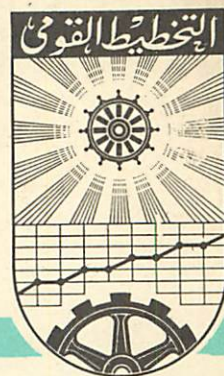


# UNITED ARAB REPUBLIC

## THE INSTITUTE OF NATIONAL PLANNING



Memo. No. 262

### Technological Analysis of Industries

Part I

By

Dr. M. Engert  
24th January 1963.

Reprint Sept. 1966.



## INDEX

### TECHNOLOGICAL ANALYSIS OF INDUSTRIES

- Chapter 1      The interdependence of economic, technical and technological problems in planning.
1. The material basis of planning
  2. Principles of planning technical progress
  3. Preparatory analyses
    - 3.1. Technical analysis on the branch level
    - 3.2. Technical analysis on the firm level
    - 3.3. Central coordination of analytical activities in the field of technique and technology
- Chapter 2      The elaboration of the technical plan.
1. General instructions for preparing the technical plan
  2. The structure of the technical plan
    - 2.1. Research and development
    - 2.2. Standardization
    - 2.3. Introduction of technical progress



# TECHNOLOGICAL ANALYSIS OF INDUSTRIES

## CHAPTER I

### The interdependence of economic, technical and technological problems in planning

National planning has to model the structure of the economy, to indicate the lines on which it must proceed and to manage all current affairs of the national economy with respect to the implementation of the plan. If so, planning cannot do without including problems of technique and technology in its field of activity. We all, perhaps, know the economic problem concerning the choice of technology which occurs in planning very often. With a view to this it might be useless to raise the problem quoted in the title of this chapter. Usually there is general agreement on this interdependence. But if we study the respective literature one must get the impression that economists or planners mostly are asked to take into consideration technical and technological problems and accomplishments. We should, however, amplify this point or better put it forward in a more precise way. To take into consideration technical and technological progress is a rather passive way of settling things. Planners must be in the reverse, first of all, active people who are trying to improve, i.e. to change the national economy and who are virtually able to do so. This can be done only if planners are fit to manage technical and technological problems freely. To take them into consideration would mean to take over that other people have done. Should we not extend our fields of knowledge, experience and activities by studying the development of technique and technology?



There often is, as we all know pretty well, a certain discrepancy or, say, rivalry between economy and technique as well as between economists and engineers. Even in case there is no theory whether priority should be given to either economy (economists) or technique (engineers), we are facing the fact that in one country or in one branch engineers are prevailing or, moreover, dominating whereas in other places things are going just the other way round.

Anyway, we have to investigate this issue thoroughly because it highly affects not only the problems of planning of industry but also research, education and training on all levels and the organisation of the national economy as well.

Simply speaking we wish to answer the questions why, what and how the planners actually must analyse, promote and manage both technique and technology. Our discussion will be based on the experience of planning activities in socialist countries where our problems have been solved so far in a rather national way.



1. The material basis of planning

Irrespective of differences in defining planning as well as its methods we must realise that planning deals with real material things. These must be studied with the view to keep them under control and to manage them in a way which will enable planners to meet the requirements of national economic progress. The primary problem of economic planning is production and labour productivity. Upon both categories depends consumption which can be regarded the final aim of planned economic activity. High consumption or its increase, therefore, can be reached if output (production) and productivity (efficiency) are increasing steadily at a high rate of growth. This, in turn, is the result of a fast extension of the main elements of production as well as of their efficient combination. It is well known that we have three main elements of production: manpower, machinery (and equipment) and raw materials (and semi-finished goods). They are called productive forces. The planner must care for an increase of production and productivity. Consequently it is up to him to study the problems by means of what and how goods are produced. In other words, this is the problem of studying and, moreover, of promoting technique and technology. The better our technique and technology are the faster economic progress will be provided that both are not subject to private or partial interests but serving the national economy as a whole.

We have thus arrived at the material basis of planning. It can be seen from this that the planner must be technically skilled to a certain degree. If not so, he has always to surrender to engineers when discussing the problems of technical and technological as one starting point of the plan.



The combination of all three main elements of production with a view to maximize its effect is a genuine economic problem. It, apparently, does not imply only the problem of how to combine them but even what is to be combined concretely and how to improve substantially each element. The planner must be fit, first, to understand quite well the problems of technical progress in order to make use of its results in his economic activity. Secondly, the planner must be able to produce clear-cut ideas as to which technical problems must be studied and solved with respect to further economic progress.

National planning must start with a thorough analysis of the decisive factors of growth, i.e. the development of the mentioned main elements of production each separately as well the combination of all. This is true even as regards developing countries. They generally wish to bridge the gap between the industrialized countries and the less developed economies. To reach this it is indispensable to make full use of all the accomplishments of modern technique and technology in those fields and branches (sectors) which they have decided to extend. It is clear that for the time being they have "to import" the relevant knowledge and experience. But after this they must gain full control of technical progress in their own economy and they must do their utmost, too, to run all imported modern equipment themselves and, furthermore, to contribute to their development. To follow this way does not mean, of course, that it will be enough to get well-trained people in the fields discussed. Skilled labour is one main element of economic progress. The second is machinery. One should not only be able to understand modern machinery and to use it rationally but also be able to produce it. This obviously is a first practical consequence for the planner which can be derived from the fact that



(skilled) labour, machines and (in addition to this but with less importance) raw materials are the main factors of growth. They are so in a combined manner. If new machines had been invented they ask for higher skill of the labour force. Moreover, higher education and skill of the labour force makes it possible to build new machines or to create new technologies. If new raw material are produced, e.g. new varieties of plastics, new processing machines have to be built etc. Anyway, there is an interdependence of all three main elements which must be given due attention in planning.

We shall try now to draw some conclusions from what has been said before:

- (i) Planning if conceived as national and comprehensive planning includes foreseeing and planning of technical and technological progress. This is to give the country the possibility to manage independently the main factors of general economic progress.
- (ii) Planning starts with thinking about production and productivity as well as about the material basis of both.
- (iii) Planning of technical progress is one starting point of planning the various sectors and branches of the national economy (and first of all industry). This refers to production, productivity, investment and manpower.
- (iv) The necessities and possibilities of technical progress determine and predict the concrete ways of planning activities in the field of research and development (areas and topics of research, scientific personnel and institutions etc).



- d) Technical progress is a business of planners and economists. It must not be left to engineers only. To think about technical progress and to promote it should absorb a great part of the planners' interest and working time.
- e) Planning of technical progress means detailed planning of the increase in labour productivity.

### 3. Preparatory analysis

Before the technical plan is drawn up some preparatory work must have been done. We shall discuss, briefly, some of these activities.

#### 3.1 Technical analysis on the branch level

Within the framework of the general objectives of the long-range national plan, a detailed plan for each branch has to be mapped out. This plan must be based on an analysis of problems of the respective branch in industry. In the G.D.R. it is called basic conception of technical progress. It is in line with the mentioned general objectives (giving, of course, more details) but it is not necessarily identical with the detailed targets of the various annual plans by which any long term plan is broken down. This basic conception is meant to give a clear description of the substantial technical (and economic) trends of the respective branch. The basic conception contains all measures which must be taken by the planning authority of the branch in order to promote technical progress. The plan, however, will pick out later those measures which fit in the entirety of branch targets as well as national targets for that period for which the plan actually is



established. If e.g. a certain basic conception points out that mechanization of some operations must be carried out (from the point of the branch) which will cost, say 10 millions, the plan will finally decide when this will be realized. This is so, because the national (annual) plan has to balance in detail the requirements of all branches with the resources available. The plan, moreover, gives a precise timing of all measures. If on the other hand, the plan sets aside a considerable sum for a certain branch, the responsible planning authority for this branch is expected to have a clear and thoroughly calculated idea about how this sum could be used most rationally.

Concluding we can say that this kind of working out a basic conception for each branch enables planners, first, to be well prepared when the elaboration of the plan will start, and secondly, this is a means of being kept well informed on all technical (and economic) problems, tendencies etc. of the respective branch. These basic conceptions will tell them what they must do. Last not least, by this way the central planning actually is complemented and detailed on the branch level.

Although the concrete contents of the basic conception is different from branch to branch each conception has to give an extensive answer to a lot of questions common to all of them:

- (i) Main tendencies in the field of
  - a) technique (typical machinery)
  - b) technologies
  - c) new raw materials
  - d) products (technical data, utility)



- (ii) Organisational measures in the field of
  - a) concentration and specialisation of production
  - b) changing the production program owing to international agreements  
(this part contains concrete measures which enterprises have to be reorganized or set on another production program or to be transferred to another branch)
- (iii) technico-economic level
  - a) degree of mechanization and automation (how to be improved and in which enterprises preferably)
  - b) where to renew existing capacities and where to build up new ones
  - c) labour expenditure per product (how to improve it; international comparative studies)
  - d) competitive situation of products on the world markets.

All data resp. all measures must be calculated as regards their economic efficiency, i.e. funds needed and the return to be gained. Furthermore, there must be mentioned the sequence of all measures according to which the latter will be transferred to the final plan. Finally, the basic conceptions can not do without some, though rough, calculations with respect to total output etc. because problems of e.g. technology cannot be solved from the pure technical point of view. It is natural that this Offers some difficulties. Several variants of measures, therefore, are recommended.



### 3.2. Technical analysis on the firm level

All preparatory work for the technical plan must be done very thoroughly. In addition to the central planning in this field much has to be carried out on the enterprise level. To keep up with technical progress or to have modern accomplishments as one starting point of planning requires rather concrete studies and analyses. A system, therefore, is necessary which will enable us to cope with this basic task. This system can be sketched as follows:

A list of products must be compiled containing such which are of crucial importance for the national economy. This importance may be determined (a) by the foreign markets where our production is sold or intended to be sold, (b) by the role a certain product has to play in local production and productivity, (c) by the local demand and or by other factors. Products included in this list must be systematically analysed in various respects thus providing the necessary data for planning technical and technological progress in each case separately and concretely. This analysis has to be undertaken by that enterprise which is the main producer of the respective product.

The aims of this work are:

- a) to fix the starting points of the technical plan of the enterprise
- b) to analyse the requirements for improvement of organisation of production
- c) to analyse all data (technical, technological, economic) concerning the product as a whole
- d) to collect information which can help to improve the technical plan instantly



## TECHNOLOGICAL ANALYSIS OF INDUSTRIES

### CHAPTER II

#### The elaboration of the technical plan

We have already learned that planning of technical progress has to start on the central level. This so, because the economic growth basically depends upon combined and coordinated efforts in the field of technique and technology. Modern planning, therefore, means that any national plan should have a special section which may be called the technical plan. This section of course, has to be coordinated with all the other sections of the comprehensive plan on many lines.

#### 1. General instructions for preparing the technical plan (directives)

The supreme planning authority gives rather concrete instructions to all other central organs which are responsible for planning in their respective fields. These instructions are naturally based on the preparatory analyses which had been briefly described in chapter I. They channel all respective planning activities in accordance with the general line of economic development of the nation.

It is true that planning of technical progress often seems to face unsurmountable difficulties. Every day innovations are made, technologies are being improved. Nevertheless the planner has to look for factors and data which could form a solid basis for his technical plan which, in addition to this, must be flexible too. The general starting points for the technical plan are:



- (i) the choice of the main branches which will be given priority in forthcoming period; efforts must be concentrated in order to solve the technical problems of these branches (this highly effects international division of labour in the field of research and development);
- (ii) results of basic research in the respective fields;
- (iii) results of applied technical research and development which can be used straight forward in production;
- (iv) informations about the best possibilities of modern technique and technology irrespective of the fact if or not they are already utilized somewhere;
- (v) informations about the actual international level and accomplishments in the various fields of technique and technology.

The most important items are (i) and (iv), which show where great efforts must be made and which results of research etc. are already available and ready for use.

Now the supreme planning authority after having studied all those data will draft its general instructions (directives) for the technical plan. This work is done annually. Those directives broken down by branches cover, at least, the following problems:

- (a) main topics for technical and technological research and development activities
- (b) new products, the output of which must start in the forthcoming planyear (kinds of products and volume of outputs)
- (c) products which are to be excluded from the production program (because they are now imported or there is no demand anymore etc.)
- (d) which products and technologies are to be standardized
- (e) which enterprises are to be specialized with respect to their program of production
- (f) which enterprises and technological (production) processes are to be mechanized resp. automatized preferably)



The Council for Research is an executive, advisory and coordinating body which is attached to the government (Council of Ministers). It is actually part of the governmental administration without, however, being engaged in pure administrative matters (except while elaborating the research plan).

- c) Finally, a central administrative institution, the State Secretariate for Research, is in charge with current affairs in this field. It is an auxiliary authority of both the Council for Research and the State Planning Commission administratively being subordinated to the latter. The State for Research is a cabinet member.

The Council for Research obviously is vested with the authority to channel almost all analytical work on all levels (central, branch, enterprise) and in all organisations, institutions as well as enterprises. It is, moreover, in a position to give sound and detailed instructions to all the bodies engaged in preparing and elaborating the research plan because its members are exclusively high-ranking scientists of the academies, universities etc. All comments on relevant technical problems given by the Council therefore, are some kind of combination of the results of technical analyses on the lower levels with ideas (or general objectives) of the central authorities on further technical progress in general. The actually helps mobilize the scientific potentiality of the country and, by this way, elaborate a well-balanced national plan.



## TECHNOLOGICAL ANALYSIS OF INDUSTRIES

### CHAPTER II

#### The elaboration of the technical plan

We have already learned that planning of technical progress has to start on the central level. This so, because the economic growth basically depends upon combined and coordinated efforts in the field of technique and technology. Modern planning, therefore, means that any national plan should have a special section which may be called the technical plan. This section of course, has to be coordinated with all the other sections of the comprehensive plan on many lines.

#### 1. General instructions for preparing the technical plan (directives)

The supreme planning authority gives rather concrete instructions to all other central organs which are responsible for planning in their respective fields. These instructions are naturally based on the preparatory analyses which had been briefly described in chapter I. They channel all respective planning activities in accordance with the general line of economic development of the nation.

It is true that planning of technical progress often seems to face unsurmountable difficulties. Every day innovations are made, technologies are being improved. Nevertheless the planner has to look for factors and data which could form a



solid basis for his technical plan which, in addition to this, must be flexible too. The general starting points for the technical plan are:

- (i) the choice of the main branches which will be given priority in forthcoming period, efforts must be concentrated in order to solve the technical problems of these branches (this highly effects international division of labour in the field of research and development);
- (ii) results of basic research in the respective fields;
- (iii) results of applied technical research and development which can be used straight forward in production;
- (iv) informations about the best possibilities of modern technique and technology irrespective of the fact if or not they are already utilized somewhere;
- (v) informations about the actual international level and accomplishments in the various fields of technique and technology.

The most important items are (i) and (iv), which show where great efforts must be made and which results of research etc. are already available and ready for use.

Now the supreme planning authority after having studied all those data will draft its general instructions (directives) for the technical plan. This work is done annually. Those directives broken down by branches cover, at least, the following problems:

- a) main topics for technical and technological research and development activities
- b) new products, the output of which must start in the forthcoming plan year (kinds of products and volume of outputs)



- c) products which are to be excluded from the production program (because they are now imported or there is no demand anymore etc.)
- d) which products and technologies are to be standardized
- e) which enterprises are to be specialized with respect to their program of production
- f) which enterprises and technological (production) processes are to be mechanized resp. automatized preferably)

These general instructions given by the top-level planning authority are complemented by more detailed informations which come from the top-level supervising authority for industry (National Economy Council to which almost all general organizations of national enterprises are subordinated). Those informations (called "orientation data") indicate the quantitative frame-work for the a.m. planning of technical activities. They imply, at least, the following data:

- (i) financial funds for research and development
- (ii) output
- (iii) labour force
- (iv) productivity
- (v) investment
- (vi) decrease of cost

All enterprises now can start their second stage of mapping out the technical plan. In this stage they will see how their own preliminary analyses and calculations can be coordinated with the orientation data from the top. As there is a systematic



cooperation between enterprises and all planning authorities both the preparatory analyses and the general instructions (including the orientation data) have not been made without due regard to the ideas and calculations at respective lower or higher level of the whole planning system. Consequently, although there is a clear sequence in drafting the plan neither the enterprises nor the planning bodies should wait unless they have received the necessary instructions and information from the respective party.

2.        The structure of the technical plan

The technical plan must not be understood merely as a problem of coordination of technical progress and production activities although this is one task of national planning. The main points are, first, to plan the entire process ranging from basic research up to the introduction of new techniques, machines, technologies etc. in production, and secondly, to set a well-knit system of technical planning to which all planning authorities as well as enterprises will contribute within their respective competence. Consequently, there must be a twofold subdivision of this plan: by stages of the mentioned process from basic research up to its utilization in production and by levels of planning .

It goes without saying that the technical plan will be best if it is set up in a way which helps keep under effective control all the subsequent steps in technical progress. They themselves predetermine which sections the plan must have. According to this there are two main sections in German planning:

- preparation of scientific-technical progress
- implementation (introduction in production) of scientific-technical progress



Preparation of scientific-technical progress is a synonym for research and development as well as of standardization. The second part of the technical plan contains, in a systematic way, all measures which will be taken in the plan-year with respect to technical and technological changes of production.

The following is an outline of the main sections of the technical plan.

## 2.1. Research and development

If it is true that to promote technical progress means to mobilize the final and decisive power for economic and social progress in general, planners should endeavour to set up an accurate and widely detailed planning system as regards technique and technology. This is a precondition for successful planning in many other fields e.g. production, manpower, etc. After it had been decided which technical problems must be solved or to which branches of the economy all attention must be paid in order to improve their technological level generally all the respective problems have to undergo an intricate procedure which consists of 4 main steps.

- (i) Basic studies (Studienentwürfe)
- (ii) Research
- (iii) Development and design of new constructions
- (iv) Introduction of newly designed machines etc. in production



The first step, basic studies, must result in a clear idea whether a certain concrete technical problems of a branch, enterprise etc. should be included in the technical plan. With a view to this question the respective planning authority will analyse if work on this special problem will really help settle the main technical problems raised in the general instructions. Furthermore, some analysis is required of the effect on the national economy which could be expected from the issue under consideration e.g. timing of research and development, costs, comparative studies of the technical standars to be reached with standards abroad, productivity effect, trade mark and problems etc.

If the answers to most of these questions are in the affirmative the problem itself becomes part of the technical plan. It is then transferred to the next stage which is called research. This part of the plan has to answer theoretically how the problem under consideration should be solved. It is subdivided in four steps, starting with studies of relevant references (including of course, an analysis of existing patents in the respective fields) and ending with a suggestion how to develop practically the new machine, instrument, technology etc. This result must be confirmed by laboratory experiments which form one of the mentioned steps within the research part of the technical plan.

Next comes the design of the new machine etc. This work is done in five steps. In the first one the prototype of the new machine has to be tested. This is to check the principles of the new construction as well as its functioning as such.



The subsequent work on introduction of the new machine in production does not only concern the designer, but also the technologist. He has to prepare and to test the production prototype of the machine, This is necessary for adjusting the production apparatus in accordance with the technological problems that emerge from the new machine. This work is repeated with the testing series of the new machine. Finally, the normal output of the new machine can start because it had been tested from two points of view: the construction itself and its functions as well as the technology, i.e. the way of series-production. By the way, the preparation for output of the new machine consists of six steps.

One may be shocked by the great number of steps in this field (altogether 16) and therefore, doubt perhaps, whether this system of planning technical progress is efficient. The system would be defective, if one would bureaucratically adhere to this list of steps urging that absolutely all problems must undergo each step. This formal approach cannot be called planning . If we are going to design a new machine which is similar to another one we can omit, e.g., one or two steps because the respective studies of references and patents had been made already and the results can be used for the new work. Consequently, the problem is not to solve all problems by accurately 16 steps, but to have a consistent system of planning technical progress. Even if we can omit some of the mentioned steps we must know which can be omitted because in that case we need less time, money, manpower, etc. for doing our work. And this is quite important to know.



The main ideas of this system are:

- (i) to keep under constant control the progress of work in the field of technique and technology so that the planner knows which results can be reached and at what time they are ready for use;
- (ii) to give clear orders to all authorities, enterprises and single persons working on the respective problem; this means to fix the sphere of responsibility for each;
- (iii) to calculate what is required for research and development activities: manpower, laboratories, pilot equipment, money etc.

The last point indicates that the technical plan is linked not only with the production plan but also with other sections of the national plan. If one enterprise is working, e.g. on four technical problems, it must exactly know when and at what extent its pilot or testing equipment and laboratories are required for the different testing steps or if some testing must be carried out elsewhere due to lack of capacity of the own pilot establishment etc.

We started our discussion with the choice of technical problems or tasks which are to be included in the plan on the central level (general instructions). Such choice is made on all levels in addition to the central problems which in many cases, do not cover all research and development activities on the lower levels. The technical plan of an enterprise therefore, is subdivided by different kinds of problems. First, its contribution to the central problems which are included in the central



technical plan, and secondly, its own technical problems which are not of general national importance. The same procedure is followed on the other levels. In the whole system of technical plans it is marked which problems are regarded central, ministerial, branch (and regional ) or enterprise ones. According to this classification, the degree of importance is a tool of planning in general. It is used also in production etc. and helps subdivide responsibility and work by levels.

Our study so far dealt with the planning or research and development as much. Now we should return to one economic point which has been mentioned in the beginning. Planning of technical progress has no ends in itself, it is to serve the national economy. But how does it serve the national economy? This question should be answered in any case. The best way for doing so is to set up a list (nomenclature) or some kind of classification indicating the economic (national) purpose of a special problem or task of the technical plan. This list may be altered or complemented when new problems of crucial importance arise in national planning. Actually, this list is to check whether technical planning is geared to the needs of the economy. As an example we can see which list is used in the German Democratic Republic:

- I. Basic research in science and technology.
- II. Mechanization and automation
- III. Economy of raw materials and substitutes for them which are available from local resources
- IV. Extension of the national raw material basis and development of new materials
- V. Improvement of the technical level (design and development of new machines, instruments, technologies)



- VI. Diversification of the assortment of consumer goods
- VII. Improvement or maintenance of quality
- VIII. Standardization and unification
- IX. Substitutes for imported goods
- X. Extension of exports
- XI. Public health and labour security
- XII. Increase of yields in agriculture, foresting and fishing

## 2.2. Standardization

A modern industry is an industry where is full scope for technical progress as well as full application of all its accomplishments. We know that technical progress can be promoted only if the production system is set up accordingly. This means that concentration and specialization of production should be stressed both on the national and international scale. Specialized and concentrated production, in turn, asks for a certain improvement in its technical or technological basis. Highly productive and highly specialized (concentrated) production presupposes that all operations, parts and functions which occur repeatedly in producing a certain machine or kind of machine (or of one part of it) as well as in processing a certain raw material had been unified, i.e. standardized. It should be pointed out that all standards are understood as giving the compulsory parameters, technologies etc. for all respective producers (enterprises, designing institutions etc.) on the basis of the most favourable and efficient way of doing a certain operation. Standardization does not simply mean to unify operations etc. but to do so according to the best results and



accomplishments in the respective field. Thus the productivity effect is twofold: standardized production as such, and secondly, application of the best technical or technological achievements in practically all producing and designing units.

Standardization is a specific activity of research and development. It has to be done in an equally planned manner. The targets for standardization are set, therefore, according to the respective stages of the research and development section of the technical plan. It is, to a certain degree, a relatively independent activity because its results are to be applied not only as regards new products or technologies. Standardization (standards) will make sense to economic progress by being used as basic designing and constructing regulations for all respective production activities in one field or branch.

The general economic ideas of planning standardization can be defined as follows:

- it has to ensure series (or mass) production by means of unifying all operations and parts as well which virtually can be standardized, i.e. which have to fulfill the same or, at least, similar functions;
- it aims at making production more economical and rational;
- to concentrate all designing and producing capacities on new technical problems and to avoid paralld work;
- to bring auxiliary and repairing activities in line with modern production methods (construction of



models, instruments, spare parts; total and partial repair and renewal of equipment etc.)

- to apply modern technical achievements in all respective production units by introducing a compulsory standardization system.

The plan of standardization itself consists of a list describing, first, what should be standardized and, secondly, what the specific aim of each standardization activity actually is.

Mention should be made that planning of standardization is executed, too, by different steps according to the technical requirements. This is the very same system which had been sketched with respect to the planning of research and development.

There is, however, another problem of paramount importance. Standardization is to serve production. As production in those socialist countries which are members of the Council of Mutual Economic Aid is coordinated internationally, standardization cannot be managed only nationally. This activity has to be coordinated and jointly planned throughout the whole area. Consequently, any decision on internationally specialized production has to be complemented by an adequate analysis and decision on standardization problems involved. This must be planned thoroughly because once a decision on standards has been taken and internationally agreed upon, it will be used in all national economies under consideration. All relevant systems of organization of production (technologies), technical parameters, spare parts etc. must be accordingly adjusted to these standards. The



standardization section of the plan, therefore, has to indicate with which countries the respective problems must be solved jointly, and calculate all repercussions on the national economies concerned.

### 2.3. Introduction of technical progress

This section of the technical plan shows which results of the previous research, developing and standardization activities should be introduced in production in the respective plan year. By means of this section technical progress can be linked with the other economic activities. Thus, we arrive at a full coordination of the technical plan on the one hand with all other sections of the plan on the other hand.

It is clear that technical progress is proceeding on various lines. The results of research and development in this field can be applied in different ways with different effect. Moreover, certain innovations can be used for different purposes. Anyway, the section of the technical plan which we are discussing now must give a clear-cut idea how and where the results of research etc. should be used and what would be its effectiveness.

In order to avoid a long verbal discussion of this section of the technical plan we shall give a concise list of measures which usually are included in this section:

- (i) output of new products
- output of old (obsolete) products which will stop
- improvement of quality of production



- (ii) modernization, mechanization and automation of production processes and of equipment
- (iii) introduction of new technologies and materials technologies which will not be used anymore
- (iv) extension of productive capacities
- (v) organisation of production
- (vi) elaboration of new work standards (norms)

In any case intensive calculations with respect to the economic effectiveness are required. These calculations should cover, in particular, the possible increase of labour productivity (in terms of output per worker and time units), the possible decrease of consumption of raw material and semi-finished goods as well, and last not least, the expected decrease in cost.



