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General Organization of
Planning of Industry

Part I
Long-term Planning of Industry

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"1" This memorandum is partly based on research work undertaken by members of the University of Economics Berlin, GDR.

General Organization of Industrial Planning

0. Introduction

The subject we want to deal with in the following memorandum comprises the general organization of industrial planning, with special reference to the experiences of socialist countries.

Planning as a coherent part of direction of national economy of both the industrialized and industrializing countries must reach the highest level possible. This so, in order to utilize all material and financial resources and manpower available as efficiently as possible in favour of national economy and the whole population. Such a high level is determined by the contents of the plans as well as by the system of planning itself. Let us consider, therefore, the main contents of prospective and annual plans, their main problems, and the main features of their elaboration.

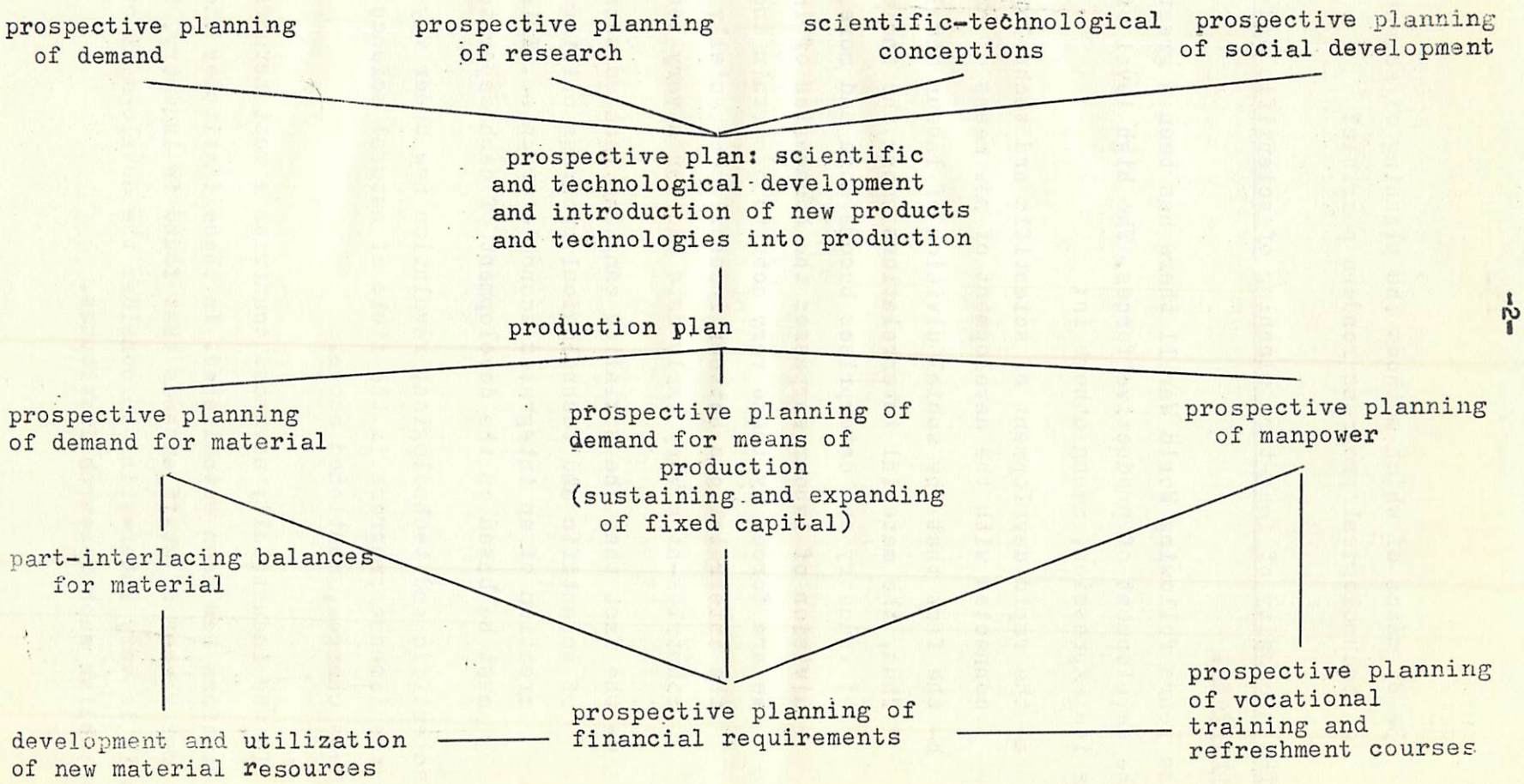
1. Long-term planning of industry

It is well known that a main problem of planning, especially long-term planning consists in planning scientific and technical progress. We would like, therefore, to explain the problems of long-term planning by the example of planning of scientific and technological progress. Scientific and technological progress itself determines all the other parts of economy as labour productivity, material consumed, etc. This can be seen by the following sketch 1. containing the position of prospective planning of the introduction of new products and technologies within the planning system. (cf. page 2). For this reason we are able to concentrate the lecture on prospective planning on these problems of prospective planning of the scientific and technological progress without neglecting the main features of the whole long-term planning. Thus, the following questions have to be answered:

1- Why do all the industrialized countries devote so much attention to the problems of long-term planning of scientific and technological progress?

2- What are the objective foundations and prerequisites for long-term planning of scientific and technological progress?

SKETCH 1: Position of planning of scientific and technological development in the framework of economic planning.



3- By means of which methods the planning of scientific and technological progress renders possible?

1.1 The necessity of long-term planning of scientific and technological progress.

In the years following World War II there has been a great acceleration in the development of productive forces. The high level of development finds its expression, among others in:

a- the rapid development of scientific and technological progress connected with the development of new means of production,

b- the fact that the social division of labour develops more and more. Thus, the material interrelations among the individual branches of industry and enterprises become more and more complicated. The division of labour surpasses the boundaries of individual nations. We are forced by these very acts to ascertain and to determine the interrelations between industries-especially of socialist countries-at a very early date and for a very long period of time.

c- the fact that the socialist camp has reached such a high level of scientific and technological progress calling for the gradual creation of an integrated economic organism. This, naturally, must be based on the development of each seperate country.

The scientific and technological revolution now under way represents, therefore, the immense progress in the field of natural science which has lead to these changes, mentioned above.

In the industrially advanced countries a vast network of research institutions has been established. In these institutes the technical equipment per member of staff exceeds that found in industry. In this connection it is very interesting to consider the development of cost necessary to establish such research institutes.

When the English physicist Faraday discoverd the basic laws of electricity in 1850 the value of the equipment used was approximately 100,-mark. The equipment used by the German physicist Hertz who discoverd the fundamentals of wireless in 1888 cost about 1000,-mark. The value of laboratory equipment in 1930 amounted on an average to 300 000,-mark. The equipment of a laboratory for physics today demands an outlay of 5 to 10 million mark.

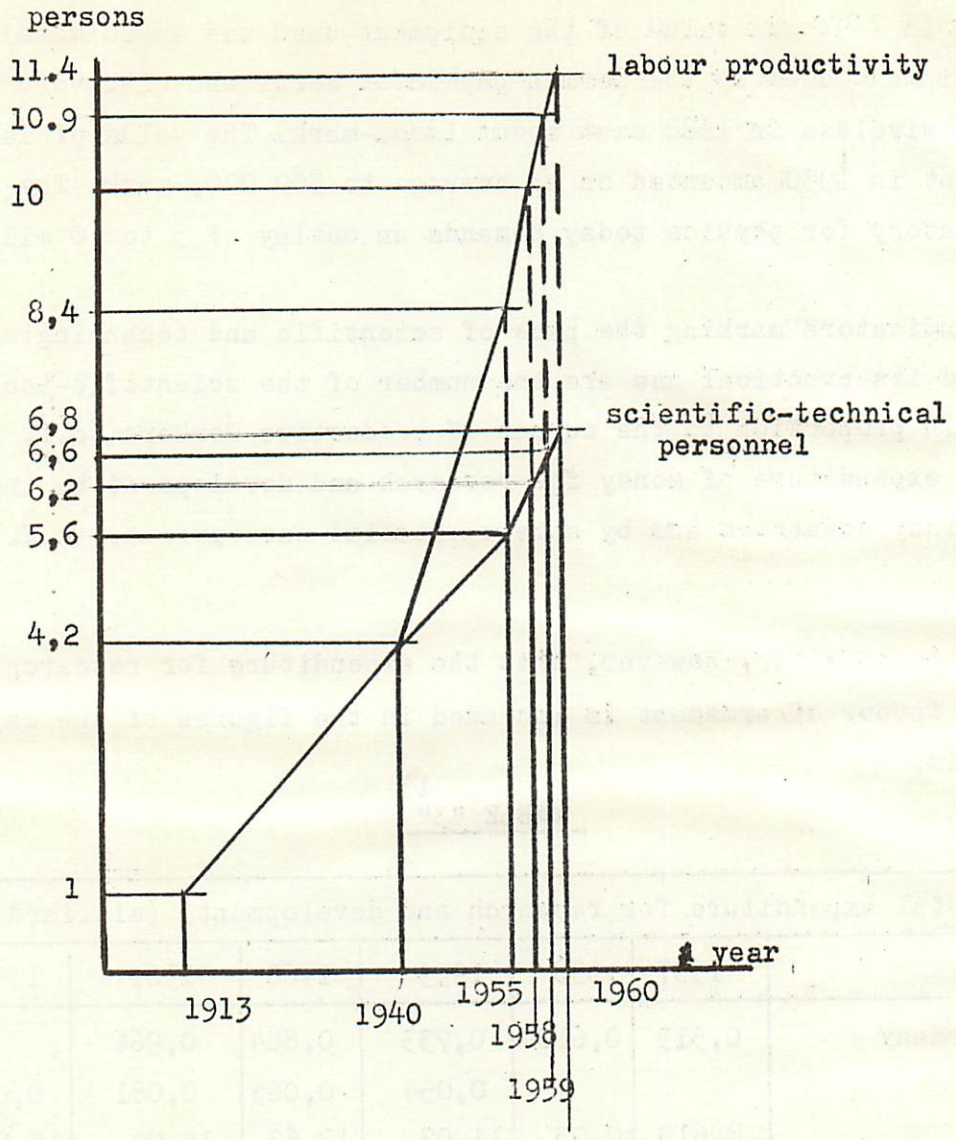
Other indicators marking the pace of scientific and technological development and its practical use are the number of the scientific-technical personnel in proportion to the number of productive workers (c.f. sketch 2) and the expenditure of money for research and development by industrialized capitalisty countries and by some capitalist enterprises. (c.f. table 3 and 4).

We have to consider, however, that the expenditure for research and development in favour of armament is included in the figures of the capitalist countries.

TABLE "3" 1)

Total expenditure for research and development (milliard dollar)

	1957	1958	1959	1960	1961	1962	1963
West-Germany	0,519	0,610	0,733	0,884	0,966		
Belgium			0,054	0,065	0,081	0,092	0,101
U.S.	8,610	10,03	11,07	12,62	14,04	15,00	≈16,00
France			0,454	0,581	0,700		
Japan	0,168	0,220	0,415	0,514			
UK		1,339			1,777		
Sweden			0,18		0, 22		



SKETCH 2: Number of scientific-technical personnel per 1000 productive worker in industry of S.U. and development of labour productivity

Source: H.D. Haustein, Statistische Praxis 10/1964 Page 277.

TABLE "4" [1]

Expenditure of some US firms for research and development 1961/1962 (Mio dollar)

Firm	net profit	expenditure for research and development	expenditure in proportion to net profit
Abbot laboratories	14,8	10,4	70
Air products	5,7	4,0	53
Allied Chemical	58,0	22,0	38
Du Pout	304,9	110,0	36
Monsanto	78,4	51,6	66

How the introduction of new inventions effects or is expected to effect the turnover of a capitalist firm can be seen by the following table:

Development of turnover of the Du-Pont-Concern in connection with introduction of new products into production [2]

year	Mio $	products
1920	100	artifical silk
1930	200	lacquer
1940	400	Acetate, Freon, Nylon
1950	1000	Polyäthylen, Teflon
1960	2000	Orlon (Dralon), Dacron
1970	4000	Mylar, Cronar, Dycril

1) Source: Die Wirtschaft, Berlin, number 46/1964, page 8.

2) Source: Statistische Praxis 11/1964, page 298 on basis of Chemical Week published on 20-2-1960).

Moreover, the discrepancy between moral and physical wear and tear has deepened in the past few years. This means that in many cases the moral wear and tear sets in at a time when the products concerned are far from being worn physically. This particularly comes true regarding the arcraft engineering and electronics.

Another feature of the scientific and technological revolution and the acceleration of technical progress represents the international exchange of discoveries and inventions. The trade in patents and licences grows more and more. The turnover achieved amounts to approximately 800 million mark a year.

The rate of development in science and technology is also influenced by the fact that the scientific and technological revolution proceeds under the conditions of two social systems on the globe. The main elements of the scientific and technological progress are, as a rule, not the secret of one or the other industrially advanced country. The endeavours to utilize the results known in the most comprehensive and economical way represent, therefore, an essential aspect of the economic competition between the two world systems. The outcome of this competition will largely be determined by the fact which system can most advance science and technology and utilize best the potentialities provided.

Summarizing these main ideas we are able to state that the rapid development of science and technology is a reflection of the objective and regular transformation of science into a productive force proper.

It is this rapid development of science which necessitates the long-term planning of scientific and technological development for reaching a speedy growth of labour productivity and, especially, of living standard in socialist countries.

1.2. Objective foundations and prerequisites for long-term planning of scientific and technological progress.

If we are to answer the question about the objective foundations and prerequisites for scientific planning of scientific and technological

progress we, at first, have to study the role and importance of the relations of production.

It goes without saying that a large public sector of industry form the main basis of long-term planning of technological development in favour of national economy as a whole.

Moreover, the development of science and technology as well as the application of new discoveries depends largely on the character of the relations of production, too. This can be demonstrated by the rapid economic development of socialist countries by means of the rapid increasing of the technical level of production and the planned introduction of new technique. This is to be illustrated by quoting some figures characterising especially those products influencing the rate of technical progress. In the GDR for example, the production of the following items was:

	1950	1955	1960	1962	1950 : 1962
electric power in twh[1)] (tera watt hour)	19,5	28,7	42.5	45.5	2.3 fold
automatic lathers (pieces)	152	270	507	548	2.8 fold
electrical measuring and testing equipment (million mark)	17,3	38,0	104,5	125,9	7,3 fold
automatic regulation technique(million mark)	14,0	18.7	≈60.0	102,4	7,2 fold

The development of engineering, electrical and chemical industries are of very importance for technical progress and for development of science and technology, too. Therefore, some figures about their development are to be given:

"1" c.f. Statistical Yearbook of the GDR, Berlin 1963, page 134.

	1950	1955	1958	1961	1962	1963
engineering[1)]	100	209	275	385	415	447
electrical industry	100	243	369	551	628	668
chemical industry	100	192	246	316	341	363

(Basis: gross industrial production)

That means that in the past few years production rose from 3.6 to 6.6 times in those industries of the GDR which are most important for a further development of science and technology.

The USSR achieved an even high rate of growth. In that country the production of engineering had increased 4.5 fold from 1950 to 1960. In 1960 about 2.800 automatic, semi-automatic, and highly mechanized assembly-lines were taken into operation.

There is no such a proportional and continuously increasing development in capitalist countries. This represents, in our opinion, an expression that the domination of the big monopolies hampers the development of scientific and technological progress and its utilization in favour of society as a whole.

This, however, should not lead us to the conclussion that the development of productive forces stagnates absolutely under capitalist relations of production. On the contrary, the development can be rapidly accelerated in certain periods. In the past few years the degree of automation in various industries in USA has grown considerably. Following an estimation of the editor of the journal "New Views of Automation" about 4,000 million $ were spent for automation.

But the single factories are only interested in technical progress as long as they can increase their profit or as long as competition force them to advance science and technology. Research work of the institutes of factories, therefore, is subordinated to an entirely pragmatic objective to increase profit. The veil of "business secret" covers these research

1) c.f. Statistical Yearbook of the GDR, Berlin 1964, page. 131.

institutes resulting in parallelism in the research of competing companies and in waste of financial means and work of scientists. It is obvious that the technical development is hampered by both parallelism and capitalist competition and practically renders impossible the exactly founded long-term planning of scientific and technological progress. The development of science and technology and the implementation of its results into industry under the control of the big monopolies leads, furthermore, to the fact that both are proceeding unevenly and national economy is developing disproportionally. That means, under capitalist conditions mainly those branches are developed that promise maximum profit in this respective period. The militarization of economy must be mentioned here which will more and more become a serious check to the development of science and technology for the benefit of society. In the 1962/63 US-budget about $ 6.65 milliard was provided for military research. This figure represents three fourth of the total government expenditure for scientific purposes.

Under socialist relations of production the objective requirements of national economy and the economic benefit form the determining factors in allocating the means available. Full use has to be made of the advantages of the socialist relations of production. These advantages are, e.g.:

a- in socialist economy it renders possible to concentrate and coordinate all scientific and technological potentials and means by a plan expressing the interest of the national economy. That means that parallelism in research-work is overcome generally. The waste of funds and of scientist's work has been put an end to.

b- For the first time in the history of the development of productive forces of society, socialist relations of production enable us to make conscious use of economic laws of socialism and to make them the basis of our long-term plans.

It is our task now to care for full utilization of these advantages serving the long-term planning of national economy. This requires, however, that all those who are responsible for management and planning both in factors and in central organs are expected to consider a number of special aspects in the long-term planning of science and technique, for instance:

a- It is impossible to determine the results of scientific and technological activity with the same degree of certainty as the results of production. The degree of certainty differs on various stages. Therefore, the long-term planning of scientific and technological progress has to distinguish;

- basic research, i.e., that is to explore entirely new ground;
- precisively directed basic research, and
- applied research and development.

In the successive stages from applied research to technological development and its application in production it becomes increasingly easier to pre-determine the results expected in a concrete and specified way.

b- Generally, it is not possible to arrange scientific work in such a way that the goals set are bound to be reached.

In long-term planning of technical progress it is necessary to bear in mind that the process of science and technology is following certains laws and does not proceed in a straight or linear way. This process is expressed in a great variety of different tendencies. They seem to contradict each other and make long-term planning a highly complicated process. On the other hand, an analysis of periods required for accomplishing development (the time required from the original idea to its introduction into production) shows that this space of time is more and more shortened.

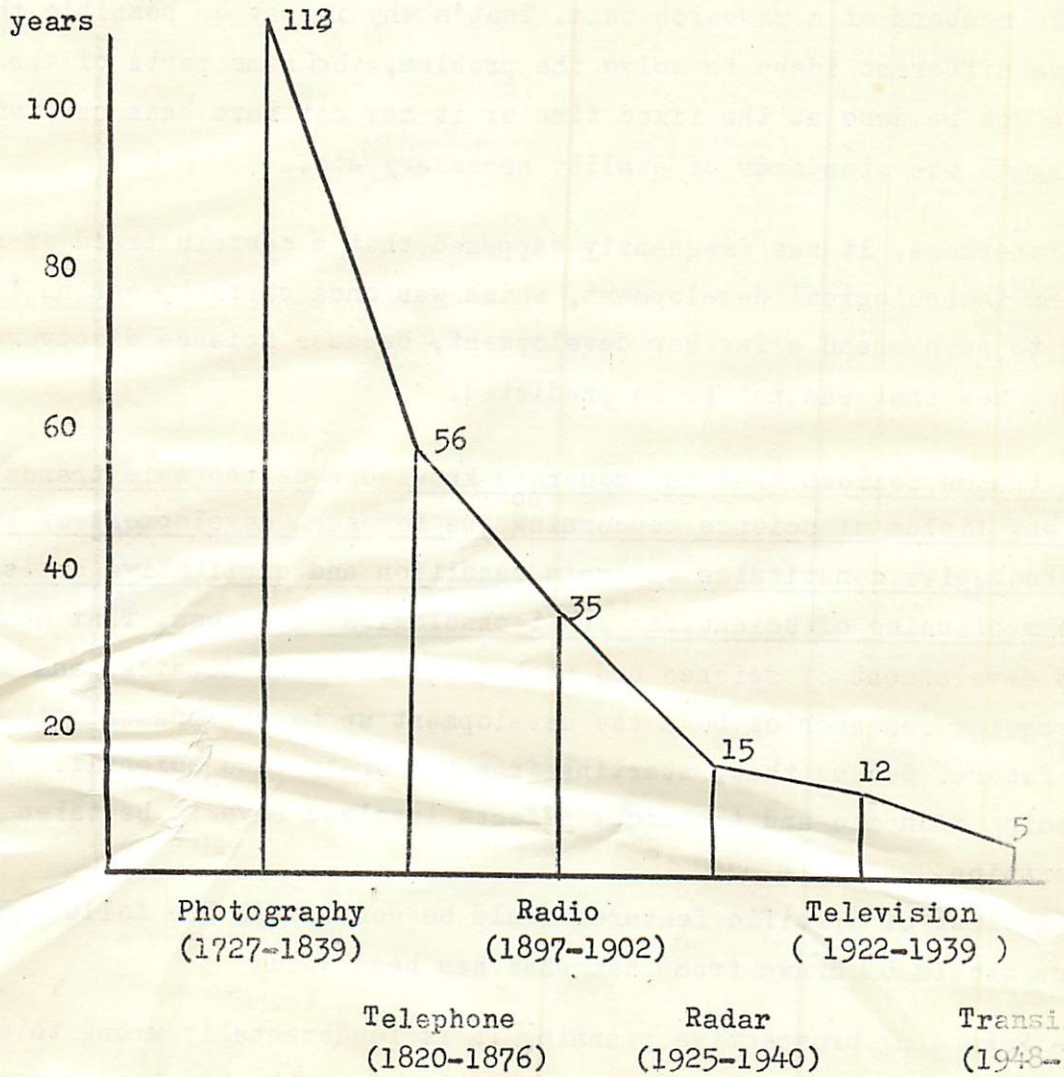
(c.f. sketch 5)

Let us consider the development of the telephone. It took 50 years to be fully used in practice. The development of television took more than 10 years and the development of transistors took only 5 years.

There is a great number of factors which may further or hamper this tendency. Nevertheless we are forced by these very facts to improve the system of planning if high economic results shall be reached by introducing new inventions. In the beginning, the social division of labour was a factor advancing

SKETCH "5"

Shortening of space of time needed to introduce new inventions into production



SOURCE: Die Aufgaben der Forschung ..., by D. Chorafos, München-Wien, 1963, p. 91.

the further development of science and technology.

Specialization of scientists makes it possible to achieve better results and to creat more favourable conditions for a high rate of development of science. But this specialization can also lengthen the period required for research and development caused by "losses due to frictions" among the members of a research team. That's why it may be possible that there are different ideas to solve the problem, that some parts of the task set have not be done at the fixed time or it may not have been carried out according to the standards of quality necessary, etc..

Furthermore, it has frequently happened that a certain trend of scientific and technological development, which was once correct, can no longer be used to push ahead a further development, because science discovered something new that was not to be predicted.

It thence follows that the concrete knowledge of the main trends of the different fields of science concerning the foreseen development of products and technologies constitutes the main condition and qualitative basis of long-term planning of scientific and technological progress. That means, the planned development of science and technology requires detailed and thoroughgoing research of both the development up to the present time and in the future. Beyond that, starting from the up-to-date scientific knowledge, forthcoming economic and technical effects involved have to be taken into consideration.

This list of specific features could be continued. The following conclusions should be drawn from that what has been said:

1- Regarding prospective planning it is fundamentally wrong to expect a further linear development starting from the level already achieved. The possibility of qualitative changes in development must duly be considered.

2- Long-term planning of scientific and technological progress must be a very flexible one. Possible alterations have to be taken into account. That is to say, planning must be understood as an unceasing process and the tasks of technical development included in a long-

term plan have to be adapted to the latest level of knowledge.

3- Only the final result will show wether the path chosen was correct.

Not even intermediate results can answer the question since the manager in charge does not have a full survey or all the details. Thus, the very job of long-term planning of the scientific and technological development requires exact scientific research in the field of planning, too.

The next problem under discussion concerns the concrete basis of reference of long-term planning of scientific and technological progress. But to find this answer you have to start from objective criteria.

As it is well-known, scientific and technological progress is no end in itself, but it aims at achieving a definite purpose. The final aim of any scientific and technological development under socialist relations of production is to raise the technical standard and the further production of goods and performances. In the long-term planning of technology, therefore, the development of products must be chosen as the basis of reference.

This is a main question. But from the point of view of planning a purely practical question has to be considered. Is it really feasible to elaborate a long-term plan for the scientific and technological development of each product? In the GDR the practice of long-term planning has not confirmed this view, it has not been found feasible. Long-term planning, therefore, has been done on basis of groups of products meeting certain present or forthcoming requirements, and produced within a certain producer group .[1)] Such a producer group comprises a number of enterprises producing different products which have the same or, at least, similar properties and the same or similars technological feature.

The advantages of producer groups being the basis of long-term planning of scientific and technological progress can be summarized as follows:

"1" c.f. Memo. No. 495.

1- Long-term planning of scientific and technological development on basis of producer groups enables a comparitively concrete determining of trends of science and technique. Long-term planning, furthermore, enables long-term preparation. The economic a-spects involved and the production methods can be duly taken into consideration with a view to secure maximum effectiveness for the national economy.

2- By taking producer groups as the basic unit for long-term planning you get more favourable conditions for long-term analyses. This creates possibilities to study the concrete sphere of action of objective economic laws and to get better conditions for a further long-term planning.

3- Last not least, by taking producer groups you get favourable conditions for estimating the quantitative and qualitative development of demand in connection with the development of science and technology. By considering these trends we will be able to a long-term preparation of production and to determine the material relationship. That means, we have to determine the collaboration of the branches or enterprises producing and supplying components or equipments needed to produce the goods in question.

In this connection it has to be mentioned that there is a close interrelationship between investigation in the field of future trends of products or groups of products, on the one hand, and the quantitative and qualitative development of demand on the other. These interrelations can be expressed as follows:

- The development of social and individual requirements must be derived from the further development of science and technology.
- The scientific and technological development is stimulated by the development of social and individual requirements.

Thus, besides knowing the development trends of science and technlogy the concrete knowledge of the development of future demands is a major

prerequisite for determining optimum targets for the enterprises, the producer group, and for the branch of industry.

The development of demand and its structure has to be determined as early as possible. The earlier this can be done the better the basic conditions can be fixed for the development of adequate and correct proportions between the branches of industry.

The complex analysis of sales, which has to be constantly perfected, is a main instrument for exactly ascertaining demand. This analysis is to be completed by the results of permanent market surveys. Both show the main trends of development in the field of demand as well as in science, technology, and economy. Thus, they represent a decisive instrument for long-term planning not only of production but also of science, technology, and economy.

In addition to this, some remarks on the economic part of such as a comprehensive analysis.

In our opinion, comprehensive economic analysis is a main method aiming at raising the economic effectiveness of production. It shows the scientific and technological resources available and helps to make better use of them. These analyses have to answer the question wether the trends of scientific development have been in conformity with the demand for a highly economic production. The main contents of the economic analysis is determined, therefore, by the socio-economic goals to be achieved. That means, it is an analysis of the previous, present and future scientific and technological development in connection with the economic effects bound to be reached.

Summarising these problems, mentioned above, we can state that the complex analysis has to comprise the trends and future direction of scientific and technological progress, the trends and future direction of development of demand, and the relationship between scientific and technological progress and its economic results and effectiveness.

After dealing with objective foundations and prerequisites of long-term planning in the sphere of scientific and technological progress, it is necessary to analyse the most essential methods by means of which the long-term planning of scientific-technical progress is being implemented.

1.3 Main methods of long-term planning of scientific and technological progress:

In socialist countries, great attention has been paid so as to improve long-term planning in general and of scientific and technological progress in particular. A great job has been done in connection with the elaboration of the new economic system of planning and managing the national economy in the GDR. The main results are the following:

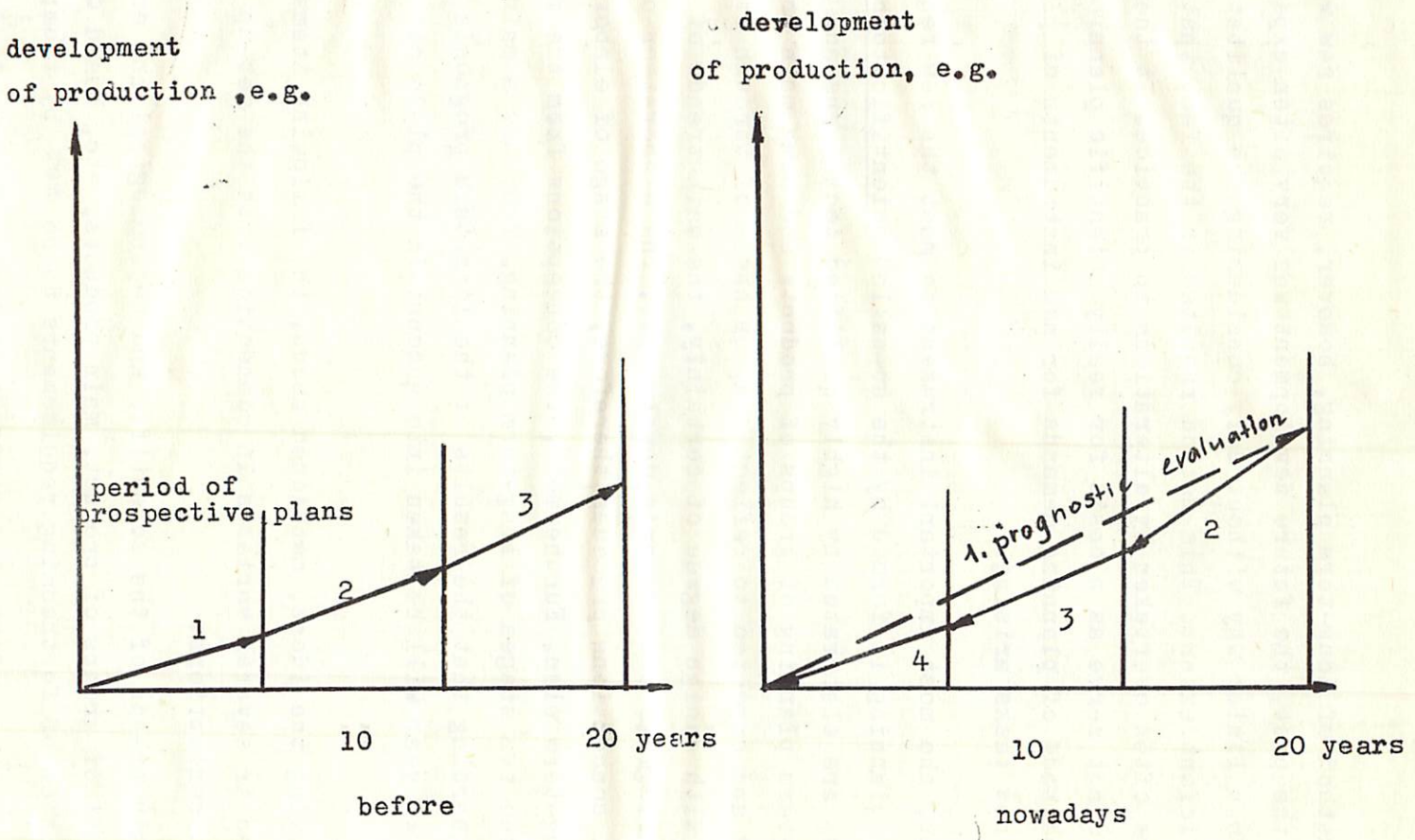
Considering the objective requirements of a rapid growth of the productive forces, it is obviously necessary to distinguish two stages when elaborating the technological and economic prospective.

The first stage is formed by a/ prognostic estimation of the future development of productive forces on the basis of main trends in the development of science and technology. This should comprise a period of 15 to 20 years. By means of such an evaluation, our material potentials and financial means can be arranged in a way that future productive forces will be developed and implemented in conformity with the main tendencies of science and technology.

The second stage contains the comprehensive planning of the national economic prospective for a period of five to seven years. Starting from the main trends of scientific and technological progress in connection with the development of the main proportions within the national economy, we have to elaborate the targets for implementing investigated or to be investigated scientific and technological phenomena.

(c.f. Sketch 6)

Sketch 6: Stages of prospective planning



1-4 Stages of prospective planning

The new method of long-term planning, however, requires new ways of thinking. In the past, the future development was very often expected to proceed in a liniar way without duly considering the qualitative changes to a sufficient extent. This method resulted in the fact that the estimations were often overtaken by alterations in practice. It thence follows, they could not serve as a basis for really scientific planning. Morover, the new method of planning demands for new instruments of planning to solve he new tasks arising.

At present, the most important instrument to meet the new requirements of long-term planning is formed by the so-called scientific-technical conception. They are elaborated by highly qualified technicans and economists for long-term planning of groups of products and some main products, respectively, and expected to reflect and, on basis of through studies, to predict, with a high degree of certainty, the main trends of scientific and technological and economic development. The elaboration of scientific-technical conceptions precedes, therefore, the stage of elaborating the final long-term plan. Furthermore, the conceptions foom the main link between the two stages of long-term planning. They are a main instrument for safeguarding that the results of the long-term prognosis for the period of 15 to 20 year will be taken into account in the plans covering 5 to 7 years.

Following the ideas, mentioned above, the following items have to be elaborated in several variants in connection with the set-up of scientific-technical conceptions:

a. main trends of the scientific and technological and economic development of groups of product, main products, etc, based on an investigation of forthcoming requirements to be met by them;

b. main tends of the scientific-technical and economic development applied in the production technique and;

c. main conclusions with regard to economic, technical and personnel aspects resulting from the implementation of these trends of development.

nus, the elaboration of scientific-technical conceptions is determined by the further development and perfection of products to be produced.

To give an example:

In connection with the investigation of the trends of scientific and technological and economic development in the field of electronic components, great attention has to be paid to the consequences of miniaturization. In this connection we have to take into account not only those features of application which are well-known and the materialization of which can more or less be foreseen as, for example, the technology of printed wiring etc., In addition to this, it is imperative to study the scientific and technological consequences of molecular electronics and its effects on the development of new products. In other word, we have to consider not only these fields of application for which the components are mainly to be developed but also those in which they possibly can be used in the future. This must be done in close collaboration with the institutes engaged in basic research in the respective fields. By elaborating the scientific-technical conceptions it has to be determined when and how this branch of technology-molecular electronics-will be largely effective in production. The concrete stages and conditions of miniaturization are to be laid down necessary for the further development of molecular electronics. These questions can only be answered if relevant investigations are being carried through simultaneously in the different fields and by considering the latest scientific-technical knowledge obtained from research work all-over the world.

There is another important question that must be answered when elaborating scientific-technical conception,. This concerns the fixing of the data for introduction of new products, Many enterprises all over the World have suffered from high losses because products could not be manufactured by the appointed date or because the date fixed was not the most favourable one.

Primarily, there are the market requirements that decide when to start manufacturing a new product and not-although this is very often the case-the available facilities of research, development, and production. For avoiding losses, by means of scientific-technical conceptions have to be laid down:

a- over-all strategic targets, i.e, the data for starting research and development, for starting manufacture etc.

b- necessary measures and procedures required so as to carry through the strategic plan; the most expedient succession of the various measures and the financial means required.

Such measures are:

- to concentrate research and development potentials on the most urgent tasks,
- to extend important departments of scientific-technical research institutes as well as of manufacturing enterprises.
- to fix the tasks set for basic and applied research with a view to determine the highest level in science and technology,
- to fix measures for standardization and specialization of production ,
- to fix measures for improving the quality of products and to decrease expenses in production.

The development and perfection of products is closely connected with the development in the field of production technique. Thus, it is necessary to observe this interdependence in scientific-technical conceptions, too. The level of production technique influences the amount of production expenditure and the quality of products. You will find, therefore, that the development of new products gives rise to new investigations regarding their production technique. On the other hand, newly developed production techniques influence the development of new products, or allow to manufacture already investigated products economicly.

The development of new technological processes themselves may call for a large-scale scientific research. This demands that already at the stages of research and development of a new product technological aspects resulting from this development must be taken into account; especially, if mechanized

automated manufacturing is to be applied. In this way scientific-technical conceptions have to indicate which production processes are going to be rationalized by more up-to-date technique, by mechanization or automation.

Besides these two main questions concerning the development of products and technologies, scientific-technical conceptions have to contain measures so as to meet further requirements. This means that it must be considered the scientific-technical and the material interrelationship of, for example, a given group of products with other branches of the national economy. Furthermore, those requirements resulting from a further deepening of the international division of labour and the increase in the volume of foreign trade have to be taken into consideration. Other problems which must be included in scientific-technical conceptions are:

- planned investments and measures of reconstruction required for implementing the trends of scientific-technical and economical development,
- qualitative and quantitative demands for scientific-technical and economic cadres,
- measures in order to prepare the tranining and education of such cadres, etc.

1.4 Concluding remarks.

The ideas, mentioned above, show that the prospective planning of scientific and technological progress represents the main task within perspective planning. All the other parts of prospective planning as planning of production or material consumed have to be considered in close connection with the development of science and technology.

Central managing of production process in socialist countries on the basis of nationally-owned property of the main productive forces grants the most favourable preconditions for drafting scientific-ally-based prospective plans of scientific and technological progress. This so, because all available potentialities can be concentrated and used in order to investigate the

main trends of scientific-technical progress and their possible implementation in favour of national economy as whole.

The elaboration of scientific-technical conceptions for groups of products or main products serves as a main instrument for drafting the prospective plans of scientific and technological progress. Simultaneously, the complex character of these conceptions allows to derive such important parts of the prospection plan as production plan, investment plan, plan of vocational training, etc.

Methodical questions of prospective planning are subordinated to the solution of the main economic tasks. Planning methods, planning forms, etc. have to serve and to support the elaboration of scientifically-based prospective plans. It depends on the creative faculties of the managerial personnel proceeding from the basic knowledge in this field to design planning instruments that serve best for reaching a high quality of prospective plans.