparation, melting in finished charge electric automatic cupola, automatic casting, etc. Special castings	-Induction heating -Closed-die forging -Automatic hot-trimming and straightening system	-Use of large sized presses -Possibility of deep-drawing -Automatic forming pressing cycles

TECHNICAL CHARACTERIZATION OF THE FOUR LEVELS OF COMPLEXITY OF HEAT TREATMENT, ASSEMBLING, MACHINING

	HEAT TREATMENT	ASSEMBLING	MACHINING
Level 1	-Simple continuous heating and water quenching tentative hardening	-Electrode arc-welding -No jigs	-Hand hacksaw cutting -Universal lathe turning -Drilling -Hand tapping and threading -Not very accurate machine-tools and no cure workings
Level 2	-Oil furnace heating -Hardening in high-heat salt bath -Possibility of tempering, normalizing, annealing	-Electrode arc-welding -Spot welding -Use of clamp jigs, small presses	-Bandsaw machine cutting -Hydrocopying lathe turning -Use of milling and shaping machines -Lathe tapping and threading -More accurate machine-tools
Level 3	-Gas heating in fully instrumented furnaces -Possibility of case hardening, nitriding, etc. -Semi-continuous cycling	-Continuous rod arc-welding -Sheet flanging -Use of semi-automatic jigs, large presses	-Automatic sawing machine cutting -Turret lathe turning -Use of grinding, boring, column drilling, grinding machines, gear-cutting
Level 4	-Heat treatment continuous transfer line. -Special treatments	-Seam resistance welding -Automatic and special weldings -Robot multiple spot welding -Automatic jigs	-Use of all other available machine-tools (planing machine, special gear cutting machine, etc; multiple-spindle lathe, drilling machine, etc.) -Use of numerical control machine tools and transfer machines -Special machining

TECHNICAL CHARACTERIZATION OF THE FOUR LEVELS OF COMPLEXITY OF ASSEMBLY LINE, PAINTING, TESTING AND INSPECTION

	ASSEMBLY LINE	PAINTING	TESTING AND INSPECTION
Level 1	-Stationary assembly -Hand tools and fixtures	-Hand painting	-Nil
Level 2	-Stationary assembly -Electric hand tools and fixtures	-Spray painting with drying chamber	-Sampling inspection -No test
Level 3	-Assembly line -Electric hand tools and fixtures	-Pickling, painting and drying tunnel	-Detailed inspection of parts and groups -Engine, group testing, balancing, final test
Level 4	-Fully automatic assembly line -Timed step conveyors	-Automatic continuous pickling, painting and drying cycle	-Specific electronic inspection and testing