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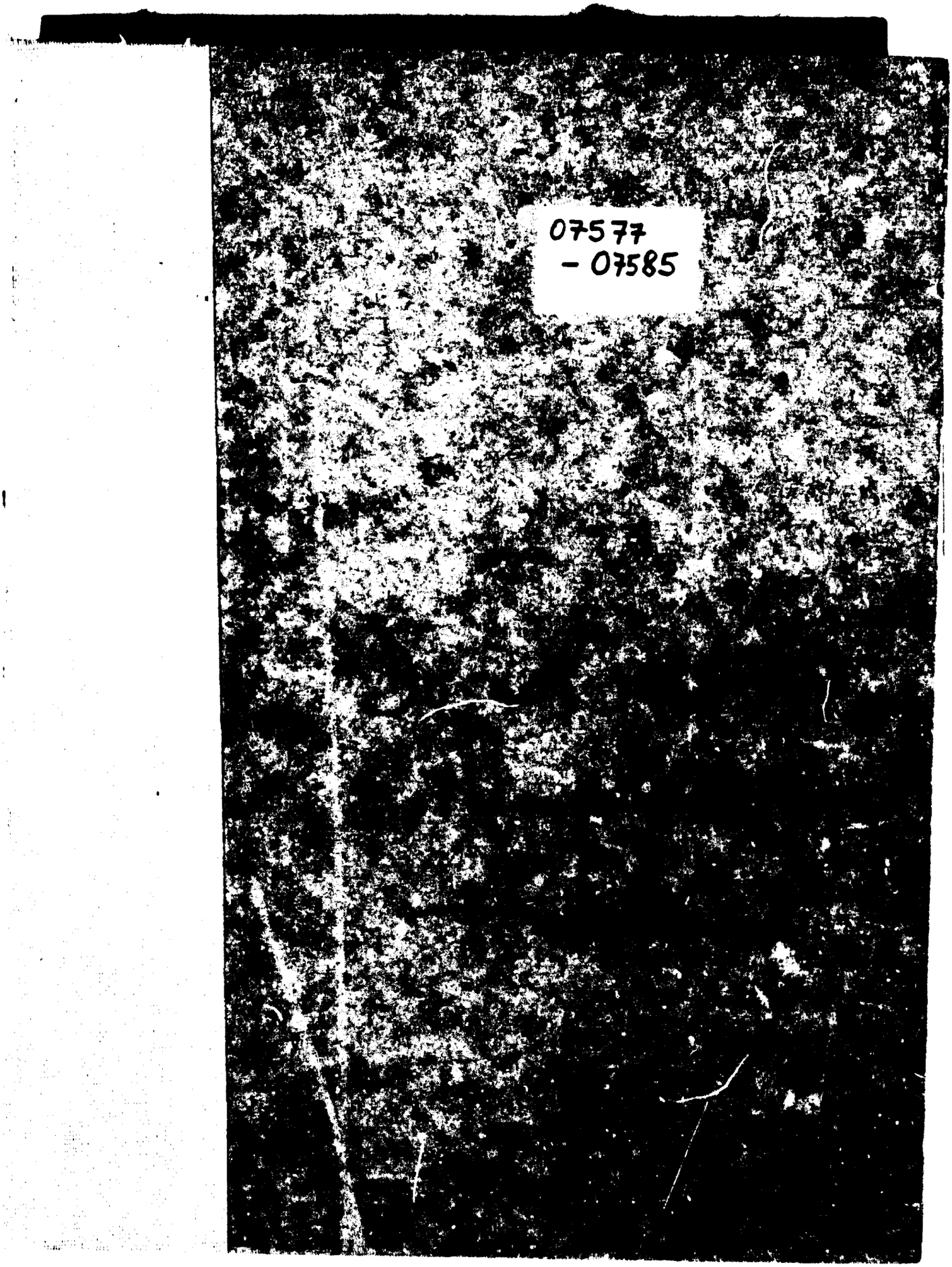
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United Nations
Centre for Industrial Development

Inter-regional Symposium on
Industrial Project Evaluation

CIE/IPE/Gen.2

Prague, Czechoslovakia
11 - 29 October, 1965

GENERAL DOCUMENTATION FOR THE INTER-REGIONAL SYMPOSIUM ON INDUSTRIAL PROJECT EVALUATION

A Preliminary step in setting up Industrial Projects

B. Considerations in Evaluation of Industrial Projects

C. Follow-up and supervision of Industrial Projects

D. Survey of Country Experience (including Case Studies)

... Miscellaneous Documents

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2	CID/IPE/A.2	Implementation of Industrial Development Programs using Critical Path Network Theory	E.P.C. Fernando
3.	CID/IPE/A.3	Project Evaluation and the Consistency of the Plan	G Cukor
4.	CID/IPE/A.4	Organizing Professional Cadres for Industrial Project Evaluation, Selection and Follow-up	J.D. Nyhart
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6.	CID/IPE/A.6	Information required by ICICI Ltd. for Project Appraisal for their Clients	Industrial Credit and Investment Corporation of India, Limited
7.	CID/IPE/A.7	Strategie du Développement Industriel: Programme d'Etudes Generales pour les Pays Associes à la Communauté Economique Europeenne	André Huytrechts
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10.	CID/IPE/A.10	Standard Designing in Industrial Construction in the CMEA Member Countries and its Evaluation	Council for Mutual Economic Assistance
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15.	CID/IPE/B.3	Uncertainty in Industrial Project Evaluation with Special Reference to Export Industries	[illegible] Rejovic
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[illegible]	CID/IPE/B.[illegible]	Financial Planning of Industrial Projects and their Appraisal	Joel Dean
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55.	CID/IPE/B.43	Assessment of Factor Endowments in Industrial Project Evaluation	K. Baba and T. Unno
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57.	CID/IPE/B.45	Combined Criterion for Investment in Manufacturing Industries in Developing Countries	Research Division, Centre for Industr Development, United Nations
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C. FOLLOW-UP AND SUPERVISION OF INDUSTRIAL PROJECTS

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66.	CID/IPE/D.5	Criteria for and Experience in Project Evaluation	M. Reza Amin
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69.	CID/IPE/D.8	Foundry Forge Project	S.P. Joshi
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104.	CID/IPE/D.40	Financing of Industrial Projects	Instituto Mobiliare Italiano, Italy
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* Title is tentative

MISCELLANEOUS DOCUMENTS

Symbol	Title	Author
CID/IPE/Misc.1	Summaries of Documents Submitted to the Symposium on Industrial Project Evaluation	Centre for Industrial Development, United Nations
CID/IPE/Misc.2	Definitions and explanations of Selected Terms used in Industrial Project Evaluation	Jacob Sonny
[illegible]	Program and site evaluation for the iron and steel industry in Mexico	Gordon Quintana [illegible]
[illegible]	Technical and economic [illegible] project evaluation	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	Criteria for evaluation of industrial projects	Industrial [illegible] of India
[illegible]	[illegible]	[illegible]
CID/IPE/Misc.7	Final [illegible] project [illegible]	The [illegible] Institute for Planning and Architecture

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PROBLEMS AND METHODS OF RESEARCH INTO THE EFFECTIVENESS OF INVESTMENTS IN POLAND

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This paper aims at presenting the problems concerning research into the effectiveness of investments in a developing country constructing socialism, such as Poland. For these reasons it is possible that a number of approaches used here will not correspond with the problems faced by the developing non-socialist countries. Nevertheless, a number of problems occurring in Poland may also interest those countries.

Poland has followed the path of rapid development for 20 years. During this period, a number of investment and non-investment factors have been in force, acting in various combinations. Initially there were large possibilities of a better utilization of the existing capital stock, as well as of utilizing, without additional investments the large labour force reserves, coming mainly from the villages.

These possibilities of attaining on the one hand relatively fast development largely through the use of non-investment factors, and on the other hand, the necessity of implementation of strictly defined goals mostly in the field of assuring a complex growth of the economy, assigned

secondary importance to a more detailed analysis of the effectiveness of investments. Despite many mistakes made in investment management during the initial period of construction and the lack of economic calculation, or use of primitive methods of such calculation, the economic development moved quickly forward precisely due to the wide range of utilization of the above-mentioned non-investment factors. With the further development of economy, however, these extensive developmental factors, which came into being mainly as the result of changing to a system of planned socialist economy (which, unlike the previous private-capitalist economy, wasteful of such reserves, could utilize them), were gradually being used up. For this reason investments became the chief factor of development, and the attaining of their maximum effectiveness has been in reality the most important element making possible the attainment of the largest possible increase in production, and generally speaking fast rate of economic growth from the total sum of investment resources available to the society. That is why the determination of relatively strict criteria of measuring the effectiveness of investments, allowing for the selection of the best solutions from among the great number of possibilities, is one of the central problems of economic science in Poland and other socialist countries.

To avoid any misunderstandings one should point out that even in the socialist countries, despite a planned-type economy which makes economic development more stable than in the capitalist economy, the calculation of investment effectiveness can not be exact. This is so because, unlike the calculation of current transactions, the calculation of investment effectiveness concerns the potential effects, inputs and outputs, which are expected to materialize in the distant future. It is obvious that all elements of this calculation, and particularly the inputs and outputs, are, due to the economic changes in the whole system, impossible to forecast perfectly, and are relatively inaccurate, and so the calculation of economic effectiveness can only have the character of rough approximation. The point is not that the solution accepted as a result of the present and future economic parameters should definitely be the best solution, but that, after the search of those best solutions on the base of the parameters known at present, to make certain that no really bad economic mistakes will be made.

At this point it might be worthwhile to emphasize the important and basic difference between the criteria of effectiveness prevailing in a capitalist economy and the effectiveness criteria used in the socialist economy.

Despite the great changes which took place in the capitalist economies, the deciding criterion for the effectiveness of economic activity has still remained the ratio of attained or expected profit from the designed and implemented investment to the capital outlays. Using this criterion, and accepting the prices of the goods sold as an objectively independent magnitude, beyond the control of individual producers, the entrepreneur and investor in a capitalist economy may compare the effectiveness of the production of various goods with absolutely different use values. For him, with the unhindered mobility of capital from one industry to another, it is quite irrelevant what will be produced, just as long as the desired rate of profit is obtained.

This criterion can not be used as the deciding one in a planned socialist economy. Such an economy at each stage of development sets up for itself a certain set of basic goals of increasing the basic use values needed by the society for consumption increases and the acceleration of economic development. This set of goals, determined in the economic plan consists of elements which are mutually unsubstitutable or substitutable only to a small degree.

Because of this, a planned socialist economy does not, with a few exceptions which will be discussed later, face the problem of choice whether it is worthwhile to invest in the production of certain consumer goods, which are also in most cases mutually unsubstitutable or in the production of certain investment goods and other means of production. All those are indispensable in certain proportions at a given stage of development, and for this reason the main task of the economic calculation is not to determine whether it is more effective to produce textiles or machines from the point of view of profit expected, but to attain the planned increase in the textile or machine production with the most effective methods. And so the central problem of the effectiveness calculation in a socialist economy does not consist in determining what is to be produced for the maximization of profit but in attaining the set of use values needed in the most advantageous way. Of course, this is just a simplified approximation. In reality, as will be shown later, with the prevailing tendency to maximize the overall productivity of labour, the problem of how to produce a given set of the same or similar use values taking into account foreign trade, may influence what will

be produced. This secondary influence of the production methods on the production programme should not, however, overshadow the differences between the basic assumptions of the effectiveness calculation in a capitalist economy, where it is subordinated to the maximization of profit, and the basic assumptions of such a calculation in a socialist economy, where it is subordinated to the maximization of the sum of the planned utilities i.e. use values.

The effectiveness calculation in a socialist economy has as its central goal the comparison of different variants of implementation of the same investment task and the choice of the best variant, where the given investment task concerning a certain use value is not directly comparable with a different investment task, concerning a different use value.

The fact that particular investment tasks are not directly comparable as far as their effectiveness is concerned does not mean that they are isolated from each other. In reality, for the implementation of the total sum of investment tasks the society has at its disposal one overall fund of investment resources, stocks and labour force. For this reason, if the investments made in any one field will be ineffective, it will reduce the economic resources

for the development of other fields. Consequently, the general requirement of the economic management is the attainment of the highest possible effectiveness of the total sum of investments from the overall fund of resources available to the society. Thus, the problem is to obtain from the total sum of these resources, consisting mostly of investment and labour force resources, the maximum possible increment of national income with the required structure as far as the use values are concerned of which the final product for distribution is composed.

Outline of the main methods and criteria of measuring the effectiveness of investments

As already mentioned at the beginning, the research into effectiveness developed gradually. Due to the necessity of undertaking certain clearly defined investments, the lack of alternatives prevailing in the initial period and the imperfections of the price system, the effectiveness calculation limited itself (if it was done at all) to the comparison or outline of the basic techno-economic indicators, such as the raw materials

input per unit of production, or the labour productivity in the planned works. With the development and arrangement of the economic calculation based on value elements used in a socialist economy mainly for the rational comparison of labour inputs required in different parts of the economy, the techno-economic criteria providing the initial, very general orientation as to the effectiveness of the planned undertaking were treated as insufficient economic criteria. This is understandable, since particular techno-economic indicators may be contradictory to each other. We can compare, for example, two variants of a solution of the same investment task, where one variant is more labour-saving, and the other more raw material saving. Were the first variant superior both as far as the labour efficiency and the use of raw materials is concerned, the choice would not be difficult.

If, however, one variant is better in one field and the second in another, then taking a decision based on the techno-economic indicators alone is not possible. Therefore, the next stage in the development of economic research was the change from evaluation of the comparative effectiveness of various variants of implementation of

the same investment task on the basis of a great number of techno-economic indicators pertaining to individual aspects of the investment to an evaluation with the aid of generalized indicators, such as the capital intensity of production, i.e. the investment outlay per unit of production and net unit cost. In this way the comparable evaluation of an investment could be reduced to a few basic indicators, making it possible to obtain a much clearer picture of the effectiveness of an investment. To be absolutely just one should add, however, that this change can be called true progress in research only when there is certainty that the price system, which allows for a synthetic treatment of various kinds of inputs does not deviate too far from actual labour inputs. It is understandable that one can not assure complete accuracy here, it is only a question of removing the most glaring deviations. The price reforms already carried out in Poland and in other socialist countries may justify the assumption that the deviations of prices and costs employed in calculating the effectiveness of investments do not, in most cases, differ glaringly from the labour inputs in those products, and that is why they may be used in effectveness calculation. This does not mean that the necessary corrections of the price system should not be

continued. Here one may point out that the system of current prices is not fully adapted to the needs of the effectiveness calculation, since it must take into account the current preferences and shortages, not to mention the problem of market equilibrium. The effectiveness calculation would require a price system as closely linked to the labour inputs as possible. Since it is impossible to create an independent price system for the needs of effectiveness calculation, in practice one may use the existing price system, correcting it when the need arises.

A generalized evaluation of the effectiveness of each plant with the aid of inputs and costs per unit of production also does not provide a full solution for the choice between variants. A number of reasons make up for it: First, the variants of the plants may differ in such a way that one has higher investment outlays and lower net costs per unit, and the other vice versa, lower investment outlays and higher net costs per unit.

In this case the comparison of the two variants will not provide us with a direct answer to which should be chosen as the best, unless we know of a method which will make the investment outlays and net costs per unit comparable with each other.

Secondly, the plants may differ from each other not only in the investment outlays and costs (even assuming that they have an identical utility effect), but often also in the time required for the construction, expected exploitation period, the production spread over time etc. Due to this arises the problem of how to bring all those varied factors to a single synthetic expression, which would allow for a non-ambiguous evaluation, with the aid of a single indicator, of the effectiveness of a given investment, and compare it with a similar synthetic effectiveness indicator of another investment variant, assuring the realization of the same production or service task, in order to finally determine which of the variants is the best.

Before we pass over to the discussion of the premises on which the synthetic formula for the effectiveness of investment was based in Poland in its present form, it may be pointed out that the variant calculation should in no way be removed from reality. Let us imagine that we compare two variants and choose one of them as the better one. We may still, however, find out that even this better variant is inferior to solutions already in existence, or that it does not

keep up with the progress attained in other countries. For this reason, in our research into effectiveness we try to closely follow the principle of not only comparing variants with each other, but also compare them with the tried out plants both at home and abroad, producing similar products.

Basic premises determining the synthetic formula for effectiveness

The basic problem encountered here, as we have already mentioned, is the reduction of the single time outlays and the current outlays to a common denominator. In a capitalist economy this is done by interest on capital, which, discounting cyclical fluctuations, reflects the average rate of profit, i.e. the ratio of the total profits to the amount of capital used in the economy.

A problem arises whether this criterion is correct for the socialist economy. On the negative side we may say that it is not correct, for in no way is it possible to prove that its employment would favour the maximization of economic growth with the investment resources and labour force at hand. This criterion is simply an expression of the existent distribution

of national income between wages and profit, but it does not reflect the needs of economic growth.

It should be noted, however, that in the socialist countries one also finds economists who believe that profit is the correct criterion for evaluation of effectiveness. The author does not favour this view and hence has not included it in the present study of the methods of research into the effectiveness of investments used in Poland.

Below an attempt will be made to present the positive view in this matter. Starting with the assumption, that for realization of the target of obtaining the maximum possible growth of national income with a certain structure, we have a limited quantity of investment resources and labour force, we should carry out such technical policies, which would permit the implementation of this goal. If, for the moment we forget the limitations of the labour force, then the correct direction of development is the tendency to reduce to the lowest possible level the capital intensity per unit of production of our solutions. There are many fields in which the least capital intensive solutions are also the most progressive ones. One may observe this, e.g. in the electric, chemical, steel mill industries and others in which

there already exists a developed system of machines, in which the better machines replace the inferior ones. In these fields there are parallel tendencies of the decrease of unit capital intensity per unit of production, increase of labour productivity and fall in the raw materials requirements. In these cases the choice is just one, even for a country having few investment resources: in these fields one must introduce the highest technical progress, providing the highest labour productivity, since it is the least capital intensive. That is why, for example in Poland we, without hesitation, develop modern power stations, steel mills, refineries, concrete plants etc.

This should be done, since in this way, it will be possible to obtain the highest possible increase of production from the investment resources at one's disposal. This does not, however, hold true for all fields.

If we consider the basic fields in which a large part of work is done manually, to be gradually replaced by machines, then the switch to higher labour productivity, which to a certain degree is a social necessity, brings with it an increase in the capital intensity of production. This means that there is

a marked contradiction between the tendency to increase the labour productivity and the tendency to maximize economic growth on the base of investment resources available. This problem, concerning in such conditions the major part of production, and therefore having vital overall economic importance should be solved by trying to find the optimum combination of labour productivity and capital intensity of the development of production. If we were to tend to maximize economic growth through the lowest possible capital intensity, then we would build a great many plants, yet they would require so much employment, that the available labour force would not suffice, and so the plants would not be utilized, which would result in great wastage of investment resources. This has occurred in certain fields in Poland, where certain plants operate on one shift only, due to the lack of labour. On the other hand, if in the macro-economic scale we built plants with high labour productivity, and at the same time with high capital intensity, then the total increase of production would be relatively small precisely because of this high capital intensity. At the same time we would obtain a small increase in employment, and we would have

to deal with unemployment; this would mean a great wastage of the basic force of the society, such as human factor which would run contrary to the principles of socialist economy. So, the problem of the full utilization, and at the same time optimum utilization of the investment and labour force resources at the disposal of the society at a given stage is the central problem for the realization of the optimum technical progress policies from the overall economic point of view.

In the simplest terms, the question may be presented as follows: The total investment resources at the disposal of the society may be in one's mind divided into two parts; in the part providing the increase in production and the part which is needed for the balancing of the labour force i.e. the demand and supply of the labour force.

If it turns out that in planning a certain overall increase of production at a defined technical level the amount of the labour force needed is larger than the foreseen increase of the labour force, it will mean that there is a need to spend a certain amount of the investment outlays for the releasing of the labour force either from existing plants through their modernization, or through an additional increase

of the technical level of new plants, or through the liquidation of old plants and their installations. All these are outlays which result in releasing the labour force without an increase in production. If one should now sum up the investment outlays needed for the attainment of the originally planned increase of production at a defined technical level and the outlays for the balancing of the labour force in those conditions, one might find out that the aims of the plan do not correspond with the investment resources at one's disposal. In this connection there is, of course, the need to match again the planned increase of production and the balance of the labour force in order to have the investment and labour force resources in agreement with the planned increase in production and its technical level. This consistency can be reached in various ways, which may be optimal or non-optimal.

The optimal method, in our opinion, can be expressed as the attainment of the maximum increase of the national income with the available resources, and this will be possible if the part of investments which is done solely to save the labour force, bringing no increment of the national income, is minimized, in other words, if the outlays for technical progress indispensable in given conditions from the point of

view of balancing the labour force are reduced as much as possible, or, to put it in yet another way, if the expenditures for technical progress which brings about only a decrease of employment in social scale are no higher than they could have been. This exactly is the reason why the instructions concerning measurement of the effectiveness of investment in all socialist countries include the concept of the recoupment period of the additional investment outlays which may be spent in order to obtain a decrease of current exploitation costs.

In Poland the problem of determining this recoupment period has been clearly connected with the problem of labour force. Similar assumptions are accepted also in the methods of research on the effectiveness of investments in Hungary and the German Democratic Republic. In other countries, such as the Soviet Union, Czechoslovakia, Rumania, Bulgaria, the problem of determining the permissible recoupment period is justified by other considerations, such as the general requirements of technical progress, past rate of lowering the costs in relation to the investment outlays spent for this purpose, the role of the particular branches in economic development, etc.

In our opinion explanations of this type to justify the application of the recoupment period to the investments connected with technical progress are not convincing. The main reason determining the economic character and the length of the recoupment period of outlays for additional cost reduction should be sought in what was said above, i.e. in the tendency to balance the labour force with the aid of resources as small as possible, which at the same time makes possible a maximization of the increase of national income. Determination of this recoupment period is, in practice, not an easy thing, since as we know all the future techno-economic parameters, and particularly those concerning new plants are rather fluid and inaccurate. Nevertheless, in practice there are ways of determining this recoupment period at least as a general estimate.

To do this, one should take into account at least the basic fact, that the real, (and one occurring on a large scale) alternative to the technical progress resulting in the lowering of costs in new plants is the removal of old installations and replacing them with new ones in the existing old plants. The effectiveness of such a change may be defined rather accurately. If, for example in Poland, we would

substitute a large part of the installations, particularly in the manufacturing industry, which is relatively less capital intensive, with new installations of higher productivity and lower exploitation costs, then the recoupment period of such an exchange would in most cases not exceed 3 - 4 years. It does not seem purposeful, therefore, in comparing different variants of new plants providing the same utility effects, to agree with the expenditure of additional outlays for technical progress providing nothing besides a decrease of the costs which considerably exceeds the period of 3 - 4 years. In this case, just to remain on the safe side, it was accepted that this period should not exceed 6 years. However, in view of the present situation of Poland, particularly as far as the population is concerned, where one expects in the whole period of the next 20 years, a rate of increase in the non-agriculatural labour force of 3 - 4% annually due to the demographic development and the shift of the labour force from the villages to towns, the acceptance of a 6 years recoupment period seems too liberal. In practice, it should be shortened to 5 or 4 years.

In Poland we in principle adopt a uniform recoupment period for all sectors of the national economy. The adoption of the uniform period is based on the assumption that the national economy as a whole, and particularly as far as its basic long-term aims, such as investment plans are concerned, on a country-wide scale, there exists a principally uniform stock of investment resources and labour force, since in the long term planning period one can to a large degree, change according to the needs of the material structure of investments and their destination for particular uses; one can also change the qualifications of the labour force, move it to various regions, etc. For this reason, even though with such changes certain difficulties arise, they do not invalidate the uniform character of the national economy and investment process, so that a uniform recoupment period for the outlays on technical progress should be used. The problems connected with, for example, moving of labour force, changes in their qualifications, changes in the structure of investments, etc. which bring about the fact that the investment process in various fields and regions may require in practice different outlays and costs, should be solved by means of taking into account the differences in the outlays and costs resulting from those specific conditions,

and not by means of using different recoupment periods for particular fields and cases.

An additional argument against establishing different recoupment periods for different fields is the fact that this would be connected with great subjectivism and may result in the State (in our conditions the central manager of investment resources) requiring an excessive extension of the recoupment period, for some special reasons, usually not justified economically.

Also on this question there is no agreement among the economists in the socialist countries. The economists in Poland, Hungary and the German Democratic Republic are proponents of a uniform recoupment period in principle. The economists of other countries believe that the recoupment periods should be differentiated , (for example, it should be 3-4 years for the light industries, and 8-10 years for the power industry, transport, etc.) justifying this by the great role of the latter industries for the overall economic development. This role, in the opinion of the proponents of the varied recoupment periods required particular stress on technical progress in those fields, even at its high cost.

In our opinion, fostering of the technical progress i.e. lowering the costs and employment with

high investment outlays in certain fields, when somewhere else it could be achieved with low investment outlays means an unnecessary wastage of the investment fund, which could provide an increase in national income in other fields, often in the most needed and neglected sectors.

On the mathematical side, the requirement, of the recoupment periods of the additional outlays intended to reduce the costs may be expressed in the variants comparisons as the minimization on of the function $E = \frac{1}{T} I+K$, where E stands for the synthetic investment effectiveness indicator, T - the recoupment period (6 years in Poland) , I - one time, single investment outlays, K - annual exploitation costs.

The investment variant with the lowest value of the synthetic indicator is accepted as the best one. The shape of the investment effectiveness formula adopted is, judging by appearance, very similar to the normal cost formula with interest on capital used in practice in the capitalist countries. In our opinion, the similarity is more apparent than real. The question here is not that capital, just by reason of its existence should bring profit, but that a border should be set for the use of additional investment resources in variant comparisons, so that the additional investment

resources for teohnical progress do not come into collision with the general tasks of the maximization of national income.

The formula presented is a most general, simplified one. It still does not take into account a number of very important problems which one comes upon in practice in comparing investment variants. These problems concern the differences in the periods of construction and exploitation of plants. As far as the construction period is concerned, everyone understands that its undue extension causes unnecessary freezing of the investment resources during that period, which in case of a shorter construction period could be used to some purpose in other fields, contribution to an additional increase in the national income.

If there was a surplus of labour force, then in the period of defreezing investment resources by means of the shortening the construction period, these resources could provide an additional increment of national income of I/m, where m - stands for the average capital intensity of national income, calculated in Poland at approximately 3.

If, however, there are no free labour foroe resouroes, then in order to obtain additional national

income from the defrozen investment resources, part of the resources released should be spent to release the labour force in some other field of the economy.

Obviously, this reduces the final effect of the defreezing of investment resources during the construction period. In our conditions, we estimate that this result can be accepted as 16% for each year of defreezing resources, and vice versa, it burdens each year of investments frozen with 16% interest. If, for example, the construction costs 100 million zlotys and takes 3 years, with an even spread of outlays over time, then to the effectiveness calculation we adopt not the sum of outlays (= 100 mln zl) which we would be adopted if the investment was implemented without a time lag (which occurs in practice for example with the purchase of transport equipment) but the amount $100\ /1 + 0.16 \cdot 3/2/ = 124$ million zlotys.

Such evaluation of the role of freezing is correct only when one assumes that the production will be obtained in the variants compared at the same time, i.e. assuming that the construction of the variant with shorter construction cycle will be begun some time later, so that the production would be undertaken in both variants at the same time. If this requirement in comparing variants is not fulfilled when the variants

are compared and the reverse takes place, (for example, the constructions are begun at the same time with important differences in the time span required to obtain production results) then the method of accounting for the role of the freezing of investment resources does not reflect exactly the problem of the economic consequences of the difference in construction periods of the investments compared, and these differences will have to be taken into account in other ways, depending on the circumstances and economic gains from the acceleration of the given production.

In the process of construction one often comes upon the fact of staging an investment, so that, as the needs arise, parts of the plant are put in service, with often a few years break in between. If a plant was put in service immediately at full productive capacity, with a shortage of the right demand for the production, then there would be a considerable freezing of the non-utilized investment resources and excessive exploitation costs. The staged construction of an investment may formally cause a certain increase in the total of the investment outlays, yet at the same time it makes it possible to avoid excessive freezing of investment outlays and waste exploitation costs, besides permitting the inclusion, at later stages, of the results of

technical progress attained in a given field of production in the meantime.

The effectiveness of a staged investment is determined by comparing it with a one-time investment or with other variants of a staged investment with the aid of methods taking into account first of all the lesser economic weight of the investments done at a later stage, according to the formula:

$$I_t = \frac{I_o}{/1 + 0.16\ t/}$$

where I_o stands for the investment outlay concerning the stage put in service at the moment 0, I_t similarly the outlay concerning the stage put in operation at a moment later by period t. This formula is built on the principle of analogy to the formula for freezing of investment resources during construction. The above formula of the effectiveness of investment (including the ammendment for freezing outlays during the period of construction) we accept basically as correct for average conditions in which plants exploited by the Polish economy operate, i.e. for a period of approximately 20 years.

How can one, however, compare plants of different life times, for example, of 10 years, and

another of 30 years? Can one, in comparing, use only the different depreciation allowances? In the method used in Poland we started with the assumption, that the differentiation in the depreciation allowance does not correctly reflect the economic differences between plants of various life times, and that life time of a plant itself is by no means a purely physical concept, but an economic concept connected with the economic aging of plants, as the economic progress moves forward.

To make one point clear, since the recoupment period in our opinion, is a way of comparing the additional investment outlays with the additional savings from running exploitation, then depreciation, which is not an actual running expense, but is rather a method of settlement of the previously borne one time investment expenditures, is not included in our method in the size of K, reflecting running costs.

Moving over to the crux of the problem of the economic role of various plant life-times, one must say that:

The particular investment is treated as a particle of the systematically broadening investment process, and on this background we evaluate the economic gains and losses resulting from the fact that the life times of the plants constructed will be shorter or longer.

If we should assume, and tnat is consistent with the many years of experience in our economy, that tne annual rate of increase in the investment outlays and real increase in production amount to approximately 7% and the annual rate of increase of labour productivity approximately 4%, then the assumption of systematic construotion in tne whole economy of, for example, plants with a 30 years life time, in comparison witn an assumption of constructing plants with a 20 years life time would mean, that from the same annual flow of investment outlays our economy would obtain a 17% larger number of functioning plants, and at the same time tnose functioning plants would have 32% higher exploitation costs tnan plants of 20 years life time.

Similarly one could make calculations concerning the size of the flow of output and costs witn an identical flow of investments for other life time of plants. To prove the point, witn a 10 year plant life time, witn tne same investment flow, one could obtain in tne economy a total output equal 66% and total costs equal 57% of the respective amounts for plants of a 20 year life time.

Using those corrective co-effioients for an exploitation period, of any number of years, one can establish tne amount of output and costs comparable

with an average, 20 year period of exploitation for plants having periods of exploitation different than 20 years.

Extension of the exploitation period has a positive effect on the investment effectiveness indicated by the fact that it increases the comparable amount of output, to which the amount of outlays and exploitation costs refers. From this point of view extension of the exploitation period would be most convenient. On the other hand, extension of the exploitation period increases the total of the comparable exploitation costs to an even higher degree, since in the meantime plants are being built with ever lower unit costs, and the extension of the exploitation period makes it impossible for the given plant to keep up-to-date on technical progress. This can be seen in the fact, that the total of the costs of a given plant increases rather quickly, so that the extension of the exploitation period causes losses for the economy. Therefore, there is a certain optimum period of exploitation, in which the losses and gains even out, and in which the effectiveness indicator of the plant is comparatively the lowest.

With the aid of the calculation method used in Poland we are able to determine this optimum

exploitation period for plants of various types. If the investment outlays are relatively large, and the exploitation costs relatively small, then the optimum exploitation period is long, and vice versa. With our assumptions, if, for example, the ratio of investment outlays to annual exploitation costs (without outside raw materials) comes out to 1, then the optimum exploitation period is 20 years, if this ratio is 8, then 30 years, etc.

In principle, we believe that the effectiveness indicator for each plant should be calculated for its optimum exploitation period, if there are no physical obstacles to it such as the earlier wear of the installations, exhaustion of the raw material deposits, etc. In this way we have reviewed in short the principles of the investment effectiveness calculation used in Poland for comparison of investment variants giving the same utility effects in approximately the same time.

Here is a short review of how these problems are approached in other socialist countries. The views held on the recoupment period have already been discussed. As far as the views on the role of the freezing factor are concerned, they are relatively close in the various countries, although one may also come upon the view that the gains from defreezing of

investment funds during construction are of the same economic character as the gains from additional investment outlays on the lowering of net costs.

The approach to gains from staging an investment is also similar in most countries. The problem which we have presented of the optimal exploitation period in the function of economic aging of plants is considered only in Poland. We believe it, however, to be very important, since it enables us to oppose the tendencies of showing excessive gains from a long exploitation period of a plant and of taking no account of the economic losses connected therewith.

In conclusion, it may be useful to add a few words on the necessity of a differentiated approach to the saving of direct labours and raw materials. This problem is particularly stressed in the method of the effectiveness calculation adopted in Hungary, where large preferences have been given to the saving of raw materials taking account of the high capital intensity of this production. In Poland this problem is also taken into account, either with the aid of the calculation of intermediate investment outlays, tied with a smaller or larger use of raw materials in different variants, or by including the raw materials in the calculation, not according to

their prices, which take account only of depreciation, but according to this effectiveness indicators, which are much higher, since they take into account the interest on investment outlays.

Some special fields of using the effectiveness calculation.

The calculation methods presented above are useful, first of all, for comparison of different variants of single new plants. In practice, however, one comes upon a number of special and important fields of effectiveness research, in which these methods should be modified to a large extent, to make possible their utilization for practical tasks. Here we will discuss the following problems:

a/ the modernization of existing plants,
b/ the effectiveness of investments connected with international trade and specialization,
c/ the development of whole branches of production.

a/ The investments made in existing plants for their modernization usually yield two results. They increase the production and lower the costs. Therefore effectiveness of those investments may be calculated through

the joint comparison of them with the total investments in new plants, which would yield a similar increase of production with costs characteristic of new plants, and investments which it is worth undertaking in the economy in order to obtain such decrease of costs, as is provided by modernization in a given plant. In such comparisons one should, however, take into account several additional factors. The basic one is the question, whether it is profitable to modernize a given plant at all. Let us assume, that calculations show that through modernization one may obtain an increase of production and a reduction of costs without great expenses. If, however, the plant is very obsolete, and from the point of view of economic calculation, it should have been exchanged for a new one a long time ago, then it may turn out that modernization which in itself is effective would mean a consolidation for a long time of the whole economic system, which even after modernization would as a whole be ineffective. Therefore, not only the profitability of the modernization in itself, but the profitability of existence of the whole system which would be touched by modernization is a condition of the rationality of modernization. Additional difficulties in the modernization calculation occur,

when the modernization influences the quality or production. There are ways of taking this factor into account, one can not say, however, that they are accurate.

a/ The development of international trade from the point of view of a given country is needed and used primarily for the purpose of obtaining the necessary component of the final product of the national economy with the aid of smaller outlays than would be necessary, were there no international trade. That is why a country is interested in the export of products with relatively the lowest cost of production per unit of an international currency calculated according to the indicator of the effectiveness of investment. For the same reason, it does not matter to a country what it exports, if it is able to export at all, provided it can obtain the foreign exchange at the lowest cost. Therefore, differently from the efficiency calculations for products which have to meet the domestic needs (where we assume that investment variants are comparable with each other where they only concern the same use values), in calculations concerning international trade, we believe that we may compare all products with each other, as long as they earn the same amount of foreign exchange earnings.

In this field the possibilities of economic action are very broad, not only with in the field of development of exports, but also in the field of development of substitutes for imports. Under the Polish conditions, when the country on a rather large scale gradually changes over from exports of raw materials to exports of semi-manufactures and finished products made of the formerly exported (or imported) raw materials, the method of calculating the net effectiveness becomes very important. In this calculation, the foreign exchange earnings are defined as the difference between the foreign exchange value of the finished product and the foreign exchange value of the raw materials used which are imported, or could be exported as such, and the labour outlay is defined as the manufacturing cost and the interest on outlays in the manufacturing plants, spent for the manufacture of those raw materials into finished products.

A special problem, gaining in importance recently in international relations is the question of the development of infra-branch specialization. The essence of this specialization is a planned

limitation of the number of assortments, of a given product, e.g. machine tools, and simultaneous extension of the scale of production of the assortments to be produced. This is carried out in agreement with other countries, which on their side make similar moves concerning the other assortments. The surpluses of production in one country are exported to other countries to cover the shortages resulting from the liquidation of the production of certain assortments. Through increasing the scale of production the specialization enables the participating countries, with the same degree of demand satisfaction for particular assortments, to obtain, in most cases, an essential reduction of costs and acceleration of technical progress through better utilization of the technical personnel.

Calculation of the effectiveness of specialization from the point of view of a particular country is done by comparing the total production costs which are required to obtain the same degree of satisfaction of the needs of the economy before and after specialization, taking account of the balance of changes in the foreign trade, which is recalculated into home costs using terms of trade with a given country.

a/ At present, in connection with the gradual improvement of the planning methods the elaboration of the general perspectives of development of particular branches of production for long periods is becoming an ever more actual problem. The preparation of such development perspectives is impossible without consideration of the effectiveness calculation. Obviously, the use of this calculation for the economic evaluation of a difficult complex, such as a whole branch of production is much more difficult than it is for comparison of a number of variants of a single, isolated plant. Nevertheless, it is possible, and what is more, it is purposeful, and it is beginning to be used in Poland. At this point, it might be useful to mention a few possible ways of approaching this economic calculation, which seem to be most useful.

First of all is the determination of the optimum model of a typical plant or a few typical plants, which should determine the main developmental directions of a given branch. In almost every branch there is a possibility of choosing between plants at different technical levels, between the use of different technologies, depending on, for example, the raw materials base or on different assumptions as to the quality of production, there is a possibility of choosing plants

of different sizes and locations and finally, of different ranges of specialization.

Therefore, there is a need of finding an optimum oombination of those various factors, as to obtain a typical plant with the relatively highest value of the indioator of the effectiveness for comparable production. Such a plant should determine the pattern of development of the branch. Obviously, since in eaoh branoh, out of neoessity, one must use a different raw materials base, take into account to the local demand pattern etc., then one has not one but a number of optimum plants.

The second stage of detailing the developmental programme of a branch from the point of view of effeotiveness of investment is the determination of the effectiveness hierarchy of the plants to be constructed. Since for all kinds of practical reasons, various plants projeoted in a given branch, particularly those connected directly or indirectly with the raw materials base, may have different effectiveness indioators, the problem arises of eliminating from the investment programme the oomparatively least effioient plants, and, on the other hand, inoreasing the range of the comparatively most efficient plants and accelerating their construction in time.

Considering the branch development programme as a hierarchised d whole one can also realistically approach the problem of effectiveness of liquidating absolete plants, which should only then be liquidated, when their running costs are higher than the effectiveness indicators (including the interest of outlays) of the comparatively least efficient new plants projected.

A third basic effectiveness problem, which should be considered in programming the development of a whole branch, is its "competetiveness" in comparison to other economic alternatives transcending beyond the given branch of production. If, for example, the effectiveness indicator of the development of fuel extraction in a certain range would be inferior to the efficiency indicator of fuel saving with particular users, then it is rational to properly limit the programme of the development of fuel extraction, and to enlarge the programme of the development of fuel saving, since in this way it will become possible to have the same degree of satisfaction of the economy's balance needs for fuel with the aid of a comparatively smaller amount of social labour outlays.

Similarly, if instead of a product one can use substitutes, then there is a need of comparing the efficiency indicator of a given product with the similar efficiency indicator of its substitute, calculated for the same utility effect, taking into account the possible differences in investment and exploitation connected with the utilization of the product or its substitute. Again, if it turns out, that a given range of utilization of substitute is more effective than the original good, then one should limit the production of the original good, while increasing that of its more effective substitute.

Similar effectiveness problems occur also in comparing home production and imports. They may lead to an extension or contraction of the range of international trade so as to obtain the minimization of the total labour outlays. The development programmes of particular branches of production under preparation at present, in their research programmes take account of the above presented problems. One can see from what was said here, that with the long term planning of the development of particular branches of the national economy and their complexes, the effectiveness calculation in its broad sense is beginning to play an ever increasing role in our country.

THE MAIN DIRECTIONS OF SEARCH FOR THE OPTIMUM SOLUTIONS IN THE FIELD OF INVESTMENT TAKING INTO ACCOUNT THE PRESENT SITUATION OF POLAND

The present economic situation of Poland is the situation of a country which quickly moves to a higher stage of economic development, and therefore must solve a number of economic problems anew. Generally speaking, this finds an expression in moving over from a more extensive to a more intensive type of production. The necessity of such a move is connected with - as has been mentioned at the beginning - the using up of the reserves of existing fixed capital stock, which allowed for a large degree of non-investment or small investment type of development.

The possibility of that changeover is connected in the present situation with the great development of productive forces in many fields. Let us take a closer look at this question.

As far as the intensification of production, one can clearly see the following possibilities. First - the change of the structure of industrial production in the direction of a large increase of the part of higher phases of manufacturing, increase of the quality of production, its refining, and a large

decrease in the raw materials input per unit of production as a result of technical progress and the change of the assortment structure. This direction of intensification of production may in most cases be relatively less capital intensive, while relatively more labour intensive than the quantitative development of the raw materials base or the production of semi-manufactures. It corresponds with the present economic situation of Poland, where we have a shortage of investment resources, and at the same time a large inflow of the labour force due to the post-war baby boom. One should emphasize the fact that this new labour force, the new employees will in most cases be highly trained and qualified workers, which from the technical side creates sound premises for the intensification of the production process and the development of the higher phases of manufacturing.

Second direction of intensification is the intensification of agriculture. In this field there are many possibilities connected with the large development of the production and use of artificial fertilizers, high albumen contents feeds and the investments in various small machines, construction and other intensifications, making it possible to intensify agriculture and limit the agricultural losses.

One should particularly emphasize the possibility of the development of the production of labour and fertilizer intensive root crops with comparatively small investments.

With regard to the problem of the labour force then in the present situation it is very different in different regions of Poland. As a result of natural population increase and the hitherto prevailing directions of eoonomic development, there are large shortages in some places, while in other regions there are surpluses. Tolerating either one or the other would lead to large economic losses. In regions with labour force shortages, such as the Warsaw region, or Silesia there would be an under-utilization of the productive capacities, and in other regions there would be an under-utilization of the labour force. Attempts to solve the shortages of labour force in great industrial and city agglomerations through a large scale migration would mean the expenditure of huge sums for resettling. In such cases, a large scale action of passive and active deglomeration is undertaken, and one may hope that an action of this type, through bringing the production and investments to where the labour resources are available will result in large investments savings for resettlement and will make possible the better utilization of the

productive capacities of the plants already functioning. In short, at the level of the national economy it will bring large investment savings, making it possible in this way to achieve from a given amount of available resources, of a larger total increase of production.

The next question is the problem of the optimum directions of development in particular branches connected with the problem of utilization of the products of those branches. Here one may mention, as examples, a few problems, such as the optimum composition of the fuel balance by the main energy sources: coal, gas, oil, electricity, taking into account the different economic characteristics with different users, problem of the optimum quality of the assortment structure of the steel mill products from the point of view of their consumers, problem of the optimum connection of the machine industry with the requirements of the mechanization of the national economy, etc.

Finally, one should point out the complicated question connected with the optimization of the international division of labour, in which Poland participates actively.

In the optimization of the production structure of particular branches, and the intensification of the methods of production in those branches, we see a large scope for the lowering of the capital intensity of the overall development and in this way accelerating the rate of economic development under present conditions.

Aiming at the development of international cooperation on an even increasing scale, we try to obtain the largest possible advantages from it, and to develop it in those fields where such advantages can be expected, either due to shortage, or high production costs of the raw materials in our own country, or due to the gains resulting from the international specialization of production. At the same time, there are a number of fields in which Poland may develop its own production with relatively low cost and may contribute to the reduction of its import requirements. This in turn will make possible the limitation of exports of non-effective products and the increasing of import of the products which have great importance for our economy. So, for example, one of the basic assumptions of our economic plan is the limitation of the import of grains, the production of which we may ourselves increase with the aid of artificial fertilizers, or the consumption (for feeding) of which we

could limit by using high albumen feed mixtures.

It will also be convenient for us, based on the development of our own production to limit the import of certain chemical raw materials, rolled steel products, etc. Such a policy of simultaneously increasing the change in areas of production convenient for us, and limiting it in inconvenient fields, i.e. fields where we can produce similar products with comparative advantages will us to obtain not only a quantitative increase in foreign trade, but also raise it to a higher quality level, to reach an optimum from the point of view of the whole economy through the minimization of the overall cost connected with international trade, and the cost per unit of the same final product. It is obvious, that making a large change in the structure of foreign trade towards its optimization requires the right set up of the investment programme both for the export production and the import substituting production.

The above mentioned problems are only a part of the extremely rich set of problems of our economic development, but even they suffice to show the great importance of the effectiveness calculation for the optimization of the economic development of Poland at the present stage.

Here one should emphasize once again, that the effectiveness calculation, which we are beginning to apply more and more in a number of fields is intended to fulfil a clearly defined task, namely to contribute to the maximization of the economic growth with the overall amount of resources available to our economy at the given stage.

We hope that the problems and methods of effectiveness research presented here will also be interesting to economists in the developing countries, despite the different economic systems in these countries.

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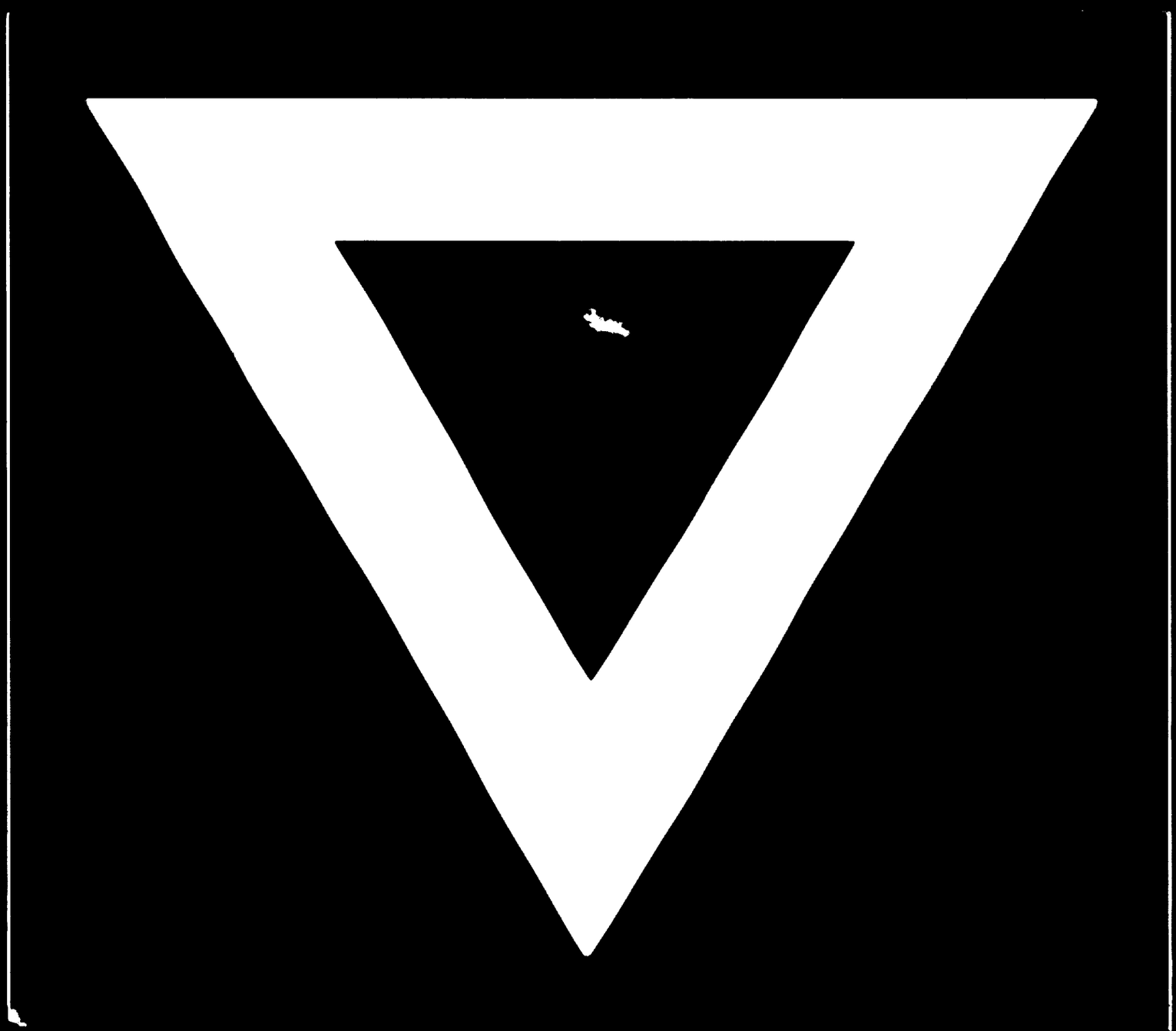

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