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CRITERIA FOR EVALUATION OF INDUSTRIAL PROJECTS IN AN OPEN ECONOMY

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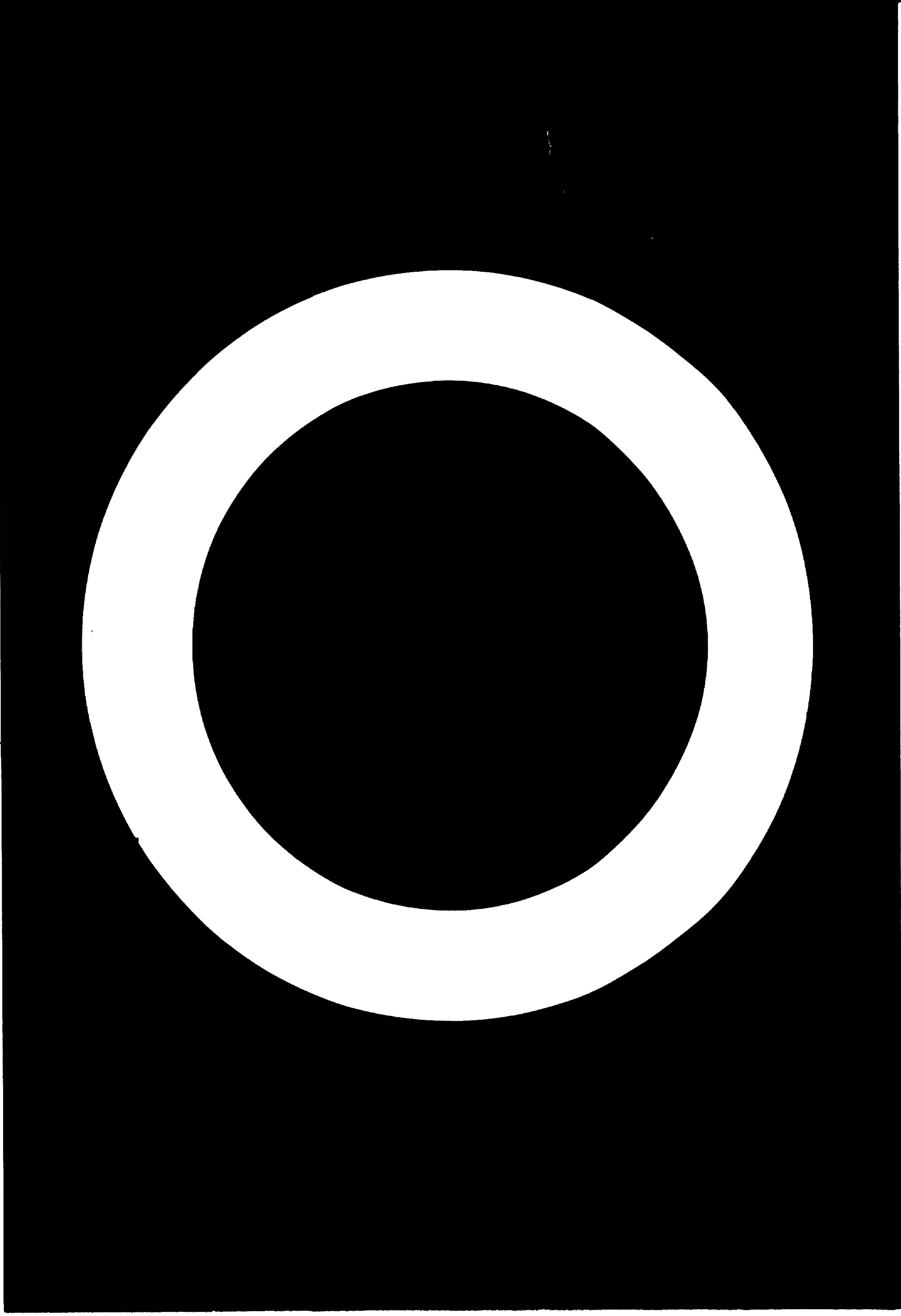


PREFACE

In a relatively short paper it was impossible to describe all the features of industrial project evaluation in Hungary. Therefore we stressed the points we considered the most important. We also assume that the basic characteristics of a centrally planned model are known. In case it is not so, we would recommend a study of the paper "Planning for Economic Development" U. N. 1964, New York, Vol II. In this volume the reader will find a complete description of the Hungarian system of central planning.

The ideas, views and critical remarks in this paper should be considered as the private opinion of the authors. None of the ideas or remarks in this paper may be taken as official statements of any Hungarian offices or authorities.

I. Introduction: Development strategy and conditions.

During the last twenty years Hungary has changed from a relatively underdeveloped agricultural country into a relatively developed industrial country. In this process the high rate of industrial growth played a very important role. Between 1950-60 industrial production has increased by 10 percent on an annual average. The economic structure of the country changed radically. While in 1938 industry produced 35.7 percent of the national income and agriculture contributed 36.5 percent, in 1961 70.3 percent of the national income has been produced by industry and construction and only 20.4 percent by agriculture. According to census data in 1941, 48.1 percent of the working population was agricultural and 22.4 percent industrial while in 1961 the share of the agricultural population decreased to 35.2 percent and the share of the industrial population increased to 31.7 percent of the total. These results were achieved to a large extent through extensive investment activity. Before the II World War the share of accumulation in national income was no more than 8.5 percent annually. During 1949-62 this proportion has increased to 25 percent on an annual average. It has to be mentioned here, however, that in some years the share of accumulation in the national income increased to as high as 35 percent annually. This fact can not be seen from the statistics because of the two level, distorted price system, (Low prices of capital goods and high prices of consumer goods.) The price system changed in 1959. Before the war about 15-20 percent of total investments was spent on industry annually, while between 1950-62, with the exception of two years, the share of industry in total investment outlays increased to about 40 percent annually and in 1953 has reached the peak with 47 percent of the total. We mention here these facts to indicate that during the last twenty years in Hungary special attention has been paid to investment problems and also to research and experimentation in order to find the proper criteria for evaluation of industrial projects. There are some results. We can not, however, state positively that we found the solution and now we have the correct system, principles and methods of industrial project evaluation.

The first lesson we may draw from our 20 years' experimentation is that the formulation of the correct criteria for industrial project evaluation is extremely difficult.

In this paper we will try to draw the most important lessons from our past experiences on the one hand and to explain those new ways and means we intend to use in the near future, on the other.

The question to be answered is this: what facts and principles have we to consider in order to formulate the proper criteria for project evaluation? And the second question: what are the right criteria and the methods of applying them?

The second lesson we should draw from the Hungarian experiences - and this is probably the most important - is that it is impossible to formulate such general criteria which are applicable in any country at any time irrespective of the given circumstances. Such general criteria are non existent. Criteria of project evaluation in general depend on two factors: (a.) on the development strategy and (b.) on the economic situation and possibilities of a given country in the given period of time.

The first factor, however, is not independent of the second and both of them are changing from time to time. By a development strategy we mean the long term development targets and the means required to fulfill them, on economic situation and possibilities we take into consideration: the existing amount of capital, labour, natural endowment, and the institutional framework of the economic activity. Since both of the above mentioned factors are changing over time the criteria of project evaluation have to change too. As a consequence the criteria are always highly relative by nature. This, of course, does not mean that we are unable to formulate relatively stable criteria. In a centrally planned system it would be impossible to elaborate investment programs for the economy as a whole without some kind of criteria elaborated on the basis of the above mentioned two determining factors. In a market economy, of course, where investment decisions are taken . private enterprises the conditions and criteria of the investment decisions are different but there are many similarities common to both systems.

In recent years, economic research devoted attention - both in the West and East - to experiments which provide proper methods in choosing the optimum variant within given limiting factors (mathematical programming).

The limiting factors usually are official plans and development programs prepared by leading circles or governments. On this basis, economic models are built. The models usually start with the limiting factors established in the official programs. These limiting factors are built into the models and the optimum size of the activity is calculated at those limiting factors. In other words: the criteria of the optimum variant are determined outside the model and the model itself is dominated by them. The optimum is always relative and depends on the evaluation criteria, whilst the evaluation criteria are determined mainly by the development strategy.

At the same time, research efforts are seldom directed to finding out the proper ways and means and methods of how to elaborate a long term development strategy, and further to formulate a sound investment program on national and sectoral levels, applying the criteria determined by the long term development strategy. This is one of the main reasons why it is so difficult to formulate the criteria for project evaluation. In the real planning activity the criteria for industrial project evaluation have been decided with the elaboration of the long term development program. In the optimum calculations the criteria of evaluation are built into the model as limiting factors and the optimum variant is a relative optimum, in relation to the limiting factors decided upon by the targets and objects of the long term development strategy. We base this statement on the real experiences gained in the development of the Hungarian economy.

The post-war reconstruction in Hungary ended in 1947-48 and a radical change of the socio-economic structure began. The development strategy elaborated by leading circles composed such goals as: speeding up the rate of growth for a long run, industrialization at a high speed, full employment, complete reconstruction of agriculture and infrastructure, increase of consumption, ensuring complete economic and political independence of the country, reaching the economic level of the highly developed industrial countries within 10-15 years etc. It was obvious from the beginning that the fulfillment of the above mentioned targets require a very large investment activity. To achieve these ambitious goals three variants of an investment program had been considered:

(a) A rapid increase of investment in such a way that consumption also increases, however slowly, as investment and national income rise.

(b) A rapid growth of investment at a stagnant level of consumption.

(c) A rapid growth of investment at an absolute decreasing level of consumption.

At the same time the economic conditions and possibilities were as follows: external resources were not available; the development targets had to be achieved by domestic accumulation and resources; the natural resources of energy and basic raw materials were very limited; a large part of the main raw materials and machinery also had to be imported; free labour resources were at hand but mainly unskilled agricultural labour force; agriculture and infrastructure were socially and technically backward, the economy had an "open" character; export-import sensitiveness were high; the institutional framework had been transformed from a market economy into a centrally planned model based on the state ownership of tools of production etc.

The official development strategy accepted the first investment variant. Rapid growth of investment and a moderate increase of consumption were the targets in the first Five Year Plan (1949-54). National income was expected to rise by 63 per cent and consumption by 35 per cent.

At the implementation of the plan, however, the government was forced to achieve all the above mentioned targets at the same time and as rapidly as possible. In consequence of this development strategy the third variant of the investment program was realized. Investment increased rapidly whilst consumption declined considerably. In this paper we cannot explain all the consequences of the development strategy. Therefore, we shall focus our attention on the consequences connected with the criteria for industrial project evaluation:

(1) The above mentioned ambitious targets decided by the development strategy and the forced implementation of these targets within a relatively short period of time has shifted the whole development program towards an autarchic-type development, neglecting the open character of the economy. Every capital intensive raw material producing branch had to be developed at a very high rate and also every branch of manufacturing. This situation necessarily led to the dispersion of the limited investment resources: the volume of unfinished investments continuously increased, the average time of project completion did not increase and the technical level of new projects lagged behind the required level etc.

(2) Determined by the development strategy the basic criteria for project evaluation became as follows :

(a) every project providing the planned increment of production in quantity has been considered useful and necessary irrespective of the cost and commercial profitability of the project.

(b) the basic criterion of a project was the maximum level of production and employment the new capacity could produce.

The Hungarian experiences without any doubt indicate that the criteria for project evaluation are determined basically by the development strategy.

We would like to call the attention of the reader to some of the consequences of the applied criteria in the extensive phase of industrial development which might be useful for some developing countries with an open economy where the extensive period of industrialisation has just begun. In Hungary between 1949-53, the share of new construction in national income was about 15 percent. The ratio of construction to machinery and appliances was 5.3:1. (It is worthwhile to mention that the same ratio in the U.S.A. at the end of the nineteenth century when the industrialisation drive started was about

3:1, and after the Second World War it declined to 1:1. Moreover, machinery became a little higher than construction). At the same time, in case of new projects the capital coefficient

$$\frac{\text{increment of national income}}{\text{increment of investment}}$$

was no more than 0,28 while in old factories every one unit invested in expansion and reconstruction produced 3-7 unit increment.

Between 1957 and 1962 the construction-machinery ratio has changed to 1.3:1 while the capital coefficient increased from 0,28 to 0.39. In the first Five Year Plan about 35 percent of the national income has been invested and the national income increased by 50.3% about 8-9% on an annual average, between 1958-62 23.7 percent of national income was invested while the increment reached 38.8% or about 7% in an annual average. In addition to this personal consumption has increased considerably.

In the 1960's investment decisions were dominated more and more by the criteria of efficiency and profitability.

The basic shortcoming in our opinion of the development policy of the 1950's was that the open character of the economy has been neglected. Therefore, in an autarchic-type development the basic criteria of project evaluation have been necessarily reduced to the maximisation of output and employment. In spite of these difficulties one of the most important targets, i.e. full employment, has been achieved. Industrial employment increased from the 547.409 1949 level to 1.193.800 in 1962. During the 1960's rather a lack of labour power is characteristic, indicating that the period of extensive type industrialisation has ended.

We are approaching a new stage of development referred to in the Hungarian literature usually as intensive type industrialisation. The most important question of this stage could be formulated as follows: what should be the criteria for project evaluation in an industrial country where, (because of the scarcity of natural resources, industrial raw material and energy) resources etc. are very limited and therefore a large part of the national income is flowing through the channel of foreign trade (more than one third of the G.N.P.). In the following chapters we will try to summarise the new efforts and research attempting to discover the proper answer for the above mentioned questions.

11. Basic assumptions and theses.

(1) Definition of the "open economy."

We consider an economy to have an open character when the actual and potential scarcity of natural resources and conditions makes it impossible to utilise the existing and expected capacities in the long run on the basis of domestic resources, at a full extent. From this definition follows the basic characteristic of the open economy: the amount of foreign trade activity is very high measured by its share in national income, both on export and import side. The open character of the economy of course influences the criteria of project evaluation both in the extensive and intensive stage of industrial development. However in the intensive stage this influence is much stronger. While in the extensive stage the rate of growth can be increased by building a large number of relatively low technical level projects and using the maximum amount of labour and domestic natural resources in the short run, in the intensive stage these resources are already exhausted. The more rapid was the development in the earlier stage the more pressing is the scarcity of natural resources in the intensive stage since capacities increased by a large amount. The import needs of the economy are suddenly rising to a qualitatively new level. Therefore, in an open economy (such as the Hungarian economy) where a certain high level of industrial development has been achieved the implementation of any long term development program, even at a reduced, moderate rate of growth, is a function of the increasing export ability of the economy.

This is the most important premise in an open economy which has to be taken into account in any sound development strategy. Taking into account the cumulative effects one unit decrease or increase in export produces much more than one unit fluctuation in national income, in employment, and in the living standard. This indicates a very high foreign trade sensitivity. According to our present estimate one unit decline in export through the decrease of import produces 4-5 unit decline in national income. These conditions of course determine the criteria of project evaluation. Since the increase of national income, employment and consumption are the function of the economy's export ability the most important criterion for project evaluation (and at the same time the most important criterion of efficiency of the national economic activity) is the expected maximum net foreign exchange earnings (yields) of a project, or of the national economy as a whole, in the long run.

If in the open economy the maximum of the net foreign exchange earnings is the basic criterion, the character of the efficiency computations is already determined by this very fact. On the other hand the criteria of sectoral allocation and project planning are determined too.

(2) An experimental method for the calculation of net foreign exchange earnings.

The objects of the experiments are as follows:

(a) to determine the net yields of a single project (i.e. the difference between the inputs and yields in foreign exchange for the expected lifetime of the project.)

(b) to determine the expected increment of national income (expressed in foreign exchange) produced by investment expenditure.

(c) to determine the expected net foreign exchange yields in every sector and on this basis allocate investment funds among sectors. (choosing the "leading sectors".)

The first bottleneck encountered by planners in these computations is the price system. In centrally planned economies domestic and foreign trade prices are rigidly separated. Domestic producer prices are calculated in domestic currency on the basis of domestic inputs. In addition producer prices and consumer prices are separated both for industrial and agricultural products. The changes occurring in producers costs does not reflect in consumer prices. Taxes are differentiated by sectors. Therefore, calculation of the real costs is very difficult. Since domestic prices are separated from world market prices (while more than one third of the national income is realized on international markets) national income calculated by domestic prices and in domestic currency is different from the national income measured in world market prices.

In an open economy, however, where the real rate of growth is a function of export ability (and export ability is a function mainly of costs related to international standards) efficiency of a project or of the economic activity as a whole, can be measured only by the net foreign exchange earnings realised or realisable on the world market. In order to get the net foreign exchange earnings of the economy (or a sector, or a project) we should be able to express inputs and outputs in foreign exchange on the level of world market prices.

The first experiment in this direction started in 1964, and it is in process. The experiment is called in our literature "World market price model". There are two preconditions we had to provide for the computations:

(i) an input-output table containing the quantative relationships of sectors

(ii) foreign exchange rates for comparison of domestic and foreign trade prices - substituting for the rate of exchange. In Hungary since input-output analysis is very well known we have the proper tables. The formulation of foreign exchange rates is however very difficult, namely we need such kind of rates which take into consideration the differences of the price levels of market and centrally planned economies. The root of the matter is that total domestic production will be calculated in dollar prices on the basis of the input-output table. As a result first we will be able to get a real domestic price structure and as a second step we might have a static comparison of sectoral efficiency measured by the realised net foreign exchange earnings of the sectors.

The main steps of the calculations are as follows:

(1) The output of various producing sectors will be calculated and expressed in dollar values taking into account the average world market prices possible at a certain time. The total output of a sector shall be divided in two parts:

Sectors total output

a.) main products
relatively few products of a sector which determine the sectors profile. These products are subdivided into the following two groups:

- products for export
- products which are not exported but could be exported

b.) secondary products
a smaller part of output

- products not characteristic for the sectors profile
- products characteristic for the sectors profile but their weight is very little.

The world market prices of the main products are immediately given. In case of secondary products we use foreign exchange rates. For products not characteristic for the sectors production we use average rates of foreign exchange calculated on national level, while for products characteristic but not important for the sectors main activity we use average rates calculated on sector level. At the formulation of product groups is a basic rule in general to represent domestic composition of production in every sector as accurately as possible. Applying this method, the total outputs of the commodity producing sectors are expressed in dollar terms calculated in average world market prices, i.e. linevectors of the input-output table are expressed in dollar terms on average world market price levels. There are of course, several difficulties to overcome during the calculations. We mention here a few of them: in some sectors output is not homogeneous, price calculations of a single product are usually misleading and in such cases we have to use price indices related to product groups, etc.

Above we have mentioned the calculations connected with the commodity producing sectors. This is, of course, not enough. We have to calculate the outputs of service producing sectors (communication, transport, trade etc) and also output of construction. We shall deal with these sectors later.

2. As a second step input of commodity producing sectors has to be calculated taking into account average world market prices in dollar terms, i.e. column-vectors of the input-output table has to be expressed in dollar terms. Since, in the first step we calculated outputs of commodity producing sectors in dollar terms and intersector relations are given by the technical coefficients of the table, on this basis those domestic material inputs originating from various commodity producing sectors are also given in the column vectors, expressed in dollar terms on average world market prices.

The next input item of the column vectors is: import material. Dollar prices of import materials however are immediately given. The most complicated items of the column vector to calculate are wages and amortisation which has to be calculated in dollar terms too. Calculation of wage input starts from the so called "food basket". We take the average world market prices of the products represented in the "food basket" in dollar terms. In this way one part of the wage bill is expressed in a proper scale. It is more complicated to compute those services which are used by oonsumers. We do not have the proper methods yet and many possibilities are under discussion at the present time.

The next input item of the column-vector is amortisation. The calculation of amortisation starts with the computations of the dollar values of investment expenses. Before that, however, we have to be able to express the value of construction activity in dollar terms. The output of construction cannot be determined from commodity side. Therefore wages have to be determined first and later using various calculation methods based on wage costs expressed in dollar values output of construction (and in the same manner outputs of service producing sectors) will be computed in dollar terms too. At the pricing of amortisation a special index will be used which is a quotient of the total domestic price of investment-replacement and foreign exchange price of the same aggregate. The sum of investment and replacement is given in investment column of the table.

The calculations are accomplished on three price levels:

(a) on the level of average export-import prices accepted in 1961 among centrally planned economies in foreign trade treaties,

(b) on the level of average Hungarian foreign trade prices with the western market economies, (In case of products which are not exported to western markets we use the method of "price identification" based on the comparison of technical-economic parameters of the given product.)

(c) on the level of average prices of one of the "main markets". When the above mentioned computations have been completed we have the following results: the balance of sector activity, gains or losses in every sector expressed in foreign exchange terms (in dollars) and the net aggregated foreign exchange earnings (direct and indirect) for the national economy as a whole. These calculations, however, are static by character. Therefore as a third step the model has to be dynamised. Since we do not have an input-output table for every year the foreign exchange gains or losses calculated for one base year have to be estimated for other years or for a period of time on the basis of changes in production, in technical coefficients and in world market price levels. The estimated foreign exchange gains or losses should be related to the foreign exchange value of investment expenses in every sector.

The calculations reflecting foreign exchange gains or losses by sectors for 1961 will be completed at the end of 1965 anddynamisation of the model follows in the next 2-3 years.

We indicated above that the first picture is a static one, gains or losses by sectors in a certain year. Therefore the next step is to dynamise the model by interpolation, and get a picture about the trends of gains or losses. Let us suppose as a first approach we are interested to know how the foreign exchange balances of various sectors have changed between 1951-61.

Let us suppose further that sector "A" had:

output	$ 200 million
input	$ 140 million
Balance of foreign exchange	$ 60 million.

Volume of production in sector "A" doubled. Foreign exchange gains of sector "A" interpolated only on the basis of the production index equal $ 30 million in 1951.

We suppose the developments in sector "A" in the last eleven years were as follows: (in millions of $)

year	Chain index	Balance of foreign exchange	Changes in balance of foreign exchange in relation to the previous year
1951	100	30	-
1952	110	33	3
1953	109	36	6
1954	108	39	9
1955	108	42	12
1956	107	45	15
1957	107	48	18
1958	106	51	21
1959	106	54	24
1960	105	57	27
1961	105	60	30

Total: $ 125 millions.

Taking into account production increase only and extrapolating changes of foreign exchange yields during eleven years foreign exchange earnings originating from sector "A" are $ 125 million total (discount effects are disregarded yet). We neglected for the moment the effects produced by changes of the technical coefficients labour power, as well as by world price level movements. These effects, however, should be taken into consideration too. The proper methods to consider them are not elaborated yet and various ideas are widely discussed.

At the final end calculated foreign exchange increases by sectors have to be related to the foreign exchange values of invested capital by sectors. Applying the method described above we expect to get the following results:

(a) When the "world price model" is completed, all basic data we need to calculate net foreign exchange earnings of a project, sector, or the national economy as a whole are given.

(b) We will have a sound basis (difference among sectors in net foreign exchange earnings) for sectoral allocation of investment funds based on the principle of maximisation of net foreign exchange earnings. (as the most important indicator of efficiency in an open economy).

(c) With the help of a dynamised "world price model" we expect to get a good method for elaborating long term investment programs.

(d) Since we expect to be able to have all basic data in foreign exchange value it will be possible to calculate the increment of national income also in foreign exchange and have a clear picture about the efficiency of aggregated investment activity on sectoral and national level.

In other words, with the help of this method we expect to apply in practice our principle that in an open economy the most important criterion of project evaluation is the net foreign exchange earnings gained in the long run. The method described above in general terms, of course, is only a starting point for industrial project evaluation in so far as it indicates at a certain moment the net yields of various sectors on the one hand and the world price trends calculated "ex-post" might be used as starting points for estimations of world market price trends "ex-ante" on the other hand. There are some other aspects of project evaluation in an open economy which have to be considered in the preparation stage of the investment program. Because of the foreign trade sensitivity of the economy the number of "uncertainty factors" are considerable. The longer is the duration of the investment program (and in many cases we have to deal with 15-25 years) the higher are the number of "uncertainty factors." In connexion with a high degree of uncertainty the importance of the "risk element" and the calculation of possible risk is increasing.

The first question which planners must answer is how to minimise an uncertainty and risk? The first step - because of limited domestic resources and the high degree of uncertainty - to be taken is to concentrate investment funds into those branches where expected foreign exchange earnings are the highest. In this way we choose "leading sectors". The allocation of investment expenses mainly into these "leading sectors" and the additional and auxiliary investments induced by the "leading sectors" main investment expenses determine the investment program as a whole. As a consequence of applying the principle of the "leading sectors" approach foreign trade sensitivity of the economy will increase in the long run. In spite of this effect in an open economy we do not see any other possibility or way to achieve a considerable growth of national income, employment and consumption, in the long run. The concentration of scarce resources into a few leading sectors is the key to increasing efficiency. If the above mentioned principle is accepted some of the criteria for project evaluation are determined almost automatically. The open character of the economy makes it necessary and the concentration of limited resources into "leading sectors" makes possible in general to use the most modern, up to date machinery and technology for the construction of new industrial projects. Probably this is one of the most important criterion for project evaluation in an open economy.

Applying the principle of "leading sectors" approach and as a consequence of this use of up to date technology of new projects are the only real guarantees against uncertainties and risks in the long run; otherwise, decreasing costs and increasing net foreign exchange earnings in the long run cannot be ensured.

According to our experience, to apply the above mentioned means is still not enough if the foreign trade sensitivity is so high as it is for example in Hungary.

An economy producing for the world market and depending on it to a large extent has to be ensured against uncertainties by "strategic reserves" which are able to counterbalance the effects of the uncertain movements in any circumstances. The quantity and composition of "strategic reserves" are determined by many factors (both economic and political) but a relatively considerable part of national income has to be reserved for this purpose in general. The material forms of these reserves are: capacity, labour, raw material and foreign exchange reserves.

As far as industrial project evaluation is concerned determination of capacity reserves has a high importance. At the present moment we do not have the proper methods to determine the necessary capacity reserves. One part of research efforts should be devoted to this object in the near future. It is obvious, however, from our present discussions that capacity reserve" is a special form of risktaking, therefore the costs of "capacity reserves" should be calculated as a rate of risk, and should be incorporated into the inputs of new projects as a necessary cost element. The other forms of necessary reserves have to be calculated in the same manner. A basic rule of development strategy in an open economy - which determines some of the criteria for industrial project evaluation - is that balanced growth of the economy cannot be achieved without "strategic reserves" or in other words: balanced and optimum rate of growth can not be sustained at the full employment of all the resources (capacity, labour, raw material, foreign exchange.)

In this chapter we were trying to explain the basic ideas of "strategy" formulation in an open economy and in connexion with it those main criteria of project evaluation which are determined automatically by the development strategy. In the next chapter we intend to explain those conditions and methods by which the above mentioned criteria might be used in practical project planning.

111. Process of industrial project evaluation.

(1) Preliminary steps in setting up industrial projects.

We indicated in the previous chapter that the "world market price model" is only a first step to calculate expected net foreign exchange yields in the long run. The static model should be transformed to a dynamic one in order to formulate sound investment decisions.

The first step of dynamization is the elaboration of special studies about expected foreign market and price trend movements i.e. a long term estimation of future market and price trends, by main products or main groups of products. We do not have wide experiences in this field yet and the first studies were prepared in recent years. Foreign and domestic market estimates and price trend movements should be calculated for at least 10-15 years in order to calculate expected net foreign exchange earnings. Market studies have to be prepared through the following steps:

(a) selection of main markets. The proper selection of main markets means we are choosing those markets where we are already in successful competition or we will have a chance for successful competition in the near future. In general we have to analyse the "accessible markets." In this respect current foreign trade practice provides much information to start with. This information of course is not enough. The selection of the proper market as a first action requires extended research and analysis.

(b) estimation of capacity increases and market possibilities of prospective competitors. This study and analysis is the most complicated to prepare. Limited information is the most important bottleneck. In case of centrally planned economies we are in a better position since their development targets and economic situation are well known. So we are able to estimate their prospective capacities and export ability too. To estimate trends in market economies is the most difficult task (business interests, government interference etc. are distorting factors). In spite of these difficulties we have to prepare some estimates otherwise we can not forecast expected supply position and price movements in the market.

(c) estimation of prospective changes in technology and research including the possibility of new technology creating new methods for mass substitution of the given product. This estimate is very important from the point of view of expected costs and prices.

The importance of these preliminary studies came to light in connexion with the development planning of rapidly growing industries such as chemical, artificial fibre, instruments, precision machinery, telecommunication industries etc. In these industries calculations based on current price movements may cause a complete misunderstanding. We are mentioning here just one example: and this is rather a classical one. Production of B_{12} vitamin has been decided on the basis of current world market prices. When the capacity expansion started the prices were very high. At the completion of the new project, prices came down to a fraction of the earlier prices.

World market prices of B_{12} vitamin 1958-64. (in dollar gramm.)

1958	1959	1960	1961	1962	1963	1964
100	65	42	16,5	9,5	8	6,6

In spite of the importance of market and price forecasting at the evaluation of industrial projects, only very few studies were completed until today. This is due to various difficulties. The remnants of the earlier development ideas and criteria and bottlenecks in information gathering hampered the elaboration of the above mentioned studies. Notwithstanding these facts preparation of market and price forecasting studies has been carried on since the 1960's. The first experimental studies were connected with the development of mathematical programming in two sectors, in artificial fibre and in aluminium industries. On the following pages we will explain the main steps of these experiments.

Elaboration of price forecasting studies.

The research work started in 1963 and its aim was to predict the expected world market price level in dollar terms for 1975 for some artificial fibre and for aluminium.

(a) Planners have gathered all information about production conditions and technology of the product. On this basis - taking into account that discovered technological results will be applied - they calculated the expected cost level of 1975 (direct material, labour inputs etc.)

The cost level gained for 1975 has been expressed in dollar values and it was considered as a minimum level of the expected price. They have also presumed that in case of introduction of a new technology between research and mass implementation about 6-12 years are required. Therefore this process would not change the main price trends for the calculated period of time. They came to the conclusion that in 1975 the expected minimum level of price will be equal with the cost of the product.

(b) Prices had been analysed for the last 10-20 years "export" by products and by main producers. At first, domestic prices were calculated and expressed in dollar terms by countries. Spreading was very high and the prices were considerably far from the price level of the Hungarian import. Planners then presumed that Hungarian import prices from market economies in the base year were objective and real prices and they transposed the price lines of various countries upon the level of Hungarian effective import prices. In this way price changes were related to the average Hungarian import price in the base year. After that they constructed regression functions and fitted curves to the various prices and in this manner prices have been expressed in the function of time. The trend lines and zones covered by the curves clearly indicated world price movements "ex-post." These export analyses have been used as starting points to "ex-ante" price analysis.

(c) As a third step expected export market changes have been estimated taking into account prospective capacity increases of the main producers and changes in demand. The lack of information in this field was the biggest.

In case of new products current prices were taken as dynamised median values. The uncertainty of price level in this case was indicated by a higher degree of oscillation around the current level.

Further research has tried to take into account as many factors as possible. In case of artificial fibres production for example, various raw materials are used such as: bensol, fenol, toluol, paraxilol, the so called aromatic compounds. Since these products are produced from the same basic material (coal bitumen or by petro chemistry) market analysis had to deal with all of them at once. After the II World-war raw material basis of artificial fibres production has shifted from the coal base to the petro chemical base and this change influenced prices more than many other changes in technology, skill etc. Therefore special attention had to be devoted to oilprice estimates. These examples indicate the difficulties confronting market and price forecasting. Interrelationships of world price movements also have to be considered. For the period of 1953-60 price correlation computation has been applied between various product prices.

On the basis of "ex-post" correlation coefficients planners estimated "an expected correlation" for 1975 etc. After "ex-post" analysis has been completed they calculated export prices. Since these products were not produced and exported before, export prices were calculated from import prices presuming that Hungarian export can not realise better prices than the western competitors. Therefore the export price should be calculated lower by the double of transportation costs as the import price. In addition some price losses had to be taken into consideration due to expected discrimination policies etc. (This factor was neglected with regard to raw and semi-finished products).

With these methodological aspects price of aluminium has been calculated as follows:

(1) <u>prospective costs of 1 ton of aluminium based on expected conditions of production.</u>

Electric energy	14.500 kwh	0,45 ¢	65 $
Aluminious earth	1.91 tons	60, $	115 $
Kriolit and aluminium flourid	50 kg	33 ¢	17 $
Electrodes	600 kg	5,5 ¢	33 $
Labour costs	17,6 hours	2 $	35 $
		total:	265 $
Estimated amortisation and overhead expenses			165 $
		total	430 $

The expected cost level $ 430 is equal with the expected minimum price level. Aluminium price data have been collected and transposed upon the level of Hungarian export price (western) and later has been deflated.
(see table on next page.)

CONCLUSIONS

(a) We can not formulate a regression function because there are three different periods

(i) between 1938-50 prices declined considerably

(ii) between 1950-58 prices increased considerably

(iii) after 1958 prices declined slightly.

(b) Taking into account market factors the rising trend of aluminium prices has stopped. A relatively stable or slightly decreasing price level can be expected because prices did not follow decreasing costs (effects of monopolistic producers.)

(c) Capacities increased and are rising further slightly while a decreasing rate of use of aluminium products is highly probable.

(d) Presumably price level will oscillate around production costs.

(e) The minimum expected cost level $ 430/ton. If the expected price will be equal with $ 430 the American producers can not hold this level since American labour costs are higher than $ 2/h. Therefore the difference between U.S. domestic and international price levels will increase.

(f) International commercial price of aluminium in 1970-75 will fluctuate presumably around $ 430- $ 450/ton.

When foreign market and world price forecasting are ready we are still in the stage of preparation and a number of further investigations are still left. Special studies have to be prepared about the following topics:

Evaluation of import possibilities, including capital import by countries or relations (from centrally planned economies, from market

Aluminum price^.

	Canada K.$/ton	Norway N.K./ton	Hungary $ ton	USA $ ton	U.K. £/ton	France Fr/ton	Italy lira/ton	Germany Dm/ton
1938				926	314	38.100	574.000	2.900
1948					122			
1949					136			
1950	413			391	120	21.600	323.000	2.100
1951				428	93	18.100	366.000	2.114
1952		2.940		451	139	21.900	398.580	2.[illegible]50
1953	437	3.140		434	157	21.520	398.580	2.267
1954	444	3.070	525	409	152	22.000	379.000	2.230
1955	485	3.210	638	4[illegible]7	156	22.000	390.000	2.210
1956	525	3.590	497	508	177	21.300	422.000	2.100
1957	531	3.800	504	522	184	21.600	421.000	2.220
1958	507	3.630	520	506	182	21.900	403.130	2.130
1959	504	3.500	470	505	177	22.600	410.000	2.[illegible]
1960	516	3.560	474	531	180	22.500	413.000	2.[illegible]0

Changes of the above prices deflated by wholesale price index and transposed upon Hungarian export prices in 1960 (to western markets).

	Canada	Norway	Hungary	USA	U.K.	France	Italy	Germany
1938				825	825	802	658	673
1948					322			
1949					360			
1950	379			350	317	455	370	489
1951				336	246	384	421	493
1952		394		384	365	460	445	526
1953	403	417		403	412	455	445	526
1954	408	408	525	388	403	464	436	530
1955	436	426	638	436	412	464	450	513
1956	434	479	497	436	455	450	434	504
1957	489	508	504	464	484	45[illegible]	464	519
1958	464	489	520	450	479	459	459	497
1959	464	489	470	450	469	479	469	474
1960	474	474	474	474	474	474	474	474

Sources: Preise, Löhne, Wirtschaftsrechnungen,
Reihe 8. Wisbaden
UN Monthly Bulletins-
New York, National statistics etc.

economies etc.) At this stage we may use the information gathered earlier in connexion with market and price forecasting.

Calculation of the expected reserves: Based on market analysis we have to estimate future changes and calculate optimum size capacity, labour, raw material reserves, and foreign exchange stocks necessary to counter-balance any eventuality.

Estimation of integration and cooperation possibilities, by countries and relations taking into account existing trade connections and treaties.

Estimation of domestic market developments. In this study the open character of the economy also plays a very important role. Not only raw material and machinery but consumers tastes and habits are also often "imported". Therefore we have to use the method of extrapolation based on domestic norms, and the so called "comparative analysis" which follows the development of more advanced countries, analyses development of consumption in those countries expecting that similar consumption patterns will dominate domestic markets etc.

(2) Analysis of domestic resources. This study should contain the following items:

(a) Natural resources: (Energy resources, geological resources mining products etc.)

(b) Existing capacity: volume, age, technical level, possibility of reconstruction or expansion, capacity of construction by sectors and in the economy as a whole.

(c) Labour force: actual labour force, reserves, long run demographic estimates etc.

(d) Material resources: Stock and composition of raw material semi-finished and finished products (import material separately).

(e) Foreign exchange situation: analysis of the balance of payments position, debts and foreign exchange reserves etc.

(3) Preparation of a preliminary investment program.

When all the above mentioned information is collected and the main targets and political-economic aspects of a long term development strategy are formulated a preliminary investment program should be prepared containing a hypothetical allocation of investment funds and indicating the "leading sectors" and the most important, large single projects by sectors. This is what we may call primer investment decision.

(4) Optimum computations on sector and national level with mathematical programming taking the maximisation of net foreign exchange earnings or (and) minimisation of import expenses as basic criteria.

At this stage three problems should be solved:

(a) the sector model computations should produce an optimum variant for the sector as a whole and optimum variants for the most important single projects within the sector.

(b) the model of the national economy should produce an optimum allocation among sectors.

(c) the model of the national economy should control the preliminary investment program.

Finally planners should have a quantitative form of criteria for project evaluation.

In this respect we are glad to introduce a new Hungarian experiment in process initiated by the Hungarian Planning Board in connexion with lll. Five Year Plan. The experiment started in 1963 and the object of it is to prepare a long term plan by mathematical programming. As far as we are informed this is the first experiment of this kind in a planned economy.

Programming on national level means a series of calculations by computers. The computations will be arranged in four stages:

(1) basic computations on sector level

(2) sensitivity computations on sector level

(3) basic computations on the level of the national economy as a whole

(4) sensitivity computations on national level.

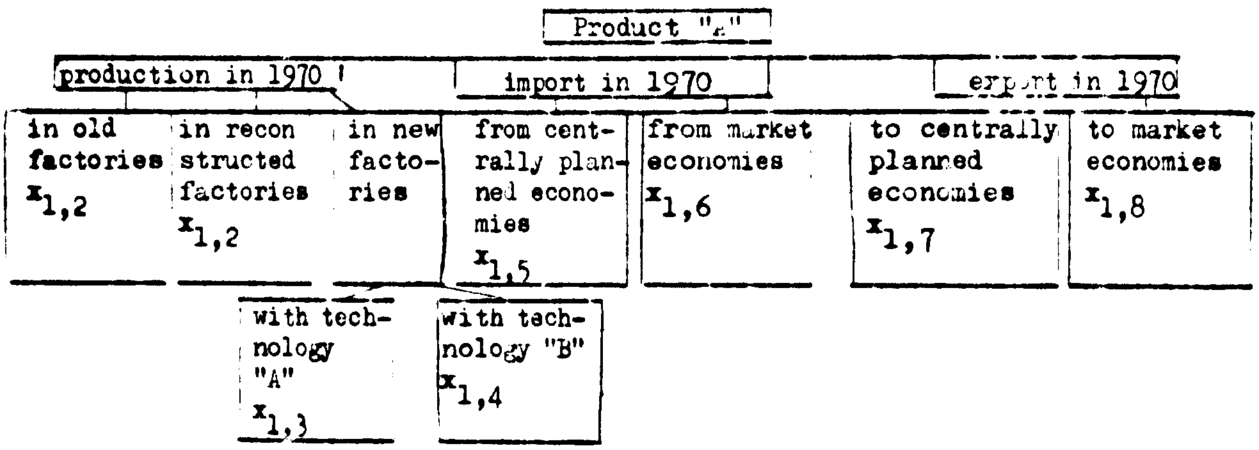
(a) Basic computations on sector level.

There are 39 sectors in the national model. (The number of sectors might change somewhat during the research). These sectors are as follows:

1. Bauxit-Aluminium
2. Leather-shoe-peltry
3. Food industry: vegetable oil
4. " " : milling, beer, vine
5. " " : meat, poultry, milk
6. " " : sugar, alcohol
7. ' " : canned food
8. Building material: brick, cement
9. " " : panel
10. Construction
11. Machinery : vehicles
12. " : agricultural machines
13. " : engine - freight car-coach
14. " . ship building - crane
15. " : instruments
16. " . casting
17. Telecommunication goods I.
18. " II.
19. Transportation: railroad
20. " : automobile
21. Oil production
22. Oil processing
23. Agriculture: cereals
24. " : animal products
25. " : potatoes-vegetables
26. " : fodder
27. " : fruits
28. Artificial fibre
29. Chemical fertiliser
30. Paper
31. Coal mining
32. Organic basic chemical I.
33. " II
34. Textile-clothing: silk-cotton
35. " : wool-linen-hemp
36. Chemical: except 28. 29. 32. 33.
37. Iron metallurgy: iron-steel
38. " : plates
39. Electric energy

Sector activities include: production and foreign trade, for example: textile export-import are included in textile sectors. Each of the sector models are dealing with 6-10 groups of products. (We will call them products.) In exceptional cases we have one homogeneous product (electric energy) in the majority of sectors we are dealing with groups of products (product aggregates.) In some sectors "product" means a service (f.i. in sector railroad - volume of transported goods etc.). The model in general deals with about 350 products. Each product is connected with various alternative "activities".

<u>Activity alternatives of product "A".</u>



Each product, of course, will not be connected with the same activities in every case but only with those activities which are applicable by economic considerations to the given product. In special cases (transportation, communication etc.) special activities are connected, determined by the economic nature of the product.

One sector model in general contains 60-80 activities. <u>The volume of various activities are indefinite</u>, they are the <u>variables</u> of the model. Computations should determine the volume, (quantity) of $x_{1,1}$ ....$x_{1,2}$ ....$x_{1,3}$ ....$x_{1,n}$.

The sector program is determined by aggregated activities of a sector model. The program is the amount of such type of numbers as: $x_{1,1} = 0$, $x_{1,2} = 5000$ etc. In other words: the program provides targets for all the 60-80 activities.

The determined sector program will provide an answer for the following questions:

(1) What quantity of each product should be produced in 1970?

(2) What are the projects for which technology should be constructed during 1966-70 in order to achieve the optimum size production in 1970?

(3) What should be done with the old capacities existing on 1 January 1966? (working further, reconstruction or discarding).

(4) What kind and what size of new factories should be built?

(5) What should be exported/imported in what quantity, to/from which country?

The model deals with the plan prepared by traditional methods as an official program. The targets elaborated by traditional methods (balance method) represent only one of the possible variants. The model produces more variants and provides an opportunity for simultaneous comparison of a number of alternatives. The program is an aggregated, complete production, investment, technical development, export-import plan of a sector at the same time. The x values, variables, of course can not be determined voluntarily. The program should contain several real limiting factors.

The reality of the program depends on the reality of the limiting factors. (Such limiting factors are for example: the upper limit of export, capacity limits, technological proportion within the sector etc.) Therefore the elaboration of preliminary studies we mentioned earlier has a decisive importance from the point of view of realistic model and program construction, since the limiting factors of a program should be determined by those preliminary studies. We may draw up a simple scheme of relationships between limiting factors and program as follows:

Upper limits: No more resources can be used as indicated by the official program	program	Results: No less output as in the official program
These we may call: sectoral input of the mathematical program. Investment (construction, domestic machinery, import machinery, labour, wage fund, important materials, energy, transportation capacity etc.)	foreign exchange earnings must be higher as in the official program	This we may call: sectoral output of the mathematical program: output for domestic use output for export

Object function of the model

net foreign exchange earnings=max

Basic computations on sector level are prepared with linear programming i.e. both limiting factors and function are given in the form of linear equations.

(b) sensitivity computations on sector level.

One part of limiting factors at a certain moment is independent of the will of planners (capacity limits) another part of them can be changed during the period of calculations (investment funds).

When the optimum program has been computed already computation of cumulative effects induced by any of the changes in various factors of the model is very easy. The object of sensitivity computations is to measure the effects caused by changes of one or another factor for the sectors program as a whole. Therefore, the sensitivity computations play a decisive role in the process of project evaluation as well as in formulation of criteria for project evaluation. Changing construction expenses for example we are able to see the effects of this change on the whole investment activity of the sector, moreover changes in output, export, import etc. might be considered also.

To construct a sectoral model may take from one to two years of hard research work. But once the model is ready, computation of a given program or a sensitivity analysis will not require more than a few hours to accomplish on computers.

(c) Basic computations on national level.

The object of these computations is to find the optimum allocation proportions among sectors by mathematical programming. This method is called in the Hungarian literature: "two level planning" or method of "iteration". The substance of the method is that sectoral models are aggregated into a large united national model. The object function of the national model is the maximization of the net foreign exchange earnings of the national economic activity, expressed in dollar terms. As a starting point, limiting factors are taken from the official development program. These limiting factors as: realisation possibilities, capacity limits, investment funds, labour etc. are aggregated on national level by traditional methods for the time being. At national level the variables (the x's) of the model are the optimum allocation proportions (among sectors) - including investment fund allocation - applying the function. net foreign exchange earnings of the economy as a whole should be = max → [illegible]. The national model contains about 2500 variables (x) and as in case of sector models it is presumed that no more resources will be used and no less output will be produced as by the official plan but more foreign exchange earnings should be gained during the same period of time as in the case of sector models.

(d) Sensitivity computations on national level.

The object of national level sensitivity computations is to measure the cumulative effects of any factors on the others. We would like to know, for example, the effect of a decrease of investment funds on consumption, export or on sectoral allocation of investments, labour etc. and sensitivity computations will provide it easily if the model and the optimum size of various activities are already determined.

At the present moment we can not give a detailed list of mathematical apparatus and other methods used in model or program construction since the research work is just in the process. Some of the advantages of this planning method, however, can be described already in this stage.

(1) In case of traditional planning (balance method) "complex coordination" i.e. measuring the effects of pertial changes through all the balances and plan targets is extremely difficult (usually impossible within a short period of time). In the model however, plan coordination is mechanised since every important plan target is included in one simultaneous system of linear equations.

Changes in various parameters could be controlled almost automatically in every segment of the model.

(2) In traditional planning, planning of economic activities and prices are separated. By the programming model these two kinds of activities are connected and we get a "calculative price system," called "shadow price system". In this way, we may calculate the following items quite exactly: rate of interest for existing capacities (fix capital), rate of interest (Δ) for investment, wagetaxes, rent, minerent, rate of exchanges ($, Rbl.) export-import duties, dotation etc. Therefore a real price system can be built up which reflects scarcities and possible development goals at the same time. (We intend to return to these questions of shadow prices of the efficiency computations of single projects.)

(3) With the help of programming we are producing variants for various activities which are impossible to calculate with traditional (balance) methods.

It is obvious from the requirements of model building and program determining that a number of parameters and factors built into the model should be considered before model construction. We have mentioned some of them before when we described special studies needed in the preliminary stage of project evaluation (market analysis, price trend estimates, analysis of existing resources etc.)

In order to get the numerical forms of criteria for project evaluation by programming, some other aspects - in addition to the earlier mentioned studies - should be considered.

(4) Technical and economic parameters of products.

Technical-economic parameters of a product will influence the production costs, technical quality, technology, as well as investment expenses, expected prices, marketing, ability for competition etc. of a given product. These parameters of course are different for each product and, therefore, methods to measure them are also different.

The simplest methods are in cases where natural qualities determine the basic parameters of a product. (f.e. primer energy bearers, coal, oil, raw materials in general, products from extracting industries.) Many agricultural products (natural endowment, weather conditions etc. influence the special quality of the product) belong to the same group since expected markets and prices depend to a large extent on the special, natural qualities of the product. In the case of homogeneous products (artificial fibres) product analysis by technical-economic parameters is not so complicated. In other branches, however, in machinery and other rapidly developing branches where product quality analysis is indispensable for efficiency computations there is no other way of comparison by technical economic parameters or as we may call the process: product identification by parameters. Product analysis is not very developed in our country; we have only a few years of experience but we quote here an example of product identification in order to indicate the importance of product analysis for project evaluation. A comparison has been made between two T.V. sets. One is a product of a West German Company, the other is a Hungarian product.

The steps of product identification:

(a) Determination of technical-economic parameters.

(1) Selectivity measured by: field amplification (u V)
(2) Linearity " : %
(3) Tube size " : cm
(4) Line frequency " : lines
(5) Channels " : no.
(6) Automatic functions " : no. (like: brightness, etc. remote control)

(7) Adaptability measured by: W
(8) Weight " : kg
(9) Size " : m^3

(b) Comparison of parameters.

	parameters	German TV set		Hungarian TV set	
		absolute	relative points	aurolute	relative points
1.	Selectivity	100 nV	0.5	50 nV	1
2.	Linearity	max 3 %	0.66	max 2 %	1
3.	Tube size	53 cm	0.9	59 cm	1
4.	Line frequency	500 lines	0.9	550 lines	1
5.	Channels	11 no	0.9	12 no	1
6.	Automatic functions	4 no	1.0	4 no	1
7.	Adaptability	180 W	1.0	200 W	0.9
8.	Weight	38 kg	0.93	35 kg	1
9.	Size	0.122 m	0.8	0.100 m^3	1
	Number of points collected, total:		7.59		8.9

The parameters of the better product are taken as 1 unit and the parameters of the other product are related to the former in proportions of natural measurement weights. This is expressed by adding the relative points. The more points a product collected the higher is its quality. With the above described point system technical parameters have been compared on the basis of a common denominator. In this case the Hungarian product proved to be a better one since its parameters were better in 7 cases, the same in one, and worse in one case.

(5) Choice of technological variants.

In the stage of preparation all the available technological variants should be collected and considered. At this stage we do not have to choose and evaluate them. The programming model, of course, will limit the number of possible technological variants (the number of variables will be limited by computer capacity and time etc.) but we have to have an idea about all the possible variants before we start model building. In case we came to the conclusion that domestic technology is not available or obsolete we have to analyse (a) the possibility to develop a new domestic technology or (b) to import the technology from abroad by purchasing the licence. In case of possible development of a domestic technology, the time of research and experimentation as well as material-technical-personnel preconditions should be taken into consideration and calculated at project programming, how the technology will influence the instalment, capacity, etc. of the new project. (In connection with the artificial fibre programming for example, planners considered 19 technological variants). In our recent practice unfortunately already in stage of preparation technological variants are limited considerably since official plan targets (calculated by balance method) limit or determine investment funds in each sector and investment of imported machinery is also limited, therefore these conditions are reflected in the sector model as limiting factors. Only a few variants could be taken into consideration in present practice and this reduces the possibility to find the real optimum later by the efficiency computations.

(6) Machinery. (Domestic or imported.)

Machinery requirements should be determined on the basis of an analysis of possible technological variants. In connexion with planned machinery the following aspects should be taken into account:

(a) Purchasing possibilities of main machines and appliances of the project. (domestic or imported).

(b) Time of deliveries (domestic-imported)

(c) Expected prices of machinery at the moment of purchasing (in case of imported machinery foreign exchange prices should be considered) and other conditions of delivery (spare and reserve parts, costs of delivery, insurance, guarantees etc.)

(d) Required space of machinery and a plan of building site are extremely important.

In this plan we have to consider: what technological processes are connected and in which building are they located; also, which technological processes will be located outside buildings, under what conditions etc.

(7) Construction capacity.

After technology and machinery has been considered a construction capacity analysis has to be elaborated containing the following aspects:

(a) plan of required buildings

(b) information about available construction capacities (local or not local) and technology (mechanised, prefabricated locally etc.)

(c) expected costs of construction (taking into account all special construction requirements.)

(d) expected technology of heating, electricity, water supply, canals, climatic appliances etc. and special construction needs in connexion with them.

(e) System of transportation and construction needs of the planned transportation system.

(f) time of completion of all buildings, roads etc.

There are many other construction activities, however. They have to be taken into account later at the preparation of detailed blueprint work.

(8) Estimation of the optimum size of capacity.

When all the above mentioned information is at hand a preliminary estimate of optimum size should be prepared taking into account: local labour power, needs of local infrastructural and related investments, transportation costs, geographical location, reserve capacities and several other points.

(9) Expected time of technical planning (blueprints) and realization.

Time of completion should be estimated in two parts:

(a) time requirements of technical planning
(b) time requirements of realization.

The aggregated time of a project construction is the total amount of required time mentioned at the earlier steps of preparation stage plus the time of blueprint work and realization. The aggregated time requirements consist: (a) time of preliminary studies, (b) time of technical planning, (c) time of realization. The time requirements of preliminary studies should be taken into consideration in the same manner as the other elements. This aspect is usually neglected in spite of the fact that costs are involved.

(10) Required infrastructure (social not local)

These aspects of project planning can not be considered at project level. Central planning bodies should provide norms and information at every project. This factor can be calculated by input-output analysis only.

(11) Methodology of choice.

One of the most widely discussed problems of project evaluation in Hungary is the evaluation of project variants, the comparison of efficiency of various projects. Despite the officially prescribed efficiency computations since 1957 many Hungarian economists do not agree with computations accomplished by the official methodology. The authors belong to these economists. Later we intend to discuss the applied formulas used in official efficiency calculations. The first problem of efficiency calculations applied officially is connected with the price system Until now prices are centrally administered fixed prices and their function is to help implement central development decisions. Therefore prices should be diverted from the real costs. As a consequence fictitious prices have been formulated as a substitution for prices reflecting real costs in order to provide economic orientation for project evaluation and these are called efficiency calculations.

Evaluation methods used in these calculations might be divided in two main groups:

(a) methods based on the evaluation of labour costs

(b) methods of normative evaluation

Methods of the first group are not suitable for efficiency calculations in our opinion. We will try to prove our statement later at the critical analysis of domestic official efficiency computations. Within the second group we may distinguish two types of evaluation methods:

(a) evaluation based on the real world market prices which might be realised by foreign trade "world market price model" and

(b) shadow prices gained in mathematical programming. We mentioned the first method earlier. Experiments with the second type started in Hungary under the influence of Novozsilov and Kantorovics and the economists working with it are trying to use a system of shadow prices for efficiency calculations. The point of the matter is to create an optimum program for the economy as a whole by measuring primary resources (existing capacities, labour, natural endowment) and secondary resources (created during the program period by activities included in the program and these may be: semifinished and final products) and by relating them to a target function of the national economy as a whole. The optimum program is that one which satisfies most the conditions formulated by the target function of the economy. According to the opinion of these economists it would not be proper to determine the target function as the maximization of national income or "net income" since these categories are calculated at distorted present prices and this would influence unfavourably the program and distort it.

Therefore target function should be determined as a maximum of net foreign exchange earnings for the economy as a whole. The optimum program is developed on the basis of scarce resources (labour, wage fund, existing quantity of arable land, geological resources, accumulation) fix and circulating capital (foreign exchange funds etc.) The results of programming are: (a) elaboration of an optimum plan in accordance with the target function. (b) a system of calculated shadow prices indicating "yields" of factors of production (which will reflect scarcities) and these shadow prices are considered as "normative criteria" of activity (project) evaluation. Since scarcities of production factors are reflected in shadow prices, the higher the scarcity of a factor the higher will be the shadow price or yield of the given factor. Through this method they intend to determine the yields of invested resources, (rate of return) or the "efficiency coefficient." In other words they intend to substitute real market by a mathematical model of the economy playing the real market games with a fictiticus market.

In connexion with practical use of the method several questions and doubts should be answered yet. We mention here some of them: Whether all market relationships could be included into the model or not (taking into account necessary abstractions and simplifications)? Is it possible to substitute the real market games? How and what mathematical methods can be used to determine the optimum plan? Are shadow prices suitable for real price formation? How can we follow changes of productivity? What is the period of time when shadow prices provide a realistic orientation etc? And these questions are not answered yet. The other possibility we mentioned was to use world market prices (prices of a real market) as a base for evaluation. It is an accepted principle today (even officially) at every form of efficiency computations that we should calculate the results of economic activities by applying international market prices. Discussions are going on only about one aspect of the matter: whether we may use world market prices at the calculation of inputs or not? In our opinion, there is really no other way available. Since input-output technique is quite developed in our country and foreign trade plays a decisive role while computer capacity is scarce, experiencesin model buildings are limited and the required time of model building is long we have to use the method at hand in practice as soon as possible and experiment with others in the meantime.

IV. Actual practice of project evaluation. A critical approach.

(1) Some institutional aspects.

Within the limited space of this short paper we can not analyse the whole system of planning.[1/] Therefore we will focus our attention on those features of balance method which we consider important from the point of view of project evaluation.

The balances compare investment resources and needs. Needs are determined by the rate of growth of national income. Therefore every investment expenditure (or project) is deemed efficient which ensures the planned rate of growth of national income. The balance method therefore exactly reflects the requirements of an extensive type development strategy where the most important criteria of investment or project evaluation are the maximum level of production and employment produced by them. The producing units are directed by centrally elaborated obligatory and addressed plan targets and they are interested in collection of resources for the fulfillment of the plan. Since investment funds are provided centrally every enterprise is interested in securing the maximum amount of investment resources in order to ensure its most rapid development irrespective of the fact whether this is favourable or the most efficient use of resources for the national economy as a whole or not. In consequence of this system of direction and planning, inducement to invest is very high and a special "absorption effect" develops from enterprises for central investment funds.

The central planning of investments with balance methods can not take into account properly the requirements of realization on world markets i.e. the open character of the economy. The target is to maximize national income and aspects of market relations are necessarily pushed aside.

One of the main objects of central planning by balance method is to ensure the consistency of the plan. In order to have a consistent plan balances suppose the allocation of production factors (from the

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1/ Planning for Economic Development, 1964. Vol. II. UN. New York.

point of view of quantative equilibrium) at a presumed rate of growth of national income irrespective of the aspects of efficiency, (criteria of efficiency have been determined almost automatically by the desired rate of growth). There is no opportunity to formulate real variants as well as for choosing the "leading sectors" based on efficiency criteria determined by the open character of the economy. Therefore efficiency calculations are not organically connected with the planning system. These are the main reasons why - for a long period of time before 1957 - efficiency calculations for investment planning were not elaborated at all.

We try to use efficiency calculations for each project since 1957. However the reliability of these computations is very doubtful. In many cases enterprises use them to prove that establishment of this or that project is very efficient and the state has to provide the funds for them etc. Distorted prices are raising also several doubts as to how reliable these calculations might be. These reasons among many others have led to the revision of the present system of direction and planning which are under discussion in these days, and a reform of direction and planning methods is expected in the near future. On the following pages we intend to analyse methods and formulas in use for project evaluation in present practice.

(2) Investment programs, plan targets, documents in stage of project preparation and shortcomings.

Project evaluation in the present practice is connected or rather a part of investment planning. After the necessity of a new capacity arises during planning, the economic-technical preparation of the project is considered and preparation starts. In stage of preparation the main object is to ensure the consistency between the plan and single projects. Since projects should be authorized by central planning authorities, these authorities order investors to collect the information required for plan coordination and economic-technical control of the proposed project. This collection of centrally prescribed documents is called "Code of investment."

The duration of preparation is the time required from the collection of documents until decision making. The following documents have to be prepared during the preparation stage:

(a) "The object" of the investment.

The elaboration of the "object" of investment is the duty of authorities responsible on various levels. This document contains those data which prove the economic necessity of the project as well as the initial data required for control. These data are as follows:

(1) description of the project,
(2) geographic location,
(3) main data of investor,
(4) data of final realization,
(5) expected value of production annually etc.

The first shortcomings are coming to light already here. Planners usually do not have the targets of the long term plan when they have to prepare the "object" of a project and a lack of coordination is inevitable.

(b) The location of the project.

In this document investor should prepare two papers about:

(1) location of the project and
(2) establishment of the project.

In connexion with location and establishment the problem is that while sectoral allocation is decided during national planning, geographical location remains for the preparation of projects. Therefore there is a lack of synchronisation between regional planning and project planning. Complete regional development plans are not ready yet when investor should locate the project.

(c) Investment program

Concerning preparation of project evaluation the investment program is the basic document. Therefore we will try to analyse this part in a rather detailed form, especially those aspects concerning efficiency calculations. The investment program is divided into various chapters.

The investment program theoretically has four functions, they are:

(1) to prove the necessity of the project
(2) to summarise economic-financial-technical requirements of the project
(3) to analyse efficiency of the project
(4) to locate the project.

Investment program should be prepared for every project above certain limits. These limits are differentiated by sectors. The program should be elaborated for the basic project but related investment needs should be included too. In order to ensure special aspects of trade, projects are classified in seven groups as: general industrial, food industry, transportation-communication, agricultural, apartment-health-social-cultural and administrative projects, public works, and storage projects. Special aspects of each of the trades, of course, can not be solved within those narrow limits. Therefore central direction usually allows investors to prepare additional documents reflecting trade specialities. Investment program includes the following information of a project:

Chapter 1.

(a) motivation of production increase (domestic market, export increment etc.)
(b) necessity of the project (a comparison or balancing of domestic demand and import with expected capacity increases produced by the new project.)
(c) motivation of accepted technology
(d) motivation of geographic location
(e) list of related projects (declarations of all the interested investors, authorities etc should be attached)

(f) declarations of raw material producers (in case of import Ministry of Foreign Trade and the interested foreign trade companies should state their opinion).

As may be seen from the above mentioned list the motivation of a project is quite complicated. Despite this fact information in many cases is superficial even in consequence of the huge quantity of documentation required. These information documents can not substitute for real economic analysis including market and price forecasting studies mentioned earlier.

Chapter 2.

In chapter two technical-material features and soundness of a project should be described in very detailed form. This chapter includes the following items:

(a) a complete technical description of the project
(b) stages of instalment of units of the new capacity
(c) general plan of location (in a measurement of 1:1000) plan of building site indicating the integration of the project into the locality (in a measurement from 1:5000 to 1:10.000)
(d) sketch-plan of the project (list of buildings, detailed description of the project, list of roads, list of public works, related declarations of interested authorities: like fire departments, water control, etc.)
(e) list of machinery required (description of domestic and imported machinery, prices and sizes, weights etc.)
(f) detailed description of planned technology
(g) timing of preliminary and final technical planning (blueprints) and realization.
(h) data of the schedule of instalment
(i) costs of the project (construction, machinery, imported machinery and others)
(j) conditions of normal functioning:
   (I) labour, (workers skilled, unskilled, white collar, technical etc.)

(2) energy consumption (coal, steam, electric etc. by quantities and supply sources etc. domestic or imported)

(3) material (domestic-imported, quantity value, supply sources etc.)

(4) transportation requirements

(k) other information and instructions

Chapter 3.

Motivation the efficiency of the project.

From our point of view this is the most important chapter but it is also from the point of view of practical project planning and evaluation. Therefore we will focus our attention on this chapter.

Within this chapter coefficients indicating the economic-technical level of the project are elaborated. These coefficients are the following:

(a) Investment costs per unit of product and per unit of domestic value of production:

$$\frac{B}{t}, \quad \text{and} \quad \frac{B}{te},$$

where B = investment costs
t = number of products
te = value of production expressed in domestic prices.

(b) capital per unit of product and per unit of value of production.

$$\frac{E}{t} \quad \text{and} \quad \frac{E}{te},$$

where E = costs of fix and circulating capital

(c) quantity of products and value of production per worker.

$$\frac{t}{l} \quad \text{and} \quad \frac{Te}{l}$$

where l = number of workers

The above mentioned coefficients are supposed to indicate capital investment costs or labour investment costs of one unit of production. These coefficients however are not very reliable or convincing since technological character of products is very different and values expressed in domestic prices are distorted. Therefore in spite of the fact that these coefficients are prepared at every project in practice they are not analysed or used for evaluation.

(d) efficiency coefficients in practice and their criticism.

The methodology of present efficiency calculations is based on the following principles:

(1) efficiency = $\frac{\text{output}}{\text{input}}$ in other words efficiency is measured by a quotient.

(2) productive investments are divided in two main groups by the methodology. capacity or production increasing projects and labour saving projects. Efficiency coefficients are different for these two main groups.

Project evaluation with the first type of coefficient is solved in the following manner:

output will be determined by the so called "world market value" and transferred into domestic value by certain foreign exchange rates calculated by central authorities. Input is divided in two groups. original inputs of fix and circulating capital

(e) annual inputs, costs of annually repeating inputs (o).

Since dimensions of these two type of costs are different (dimension of Σ is forint - domestic currency - and dimension of ó is $\frac{\text{Forint}}{\text{year}}$) a common denominator should be provided in order to aggregate total expenses of a project. For this purpose an efficiency coefficient had been formulated which is indicated in the methodology as ([illegible]). (In the literature this coefficient has other names as: normative of profitability, interest etc.) The dimension of the [illegible] is $\frac{1}{\text{year}}$. The reciprocal value of ([illegible]) is the recovering of the project expenses expressed in years. The [illegible] makes possible to aggregate these two types of inputs in two forms:

(a.) $o + B \cdot$ [illegible]

(b.) $o \cdot \frac{I}{\text{[illegible]}} + B$

Usually the first form is accepted in practical evaluation process. The [illegible] plays a very important role in efficiency computations. The methodology defined the ([illegible]) as follows: in order to expand production tools and labour should be consumed. Presuming full employment, for production of a unit of new product one unit of labour should be liberated. Investment expenses necessary to liberate one unit of labour required are indicated by (b_g). In addition to this liberated labour unit should be supplied with tools of production which is indicated by (b_k). Therefore one unit of value of new production annually requires: $b_g + b_k$ investment expenses. The relationship expressed in an algebraic form is:

$$b_g + b_k \ (Ft) = 1 \ Ft/_{year}$$

In order to reduce the different dimensions the equation should be divided by ($b_g + b_k$):

$$1 \ Ft = \frac{1}{b_g + b_k} \left(\frac{Ft}{year} \right)$$

Consequently: $\frac{1}{b_g + b_k}$ is the annual amount of new value produced by 1 Forint of investment expenses.

This $\frac{1}{b_g + b_k}$ value is called efficiency coefficient or ([illegible]).

Time element is also considered. According to the methodology rules of simple interest are used. This method of calculation, however, is deemed unfit for considering time element by central authorities themselves. Therefore in the last year rules of partial compound interest rates have been suggested for efficiency computations, based on the following principles: national income produced by the new project will be used in part for accumulation and in part for consumption. Therefore only one part of the value expressed by efficiency coefficient will be capitalized, i.e. that part of the increment of national income which will be used for accumulation. The new value ensured for year (n) by the total amount of invested resources (B) after instalment of the new project -

$$t_n = B \cdot \lambda \cdot q^{n-1}$$

where: t_n = new value of production at the end of year (n)

B = total amount of investment expenditures

λ = efficiency coefficient

q = $1 + \lambda i$

i = proportion of accumulation in national income.

Value of time element $(b_n) = 1 + t_n$

Computations should be elaborated on national and factory levels. For measuring profitability of the project methodology contains the following indicators:

(f) <u>in case of projects of capacity expanding type</u>

Indicator of profitability on national level :

$$\varepsilon_n = \frac{T}{M + A_b + A_i + L + \lambda / B + F + B_k}$$

Where: ε_n = profitability on national level

T = value of production on world market prices expressed in domestic currency

M = wages

A_b = domestic material

A_i = import material on world market prices expressed in domestic currency

λ = efficiency coefficient (0,20)

B = investment expenses (fixed capital)

F = expenditures on circulating capital

B_k = related investment expenditures.

The methodology regulates the price problem. World market prices should be used at the calculation of value of production and import, including transportation costs. Prices of Hungarian export products should be calculated on border parity. Prices are given in $ or in Rubel and central planning authorities are giving exchange rates for calculation. The reality of the world market price should be proved by a declaration of Ministry of Foreign Trade.

In the profitability scheme losses originating from capital absorption for more than a year are also considered. As we mentioned earlier time factor is taken into consideration by the simple interest formula. We will illustrate the method by a hypothetical example. We presume that realization of a project takes 4 years and 100 units of expenses are used annually. The following correction should be applied by the time factor:

	Invested inputs	Time factor	Input corrigated by time factor:
1 year	100	1.6	160
2 "	100	1.4	140
3 "	100	1.2	120
4 "	100	1.	100
Total invested:	400		520

The corrected input is much higher.

The function of related investments (B_k) in the above mentioned formula is to ensure the aggregate character of the formula through the complexity of expenditures. At the development of manufacturing for example investment costs of raw material are taken into account by considering related investment expenditures. This method is applied because raw material needs are reflected in prices but domestic prices do not react on capital intensity. Related investment factor is used to consider capital intensity.

Related investment expenditures are calculated by single projects with norms. Related investment expenditures caused by increasing raw material needs are also regulated by norms. This norm is unified for all the sectors. Calculation of this norm is done in the following manner:

$$B_k = 2.5 (A_b + L)$$

Later methodology has been changed and norms are differentiated actually by sectors. Until now we described profitability indicator formula on national level. The same formula is different in two aspects when calculated on factory level.

(a) Inputs of previous stages (material and amortisation) are not included in the denominator but they are taken into account as result decreasing items.

(b) Related investment expenditures are neglected. Therefore formula of factory level is:

$$gf = \frac{T - (A_b + A_j + L)}{M + \setminus (B + F)}$$

This formula is used for calculation of profitability <u>only at the last</u> technological stage.

(g) Formula of labour saving projects.

At labour saving projects results (or yields) are calculated by the amount of labour saved by the project. Labour saving may be "living labour costs" or "fixed labour" embodied in means of production. Both types of labour savings are measured by the saving of costs or by the evaluation of the cost level. "Fixed labour" and "living labour" costs are sharply differentiated. In case of fixed labour savings investments saved are also calculated. At the instalment of a new heating unit for example the producing units cost level declines because of savings in material costs. This saving is considered as a net gain. Not only immediate but related costs are declining too. Saving in coal needs less investment expenses in coalmining. There is a saving in related projects. This saving should be also deducted from the calculated total (immediate and related) investment expenditures of a project. In case when cost level declines because of savings in "living labour" but "fixed labour" expenses increase, value of total input should be increased by the amount of related investment expenses. The formula is as follows:

$$Gó = \frac{c_2 - c_1}{B \pm (B_k + F)}$$

Where: Gó = efficiency of labour saving projects

c_2 = costs before the investment

c_1 = costs after the investment

B = costs of the project

B_k = related investment expenditures

F = circulating capital needs

It may be seen from the above formula that this is an indicator of the turnover type. The reciprocal of (Gó) indicates the years of turnover of a project.

We mentioned earlier that we have some doubts concerning the reliability of these calculations. Our reasons are the following:

1. Difficulties originating from the institutional framework.

(a) Efficiency computations are elaborated after planning activity allocated resources and the balances (including investment) are ready. Therefore computations are prepared after the most important investment decisions were taken on national level.

(b) Because of the "absorption-effect" of the enterprises for investment funds - mentioned earlier - investors in many cases use the computation as a tool for further "capital absorption" and they are manipulated to prove that their development ideas are the most efficient and useful. This fact of course will influence the "tendency" of the computations.

2. Difficulties originating from the price system.

(a) In cases where products are exported to centrally planned and market economies results calculated by different exchange rates will differ. Investor would apply the most favourable exchange rate therefore the real efficiency might be different from the calculated.

Calculated value of production may oscillate from 0-100 per cent above the real level.

(b) Calculation with very high world market prices. There are examples when four investors gave four various "world market price" for the same product between 200 - 260 $ ton. Sometimes prices are taken from less important, small volume foreign business contracts and the production value calculated reflects this price not representing real market opportunities.

(c) Miscalculation of the technical parameters of the product delivered by the new project. Parameters of the expected domestic product are taken better indicating a higher quality (and therefore a possibly higher price) than the potential competitors may achieve. The real situation is just the opposite.

(d) Miscalculation of the assortment produced by the new project. In many cases investors use an assortment of products at which the calculation of value of production is mugh higher as at a "realistic assortment."

(e) Miscalculation of the effect of natural features of the product, for example in coalmining when prices (including transportation costs) are calculated as a function of calorie values. If 1 ton of coal with 7000 calorie value has a price $ 18/ton then 1 ton of a 3000 calorie value coal has a price of $7,20/ton while 3000 calorie value coals can not be realized in any place of the world etc.

These miscalculations are very difficult to discover and are incorrect, and, therefore, efficiency computations may rather disorient than orient into the right direction from the point of view of realistic world market prices.

3. Difficulties originating from the structure of efficiency or profitability quotients.

(a) The quotients have a particular character. Therefore efficiency of projects on national level can not be measured by them. A project appearing efficient from the particular calculation may be not efficient for the economy as a whole and vice versa. As a simple aggregated national economy a particular efficiency is not identical with the macroeconomic efficiency.

(b) Profitability formulas by their particular character are unable to represent or provide alternative suggestions. Choice is reduced to one question: a given project should be built or not? There are practical cases where the efficiency quotient indicated a high profitability from the point of view of a single project while during mathematical programming it came to the light that reconstruction of old factories is more profitable. With particular calculations we do not have an opportunity for simultaneous comparison of variants.

(c) Alternatives are prepared by various investors and despite central regulations there are differences in collecting and evaluating basic data.

(d) Data contain many uncertainties for particular projects. World market prices and various cost elements can not be expressed by one single number. It is impossible to apply "price zones" or "cost zones" (from.....to) at these particular calculations.

(e) The form of efficiency computations (quotient) also can be discussed. From the arithmetical point of view it is indifferent whether 10.000 unit of input will result 12.000 unit of production or 1.000.000 unit input 1.200.000 unit of production. From the economic point of view however it is quite important since society is interested first of all in the volume of the realized net income and after that in the rate of it.

The above mentioned failures could be avoided by mathematical programming on national level.

4. Difficulties originating from the evaluation of various parts of the quotient.

(a) Results and input are evaluated differently. While output and import material are valuated in world market prices, input is calculated in domestic values and almost each part of them are formulated by different principles. "Living labour" costs are calculated by wages + wage taxes, while "fixed labour" costs because of the price system consist of various amounts of net income or accumulation. During the last year however experimentation started with a new method in order to eliminate these contradictions. It has been made by various calculations. Besides calculations based on producer's prices, evaluation has been made on the basis of so called "net wage cost" or "real cost" level (net of net income or accumulation included in producer price.) The point of the matter is that all inputs are reduced to wage costs i.e. material and amortization costs of the last stage of production are calculated as wage costs of the previous stages. (This was possible by using input-output coefficients.) Particular fixed and circulating capital needs have been reduced to the level of "real costs" by the correction of the efficiency coefficient (λ). In this way a common denominator has been created. We do not mention here problems connected with aggregation. The unified measurement in the form of real costs however can not solve the problems of resource scarcities. Namely, it is not a correct approach that various inputs could be evaluated by wage costs from the point of view of macroeconomic analysis. In construction for example labour absorbing less productive technology seems to be more efficient than mechanized technology. If labour costs are reflecting the real supply-demand position (equilibrium wages) it might be so. In our practice however there is a scarcity in labour, in unskilled construction workers and in spite of this fact labour consuming activities seem to be more efficient to solve by labour consuming technology as by mechanized technology. Therefore in our practice requirements of efficiency seem to be contradictory to economic possibilities. If scarcities would be considered at the evaluation in our example it would be more efficient to use mechanized technology because of higher costs of unskilled labour.

5. **Difficulties originating from the evaluation of the efficiency coefficient or ( ).**

(a) There are various views and ideas about the function of the efficiency coefficient. There are economists stating that the coefficient is providing only a common denominator for particular and regular expenses, others attribute a normative role to the coefficient form (the .) There are again others who discuss whether a national average coefficient or a differentiated coefficient should be used in each sector. Some economists that that coefficient should be differentiated on a territorial basis. There are discussions about the level, the volume of the coefficient. We have to mention here that an exact quantitative determination of norms of (b_g) labour saving investments and (b_k) labour outfitting investments is almost impossible.

(b) As we mentioned earlier another possibility is given by the shadow price calculation, by programming to determine the level of the coefficient. In this case calculated returns of inputs of a project would reflect its efficiency where scarcities of various factors of production would be considered. The practical preconditions of a shadow price system are developing in these days but are not ready yet. Therefore we may say that at the present moment we do not have the proper methods for determining the level (the volume) of the efficiency coefficient.

(c) Since ideas are different about the nature of the efficiency coefficient there are also widely differing views about the quantitative magnitude of the coefficient, from a suggested 0.8 to an 0.20. In electric energy production the coefficient similar to efficiency coefficient (it is called "intercaloric factor") has a magnitude of 0.12. This factor or coefficient is not only a common denominator for particular and regular expenses but its function is to discount various returns and inputs for a common base in time. In connexion with this another discussion arises: in the electric energy production simple or partial compound interest can not be applied but rules of compound interest are used. The partial compound interest used by the methodology is not correct since calculated rates for different points of time give various results. Let us explain it by an example:

100 units of 1960 investment expenditure according to the method used equals in 1956:

$$\left(\frac{I}{b_n} \cdot B \right) = 0.526 \text{ or } 100 = 52.6 \text{ units}$$

If we take the 52.6 units and recapitalize it for 1960 we will get 101 units. Namely, 100 units = 101 units or in other words the snake is longer from his head to his tail than from his tail to his head.

(d) At the coefficient of production or capacity expanding investments on factory level:

$$gf = \frac{T - (A_b + A_i + L)}{M + \Gamma(B + F)}$$

value of production (T) should be calculated in world market prices while items calculated in domestic prices ($A_b + A_i + L$) should be deducted from that value of production calculated in world market prices. As a consequence, <u>nominator has no real</u> economic meaning. If for example $T < (A_b + A_i + L)$ the value of the fraction will be (-) or (oo). In order to measure the efficiency of the last stage of production indicated fixed capital inputs should be calculated also in world market prices.

(e) At the coefficient of labour saving investments "fixed labour" is over-estimated in relation to actual or "living labour" since "fixed labour" prices contain a considerable net income or accumulation which increases the degree of the cost level decline. In addition to this at fixed labour inputs related investment requirements should be taken into account while in case of "living labour" inputs additional charges and related investment needs (apartments, transportation, education etc.) <u>are not</u> calculated.

Summarizing all the remarks we have mentioned above, in our opinion present methods of efficiency calculations should be considered rather as rough estimates containing several uncertainties than exact computations of profitability or efficiency of industrial projects either on national or on factory level.

Despite all shortcomings and criticism we mentioned earlier efficiency calculations after 1957 have a great importance. The very fact that some kind of computations had to be prepared in contrast to the period before 1957 indicates that economic policy changed radically for the better emphasizing more and more the importance of profitability and efficiency at project evaluation. The other very important fact officially accepted by the methodology that value of production should be calculated in world market prices is a big step forward. We would rather say this is an "unconscious" act to accept somehow the basic principle of project evaluation in an "open economy" namely the maximization of net foreign exchange earnings in the long run. The efficiency computations indicated first that domestic prices are not proper prices in an open economy for the calculation of profitability neither on macroeconomic nor on microeconomic levels. These efforts influenced many Hungarian economists in the proper direction.

We would like to hope that the reader will conclude from this paper: the new experiments with various programming models have their origin somewhere at those rough estimates we are criticizing so sharply in this paper.

6. Stage of decision. Criteria of decision.

After the stage of preparation we presume all basic information is at hand and data is reliable for decision making. In spite of the most precise preparation however, decisions can not be considered as absolutely safe decisions. This is true in general but it is more so in an open economy, where uncertainty is very high. The more ambitious the investment program, the longer is the time of implementation and the higher the uncertainty will be. Therefore calculation of risk and risktaking is one of the most important activities in the stage of decision making. We intend to analyse risk factor and levels of risktaking on the following pages.

(a) Risk. Levels of risktaking.

Risk and risktaking are influenced by the institutional framework. It is easy to see that the question of risktaking is completely different in the case of a private firm or huge corporation or in case of a socialized economy. A huge integrated corporation may take a greater risk than a small private enterprise and a socialized economy may balance losses of one producing unit with gains of the other. The advantages are obvious. These advantages however had been misinterpreted for a long time by many economists who presumed that in a centrally planned socialist economy calculation of risk and risktaking have no economic function at all.

This is the reason why risk calculations are so rarely discussed in our literature except one or two cases. Problems of risk calculations came to light during the last few years in connection with mathematical programming on sector level. In sector program planners use "zones of data" instead of single, fixed data. Zones of data (from ..... to) provide an opportunity to indicate degree of uncertainty on the one hand and elaboration of variants on the other. Uncertainty is indicated for decision makers by the space of the zone. The bigger is the certainty the narrower is the space and vice versa. Planners usually have the following combinations of data to deal with:

(1) programming based on pessimistic data
(2) programming based on average values
(3) programming based on optimistic values of data

In the first method the most unfavourable values are calculated: upper limits of costs and the minimum values of results are considered. This method is called: "strategy of maximum certainty." At the second type average values are used presuming that changes in negative and positive direction will balance each other. In this way for example variants in zone from 100-to-300 are considered as variants in zone of from 190-to-210 since in both cases 200 as average is used for the evaluation of the variant. The most hazardous case is the third where uncertainties are not calculated practically. The second and third method proved to be extremities where criteria of certainty are neglected. Therefore Hungarian literature and practice for determining uncertainty usually applies the method of "strategy of limited certainty". Values built in the programming model are determined by the following parameters:

K_{max} = maximum costs

K_{min} = minimum costs

K_a = average costs

= level of certainty value of costs, condition 0,5

K_b = $Ka + (K_{max} - K_{min})$ (- 0.50)

For example. (K max) = 100 units, (K min) = 70 units ( ) = 0,70 unit

K_b = 85 + (100 - 70* (0,70 - 0,50) = 85+6 = 91.

This is called: programming with "certainty values" in the Hungarian literature. Despite precautious planning unexpected changes may occur because of changes in technology prices, markets etc. Therefore every development decision should be taken as a risktaking action.

The measurement of risk is that quantity of potential losses or lack of gains which occur because decision makers did not choose the variant proved to be most efficient "ex-post". Or potential losses may occur because of "vis-major" but it may happen as a consequence of voluntary risk taking in hope of expected profits or gains.

A hazardous decision making of course would imperil balanced growth but from this we must not conclude that a decision making policy of maximum certainty is the right policy. The policy of maximum certainty or safety would decrease rate of growth and hamper economic development because of a gradual backwardness from the point of view of technical level. In an open economy however, technical backwardness is a kind of hazardous policy since the basic precondition of a sustained high rate of balanced growth: export ability can not be ensured without up to date technical and technological level.

Another special problem of risktakin g in a centrally planned model is to determine the various degrees of risktaking on various levels of decision making. These degrees are determined to a large extent by the institutional framework and by various methods of planning and direction.

The degree of risk taking by various enterprises in a centrally planned model is limited even in case where development and project decisions are decentralized upon enterprise level. Sectoral allocation of resources, choosing of "leading sectors" decisions affecting international economic relations etc. in our model can not be decentralized. This, of course, does not mean that every development decision should be centralised, and central order should regulate project evaluation and risk taking in form of obligatory targets. Producing units i.e. investors may be directed through an "organized market" where rules of game are determined by central planning authorities with such regulators as monetary policy, central bank system, price control, wage control, credit control, duties and subsidies etc.

But in such a case misinformation originating from centrally decided policies and losses caused by them can not be charged upon enterprises.

Enterprises may take the "managerial risk". Since directors of enterprises are not owners they can not take a risk in the form of material consequences. Therefore rules of risktaking should be centrally regulated leaving enough space for "managerial risk taking" on enterprise level.

(b) Actual and potential scarcity of production factors as limits in risk taking.

There is a form of decision making where planners are aware of potential losses at the stage of decision already. These potential losses in many cases are connected with the scarcities of resources. This is one of the reasons why stage of preparation and decision making should be separated in the process of project evaluation. In stage of preparation all the possible variants of a project should be collected while in stage of decision those variants exceeding actual and potential limits of resources should be selected. Calculation of potential losses originating from limited resources are very important for example in decisions on international cooperation or integration.

In our present practice it is rather a failure that limits of various resources are regarded as fixed, absolute limits. Substitution of resources and convertibility are not calculated properly. Substitution possibilities and the role of time in this process should be taken into account however at a strategy where full employment is a stable requirement substitution of factors of production has a very limited possibility.

(c) The role of time in the certainty of decision.

In stage of preparation we have mentioned time factor in connexion with cost effects. Here we investigate time factor as a part of risktaking. The time of carrying out of a project is connected with the uncertainty factors in decision making. If required time of realization is longer, not only degree of uncertainty increases but potential losses may occur. Especially in case of new products in rapidly developing industries where at the first time flexibility and speed to appear on markets give an advantage we may call "transitory monopoly of a sellers market", or in other words there is an opportunity for "skimming the cream". If decision is late because decision makers hesitate or they are unable to calculate potential risk involved there is a potential loss. Losing time in project realization may unfavourably influence efficiency. Therefore in stage of decision potential gains from flexibility and speed and additional costs for it should be considered and decided.

(d) Risk taking and "strategic reserves".

One of the most difficult tasks in stage of decision making is to determine quantity of "strategic reserves". The optimum size of reserves will influence rate of growth of the economy as a whole. There is no general rule which can be suggested for every project concerning necessary quantity of reserves. All information gathered in stage of preparation should be considered again and again in order to determine optimum sizes of capacity, labour, material, and foreign exchange reserves. In many cases political considerations also play a decisive role.

At the present moment we do not have yet the proper methodology to calculate them except some basic rules we are trying to apply in project evaluation. From the point of view of calculation there is a basic rule. every cost of desired reserves should be taken as costs of risk taking or as a price for insurance and safety.

(e) Questions of follow-up.

In a centrally planned model because of limited risktaking follow up does not play as important a role as in a market economy. Capacities can be transferred from one sector to another relatively easily by central orders. If all the above mentioned steps are carefully done in stage of preparation the necessity of follow-up will be limited. This however does not mean we can neglect follow-up. Possibility of follow-up should be ensured. This possibility is connected with the question of calculated reserves. One part of reserves should be in mobile form in order to introduce changes arising during realization of the project. In this respect reserves of technical planning and research capacity plays an important role too. The institutional possibilities for follow-up in a centrally planned model in general are much better than in a market model.

(f) Present practice and problems

In our present practice stage, preparation and decision are not clearly separated. Stage of decision or one part of it comes earlier than detailed preparation.

Main directions of development are decided during the preparation of the long term plan. The new capacities (large single projects) are considered already at this stage. Therefore, approval of construction of the single projects is a limited decision making. In general we may say, the first question: whether a project should be established or not? will be decided during long term planning. The second and third questions: how and where? are answered after the stage of detailed preparation during the process of approval of investment programmes for single projects. The separation of stage of decision into various parts in time and space is the basis of several difficulties, and in many cases can not be ensured. The second stage influences the first. It may happen that a planned project can not be realized because of various reasons, and the original plan targets should be changed, or because of changes in plan other already approved projects should be put aside.

Approval and preparation are accomplished in two steps in general:

(a) investment program

(b) plan target

Plan target is much more detailed as investment program described earlier, and it is ordered to elaborate only in case of large projects with complicated technical and economic relations affecting other sectors, or the economy as a whole. There seems to be only one process of decision making in other projects. In practice however there are two processes: because plan of the investment program and investment program are approved separately. In addition to this there are several difficulties originating from the process of approval. Decision making takes a long time which increases the time of realisation too. These questions are under frequent discussion recently in connexion with the revision of existing planning practices.

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