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Structural Changes and Productivity

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Contents

I. Introduction

We can estimate that about 20 per cent of productivity growth are the result of structural changes. Manpower and capital are permanently redistributed in such a way that sectors, branches, or enterprises with an under average level of productivity will be contracted, whereas highly productive industries will be expanded. The consequence is a rising average level of productivity, partly achieved without investments. This comes true to structural changes of

- production programmes,
- applied technologies,
- applied raw materials,
- foreign trade,
- qualification of the employees,
- quality of the articles, etc.

All these factors are closely connected.

A simple example may illustrate what we have in mind. All over the world production and utilization of mineral oil is competing successfully with coal. This process leads to a whole system of structural changes. The substitution of coal by petroleum as raw material in chemical industry requires far-reaching changes of the applied technologies as well as of the transport methods (pipelines). The productivity raising consequences cannot be overestimated. There is for instance the process of converting energy supply from coal to oil. In 1920 only about 10 per cent of world energy demand had been covered by mineral oil, in 1962 about 50 per cent.[1] The data listed

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1) F. Baade, Der Wettlauf Zum Jahr 2000(The Run to the year 2000), Oldenburg 1961, p. 162/163; World Energy Supply, 1959-1962, United Nations, Statistical Papers, Series J, No. 7, p. 9.

in the following table 1 are partly an expression and a result of this "substitution effect":

Table 1

The development of some main indicators of thermo-power stations, 1913 = 100.[1)]

	1913	1962
average performances of the stations	100	6000
utilization of capacities	100	218
consumption of fuel per watt/hour	100	50
labour productivity	100	1160
cost per unit	100	18

Nowadays the production of chemicals is based upon mineral oil processing: in USA 80 per cent,
in France 70 per cent, and
in West Germany 44 per cent,[2)]

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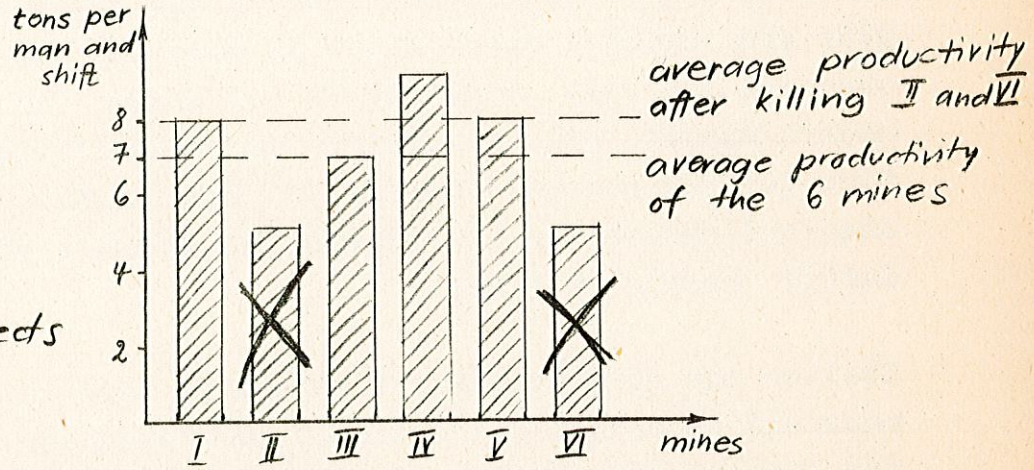
1) Bartashev, Economic calculation of Projects and of Production of Machines, Moskou 1963, p. 11.

2) Wyschofsky, Die chemische Industrie, ein führender Industriezweig (Chemical Industry, a leading Branch), Berlin (GDR) 1964, p. 43.

In the German Democratic Republic we are making many efforts to shift our chemical industry, which is up till now mainly based upon the processing of soft coal, to mineral oil, despite the fact that we are forced to import this raw material. Some of the convincing results: The five stages of the production of butadine are now reduced to only two stages, and the cost per ton are cut down to 43 per cent. A second example: The annual per capita performance in one of our new mineral oil processing plants (in Schwedt) amounts to 700 000 German Marks gross production. Some comparisons: The average gross production per year and employee makes about 39 000, the average of the entire chemical industry is nearly 76 000 Marks (in 1963). That means, modern mineral oil processings are characterized by a production per man which is nearly 10 times higher than in other chemical industries and exceeds the average of the entire industry nearly 20 times.

Besides the pure structural effect we have to consider the manifold secondary and indirect consequences. So for instance the growing possibility to apply the products of mineral oil processing, such as plastics and synthetic fibres, in nearly all economic fields, substituting more expensive or less suitable raw materials, such as metals, wood, glass, wool; etc., as well as enabling us to apply new and improved technologies. On the other hand even the negative structural changes, the reduction of outdated technologies and productions, is linked up with productivity raising tendencies. So for example the far-reaching reduction of coal mining capacities in West Germany is connected with a remarkable growth of productivity. Of course the mines with low productivity would have been closed firstly. A simplified example may illustrate the productivity

effect. We assume that there are six mines (I,..., VI) with equal shares in coal production (in order to avoid the necessity to weight the shares) but with different performances expressed in tons per man and shift, in our first case 8, 5, 7, 9, 8, and 5 tons. The average productivity of the whole coal mining is than equal to 7 (42 : 6). After stopping production of mine II and VI we obtain the new average of 8(32 : 4), as shown in the sketch:



Sketch 1:
Productivity raising effects

The increase of productivity from 7 to 8 tons per man, i.e. an increase from 100 to 114 per cent, is not the sole result. The necessary reduction of employed persons is connected with an improvement of the manpower structure, that means the skilled and young workers will keep their jobs and will continue to work in the remaining mines. In addition to our first sketch we can draw a second one which equals the first completely, only instead of mines we have workers. It is to say, that such processes have a lot of unsocial aspects, in particular under imperialism.

The same idea is the starting point to economize many kinds of economic processes, such as the determination of optimum production programmes by selecting the most efficient articles, raw materials, and methods out of respective series of possibilities. Or, in the field of foreign trade, to concentrate efforts an articles which can be sold (respectively bought) abroad with highest effectivity, in accordance with the theory of comparative costs. The most sufficient results can be obtained by structural changes in international areas, leading to international division of labour of highest efficiency.

II. Measurement of structural effects

Starting point to calculate structural effects are data regarding the productivity of the entire economy:

$$p = \sum p_s \times a_s \qquad (1)$$

In this formular p stands for productivity in general, p_s for productivity of a partial system, such as sectors, branches or enterprises, and a_s in the share of the partial system s, expressed in percentages of employees.

Compared with a basic year (o) a change can be caused either by the growth of p_s or by the alterations of a_s, at last it is possible that both factors differ compared with the basic period. In order to analyse the factors affecting productivity we want to eliminate and to determine the influence of structural changes. Therefore we calculate the actual productivity, expressed by the production per worker, under the assumption of a constant employment structure, i.e. intersectoral or interbranch structure:

$$p^1 = \sum p_s \times a_{s,o} \qquad (2)$$

That means we multiply the actual partial productivity by the shares of the basic year. The increase of productivity due to structural changes than can be calculated with the aid of the following formula:

$$p - p^1 = \sum p_s \times a_s - \sum p_s \times a_{s,o} = \sum p_s \times \Delta a_s \qquad (3)$$

In words: We ascertain the difference between the real productivity growth and the development of productivity under the assumption of a constant structure. This difference can provide us with an idea about the quantitative extent of the productivity development caused by structural changes. We obtain only the pure and direct structural effects, not the widespread and far reaching indirect effects. In our formula (3) Δa_s is the difference between the share of employees in each branch or sector in the basis period and in the period under report.

As an example we will use these formulas to calculate the productivity increase caused by structural changes in the industry of the GDR 1964 compared with 1963. The basic data are listed in the following table:

Table 2[1)]

Structural changes in the industry of the GDR, 1963 - 1964

Sectors	p gross production per employee in fixed prices		a employees, annual average, in per cent		Δa difference of employment shares
	1963	1964	1963	1964	
Basic industries	32944	32294	26.2	26.9	+ 0.7
Metal processing	28057	30280	38.1	37.5	- 0.6
Light industries	21597	22935	28.3	28.1	- 0.2
Foodstuffs	53171	55995	7.4	7.5	+ 0.1
average or sum	≈29400	≈30680	100.0	100.0	± 0

As the table shows we have increasing shares of employment in both sectors with higher performances per worker than it is achieved in average, i.e. in basic industries and in the branches manufacturing foodstuffs. That means we can expect a positive structural effect, despite the fact that the gross production per worker (expressed in constant plan prices) decreased in the basic industries. The calculation process runs as follows:

$$p - p^1 = \sum p_s \times \Delta a_s$$

$$p - p^1 = (32294 \frac{+0.7}{100}) + (30280 \frac{-0.6}{100}) + (22935 \frac{-0.2}{100}) + (55995 \frac{+0.1}{100})$$

$$p - p^1 = 226.1 + (-181.7) + (-45.9) + 559.95$$

$$\underline{p - p^1 = 54.50} \text{ (Marks per worker)}$$

1) Own calculations based upon the data given in the Statistical Yearbooks of the German Democratic Republic, 1964 and 1965.

The result is that we have a structural effect of additional 54.50 German Marks gross production per worker. Multiplied by the number of workers (2.7 million) employed in the GDR industry in 1964 we obtain the total increase of 148,636,978 Marks Compared with the whole increase of gross production, which amounts from 1963 to 1964 to more than 2 milliard, seven per cent of the whole increase are a result of structural changes. This result cannot express the structural effect completely, in reality it must be higher. We have to consider that the used data are aggregated to a high degree. The four sectors are composition of many branches, and the interbranch changes are eliminated. The growth of gross production of metal processing light industry, and the foodstuffs manufacturing industries is of course partly a result of structural changes inside these sectors. In order to calculate the entire structural effect we have to disaggregate the sectors so far as possible. We did not include also structural changes of the production programmes from enterprise to enterprise, or even inside the enterprises.

Furthermore we have to keep in mind the following points, if we want to discuss and to estimate the results of our calculation completely:

1. One of the main resources of structural effects are changes between the main spheres of the economy, such as agriculture - industry - transport - trade - services. We considered only the industry.

2. The indicator gross production per employee is not very suitable. It is better to measure the productivity growth using the indicator national

income per productive worker. The contributions of the sectors to the production of the national income differ from those to the gross production. It is even possible that a decreasing gross production is connected with a constant or increasing national income, which would be very a sufficient result, and vice versa.

3. The fixed plan prices deviate from the real values, so that our results can be distorted.

For reasons of information I would like to add a calculation of the structural effect in the economic development of West Germany. The computation has been carried out by the German Economic Institute, Berlin:

Table 3[1)]

The contributions of the sectors to the structural growth in West Germany, 1950 to 1964

Sectors	employment (in per cent)		dispersion of production per employee*)		contributions to be structural effect	
	1950	1964	1950	1964	million Marks	per cent
agriculture	27.6	13.4	42	48	+ 12405	+ 77.4
mining and energy	4.1	3.0	191	185	- 1042	- 6.5
processing industry	25.7	34.4	127	128	+ 3060	+ 19.1
processing crafts	10.2	7.8	68	72	+ 1197	+ 7.5
construction	7.8	9.6	76	65	- 1039	- 6.5
trade	10.9	15.0	140	96	+ 752	+ 4.7
transport	6.6	6.5	123	95	+ 60	+ 0.4
private services**)	7.1	10.3	169	113	+ 624	+ 3.9
Total**)	100.0	100.0	100	100	+ 16017	100

*) Average productivity of the entire economy = 100

**) Without public services

Also this calculation does not include the total structural effect caused by the rather high degree of aggregation. The 16 milliard are about 9 per cent of the whole growth during this period.

1) Research Papers of the German Economic Institute, 1/1967, Berlin (GDR), "Structural Changes, Economic Growth and Economic Policy in West Germany", p. 39.

At last I calculated the expected structural effect of the development in the United Arab Republic. The basic data are listed in the following table 4:

Table 4[1)]

Structural Changes of the UAR Economy and Structural Effects from 1965 to 1970

	national income (million L.E.)		labour forces (1000)		national income per worker (L.E.)		labour forces (per cent)		Δa_s
	1965	1970	64/65	69/70	1965	1970	64/65	69/70	
agriculture	512	627	3628	4261	141	147	50.2	47.9	-2.3
industry	517	773	836	1101	619	702	11.5	12.4	+0.9
construction	51	75	358	498	142	151	4.9	5.6	+0.7
electricity	33	40	22	32	1500	1562	0.3	0.4	+0.1
transport, trade etc.	683	1049	2393	2990	285	347	33.1	33.7	+0.6
total	1795	2564	7237	8881	248	282	100.0	100.0	±0

Using our formula $p-p^1 = \sum p_s \Delta a_s$ we calculate:

$$p-p^1 = (147 \frac{-2.3}{100}) + (702 \frac{0.9}{100}) + (151 \frac{0.7}{100}) + (1562 \frac{0.1}{100}) + (347 \frac{0.6}{100})$$

$$p-p^1 = -3.38 + 6.32 + 1.06 + 1.56 + 2.08 = \underline{7.64 \text{ L.E.}}$$

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1) The basic data are taken from "Manpower Planning in the United Arab Republic", JNP, Nov. 1966, Appendix I, Table 6 and 7.

We obtained a structural contribution per employee of 7.64 L.E., multiplied by the number of the workers estimated for 1969/1970 (8881 thousand) we obtain 67,850,840.00 L.E. as total structural effect. Compared with the total growth of the national income which amounts to 769 million L.E., the share of the structural effects is than about 9 per cent of the total growth.

A second method to measure the structural effect may give us the possibility to control our results, and, on the other hand, to show the contribution of each sector to the total effect. The contribution of the sectors to the growth caused by structural changes can be calculated using the following formula:

$$C_s = (p_s - p_t) \Delta a_s$$

The total structural effect equals than the sum of the sectoral contributions:

$$\sum C_s = \sum (p_s - p_t) \Delta a_s$$

The signs stand for :

C_s = contribution of each sector

p_t = total (average) performance (national income) per worker.

The following table contains all the needed data and the results of the calculation :

Table 5

The Contributions of the Sectors to the Structural Effect, U.A.R., 1965-1970.

	p_s sectoral performances	$p_s - p_t$ difference betw. sectoral and average performance	Δa_s structural changes	c_s contribution of the sectors
agriculture	147	-135	-2.3	+3.11
industry	702	+420	+0.9	+3.78
construction	151	-131	+0.7	-0.92
electricity	1562	+1280	+0.1	+1.28
transport, trade etc.	347	+ 65	+0.6	+0.39
total	282	-	-	+7.64

Firstly we see that the result is the same as obtained in our former calculation : 7.64 L.E. per worker. Furthermore the shares of each sector become evident. The relative reduction of agriculture on the one hand and the expansion of industry on the other hand are the most important factors creating positive structural effects.

In general we have two possibilities to obtain positive effects: firstly by reducing the share of the sectors with a productivity under the average, as it happens in agriculture, secondly by expanding the sectors with over average productivity, such as industry and electricity.

A growing share of sectors with under average productivity as well as the reduction of advanced sectors will lead to negative effects. The planned development of the UAR economy shows such a negative effect caused by the expansion of the construction sector, which is up till now very labour intensive.

III. Main directions of structural changes

1. Intersectoral changes.

The most significant intersectoral changes which take place parallel to the industrialization process are:

- the at last absolute decline of employment in agriculture and the relative reduction of the share of rural contributions to the gross national product respectively to the national income;
- the relative and absolute expansion of industry from the view point of employment as well as of production. This occurs in different stages. From a certain level of industrialization further production increase can be achieved mainly by rising productivity. Such an intensive growth hardly demands more additional workers than it might be met by the population growth, so that the share of industrial employed persons can be constant or even declining, in particular under the conditions of advanced automation;
- the service sector will increase as the standard of living goes up, caused by the achievements and requirements in the fields of education, science , health service, entertainment, etc. so for example in the United States, as our decade opens, the number of employees in services exceeded that of production, as the following table 6 shows:

Table 6[1)]

Employment structure of the USA, 1960

	Millions	Percent
Manufacturing	16	27.3
Agriculture	6	10.0
Construction	3	5.1
Mining	1	2.0
Production industries total	26	44.4
Trade	11.5	19.7
Government services	8	13.7
Transport and public utilities	4	6.8
Finance, insurance, real estate	2.5	4.3
All other services	6.5	11.1
Services total	32.5	55.6

Even if we look at the employees in the transportation sector as a part of the productive workers, as it may be done so far as transportation is attached to production process, even under that condition the service employees have surpassed the productive ones. It is expected that only a very small part of the working population will be needed to produce the goods we require in the year 2000.

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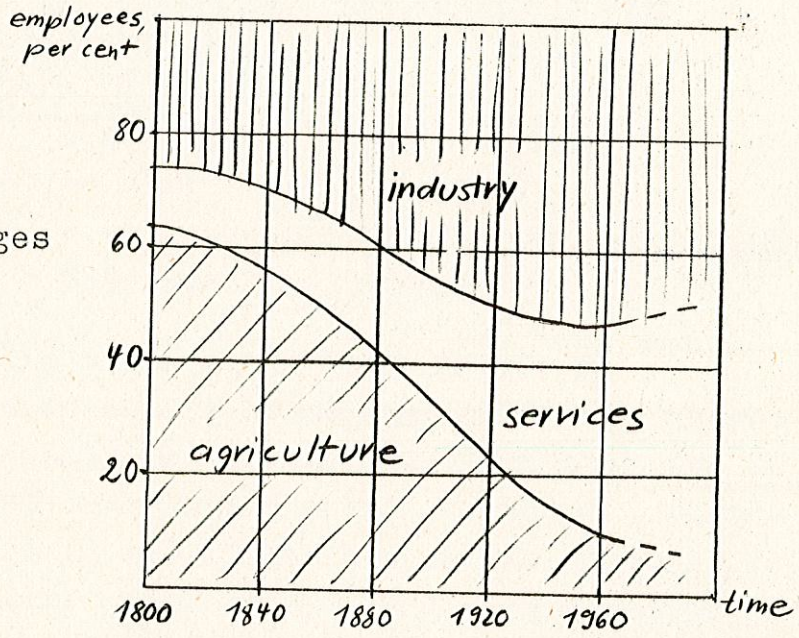
1) From U.S. Department of Labor, Manpower Challenge of the 1960 s, (Washington, D.C.:U.S. Government Printing Office 1960).

It is the"Great Hope at the 20 the Century" , expressed by Jean Fourastié, the French economist, in his book with the same title, that the danger of unemployment will be overcome by the growing manpower demand of the service sectors.

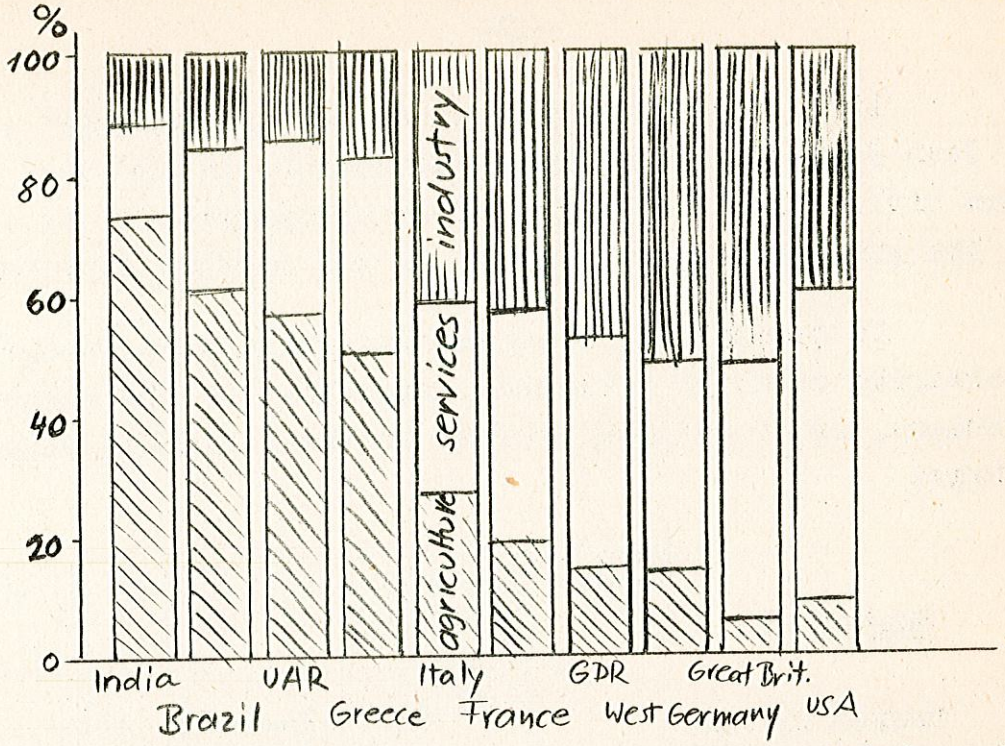
In general the European industrialized countries show a changing economic structure, expressed by the shares of employment, as it becomes evident in the following simplified scheme:

Sketch 2:

Trends of the intersectoral changes of employment



Substituting the historical and temporal sequence of structural changes by a comparison of the employment structure of several countries at the time being, the obtained picture (sketch 3) is similar to the historical one :



Sketch 3 : Employment structure of selected countries at the beginning of the 1960 th's.

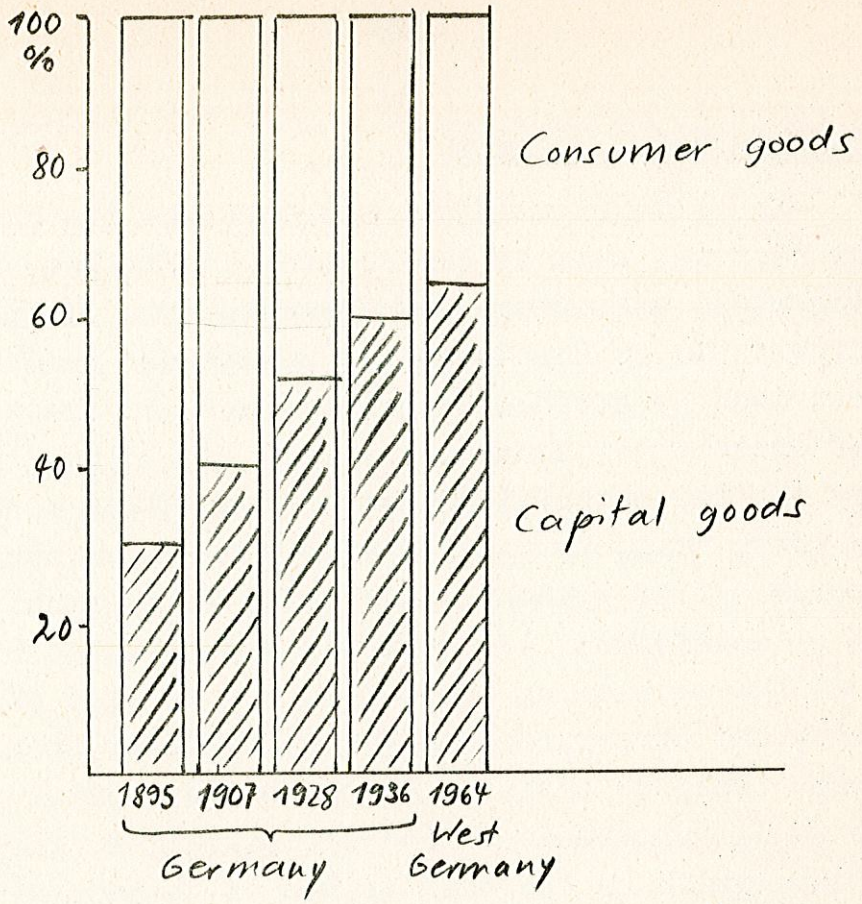
Of course we would obtain a different picture by comparing not the employment relations but the contributions of the sectors to the creation of national income or gross national product. In the U.A.R. for example the contribution of industry to the national income is nearly the same as that of agriculture, caused by the fact, that the labour productivity level in industry is about four times higher than it is in agriculture. But that is just what we want to emphasize: we have to know the differences between the productivity levels of the sectors in order to plan and to achieve structural effects.

2. Interindustrial changes

The interindustrial structure and its changes depend on many factors, such as the natural conditions of the countries, the whole historical development, etc. Compelled by imperialistic states the dependent countries' industry might be characterized by serious disproportions, by the sole development of extractive industries , such as mining, in order to satisfy the raw material demand of the ruling countries, and, on the other hand, by the complete lack of an own tool machine production. It is evident, that under those conditions the dynamics of development are strictly determinated by the urgent needs of the developing countries. It is also obvious, that structure and structural changes must differ from countrie to countrie. Despite these differences there exist some general trends in all processes of industrialization, forced by economic laws, determined by the main trends of technological and scientific progress. We will try to give a short survey on those main directions of structural changes.

a) Superiority of capital goods

Especially during the earlier stages of industrialization exists a distinct priority of the production of capital goods, such as raw materials, intermediate goods, and equipments, compared with consumer goods. It is proved by statistal data of all countries, that the growth rate of the production of capital goods is higher than that of consumer goods. The following sketch shows the ratio between both parts of industry in Germany.



Sketch 4: [1] Development of the relation between the production of capital goods and consumer goods in Germany

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1) Sources: W.Hoffmann, Stages and Types of Industrialization, Jena 1931, P. 179-181; DWJ - Research - Papers, No. 1/1967, Berlin, P. 17;

See also: Patterns of Industrial Growth 1938-1958, United Nations, New York, 1960, P. 98.

Some data about the development in the Soviet Union are listed in table 7 :

Table 7[1)]

Growth of industrial gross production , of production of capital goods , and of consumer goods in the Soviet Union.

		gross production	capital goods	consumer goods
1940-1958	(1940=100)	430	536	277
1958-1965	(1958=100)	184	196	160
1965-1970	(1965=100)	147-150	149-152	143-146

The figures of the first period are not typical. They are a result of the second world war and show the great efforts made by the Soviet Union to overcome the devastations and demolitions of the war. Furthermore it is evident that the difference between the growth rates of both main departments of industry declines in accordance with the stage of industrialization. In the United States for instance the two parts developed nearly parallel in the last years, the share of department I, production of capital goods, increased from 1947 to 1964 only from 66.5 to 67.8 percent of the industrial gross product.

1)The Soviet Union in Figures 1965 Moshva 1966, P. 54 A.N. Kossygin, On the Outline of the Five Plan 1966-1970, Berlin 1966, P. 97.

The superiority of the growth of capital goods production is caused mainly by the increase of labour productivity, of technical progress. The development of labour productivity is indicated by the relation between production and manpower. The higher productivity the less workers are needed to produce a certain volume of goods, or, the other way round, the same volume of products can be produced by a decreasing number of workers or man hours. So the reproduction of manpower requires consumer goods, the demand for capital goods will exceed that for consumer goods, expressing the fact that each unit of manpower is able to process a growing volume of raw materials with the aid of an also growing volume and value of equipments per worker:

Table 8[1)]

Consumption of means of production in GDR industry, 1950 and 1963.

	1950	1963
1. Consumption of means of production in Million Marks	13822	49644
1950=100	100	375
2. Employees, in 1000	1900	2785
1950=100	100	146
3. Funds per employee, in Marks	7270	17800
1950=100	100	250

1) Statistical Yearbooks of the GDR.

Each worker processed 1963 in average 2.5 times more capital goods than 1950. While the number of workers increased to 146 per cent of the 1950 level, the consumption of raw material and equipment increased to 375 per cent. Of course such a development is impossible without a faster growth of the production of capital goods compared with that of consumer goods -despite the fact of growing wages and living standard. The reasons why the growth rates of both departments are nearly the same in highly developed countries in the last decades are :

1. Successful imporvement of the economy of raw materials. Material inputs per product are declining, expensive materials are substituted by cheap ones in many cases. The rate of the utilization of raw and auxiliary materials, of energy etc. has been improved.
2. There is a tendency to reduce volume and value of equipments despite their increasing effectivity.
3. On the other hand we find a tendency to growing labour costs per worker, caused by increasing educational and professional requirements and wage growth.
4. Social consumption is rapidly growing.

b) Main directions of technical progress

The structural changes are determined by the main directions of technical-scientific progress. We can subdivide industry in three development types with regards to their relation to technical progress:

1. Developing or leading industries, such as chemicals, especially the production of mineral oil and its derivatives up to the manufacturing of plastics and artificial fibres, electrotechniques and electronics as well as power generation, sometimes car production.
2. Average industries, such as engineering, iron - and metal commodities, paper processing, partly foodstuffs and textiles.
3. Shrinking industries, such as ore - and coal mining, partly foodstuffs, textiles, iron and steel.

The differences from period to period and from country to country are very important, especially with regards to the second and third groups. On the other hand the importance of the leading industries can be generalized to a high degree, they go in advance in nearly every industrialized as well as industrializing country. The growth of productivity depends on the development of the leading industries. The main directions of technological progress might be characterized as follows:

Electrification:

The comprehensive application of advanced technologies, of mechanization and at last automation , require an adequat energy supply. The dominant kind of energy in nowadays industry is electricity. This is caused by the facts

that electricity has a high rate of utilization, it concentrates high performances, it is relatively easy to transport and to convert into other kinds of energy, such as mechanic , light or thermo-energy. In nearly every country the growth of power generation exceeds the average development. From 1958 to 1965 industrial production of the world increased from 100 to 156, that of electro-energy from 100 to 163. From 1950 to 1966 power generation has been developed from 100 to about 400.[1] In accordance with international trends the UAR power generation increased from 992 million kilowatt per hour in 1952 to 5475 in 1965, i.e. from 100 to about 550 per cent[2]. The further UAR - development in this field will be characterized by the realization of the High Dam, which fortunately leads to a situation that there will exist for the forthcoming period no shortage of electric power. The following sketch shows us the existing differences in per - capita production of electro energy in some selected countries, giving an idea about the targets of the developing countries in this field.

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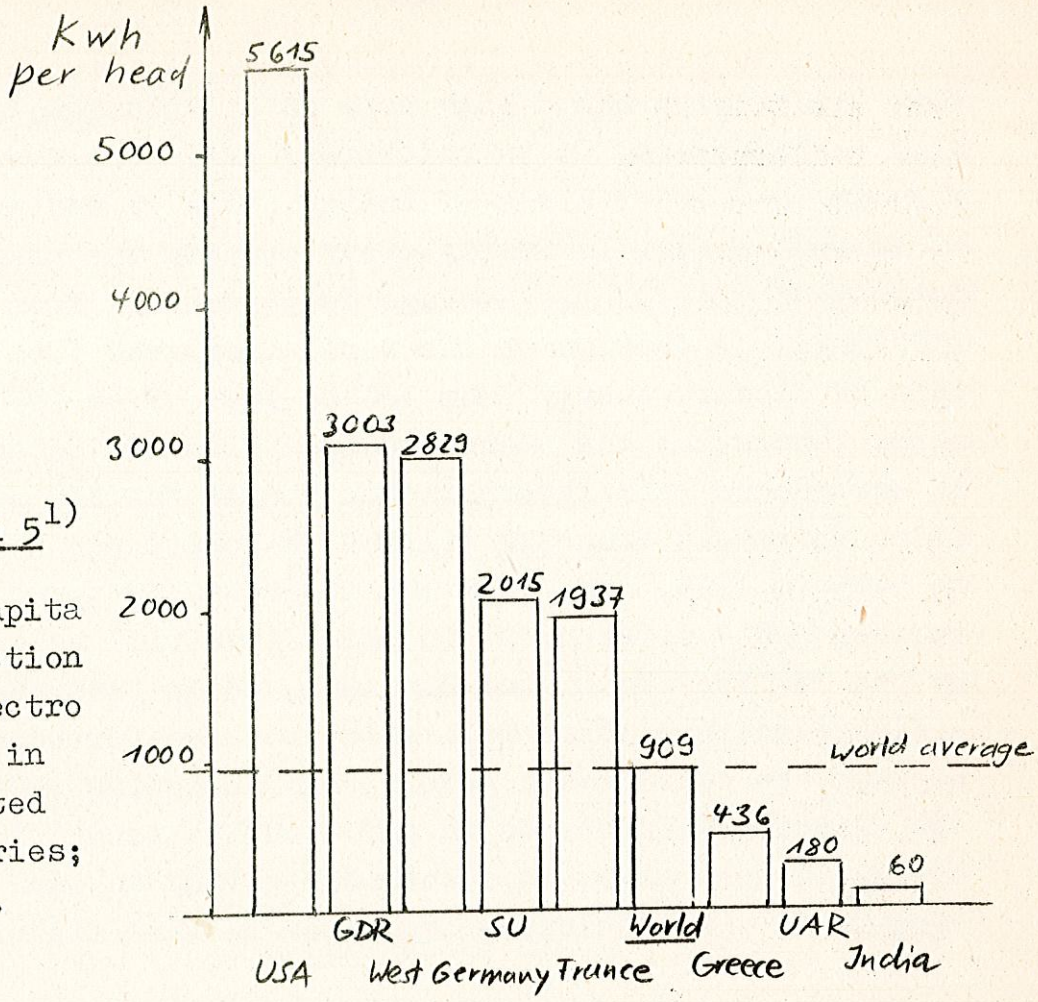
1) Statistical Practice, Monthly Review of the GDR, 1967, No. 1, P. 25

2) Statistical Handbook of the UAR, 1952-1965, Cairo, April 1966, P. 68.



Sketch 5[1)]

Per capita production of electro energy in selected countries; 1964.

Power generation is a certain indicator of the stage of industrialization. The UAR will approach the world average after finishing the High Dam, the UAR is nowadays far ahead compared with most of the other developing countries.

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1) Statistical Yearbook of the GDR, 1966, and Statistical Handbook of the UAR, 1966.

An important indicator which shows the stage of mechanization is the consumption of electro energy per productive worker. This figure increased in GDR from 1955 to 1963 from 11580 KWH to 17415 KWH , with great differences between the branches. So the consumption of energy per worker was in 1963:[1)]

in chemical industry	78921	KWH,
in all basic industries	52521	"
in metal processing	3864	"
in foodstuff production	5860	"
in light industry	5048	"

It is obvious, that chemical industry is one of the main consumers of electric power. If we consider, that even in the GDR about 40 per cent of the productive workers in industry are working without electric equipments or mechanization at all, than it requires an increase of power generation of roughly 20 per cent only to overcome physical work in this country .

Electrification creates important preconditions of a permanent growth of productivity. The productivity raising effect is as higher as better we are able to utilize energy. The rate of utilization can be indicated by the consumption of KWH electro energy per value unit of gross production. We have to make all efforts to cut down this specific consumption figure.

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1) Haustein, Neumann, Economic Analysis of the Technological Level of Industrial Production, Part 2, p. 14, Berlin 1965.

A second aspect of the development of power generation consists of its importance regarding the growth of living standard. Consumption of electricity per household goes up parallel to their growing equipment with radios, television sets, refrigerators, etc.

Development of chemical industries.

A second main direction of technological progress is the increasing share of chemical industries as well as the growing application of chemical products in all branches. Further more processing methods which are typically for the chemical industry are applied by a growing number of other branches.

During the last five decades industrial production of the world has been tripled, in the same period chemical production increased to a level which is about 35 times higher than the level of 1913. We can say that chemical industry belongs to the leading and developing industries since it came into being. All countries have high figures regarding the development of chemical production. In the UAR chemical and pharmacentical production increased from 1952 to 1965 from 100 to more the 600, in the GDR from 1950 to 1965 from 100 to about 400. Production of plastics went up as follows : 2 thousand tons 1910, 350 thousand tons 1940, 7000 thousand tons 1961 in the whole world.

The outstanding importance of the development of chemical industries is caused by the following facts :

1. Chemical processes are characterized by a very high productivity. The performances per worker, expressed in value of gross production per capita, is about twice as much as in industry in average.

2. The continuity of the production flow enables mechanization and automation as well as the permanent reduction of cost and time.

3. The utilization of raw material is very high in chemical industries. We have a high degree of complexity and combination of the production processes, characterized by many by-products.

4. Chemical industry is a leading one in the field of the creation of new products in accordance with the changing requirements of the economy .

5. Development of chemical industry is a precondition of the the growth of each other branch or sector of the economy. So we have the opinion that every country has to develop its own chemical production. The share of chemical products in per cent of all the raw materials consumed in several branches of the GDR economy in 1961 may give us an idea about the importance of chemicals:[1)]

glass and ceramics	25.1 per cent
printing, poly graphics,	23.6 " "
textiles	22.5 " "
leather, shoes	18.9
construction materials	11.4 " "
motor cars	9.1 " "
electro techniques	8.7 " "
engineering	7.5 " "

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1) Haustein Neumann, l.c., P. 20

Automation

The main factor influencing labour productivity is the technological level of the applied tools and equipments. Some of the indicators are the ratio of fixed assets per capita of the employed workers, the output per capital input, or several indicators expressing the structure of fixed funds, such as the relation between construction and equipments.

The fixed assets per worker ratio in the GDR industry increased from 1957 to 1963 from 100 to 132, the gross production per unit fixed assets increased in the same period from 100 to 114. The more capital intensive our productive processes, the more we have to concentrate our efforts on their utilization, for instance by applying material incentives. One of our main objectives in this field is now to cut down the share of expenditures for construction of industrial buildings, so far as possible open-air construction should be carried out, such as in chemical industries.

The share of automated and partly automated machineries is relatively small. An account carried out 1961, i.e. 6 years ago, has shown the following results:
Automated or partly automated were

46 per cent of wood-, paper and printing industries,
24 per cent of light industry,
24 per cent of engineering,
16 per cent of electrotechniques,
15 per cent of glass and ceramincs,
14 per cent of metal processing,
7 per cent of heavy engineering.

In the same year - 1961 - in the public owned industry of the GDR were installed :

	111	automated production lines,
	403	partly automated production lines,
	236	automated or partly automated departments, or sections of production lines,
about	23000	single automatons, and
about	32000	partly automated machine tools.[1]

Automation is connected with a rapidly growing demand for all kinds of electric, electronic, optic and mechanic instruments and equipments in the field of control, measurement and automatic regulation of the processes. The relative share of those instruments in production is permanently growing.

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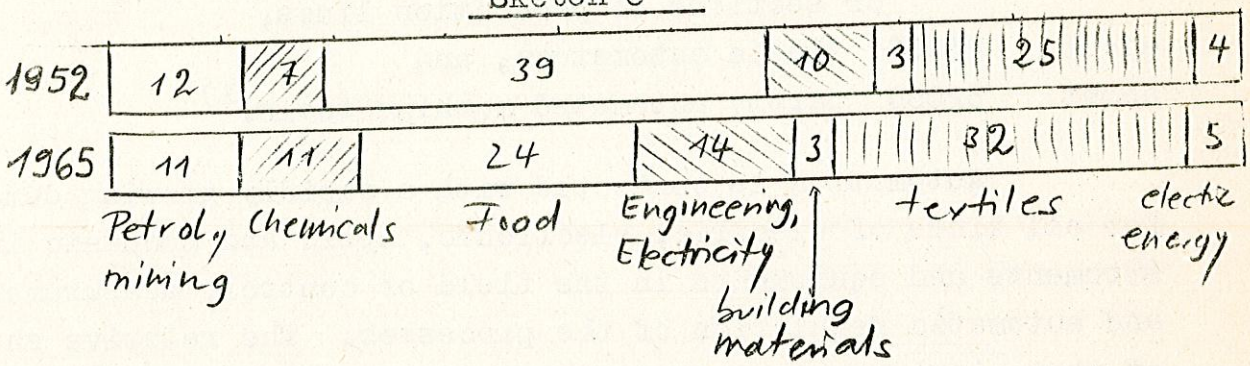
1) Haustein Neumann, L.c., P. 22.

IV. Concluding remarkes

Finally we will have a brief survey upon the interindustrial changes in the UAR:

Sketch 6[1)]



Contributions of the branches to industrial output in the UAR, 1952 and 1965, in per cent.

The sketch shows the trends of industrialization in the UAR and the remarkable structural changes. The production of chemicals and pharmaceuticals achieved the highest growth rate, the value of output of this branch is nowadays nearly seven times higher than 1952. On the second place we find the engineering and electric industries (nearly 6 times the production volume of 1952), followed by the production of electric energy, which achieved more than 5 times the output of the basic year. Also spinning and weaving achieved over average growth rates. All these structural changes are in accordance with the requirements of the industrialization process as well as the traditional and natural conditions of the country.

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1) Based upon Statistical Handbook of the UAR, 1966, P.58. (The statistic does not include all branches, so for instance military production, printings and publications etc.)

It seems to be suitable that the further priorities might be given to the following production complexes :

1. Mineral oil production and processing, including the development of related branches, especially of the chemical and pharmaceutical industry, and the production of certain chemical apparatus and equipments.

2. In the field of engineering especially the production of equipments necessary for the traditional branches, such as textile machines, equipments for food industries, and , of course, certain kinds of machine tools and agricultural machines.

3. At any rate textile industry will continue to be a very important branch of the UAR industry. All-or at least the most important - related industries must achieve a balanced growth.

4. The food industry and related branches might be developed in accordance with the internal requirements and in order to increase exports. So certain equipments for food industries should be developed in order to achieve a high efficiency in this field.

So far as possible the production should be safeguarded from the raw material to the final product by own supply. This requires to concentrate all efforts on those fields of production, in which the natural conditions, the historic development and the requirements of further industrialization process promise the most effective results in shortest time, in order to make the economy competitive in the world marked and to solve the internal economic problems.