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CONDITIONS AND METHODS OF INVESTMENT PROJECTS EVALUATION IN THE ECONOMY OF DEVELOPING COUNTRIES

By

Dr. Alexander Muller

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CAIRO
SALAH SALEM St.-NASR CITY

Aleksander Muller D.Sc.Econ.
Central School of Planning
and Statistics
Institute of Developing Countries

CONDITIONS and METHODS of INVESTMENT PROJECTS EVALUATION in the ECONOMY of DEVELOPING COUNTRIES

The problem of new investment projects evaluation in developing countries is one of the most difficult economic problems in the sphere of theory and practice of development of those countries. The degree of difficulty and the scale of complexity of the problem result from both the diversification of socio-economic forms of their economy and the necessity to solve it in a complex way in macro- and microeconomic scale.

From the macroeconomic point of view, it is necessary to primarily evaluate the general development conditions in definite countries and regions in order to be able to make research into labour and investment balances in material, financial and currency aspects. The analysis gives us grounds for the choice of the level of technical capital intensity in the new investment projects.

It is also necessary to turn attention to the sphere of investment outlays allocation as there are various purposes and motivations determining the efficiency of investment parameters in various forms of properly in the multi-sector economy typical for developing countries.

The macroeconomic analysis and the necessary data on the preferences in the field of choice of the new investment projects technical level enable us to take up research in the sphere of synthetic, and later, detailed indicators of the economic

efficiency of investments on the macroeconomic scale concerning the particular new projects.

1. The General Conditions of the Choice of Technology

Speaking about technology, we have in mind a certain combination of factors of production used in production of a given commodity or of a group of commodities, and more broadly a combination of aggregated methods of production enabling achievement of a definite production result in the form of an aggregated unit of the national income increment.[1] The means applied in achieving the intended goal and the method of their application constitute the t e c h n o l o g y of a definite economic activity, and therefore in production activity we deal with technology of production.[2] This notion we may replace with an equivalent notion of the method of production meaning "... a systh matic method of acting aimed at achieving a definite goal"[3]. In the production process, an achievement of the intended goal, i.e. some definite products requires an application of a combination of material means of production which are put into operation by human labour.[4] The ratios between the material means of production and the size of labour outlays composing the technology of production constitute an effect of the collective productive experience of people emerging in the social process of labour.[5]

The characteristic feature of the particular technologies of production is their respective "... combination of efficiencies of the separate factors of production".[6] It means that the separate technologies of production differ by definite combination of unit outlays, i.e. co-factors of production.[7] The efficiency of factors of production is increasing along with the processes of technical progress. It is expressed in an increasing efficiency

of new technologies as compared to technologies utilised earlier. The technical progress achieved under the influence of the cumulation of the collective productive experience of people comes a continuous increase of efficiency of the utilized factors of production including the human factor, i.e. leads to increased saving of live and crystalized labour.

It is necessary, from the theoretical point of view, from to differ between the coexisting technologies at the given level of technical knowledge and the technical progress understood as a process evolving in time.

Production of a product or a group of products is possible by unification of material and human factors of production. However, the role played these two kinds of factors of production in the social production process is different. The material factors of production - means of labour and objects of labour are indispensable for the production process to take place. However, they are a passive party in this process and they are put into operation under the influence of the human factor, i.e. of labour. The human labour in its diversified concrete forms constitutes a creative and active dement of the production process putting into operation the material means of production.[8]

Human labour being an active factor in the production process is the live labour while the means of production are the result of a labour expanded earlier which crystalized in the means of production.[9] The role of live labour as a purposeful and consious human activity aimed at achieving the assumed goals of the production process is exposed by the Marxist political economy indicating its decisive importance for development of the social productivity.[10]

Oskar Lange presented the described characteristics of the process of production as a unification of labour and the means of production with the following formula

$$\begin{bmatrix} L \\ Q \end{bmatrix} \longrightarrow P$$

where L denotes outlays of various kinds of concrete labour while Q - outlays of various kinds of concrete means of production necessary for achieving the assumed production goal P". The values L and Q constitute combinations of labour or means of production outlays embracing some concrete kinds of both factors constituting elements of the given combinations /L_1, L_2.../ L_m and Q_1, Q_2,..., Q_n which together constitute the L and Q values/.[12]

P in the above formula denotes the product obtained through unification of combined elements of L and Q. Both these elements can be presented in their desaggregated forms. The product P may be then defined in the following way:

$$L = \begin{bmatrix} L_1 \\ L_2 \\ \cdot \\ \cdot \\ \cdot \\ L_m \end{bmatrix} \qquad Q = \begin{bmatrix} Q_1 \\ Q_2 \\ \cdot \\ \cdot \\ \cdot \\ Q_n \end{bmatrix} \qquad \text{therefore} \begin{bmatrix} L_1 \\ L_2 \\ \cdot \\ \cdot \\ \cdot \\ Q_1 \\ Q_2 \\ \cdot \\ \cdot \\ \cdot \\ Q_n \end{bmatrix} \longrightarrow P$$

The volume of labour expanded to achieve the product P and the volume of means of production involved in this process, we define as an i n p u t; the volume of the product obtained by undertaking the input, we call o u t p u t.[13]

Ratios between input and output vary in relation to changes taking place in the conditions of production which depends an overall conditions determining the productive force of labour[14].

The progress in development of social productive forces causes changes in the volume of the product obtained through a definite input of live labour and material means of production[15]. The general trend of these changes is an increase of the volume of the product obtained through the particular input or a decrease of input in relation to the given obtained product. The duplicity of this trend is not of tautologic character as the concrete solution - maximization of results /product/ from the given input of live labour and of means of production or a decrease of input in relation to the obtained output /product/ result both from the existing needs and economic possibilities do not mean an analogous result.

The development and improvement of the conditions of production is followed by changes in relations between composition elements of production groups so that it is possible to obtain a given production result at the given level of technical knowledge not only through various inputs of human and material factors of production but also through various combinations of these factors[16]. There appear the possibilities of different formation of u n i t i n p u t s which may be expressed in the following formula

$$\left[\frac{L}{P}; \frac{Q}{P}\right],$$

where $\frac{L}{P}$ denotes a combination of unit inputs of various kinds of live labour while $\frac{Q}{P}$ a combination of unit inputs of various kinds of means of production[17]. The composition elements of these groups /unit inputs/ could be defined as technical coefficients of production of technical norms as they depend of the technical conditions of the production process[18]. Technical conditions of production, and the applied technologies of production in particular determine the efficiency of live labour and the efficiency of the means of production applied and operated by that labour. There is a certain regularity here consisting in the fact that an achievement of a higher efficiency of labour requires a bigger outlay of means of production. It is not only the possibility of processing of a bigger quantity of raw materials and materials in question here, but also and primarily a better supply of labour means /tools, machines, aggregates, etc./ necessary in achieving a higher level of labour efficiency. The functional dependence between the level of the labour means availability or technical labour equipment and its efficiency is expressed by a continuous increase of technical equipment which is a precondition of an increasing level of labour efficiency[19]. We should not miss the fact that an increase of means of production outlays in connection with an increase of labour efficiency is of a different character in

relation to the objects of labour /materials, raw materials, fuels, power/ and in relation to the means of labour. An increase of the means of labour outlays is a precondition of an increase of labour efficiency. A worker better equipped with labour means can produce a bigger quantity of the product within a given period of time /and also products of a higher quality/. On the other hand, an increase of outlays of the objects of labour, i.e. an increase of the volume of processed materials and raw materials is a consequence of an increase of labour efficiency as thanks to the possibility of producing on increased quantity of products within a time unit /which is the result of a better technical equipment of labour and in consequence an increased efficiency of the live labour/ the quantity of objects of labour processed within a given period of production process also increases[20]. Along with an increase of the technical equipment of labour, not only the labour efficiency increases, but also change the quantitative relations in production which is manifested in a relative decrease of live labour outlays /the volume of labour/ in relation to outlays of means of production /the volume of means of production put into operation by labour/. In other words, there appears the tendency towards a decrease of the human factor of production outlays in relation to outlays of the material factors of production. We may conclude, therefore, that the technical equipment of labour increases as a consequence of application of more capital intensive technoligies or as a result of the general social tendency of the technical progress. The notion of the technical composition of capital was first introduced into the theory of economy by Karl Marx[21]. The notion differs in a sense from the technical equipment of

labour indicator:

1. technical equipment of labour concerns new investment projects and is, therefore a marginal value, while the technical coefficient of production concerns the economy as a whole;
2. technical equipment of labour concerns solely the outlay of investment means in relation to the number of employed workers /in new investment projects/, i.e. the indicator overlooks the volume of the objects of labour outlays; the indicator of the technical composition of capital embraces the volumes of the means, as well as of the objects of labour /the total value of fixed and liquid means/, i.e. it embraces the total outlay of material factors of production in relation to employment in the whole economy[22].

A definite level of the technical equipment of labour characterizes the given technology of production characterized by its proper composition of unit outlays with a determined efficiency of separate factors of production. Wishing to achieve the intended production result in the form of a given quantity of the product, we may, as a rule, apply various technologies of production, i.e. various technical p r o c e s s e s, each being characterized by different ratios between human and material means of production[23]. The production experience indicates that it is possible to apply various quantities of factors of production to obtain the envisaged quantity of the product. Let us assume that the quantity of raw material used for the purpose is the same in various methods of production. We shall limit, therefore, our analisis to two basic factors of production - labour denoted by L and outlays of investment means denoted by I.

Both factors are complementary to each other, i.e. putting into operation of one of them requires a respective quantity of the other. Both factors are also s u b s t i t u t i v e to each other, i. e. they can substitute each other to a certain extent. Various quantitative relations of employment and investment /L and I/ representing various methods of production /technologies/ may appear alternatively in technical processes applied in production of a given commodity or an aggregated group of commodities.

It can be clarified by a simple example. Let us assume that the aggregated group of commodities is composed of two products A and B and each of the products may be obtained with two technologies characterized by different notion between outlays of live labour L and crystalized labour /investment goods/ I.

Product A may be obtained using for its production:

L_1 and I_1 /first method/, or

L_2 and I_2/ second method/.

For production of commodity B we have to use alternatively:

L_3 and I_3 /first method/, or

L_4 and I_4 /second method/.

For production of A and B commodities, we have to alternatively apply the following factors of production:

$L_1 + L_3$ and $I_1 + I_3$, or

$L_1 + L_4$ and $I_1 + I_4$, or

$L_2 + L_3$ and $I_2 + I_3$, or

$L_2 + L_4$ and $I_2 + I_4$ which creates the possibility of production of the aggregated group of commodities composed of A and B products by means of four aggregated methods of production. If the considered group of commodities is composed on n products, and

each of them may be produced with two or more methods, then the total number of combinations will be enormous and will reach:

$$m^n = q^t$$

where m denotes the number of alternative methods of production of each of commodities within the aggregated group of products;

n - the number of products in the group;

q^t - the total number of combinations of aggregated production methods applied in production of the aggregated group of commodities embracing n products.

The number of products in our example was n = 2 and the number of methods of production for each product m = 2. The total number of possible combination will amount to $2^2 = 4$, i.e. $q^t = 4$ which results from the example. If we had 4 products, and each of them could be produced with two methods, then the number of combinations would amount to $2^4 = 16$. If the number of products were 10 and the number of technical variants of production for obtaining each of them, say - 3, then according to our formula, the number of combination of aggregated production methods would rise to 59049.

Not all technical combinations may be taken into consideration while choosing the alternative methods of production. While appraising the methods we have to pick effective and ineffective methods. We call the method ineffective when outlays of all factors of production are higher than in other methods or when outlay of at least one factor of production in higher while outlays of other factors are not lower than in other methods. The method is effective when outlay of one of the production factors is higher than in other methods of production, but the

outlay of the other factor is lower than in other methods[24]. Only the effective methods may be the subject of choice in the process of choice of aggregated methods of production. They are, therefore, the real technical alternatives. The ineffective methods should be eliminated from the sphere of choice of technologies.

The theory of economy applies various research methods in explaining basic dependencies appearing in the process of choice of technologies. One of these methods is the model of choice of technologies based on the, so called, production curve[25] which is, de facto, the curve of alternative production methods.

The production curve is a geometric population of points representing aggregated methods of production used in obtaining the given product. The principles of its elaboration are rather complicated. Skipping the details, we may say that the curve is a broken line linking few points representing alternative technologies in cases when we deal with only one or few products. When we deal with a big aggregate in which the production result appears in the form of an aggregated unit of national income increment the production curve will be a smooth and rather continuous line as it represents numerous aggregated methods of production which are put according to the assumed order from the most labour intensive and the least capital intensive to the least labour intensive and the most capital intensive[26]. The curve represents only the effective methods, i.e. we do not take into consideration the ineffective methods which were eliminated from the sphere of choice of technologies according

to the principles of praxiology as ineffective at the present state of technical knowledge. The production curve is, therefore, a smooth line concave at the beginning of the system and dropping at the decreasing rate. This shape of the curve results from the assumptions and from excluding ineffective methods which enables a rational choice among the alternative effective methods.

An analysis of the production curve representing a set of aggregated production methods applied in new investment projects put into operation requires, first of all, a determination of production results which are to be achieved at these projects. We assume that the production result is a unit of the national income increment, $Y' = 1$. To simplify our considerations, we assume that the methods of production differ only by the number of employees / 'L/ and the size of investment outlays / I/. The number of aggregated methods of production is very big /which results from the formula $m^n = qt$/ which causes that our curve is a smooth line and is composed of a population of points representing separate technologies accessible due to the possibility of choice /see Fig. 1/.

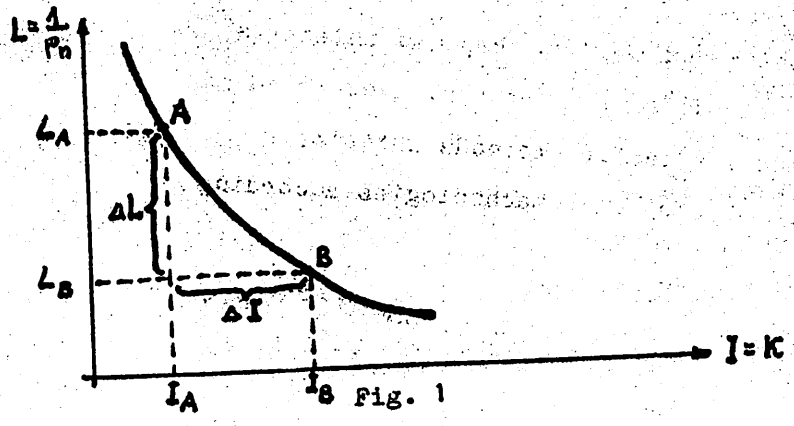

Fig. 1

The size of employment we mark on Y axis. Assuming that $f' = 1$, the value of L is equal to reciprocal of labour efficiency, i.e. $L = \frac{1}{p_n}$ /where p_n denotes labour efficiency in new investment projects created to achieve a definit increment of the national income. The size of investment outlays is marked on the x axis. According to our assumptions the outlays are equal to the capital intensity of production, i.e. $I = k$.

All points on the production curve represent aggregated effected methods of production which permit to produce a unit of the national income increment of a determined material composition at various ratios between employment and investments, i.e. with methods differing in labour and capital intensity. We have to assume here the employment is uniform, i.e. we leave aside the problem of differences in the level of qualifications. Any changes in the level of labour efficiency are then only the result of changes in the technical equipment of labour. The methods of production represented on the curve are the result of the earlier technical progress and reflect the present state of technical knowledge. Methods representing highest labour intensity and lowest capital intensity are at the beginning of the curve /left upper end/. Methods of lower labour intensity and higher capital intensity appear while moving down along the curve. At the same time, a higher labour efficiency is achieved. The given state of technical knowledge means a coexistance of various effective methods of production of differing capital and labour intensity at a definite period of time. The factors of production applied in these methods are characterised by a definite substitutiveness.

Assuming that we intend to move from A to B method as a result of the choice of technology and remembering that there are employment L_A and investments I_A in the A method and employment L_B and investments I_B in the B method, we shall observe the following changes resulting from the change of technology:

- points A and B represent alternative technologies opening the possibility of choice as they are both efficient;
- the transition from A to B method /down along the curve/ means that the outlay of human factor /employment/ L will decrease by $L_A - L_B$ which means, at the same time, a decrease of capital intensity $\frac{1}{p_n}$, and therefore, an increase of labour efficiency p_n;
- the possibility of a decrease of employment results from the change of technology consisting in substitution of employment by increasing investments; the decrease of employment takes place along with an increase of investment outlays; it means that the indicator of technical equipment of labour is increasing which is the base for the observed increase in labour efficiency;
- the parallel increase of investment outlays at the given size of product result means that the capital intensity of production is increasing /any increment of I is reciprocated by an increment of k/.

We face here, therefore, a substitution of employment by investments or a substitution of labour intensity by the increasing capital intensity, i.e. an increasing labour efficiency through an increasing capital intensity.

The differences between the outlays of factors of production in the alternative methods A and B are as follows:

in case of employment $L_A - L_B = \Delta L$,

in case of investments $I_B - I_A = \Delta I$.

The ratio between the additional investment outlays necessary for a decrease of employment and the achieved savings in the live labour outlays $\frac{\Delta I}{\Delta L}$ is called the rate of substitution of outlays. The shape of the curve declining at a decreasing rate causes that the rate of substitution of outlays is increasing because every decrease of employment by an equal value is accompanied by an increasing increment of investment outlays. The increasing rate of substitution of outlays creates the need to determine a profitabilita limit of additional investment outlays incurred in order to achieve savings in employment. It is necessary that the planning centre took decisions on the choice of technologies on the grounds of an analysis of alternative technical variants in economic practice. It requires a m a r g i n a l rate of substitution of outlays which indicates the point to which it is profitable to increase the increments of investment outlays. The determination of a proper marginal rate of substitution of outlays is an extremely difficult and complex task. However, the theoretical conclusions resulting from our model analysis are essential to grasp the sense of this task and are the grounds for elaboration of synthetic indicators of the efficiency of investments in a planned economy.

In the economic practice, the choice of technology, which theoretically means a choice of the new investment projects capital intensity level, requires a real and detailed knowledge of technical capabilities and economic possibilities of the given country. The planning centre will shape its decisions hire in relation to the concrete balance of labour force and the investment possibilities depending, in turn, of the effective

resources and the structure of production of investment goods. It could be foreseen, therefore, that the planning authorities would be inclined to choose methods of production of a lower capital intensity coefficient while faced with the existance of reserves of labour force in order to enable the economy to absorb the labour force surplus. Highly capital intensive technologies assuring a high level of labour efficiency would probably be choosen in case of a lack of labour force reserves.[27]

2. Systems and Institutional Conditions of the Choice of Technologies

The realization of investment processes is subjected to achieving the intended economic aims within the limiting factors existing in the given economic system. The investment processes in the socialist economy are, in this aspect, similar to those in the contemporary capitalism.[28] An achievement of economic growth and an introduction of technical progress in the new investment projects, an therefore in the whole economy are the result of investment acivity in both systems. The basic differences between the investment processes in capitalism and socialism result from the basic aims of the systems and the differences in the character and effectiveness of economic planning systems.

The investment projects of a socialist state have to achieve a dual aim. They have to primarily caber for the needs of the society which is the main purpose of the socialist system. Moreover, the investments should be carried out in respect of the current economic and political necessities resulting from the disposition of forces in the contemporary world. The necessity to assure a sufficient defence potential and the need to assure the country's position in the economic competition between socialism and capitalism are taken into consideration at every investment decision of a socialist state. This factor may be, and usually is, one of the principal limitation in assuring an optimum character of the process of economic growth.

The first stage of the investment decision making of a socialist state should therefore, give consideration to the necessity of dividing the disposible investment means into parts necessary for assuring the economic growth according to its planned rate

and for the defence needs of the country.

The second stage involves the division of the civilian investments into directions representing sectors and branches of the national economy. The division of investments among branches is one of the central links of the investment process as it is decisive for the future structure of production, the rate of growth of the national income, and also for the rate of growth of investment and consumption fund. The branch structure of investments shapes to a considerable degree the average, social capital intensity which at the given, representing a limitation investment fund, exerts a decisive influence on the rate of economic growth.

The third stage of investment decision making is the choice of technology on the macroeconomic scale based on the analysis of the existing possibilities in the sphere of the investment fund and the balance of labour force.

The problem of choice of technology and the calculation of economic effectiveness of investments is done on two plains which we can isolate from the point of view of scale and the sequence in time.

The first plain connected with the third stage of investment decision making embraces the choice of technology from the point of view of the general technical level of new investment projects. The problem of choice concerns here a formulation of an answer to the question: Should more people be employed at a lower technical equipment of labour and a lower labour efficiency, or should the size of employment be limited in favour of increasing the technical level of labour equipment and the level of labour efficiency in new investment projects. The choice of technology here is of a macroeconomic character and is connected with the

general strategy of the investment process. The second plain of the choice of technology is the microeconomic scale. The choice here boils down to a decision on realization of definite investment v a r i a n t s chosen from two or more projects aimed at achieving a given production result. As far as the time sequence is concerned, the choice of technology on the macroeconomic scale takes place earlier than deciosions concerning concrete projects of a defined material production result.

Due to a possible development of the economic situation related to the ratio between the investment resources and the labour force balance, we may isolate the following three probable cases:

- first - there are big and unutilized labour resources and relatively small investment resources; such situation may occur at the inicial stage of socialist building; it is also typical, as a rule, in developing countries at the preindustrial stage and at the early stages of industrialization;
- second - there are relatively higher investment possibilities but the labour surplusses are still very high; such situation may occur in the period of a developed industrialization process in countries commencing the economic growth process from a relatively low level of economic development;
- third - as a result of advanced industrialization process, the economy achieved considerable investment capability and, at the same time, there appeared considerable limitation in the labour supply showing down the rate of growth of employment; such situation may occur in industrialized countries even before achieving a high level of economic development.

The problem of choice of technology will be different in each of the situations described above. The level of technology which would be applied would be probably predetermined in the first and the third cases and the state would have a limited scope of choice within the assumed development strategy. The alternative possibilities of choice between technologies of low and high capital intensity may appear in the second case.[29]

The choice of technology is not done in relation to the existing and formed resource of production apparatus in the given economy, although there are some possibilities here the, so called, reorientation and to technical modernization of the ancient production apparatus. However, movement on these choice areas is usually negligible. It may, especially in relation to reorientation, concern marginal values of production without exerting much influence on the technical structure of production apparatus and on the average social level of the technical equipment of labour. The proper choice area of technologies covers new investments projects, an d therefore, is a component of the investment processes planning system, i.e. concerns the economic choice related to the future.[30]

The conditions of choice of technologies do not result solely from the technical and economic dependencies between the balance of employment and the balance of labour force, but also and to a considerable extent are determined by the social system and institutional factors in force in the country.

There is a view in the theory of economy that the choice of technologies may be, in principle, done in the planned economy. It may be both socialist economy the natural feature is the planned character of functionning and development and also the economy existing in many developing countries posessing a strong socialized

sector based on economic planning.[31]

The capitalist economy the basic motivation of which is maximization of profit does not, in principle, create grounds for choice of technologies. Optimum technologies in capitalist economy are those which maximize profit, i.e. geared to maximize economic surplus. The most important problem for a capitalist company is utilization of such production methods which would assure a maximum labour efficiency or, to be more presise, a maximum difference between the labour efficiency measured by the size of output and the level of outlays for labour force. A capitalist company would be inclined to use relatively lower technologies when labour is cheap. When labour is expensive and very expensive, the company will be inclined to carry out capital intensive investments assuring a possibly highest level of labour efficiency maximizing the economic surplus. In other words, the technical level of new investment projects in the capitalist system will be always defined by the availability of labour force, but determined, in a given situation by the motive of profit maximization inducing the company to utilize more and more capital intensive technologies along with the decrease of available labour resources.[32] In the microeconomic scale, i.e. in individual capitalist companies, there may of course, occur situations when production optimization conditions through choice of investment variants are considered but they are always subjected to attempts to achieve a maximum profit from the invested capital.

The problem of choice of technologies will not appear in small businesses usually run by families. Private small business owner /a small farmer or an artisan/ usually strives to maximize output to assure a coverage of his and his family basic needs. He usually does not count his labour outlays as long as there are

labour surplusses in the economy of this type and these surplusses are considerable while their marginal productivity is near zero. Labour intensive technologies are usually used under such conditions as the producer is not interested in achieving an economic surplus but aims to achieve a possibly highest output with relatively lowest outlay. When live labour outlays are considered a relatively cheap and abundant factor and, at the same time, tools and other labour objects are relatively expensive and difficult to obtain for the small and poor company, the labour intensive technologies of low capital intensity become the only possible and the whole technological process becomes determined by the conditions of the economy and the purpose of its activity.[33]

Assuming that the above reasoning is true we may formulate the following conclusions:

- the choice of technologies on the macroeconomic scale is not characteristic for any economy but is based on definite social system and institutional conditions;
- in privately owned economy, both capitalist and small business technologies are determined by basic aims of production, and therefore, there is no problem of choice of technologies;
- the choice of technologies appears as a component of investment process in the economy based on social or public ownership of means of production; it may, therefore, appear in the socialist economy the purpose of which is to cater for the needs of the society and in the economy of developing countries the aim of which is to assure economic growth and an improvement of the living conditions of the population;
- the basic economic subject and the main decision-making factor

in the sphere of choice of technologies is the state trying to achieve the aims described above; its field of activity is the state-owned economic property;

- the economic domination of the state enables it to influence in a certain extent the choice of technology in non state-owned sectors through parametric methods; these sectors are cooperatives and small business as there is only a small probability that state could influence choice of technologies in the capitalist sector even while applying planned influence on its development;
- the state faces, in the assumed conditions, the problem of choice of technologies in new investment projects providing there are reserves of labour force which seek employment and, at the same time there is a possibility of an investment maneouvre in the field of application of alternative technologies.

The possibility and necessity of choice of technologies by the state is closely connected with the shaping of the future rate of growth of national income and of its main components: Investments and consumption.

3. The Investment Decisions of the State and the Choice of Capital-intensity Coefficient Level in New Investment Projects

Two groups of investment decisions taken by the state exert influence on the level of the capital-intensity coefficient in new investment projects:

1. Decisions concerning the choice of the structure of investments in the sphere of the division of the volume of investments means between sectors and branches of national economy;
2. Decisions concerning the level of technologies in new investment projects determining principal directions of changes in the field of technical equipment of labour, its efficiency and the size of employment.

The value of the capital-intensity coefficient is shaped primarily under the influence of choice of a definite structure of investments as the separate branches are characterized by different technical features, and therefore, different levels of capital intensity. A concentration on development of branches of high average capital intensity will cause an increase of the average capital intensity in the whole economy, and vice versa, development of low capital intensity branches will cause a tendency towards a decrease /or a slower increase/ of the average capital-intensity coefficient in the new investment project. The aggregate indicator of capital intensity for the whole economy does not fully reflect the technical level of new investment projects but primarily is the reflection of their structural pattern. It is necessary therefore, to assume a given structure of investments in theoretical analysis because only then it is possible to reveal changes in the planned level of technological capital intensity reflecting various technologies utilized in new

investment projects.

Situations described earlier may appear in cases when the structure of investments was determined as a result of a state decision. There will be no place for appearance of the technology choice problem in these situations as an application of a definite technology would be predetermined by a complex of limitations active within the economy, and primarily by limitations resulting from the actual balance of labour force.

Experiences of the first period of industrialization of the socialist countries seem to confirm the above thesis. A majority of socialist countries suffered deficiences in the sphere of the investment goods production possibility resulting mostly from the anachronic structure of production inherited from capitalism and also from enormous war destructions which first of all hurt the vector producing investment goods and the economic infrastructure. There existed a parallel backwardness in the structure of agriculture and the general technical level of agriculture was very low and was predominantly characterized by manual labour based on labour intensive methods of production. Surplusses of labour appeared in this situation in most of the socialist countries, mostly in the form of a relative overpopulation in agriculture. This created a base for structural unemployment which could not be rapidly overcome because of the underdevelopment of production apparatus and the lock of a sufficient number of workplaces. The first period of industrialization in the socialist countries was characterized, therefore, by efforts aimed at creating possibilities of employment for a possibly big number of people to overcome the structural unemployment. The creation of new workplaces was mostly done by means of an accelerated development policy based on utilization of labour intensive

technologies permitting a relatively rapid absorbtion of labour surplusses. The low level of qualification of the dispossible labour resources was an additional factor determining application of this particular choice of technologies.

The objective conditions: the lack of investment means, the social pressure resulting from the unemployment, the low level of qualifications of the potential employees and the socio-economic necessity connected with the change of the economic and class structure of the society determined technical solutions applied in new investment projects assuring growth of output mostly by means of increasing employment. The relatively high increase of labour efficiency observed in this period resulted from changes in the structure of employment which grew more rapidly in sectors characterised by a higher overage level of labour efficiency. The main reason for this phenomenon was the migration of population from agriculture to the developing industry. As a result, the rate of growth of employment and the increased degree of labour force utilisation because the main factors determining the rate of growth of the national income. The state had practically no possibilities for other solutions and accepted such technologies which were accessible during the period. The applied methods of production were based to a considerable extent on copying of the existing technologies, and in some cases, low intensity technologies based on manual labour were introduced due to the scale of the undertaken investment projects and the dispossible labour surplusses.

Conditions for utilisation of high technologies of high capital intensity may appear in situations forcing the necessity

of technically predetermined investment decissions:

- first - when the need for investment characterised by a definite, predetermined technology of high capital intensity which could not be deviated from result from the structure of investments established earlier;
- second - when reserves of labour force get exhousted in the developed economy and thus the possibility of acceleration of the growth of national income depends from intensification of technological processed and an increase of the rate of growth of labour efficiency.

The first of the situations presented above is relatively simple. When the state decides to adopt a definite structure of investments and develops branches of production characterized by highly capital intensive technologies, the problem of choice of technologies is eliminated. The only alternative boils down to the question: To produce or not to produce? If the answer is "yes", a definite type of technology is automatically utilised. An attempt at other technical solutions, e.g. an introduction of a less capital-intensive technology may misfire as the intended product will not be obtained.

The necessity of introduction of highly capital intensive technologies emerges in face of the lack of labour reserves. The basic limiting factor here may be the marginal value of the rate of investments influencing the level and dynamics of consumption.

The whole above reasoning leads us to the conclussion that the choice of technology may take place in a definite social system and institutional situation and at such ratios of the balance of investments and the balance of labour force

formation which would not create the necessity to apply technologies of predetermined parameters. There have to exist, therefore, production capacities in the sphere of the definite investment goods production, as well as possibilities of their importation, and primarily it is necessary to posess labour force reserves.

4. Choice of Technologies under Existance of Labour Force Reserves

The choice of technologies in the conditions presented earlier is characterized by appearance of economic and socio-political aspects. The first aspect results from basic economic balances, the second from the general social motivations in the socio-economic activities, socio-political situation connected with aspirations of the state and the population and the influence of various internal and external factors determining the position of the given country in the pattern of international economic and political relations. The state takes decisions on the choice of technologies on the grounds of the current situation and assumes also an achievement of desired goals in the future.

The essence of the choice of technology, i.e. of the choice of the level of capital-intensity coefficient in new investment projects is the choice between alternative sizes of employment and the respective level of the technical equipment of labour and labour efficiency. This choice is made with respect to a definite size of investment fund and the labour force reserves.

In the developing countries, especially those at a low level of their socio-economic development, the basic limiting factor is the size and the structure of the national income, and first of all the material size and structure of the investment goods resources. The factor being in abundance is the labour force, the limiting factor here may be, and usually is, the size of qualified labour resource. It is admissible to assume in the theoretical model analysis that the quality of labour force is uniform and that its resources are unexhaustible.

The "Dobb - Sen model" of choice of technologies is relatively widely known in the economic theory. The model takes into

consideration short- and long-term implications resulting from adopting alternative technologies of a diversified capital intensity level.[34] Without going into details of the model we may conclude that the problem presented in the model boils down to the alternative between maximization of income and consumption and maximization of investment surplus. Maximization of income appears as a result of decisions on utilization of low capital intensive technologies which causes a relatively slower rate of economic growth and a slower increase of the economic surplus which, de facto, is a dispositive investment fund in the long run. Maximization of economic /investment/ surplus is achieved through the choice of highly capital intensive technology which permits to achieve a more rapid rate of economic growth than in the case of lower capital intensity technologies in the long run. It results from the assumptions of the "Dobb-Sen model" that the maximization of the economic surplus and the resulting higher rate of growth will cause maximization of income, employment and consumption in the long run in comparison to the variant of growth based on lower capital intensity.

The idea of the model can be grasped after an analysis of dependencies presented in the Fig. 2.

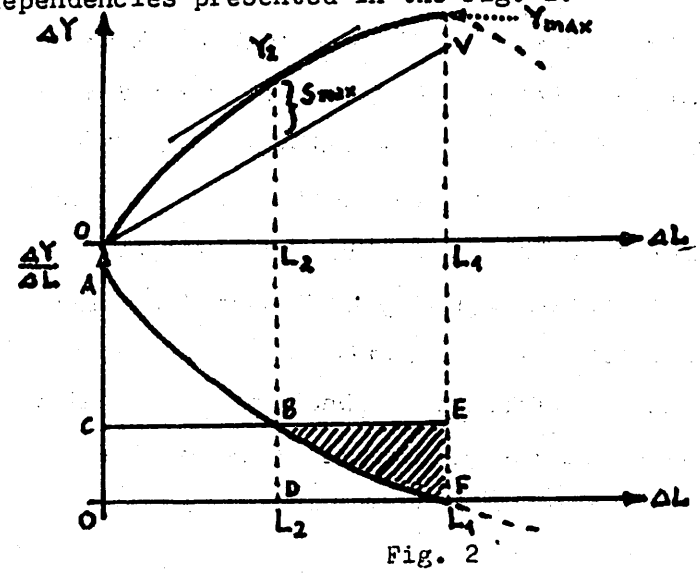

Fig. 2

The diagram is composed of two parts: In the upper part we place the size of the national income increment ΔY on the Y axis and the size of employment increment in the new investment projects ΔL on the X axis. In the lower part of the diagram, we place the ratio between the national income increment and the employment increment $\frac{\Delta Y}{\Delta L}$ on the f axis and again the size of employment increment ΔL on the X axis. The curve of income in the upper part of the diagram represents its size at various alternative sizes of employment. The curve is rising at a decreasing rate because, at the given investment fund /I = const./ application of alternative technologies of different levels of employment, and therefore, at different indices of technical equipment of labour has to cause a declining trend of the marginal income increments along with an increase of employment and a relative decrease of the labour efficiency level. Maximization of profit occurs at the employment proper for variant 1, i.e. L_1. If we assume that the aim of the state in the given period is to maximize employment in order to overcome unemployment, as well as maximization of income and consumption, the technology of variant 1 should be considered optimum. Other technologies permitting employment higher or lower than L_1 would not fulfil the condition of a simultaneous maximization of income and employment. However, a short-term maximization of employment and income not always may reflect long-term interests of the society. The line OV on the diagram represents formation of wage fund which also means the consumption fund /assuming that an average real wage is constant/ at alternative technologies and alternative sizes of employment. The wage fund grows proportionally to the growth of employment /with assumption that the real wage is constant/ while income grows at a rate

less than proportional to the growth of employment. Variant 1 will cause that the economic surplus represented by the segment between the curve 0Y and the stright line OV will start to shrink in comparison to its size at the point Y_2 /i.e. in variant 2/ when the maximum supplus S_{max} occured. It can be noticed in the diagram, at the same time, that variant 2 creating employment L_2 assures a higher labour efficiency and causes, in fact, neither maximization of income nor maximization of employment but maximization of investment surplus which creates a dynamising impact on the future rate of growth of income. This can be observed at the lower part of Fig. 2. The AF curve represents decreasing marginal increments of income which are the result of an increase of employment. At the point F which represents maximum level of income Y_{max}, the ratio $\frac{\Delta f}{\Delta L} = 0$ which means that irrespectively of the aims set by the state any further increase of employment would be irrational. The marginal efficiency of labour at the segment OD is always higher than the marginal wage OC = const. The size of investment surplus at the employment increase L_2 reaches its maximum which is represented by the figure ABC. The size of investment surplus at the maximum income is represented by the difference between figures ABC and BEF; this means that the surplus decreases by the size of the figure BEF while income is maximised.

The problem of choice of technologies understood as a choice between maximization of income and maximization of surplus boils down to the choice between the technology maximizing c u r r e n t income and the technology maximizing

the future rate of economic growth. The concept of the Dobb-Sen model presents, therefore the potential possibility of alternative technologies maximization depending on a definite economic situation and the current and perspective aims of the state. The model presents also the possible results of a utilization of one of the available solutions; this is the reason why the importance of theoretical consideration decides on their usefulness in revealing general consequences of practical economic moves. If the state is governed by some definite motives of a general social character, it has to be aware of the fact /and the theoretical model explains that question/ that attempts to achieve some perspective aims, maximization of the long-term rate of growth being one of them, requires resignation from certain current advantages in favour of the future advantages in the long run.

Logical conclusion stemming from the Dobb-Sen model create, with assumed limitations, a possibility of analyses of various mechanisms of growth and dependencies between sizes of investments, employment, income, technical equipment of labour and labour efficiency in cases of alternative choices of technology. However, the final conclusions formulated by the authors of the model preferring application of capital intensive technologies in developing countries were depreciated by criticism conducted by M. Kalecki and Z. Dobrska[35]. It results from the criticism that advantages resulting from application of capital intensive technologies get weakened and sometimes cannot be achieved at all mostly due to difficulties resulting from limitations in foreign trade in the conditions reigning in developing countries.

Experience gained by a number of developing countries created grounds for formulation of the concept of "combined technologies" /sometimes called "mixed" or "indirect"/ based on a simultaneous introduction of capital intensive technologies increasing the level of labour efficiency and labour intensive technologies of low capital intensity creating grounds for an increase of employment[36]. The concept of combined technologies is often criticized by numerous economists, but it also has supporters. There are numerous examples to be found in economic practice proving that combined technologies may bring considerable advantages and may constitute one of the possible solutions in the development strategy of developing countries. There are many facets of investment processes where it is possible to encounter a parallel application of capital and labour intensive technologies. There also emerged some very modern technologies of a high capital-intensity coefficient which may, under certain conditions, be utilized with an atternative application of modern means of production or of some definite live labour outlays of a low level of technical equipment of labour[37].

The general conclusion resulting from the analysis of conditions of technology choice with an existance of labour force reserves leads to the statement that it is impossible to formulate a uniform standard for applied technologies in the complex and diversified conditions existing in the Third World countries. The investment policy of developing countries cannot be based solely on introduction of capital intensive technologies as it was suggested by Dobb and Sen for it would overextend economic and cadre possibilities of poor countries. A uniform

introduction of labour intensive technologies cannot be assumed either as such policy would lead to pertrification of the state of backwardness in the economy of developing countries. A general application of combined technologies is not possible either as there may appear technological bottlenecks and barriers resulting from payment difficulties in foreign trade. It is necessary, therefore, to assume an extremely flexible investment policy diversified according to the phase of development. Such necessity not only embraces investment activities but also the totality of decisions concerning the policy of the socio_economic development. It is necessary to conduct a flexible economic policy adapted to the situation existing at the outset in the concrete developing countries and evolving during introduction of consecutive projects. The policy should envisage periods of an accelerated growth intermingled with periods of a decreased and steady rates of growth. Changability of sectoral objectives, arissing development irregularities and the need to overcome them, mounting envisaged and unexpected difficulties - all these cause that the process of growth is not usually harmonious but is based on changes of its rateaand application of enforced or envisaged economic maneouvers. It causes also the necessity of changes in decisions concerning consumption which should be considered not only from the point of view of its phisical size but also of its internal material structure. This is of a particular importance for those countries which suffer an acute shortage in food production. The state has to primarily solve the problem of food in overpopulated and undernourished countries which creates some definite requirements in investment and import policy.

It is not always possible to assure conditions for an increase of consumption level in the long run at the expense of the current consumption in developing countries as it was possible in the expensive growth model in the socialist economy. It happens so, because the existing level of consumption in developing countries is so low than even its short-term and insignificant decrease would be unacceptable from the social point of view.

A solution of the problem of a decrease of a current loss in consumption in case of an accelerated growth should be considered also in connection with the material structure of consumption. The state has to be aware of the fact /of which even numerous economists are not aware of/ that an increase of the rate of growth through an increase of investment in the sector producing means of production may cause long-term delays in development of social infrastructure and production of consumer durables[38]. An achievement of such an increment of the consumption fund in the long run which would sizably increase the level of social consumption might not lead to overcoming the relative loss which had to be suffered in the field of consumer durables during the period of the accelerated growth and the overcoming of delays may become a process lasting for many years[39].

However, decisions concerning an acceleration of growth have to unavoidably cause a relative loss in consumption in the short run, and therefore, the task of an acceleration of growth should be approached with an extreme caution in an overwhelming number of developing countries. The state has to be aware of the necessity to manipulate not only the value of the rate of investments, but also the capital intensity

level which is connected with the choice of technology. One of the feasible proposals of the acceleration problem solution seems to be an application of a consumption-expansive model of growth based on the principle of an "osciallating consumption" which assumes temporary slow-downs of consumption growth /freezing of real wages/ in favour of increasing the economic growth rate[40].

Our considerations on the subject of the choice of technology on the macroeconomic scale conducted till now constitute a theoretical base for preparation of a calculus for an economic appraisal of investments on the microeconomic scale, i.e. concerning separate new investment projects.

5. Principles of Preparing a Calculus for Evaluation of New Investment Projects.

An economic efficiency of investment calculus prepared for new projects requires, first of all, a determination of the socio-economic conditions in which the new projects are created. A preparation of principles of such calculus seems relatively simple in the conditions of the capitalist economy although some very complicated and detailed calculation methods may be utilized to that purpose. The aim of the capitalist production is maximization of profit, and therefore, the profit criterion is used for evaluation of the economic efficiency of investment. Planning of investment activities is based on an analysis of the intended rate of profit in a long time horison in big corporation of the contemporary capitalism. The relation between the planned profit and the expanded capital embracing investment outlays and the planned exploitation cost of the new projects is also essential. It means, that the separate investments effected within the corporation may be characterized by a diversified profitability while the total outlay has to assure a long-term rate of profit conforming to the plans of the corporation. There are also some situations in which corporations resign from the current maximization of the rate of profit in the short run in order to increase expansion, conquer new markets, eliminate the competition or finally, to accelerate their own growth. Such activities, however, are always subjected to attempts towards maximization of profit in the long run. Generally, the basic criterion of efficiency of investments in capitalism remains maximization of profit which results from the nature and the

sense of activities of the system.

Is, therefore, the criterion of the rate of profit a universal measure of investment efficiency in other, non-capitalist social systems?

There is a negative answer to that question. The absolute profit or the rate of profit cannot be the most important investment efficiency criteria, and the more so, the sole criteria in such economic systems which do not strive to achieve profit in their activities.

Not only the socialist economy, but also the economy of developing countries using general social motivation in their growth policy belong to those economic and social systems in which the profit maximization does not constitute the basic aim of production. The developing countries which, in a broad extent, build their public sector and conduct a state investment policy on a broad front consider the basic aim of production to be an assurance of a permanent and long-term economic growth and an achievement of a cardinal improvement of the socio-economic development level and of the living standard of the broad masses of the population in the long run. It is not advisable to apply the profit motivation in these conditions because it would be contrary to the overall aims of the economic activity.

It could be motivated as follows:

1. The aim of production in many developing countries cannot be maximization of profit of the separate companies and of the economy as a whole, but maximization of the national income being the sum of accumulation and consumption within the whole national economy. This general aim may, in some particularly poor countries, be made more concrete through its quantification in the form of certain indicators of the

living standard improvement in a given time period /e.g. an achievement of a certain level of consumption of basic food products in the planned year or an achievement of a certain indicator of illiterary reduction etc./.

2. In numerous developing countries, there is a policy of state price control which causes that they often considerably deviate from value. The state consiously deforms the price structure for social or economic considerations[41] or such deformation appears as a result of certain spontaneous processes within the economy. Profit being the difference between the price and the cost of production looses its objective character in these conditions and cannot be treated as a measure of effectiveness of economic processes.[42].

3. Decisions on undertaking production in economies based on social motivation are ruled, first of all, by the needs resulting from development. Some commodities will still be produced because of the social interest or development necessities irrespectively of the size of profit, or even loss incured in production. The value realized in production of a given commodity is of the primary importance for a capitalist company. The use value of the product is of a secondary importance. The use value of produced commodities is, however, of a primary importance for the state acting under development motivation. The state being an economic subject and conducting directly its investment policy cannot make the choice between investments of a lower or higher effectiveness but has to consider primarily the long term needs of the economy which means that when it

is necessary to carry out very expensive projects essential in gaining the choosen aim, the investment process has to be subjected to this necessity.

4. The complex character of economic development requires also a universal development of investments. The social considerations create the necessity to carry out investments not as separate projects but as elements of the whole investment system. Taking into consideration mutual links among various investments undertaken to achieve the planned structure of production and with respect to a harmonious development of all regions within the framework of the whole system of the national economy, the state has to take up execution of such projects which cooperate with other indispensable projects. The rentability requirement, therefore, has often to be moved aside because of the proportionality and complexity requirement resulting from the intended development aims.

It seems that even in those developing countries which have choosen a capitalist road to development and are inclined to adopt the capitalist economy mechanisms, it is necessary to abandon the profit criterion as a tool to measure efficiency of investments in their public sector.

In the light of the above we could say that it is necessary to seek other tools for appraisal of investment projects than profit in developing countries driven in their policy by general social aims. However, a solution to that problem is extremely difficult but it seems that it is possible on the grounds on utilization of at least basic elements of the theory of efficiency of investments evolved in the socialist countries.

The general criteria for investment projects evaluation in developing countries should be the use effects achieved as a result of their realization. They should not, however, be treated in a univocally formal way, i.e. based solely on the results of the pure efficiency calculus. There is always a certain number of factually immeasurable results in nearly each case related to the social and political consequences of the investment projects such as: Their influence on the improvement of life of the population, overcoming of anachronic economic structures and backwarded customs, development of integration processes on the regional and general scale, activization of areas where the new projects were localized and many other.

This does not depreciate the role of the economic calculus but just turns attention to the fact that it is necessary to take immeasurable results into consideration along with the calculus. Moreover, it seems, that such approach strengthens the role of the calculus in investment appraisal as only then it is possible using the variant calculus to make detailed corrections with respect to social, political, interregional, general economic, defence and other numerous aspects. In other words, the sequence of activities in the field of appraisal of new investment projects should, first of all, take into consideration the results of the calculus based on detailed economic information, and then analyse the separate variants of the planned investment from the point of view of additional criteria and results so that deviations from the indications of the calculus were not accidental but resulted from a consious estimation of needs and possibilities of economic and non economic character.

Taking into consideration the economic situation of developing countries including also, may be, some of the rich raw materials producing countries posessing considerable foreign currency resources, we may assume that the main criterion of investment appraisal in the conditions of limited investment funds will be the drive to m i n i m i z a t i o n of social labour outlays for achieving the intended /planned/ production result[43].

On the grounds of this general criterion expressing the relation between the input and the output of the investment project the separate elements taken into consideration in the calculus should be individually appraised.

We shall first consider the problem of investment effects appraised as they are decisive for the kind and the size of the plans concerning new projects. Every investment is made with a purpose emboded in the value or quantitative results of production or in concrete saving results. We can, therefore, distinguish three kinds of investment effects from that point of view:

- production effect expressed in a definite volume of use values in the form of output increment; this effect can be expressed in natural units /in case of uniform production/ or in value units /in case of diversified production/;
- savings effect expressed in a decrease of outlays of live and crystallized labour, or just one of these factors, achieved through introduction of labour saving technologies; the same effect may be achieved by modernization of the existing production assets or by replacement of old projects by the new ones;

- currency effect resulting from export oriented or import replacing projects; thanks to the new projects permitting to obtain export products or to limit imports, the economy achieves an inflow of currency or savings in currency spending[44].

The effects presented above may appear either solely or jointly depending on the character of the investment project and of its planned output.

Production effect is the most essential in developing countries which results from the necessity to give the economy the supply character and from the limited supply of commodities on the market. The realization of the general social aims by the state has to lead step by step to a decrease of the role of market mechanism and to an increase of the importance of the economic planning system. The industrialization, which according to general assumptions should lead to an increase of economic independence, causes that the obvious consequence of a development of industry is the tendency to replace imported products with those produced domestically. Industrialization induced by import substitution processes will eo ipso bring currency effects along with production effects through enabling savings of currency in imports.

The problem of savings effect in some kinds of outlays seems to be less important in the economy of developing countries for two reasons:

1. labour surplusses appear in most cases which induces the choice of labour intensive technologies creating employment and of a relative low level of technical employment of labour;
2. deficiency of production capacities cames that modernization

attempts appear only after reaching a certain level of industrialization because, in the initial stages of industrialization, there is the necessity to utilize all production means includin those with outdated technologies remaining from the preindustrialization period.

The problem of the savings effect planned in the newly designed investment projects will probably increase in importance along with the development of industry and limitation of the scale of unemployment which is not a simultaneous process in many countries[45].

On the other hand, it is necessary to properly determine the o u t l a y s connected with construction and exploitation of new investment projects for a proper introduction of effects and outlays in evolving of the economic calculus in order to fund the optimum solution. The main item among outlays will be the size of the investment fund designated for the new project /a plant or a combine/. The size of the investment fund will be different in different variants which has to cause a diverified level of technical equipment of labour and diversified level of exploitation costs in the considered variants. The problem of choice between two different investment projects will appear, of course, in a definite situation.

Let us denote the investment outlay in the first variant by I_1 and by K_1 the annual exploitation cost of the same projects. I_2 and K_2 will denote the same values concerning the second variant. We assume that the production effect is the same in both variants. The problem of choice would not exist if there were the following inequalities between the variants

$$I_1 > I_2$$
$$\text{and } K_1 > K_2$$

as the second variant would mean a better and cheaper solution. The problem of choice will appear in the situation when:

$$I_1 > I_2$$

$$\text{but } K_1 < K_2$$

Here, as a result of a higher investment outlay in the first variant, i.e. thanks to a better technical equipment we achieve lower annual outlays for the exploitation cost. The difference between the investment outlays in the first and the second variants amounts to:

$$I_1 - I_2 = \Delta I$$

I, therefore, is an additional investment outlay born in case of choosing the first variant in order to achieve a higher level of mechanization permitting to achieve annual savings on the exploitation cost in comparison to the second variant and amounting to:

$$K_2 - K_1 = \Delta K$$

The ratio of the additional investment outlay born to achieve a higher level of mechanization to the achieved annual savings in exploitation costs will be:

$$\frac{\Delta I}{\Delta K} = t,$$

where t denotes the individual gestation period, i.e. the number of years during which the additional investment outlay will be recuperated thanks to the decrease of the annual exploitation cost of the investment project by ΔK[46].

One might expect that it would be enough to compare individual gestation period with the expected /planned/ period of exploitation of the new investment project to obtain information concerning profitability of the additional outlays permitting to achieve a higher mechanization level. If the exploitation period were longer than the individual gestation period, respec-

tive net savings would be achieved equal to the product of the annual savings on costs by the number of years by which the exploitation period is longer than individual gestation period[47].

The point of view of the kind could be considered right if we analysed investments apart from the whole economy. An achievement of net savings due to a relatively short individual gestation period would be then a justification of increasing the additional investment outlays. However, the individual gestation period does not inform the investor about anything but the period in which the additional investment outlays will be recuperated. It does not produce any information about the advisable directions of technology choice within the whole national economy related to the investment possibilities and the balance of labour force.

The state conducting a planned economy in the social interest and wishing to influence investment decisions of the individual subjects in the public sector has to use proper control instruments which would make these decisions concurrent with the intentions of the state policy. It is necessary to determine a marginal rate of substitution determining the profitability limits of additional outlays for an increase of technical equipment in new investment projects. Having at the disposal the all-economic norm of investment efficiency, we may prepare the economic calculus formula which would permit to compare different variants of the planned new investment projects. The economic calculus based on a comparison of outlays and effects assumed in after native investment projects permits, therefore, to make an appraisal of different variants of a given project characterized by the

planned production capacity of a given commodity or a service capacity and of intended usefulness. Thanks to application of the general social norm of effectiveness; the appraisal enables to compare different variants of the project on the background of the general conditions existing in the economy, and depending mostly on the balance of labour force and of investment means.

There appears the necessity to take into consideration the admissible limits of the level of their technical equipment /the mechanization level/ in appraisal of the plans for the new investment projects so that the individual gestation period was as close as possible to the general social norm and never higher. It is also necessary to make successive corrections of the general social norm along with changes occuring in the main economic balances as a result of the general development processes.

6. The General Economic Efficiency Norm

The comparison of the basic parameters determining characteristics of the new investment projects requires a choice of analogous sets of parameters characterizing separate projects.

Along with parameters determined individually for each separately planned projects, such as:

- the size of investment outlay for building of the given plant or combine, i.e. for the completion of the given investment project;
- annual exploitation costs born during exploitation of the investment[48];
- the size of outlays for labour force employed during exploitation of the project and or the number of people employed;
- the quantity and the value of raw materials and materials used during exploitation of the project;
- the value of the annual output or services /in natural or value units/ of the given project;
- the period of construction of the plant /the planned period of realization of the investment project/;
- envisaged period of exploitation of the project and many other parameters, it is necessary to determine some general parameters enabling a comparative analysis of different variants of investment projects.

The general parameters which give a "common denominator" to different variants of investment projects should be evolved on the grounds of an exhaustive analysis of the general economic situation in the given country and during the given period. It results from the above that these

parameters will be different not only for the different countries, but they will change also in each country under the influence of changes taking place in the level of development and the structure of the economy.

It is not possible to evolve a universal rule concerning the application of the general parameters. It seems, however, that it is necessary to assume several basic values under any conditions.

It is necessary to determine first of all, the marginal rate of substitution of labour force by additional outlays for mechanization[49]. In its more general form, the parameter represents the limit of substitution of exploitation costs including also the labour cost with additional investment outlays causing a decrease of exploitation cost.
The parameter defining the limit of the admissible mechanization level of production is called the m a r g i n a l g e s t a t i o n p e r i o d. It determines the maximum admissible period during which the additional investment outlays h a v e t o be recuperated in the form savings on exploitation costs resulting from them[50].

Denoting the marginal gestation period by T, we may conclude that it should represent the relation between the maximum increment of investment outlays $/\Delta I/$ to saving on exploitation costs, i.e. would constitute the marginal value of the ratio of the two:

$$\frac{\Delta I}{\Delta K} \leqslant T$$

Reshaping the above formula, we receive the following:

$$\Delta I \leqslant T \cdot \Delta K$$

which means that the marginal recuperation time is determined de facto by the admissible /maximum/ value of additional investment outlays designated for achieving the intended savings on the exploitation costs[51]. In other words, it is a parameter determining the marginal admissible mechanization level in the given economic situation of the country.

The reciprocal of the marginal gestation period 1/T is the general economic norm of effectiveness which reduces the size of the total investment outlay to the "annual portion" limited by the necessary time for recuperation of the additional outlay designated for increasing the level of mechanization.

For example, if the marginal gestation period T = 6 years, then 1/T = 0.166, at T = 8 years 1/T = 0.125 /i.e. 12.5 per cent/, and at T = 10, 1/T = 0.1 /i.e. 10 per cent/. The general economic norm of effectiveness is, by nature, the rate of discount determining the admissible, from the social point of view, interest on investment outlays born to create new projects.

The choice of a proper discount rate is a problem which comes up not only during taking individual planning decisions but concerning the totality of the investment planning system. The determination of the discount rate must be done in the form of a government decision as it is an all-national parameter.[52] Other types of general parameters may be also used as any new investment may influence the general changes in the field of employment, the size of wage fund or the size of unemployment especially when we deal with new investment projects undertaken in a broad scale in the initial stage of industrialization policy when every new project is of

a relatively big importance in the underdeveloped economy.

The additional parameters may play a more or less important role in appraisal of the separate projects.but they are usually determined on the basis of the central data banks and passed by governments to decision-making organs at lower levels[53]. This is the reason why the determination of the discount rate for investment projects by the planning centre should embrace all basic values influencing the possible or necessary choices of technology in new projects. Government decisions depend here, therefore, from the general assumption of the economic policy and the general social norm of effectiveness is an indicator for the investors and investment project evaluating organs of the admissible limits of mechanization or of the admissible limits of labour utilization in new projects. Planning, formulation and evaluation of investment projects are, therefore, uniten in a cohesive system of decision making subjected to the assumptions of the socio-economic policy of the state and stimulated and controlled by the centrally set general economic parameters[54].

The scheme of dependancies in the pattern: Government - investors - evaluators may be set in a diversified manner. The basic principles, however, may be presented in the four - and three-unit schemes[55].

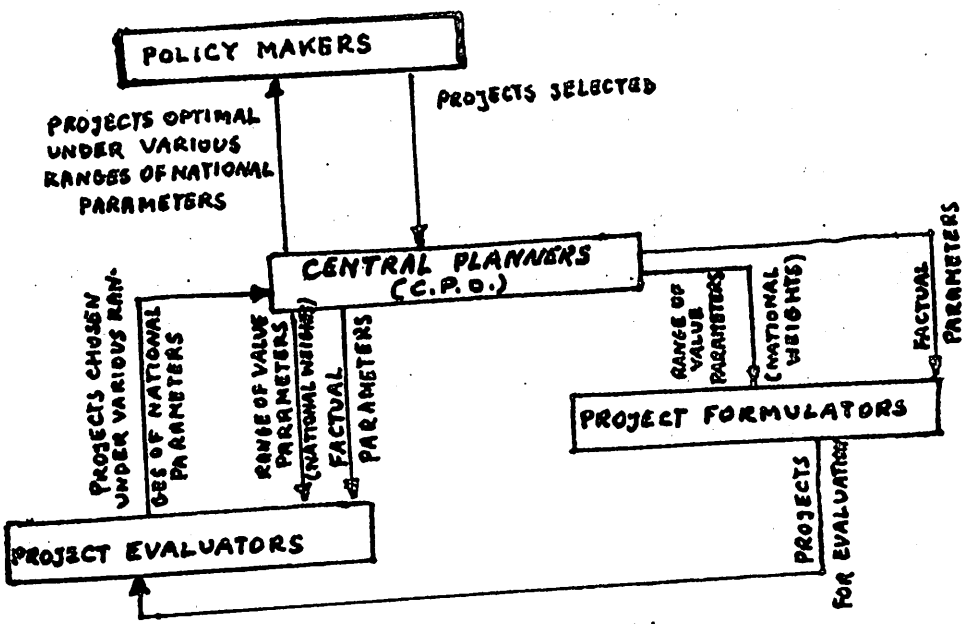

Fig. 3 A four-unit view of formulation, evaluation and planning.

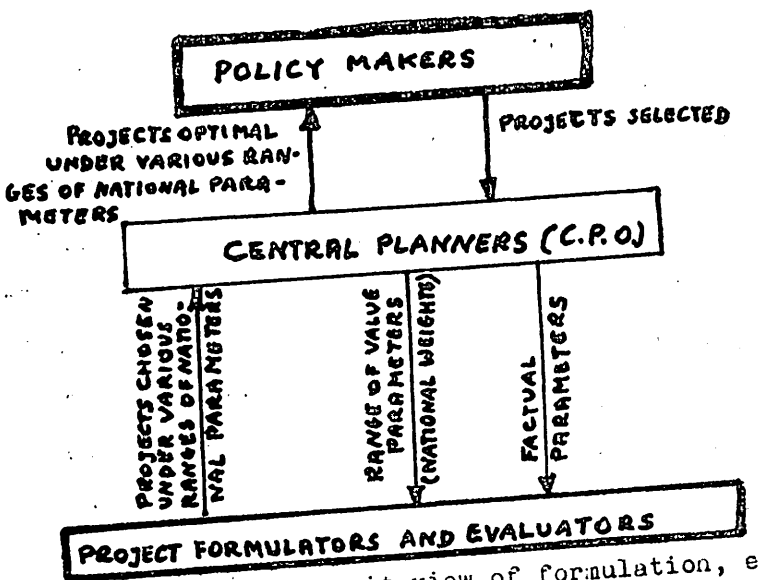

Fig. 4 A three-unit view of formulation, evaluation and planning.

An arbitrary determination of the discount rate being a general economic efficiency norm by government organs should concern, in principle, the whole economy. There were attempts to apply the marginal rate of substitution to separate branches of industry in some cases[56].

The marginal gestation period parameters, and also its reciprocal determining the rate of interest /discount rate/ on outlays have to be successively corrected according to the economic development and fuller utilization of labour resources.

This parameter is relatively low when labour is abundant. Its reciprocal - the rate of interest on investment outlays - is, therefore, relatively high. Thanks to that, the state secures influence on investors' decisions inducing them to choose solutions of a relative low capital intensity and high labour intensity. Along with the evolvement of the labour absorbtion process as a result of industrialization, labour becomes more scarce which creates the need to save it. The state should then increase the parameter of the marginal gestation period which means a decrease of interest on investment outlays. This creates stimuli for the investors to limit their outlays for labour, i.e. to reduce employment in new investment projects and to increase the level of mechanization and of capital intensity in these projects[57]. Another cause to stimulate a raise of the mechanization level may be an increase of investment possibilities or socio-economic necessities and political considerations which emerge in some areas of the economic system in connection with pursuit by the state of a more rapid overcoming of the economic backwardness /sometimes, it may be the nenessities connected

with the need to develop the war economy potential/.

The formal situation connected with an increase of the marginal gestation period could be observed on Fig. 5

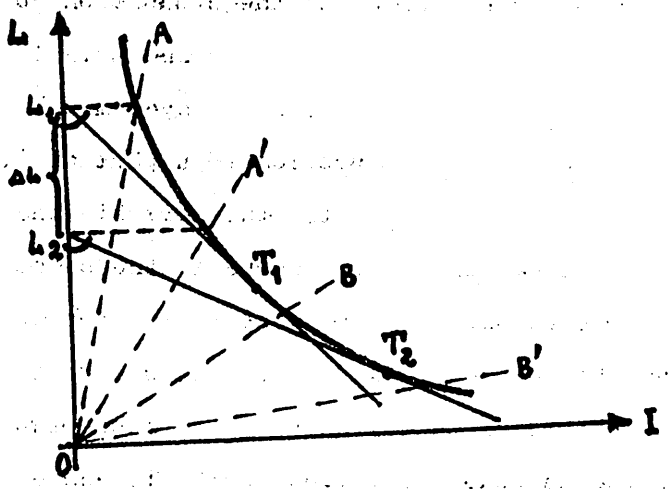

Fig. 5

We place sizes of employment outlays L on the Y axis, the size of investment outlays I on the X axis. The production curve /the curve of choice of technologies/ represents the aggregated methods of production applied to achieve a definite effect in the form of a national income increment. Changes in the size of employment are simultaneously changes in the labour intensity of production while changes in the size of investment outlays are accompanied by changes of capital intensity of production connected with the capital intensity of production.

Lines OA and OB mark limits of employment and investment resources in the first period on the production curve. The Stright line leading from point L_1 representing labour resource in the first period and tangent to the curve in point T_1 marks the marginal gestation period amounting to

$T = tg \varphi$ where φ denotes the angle formed by the tangent with the negative direction of the X axis in point T_1.

Lines OA' and OB' mark new limits of labour and investment resources in the second period on the production curve, and therefore, a new sphere of choices of technologies. With a decrease of labour resources for new investments by ΔL as a result of the previous absorbtion of a part of it by the already progressing investments, the stright line leading from point L_2, tangent to the curve in the point T_2 marks the new size of the marginal gestation period. A further decrease of the potential employment with a simultaneous increase of the investment possibilities cause that the indicator of the marginal gestation period is increasing which is expressed by the increase of the tangent of the angle. It induces investors to introduce a higher level of capital intensity, and so to increase the degree of mechanization in the new investment projects.

Investors having the parameter of general economic efficiency norm at their disposal may include it in the economic efficiency of investment calculus and thanks to that may compare various technical solutions /variants/ of the planned project of a definite production effect.

Along with this basic economic parameter, it is possible to use other general parameters of an auxiliary character in comparing variants of investment projects. The following parameters are used among other: Avarage period of investment outlays freezing in the course of the investment process; average period of new investment projects exploitation in relation to which coefficients correcting sizes of costs and production are applied depending on divergencies between the

effective and the standard period of exploitation; relative coefficient of loss /i.e. the social cost of investment outlays/ or the coefficient of the lost opportunities resulting from freezing of investment outlays during one year due to construction of new projects.

The marginal gestation period T and the general economic norm of efectiveness 1/T are the most important general parameters as they are decisive for the general directions of the choice of technologies with respect to the interests of the national economy.

Among the alternative variants of new investment projects, those are usually choosen which have the individual gestation period close to the marginal period but not longer. When the individual gestation period is longer than the marginal one, it means that the mechanization level is higher than admissible for new projects and that the project did not create the employment of the required number of workers. An excess downward deviation the marginal gestation period means, in turn, that the investor assumed a too low mechanization level /the production method is not mechanized enough/ and the employment created by the new project will be too high for the labour supply at the disposal of the economy.

The presentation of the general principles of the general economic parameters determination[58] is not a ready prescription for all countries. It only indicates the research directions which should be adopted by the separate developing countries posessing a dominating public sector and definite general social aims. The possibility of determining these parameters emerge only in a planned economy and have to be based on concrete evaluation of the economic situation par-

ticular for the given country. Some definite system solutions concerning mechanisms of functionning of the economy will influence the evaluation of the investment effectiveness along with conditions created by the social system. If, for example, the functionning mechanism will be set to realize the aims of economic subjects in the form of maximization of output or maximization of profit, then the whole economic calculus of investment effectiveness has to be conducted in a manner different to that presented above. The concept presented here shows, first of all, Polish experiences and results from the socialist character of the Polish economy. It does not need to be considered a sole and universal method of the general economic parameters setting. The economic sciences continuously make some new researches in this field and attempt to achieve possibly the most rational solutions. One of the newest concepts in the field of the theory of investments is "An Attempt at a New Theory of Investments" by a prominent Dutch scientist, professor Jean Paelinck[59]. The theory of professor Paelinck is of a macroeconomic character but creates, at the some time, considerable possibilities for research into separate branches and regions with consideration to their both technical and market specifies. It should be expected that the application of a rich mathematical methodology in the theory will open the possibility of achievement of practical solutions in the field of research into investment problems in many countries in the future.

7. An Attempt at a Formulation of the Synthetic Coefficient of Effectiveness of Investments in the Planned Economy.

Numerous coefficients were used in the economic theory and practice aimed at rafining the evaluation of the economic efficiency of investments. Experiences of the western economy formulating interesting concepts reaching far beyond the mere rentability calculus are well known here[60]. Calculation of economic effectiveness of investments done for concrete investment projects done with various calculation methods are also interesting[61].

The Marxist economy and the theory of economic planning in socialism have searched for a possibility of creation of a coefficient of an evaluation coefficient of the economic effectiveness of investments which would enable to choose optimum solutions among proposed variants for many years. The basic principles of such coefficient construction /a formula for an effectiveness of investments calculation/ are based on the assumption that it should constitute a comparison of outlays and results with reference to the basic economic and corrective coefficients. The most important problem here is to determine such a general norm of effectiveness for the whole economy which would be applicable to successively changing economic situations. This norm determining the value of interest from investment outlays would, de facto permit to determine the social cost of concrete outlays born to create a definite planned, designed investment project.

The construction of such coefficient formally embraces the size of the planned investment outlays designated for creation of a new project and the annual exploitation cost

envisaged for the project. As far as the effects are concerned, it is envisaged that it should embrace the size of the annual output in terms of value or , in case of a homogenous production, in material terms /i.e. in natural units/. Corrective coefficients are used in diverse variants of coefficients. They are connected both with freezing of means during the investment process and the exploitation period of the project. Along with the diversified parameters connected with the effective outlays and the planned results of the designed project, it is necessary to combine in a synthetic formula of the investment effectiveness also the general economic coefficients, and first of all, the norm of effectiveness for the whole economy /the rate of interest on investment outlays coefficient for the whole economy/.

The simplest form of the proposed formula for the economic effectiveness of investments can be the following:

$$E = \frac{\frac{1}{T} \cdot I + K}{P}$$

where

E denotes the economic effectiveness of the given investment project;

1/T - the norm of effectiveness for the whole economy being the reciprocal of the marginal gestation period; this norm determines the value of the rate of interest on investment outlays depending on the concrete economic situation of the country and is arbitrarily set by the government for the given economic period;

K - the annual exploitation cost envisaged for the given investment project with the envisaged technology;

I - the total investment outlay born in connection with the execution of the investment project; it embraces outlays for construction, equipment and putting the plant into operation;

P - the total annual size of output /or service capacity/ which is to be achieved by the new investment project.

When the E coefficient differs for different variants prepared for the given project, the most suitable variant is the one for which the value of the coefficient is smallest /i.e. when E = min./.

Assuming that there are three variants of the given project, we have three coefficients: E_1, E_2, and E_3 and $E_1 > E_2 > E_3$. From the point of view of the assumed type of the economic calculus, variant 3 will be the optimum one as the value of the E_3 coefficient is smallest, i.e. among the prepared alternative variants this particular one assures the minimum total sum of investment outlays and exploitation costs per unit of the planned output in the planned investment project at the assumed general economic norm of effectiveness 1/T which is the same for all the variants.

The presented investment effectiveness coefficient is of a synthetic character and does not include a number of other coefficients which must be taken into consideration in the totality of research into the effectiveness of concrete technical and economic solutions assumed in the new investment projects. The following corrective coefficients were used in the developed coefficient of effectiveness of investments applied in Poland in the 'sixties[62]:

q_z - coefficient determining the size of the social loss resulting from freezing of investment outlays during one

- year; this coefficient should be calculated separately for every country and for a definite period of its development; it is a general economic character in the economy of the particular country;

n_z - an average period of freezing of investment outlays in the course of the investment project execution depe from an effective length of the investment cycle o. the planned project and from the assumed general norm for the freezing period /it amounted to a half of the investment cycle in the coefficient assumed in Poland, i.e. $n = 3$ for a project construction of which is to last 6 years/;

$Y_n Z_n$ - corrective coefficients relating the size of costs of output to a standard period, i.e. correcting these values in cases when the effective period of exploitation of the new project was different from the standard period /20 years in Poland/ determined for the whole economy according to definite uniform rules.

Completing the basic formula for the synthetic coefficient with the additional coefficients we receive the following:

$$E = \frac{\frac{1}{T} \cdot I \,/1 + q_z \cdot n_z / + KY_n}{PZ_n}$$

The optimum effect is represented by the coefficient of the smallest value among those elaborated for the analysed variants. The developed version of the coefficient is different from its synthetic version by the number of additionally introduced coefficients but the idea of both versions is the same and is based, in principle, on optimization envisaging minimization of outlays in achieving the planned production or service effect.

The presented formula, although checked in practice in Poland, cannot be considered ideal and cannot constitute a universal example for developing countries with a planned economy. The purposefulness of presenting this formula and its whole theoretical support results from the fact that it makes it possible to understand the concept and the direction of research into evaluation coefficients of investment projects in those specific conditions when the state acting as the central decision maker and applying the principles of the planned economy has to find the proper macro - and microeconomic criteria for its investment policy and for controling the decisions of enterprises in the public sector.

The fact that derivation of the necessary coefficients and indicators requires an efficient information system and reach statistical material makes it extremely difficult to create a cohesive and rational concept of investment project evaluation in developing countries. As long as the information system is incomplete and not trustworthy, construction of even the most formally correct formulas and theoretically substantiated coefficients will be of no practical value. It is necessary, therefore, to understand the fact that the investment decisions taken by the state, especially during the industrialization period are not solely of a general character, but often concern also separate, most important projects. Such decisions are, therefore, mostly of a political character and may exert a considerable influence on the fate of multitudes of people and of whole regions of the country. Taking such decisions as the scale of production in the new projects, directions of sales of products and of purchases of raw materials, localization and the number of employed

workers, the state often determines fates of whole regions and their inhabitants for many years to come. We can draw a conclusion here, that the investment decision-making, especially in developing countries with insignificant capital resources, should not be based solely or even primarily on the economic calculus, but on an all-embracing socio-political analysis and on the research into immeasurable, non-economic effects of the new investment projects. It may happen that the investment variant with the best possible indicators resulting from the economic calculus is not the best from the point of view of its influence on the economic activation of an underdeveloped region. The variant prefering a high technical level in the new investment project according to the results of the calculus may be unacceptable due to the necessity to reduce the number of unemployed in that particular region of the country. In other words, the realization of the investment programme must be always based on the assumption that it concerns the basic questions of the policy and the development strategy of the given country, and that numerous conflicts between regional and social interests or between the short- and long-term interests may appear on this background. Solutions of such questions cannot be based solely on formal and mathematical grounds as they may prove to miss the point with respect to the general aims of the state and of its policy. The wisdom of the state management and correctness of its decisions should, therefore, play a dominating role in the process of the economic evaluation of investment effectiveness and not solely the economic calcul: which permits to determine in what way one technical variant is better than the other. The unification of a right

policy with the rational economic calculus may bring favourable results in formulation of the investment policy.

The scope of the economic effectiveness of investment calculus applications may be broader than evaluation of two or more alternative projects. It may constitute grounds to decision-making concerning the process of replacement of the old production apparatus, concern problem of choice of various materials for realization of some definite investment programmes /e.g. in the field of residential building/, concern choice of investment in production of alternative raw materials and materials, or finally in developing investments related to foreign trade and international division of labour. It is necessary to elaborate detailed information base and concrete rules of the calculus for all these spheres. They should be based on interdisciplinary research in an increasing degree. The economic sciences did not achieve a satisfactory level of cooperation yet in this field which is reflected by the flaws in the economic calculus of investment projects evaluation.

In spite of the existance of numerous limitations and imperfections, we cannot ignore the importance of the economic effectiveness of investments calculus in economic decision-making because it is a tool permitting to rationally utilize limited resources and choose such methods of production which reflect the needs and possibilities of the national economy in the sphere of labour resources and investment goods.

FOOTNOTES

1. See: O. Lange, Ekonomia Polityczna /political economy/, vol. 2, Warszawa 1966, pp. 79 - 125.

2. See: O. Lange, Ekonomia Polityczna /political economy/, vol. 1, Warszawa 1967, p. 194.

3. Ibid. p. 195; see also: M. Weber, Wirtschaft und Gesellschaft, Tübingen 1947, p. 32.

4. See: O. Lange, Ekonomia Polityczna, vol. 2, ed. cit., pp. 20 - 21.

5. O. Lange concludes that: "The joint experience obtained in the process of labour finds means, evaluates their efficiency in practice, keeps the effective means and rejects the ineffective as useless. The "natural choice" of means is done spontaneously in this manner and the techniques of economic activity are formed." O. Lange, Ekonomia Polityczna, vol. 1, ed. cit., p. 198.

6. O. Lange, Ekonomia Polityczna, vol. 2, ed. cit., p. 93.

7. Ibid., p. 93.

8. Ibid., p. 80.

9. See: K. Marx, Capital, vol. 1, George Allen and Unwin Ltd., London 1946, p. 160.

10. "A machine which does not serve the purposes of labour, is useless. In addition, it falls a prey to the destructive influence of natural forces. Iron rusts and wood rots. Yarn with which we neither weave nor knit, is cotton wasted. Living labour must seize upon these things and rouse them from their death-sleep, change them from mere possible use-values into real and effective ones. Bathed in the fire

of labour, appropriated as part and parcel of labour's organism, and, as it were, made alive for the performance of their functions in the process, they are in truth consumed, but consumed with a purpose, as elementary constituents of new use-values, of new products, ever ready as means of subsistance for individual consumption, or as means of production for some new labour processes." K. Marx, Capital, ed. cit., pp. 162 - 163.

11. See: O. Lange, Ekonomia Polityczna, vol. 2, ed. cit., p. 82.
12. Ibid., footnote 9, pp. 82 - 83 and footnote 10, p. 84.
13. Ibid. pp. 82 -85.
14. "...But the latter changes with every variation in the productiveness of labour. This productiveness is determined by various circumstances, amongst others, by the average amount of skill of the workmen, the state of science, and the degree of its practical application, the social organization of production, the extent and capabilities of the means of production, and by physical conditions." K. Marx, op. cit. p. 7.
15. See: O. Lange, Ekonomia Polityczna, vol. 2, ed. cit. p. 89.
16. ".../3/ the productiveness of labour, whereby the same quantum of labour yields, in a given time, a greater or less quantum of product, dependent on the degree of development in the conditions of production. Very different combinations are clearly possible, according as one of the three factors is constant and two variable, or lastly, all three simultaneously variable. And the number of these combinations is augmented by the fact, when these factors simultaneously vary, the amount and direction of their

respective variants may be differ." K. Marx, op. cit., p. 528.

17. See: O. Lange, op. cit., vol. 2, p. 90. The above formula may also be presented in the disaggregated form showing the components: $\frac{L_1}{P}, \frac{L_2}{P}, \ldots, \frac{L_m}{P}$ and $\frac{Q_1}{P}, \frac{Q_2}{P}, \ldots, \frac{Q_n}{P}$

18. "Co-factors of production are the outlays of factors of production, i.e. some concrete lauds of labour and concrete means of production which are necessary for obtaining a unit of the product in the concrete technical conditions." O. Lange, op. cit., vol. 2, p. 91.

19. See: A. Müller, The Theoretical Aspects of the Choice of Techniques Problem in Developing Countries, The Institute of National Planning, Cairo, Feb. 1977, Memo. No 1188, pp. 8 - 10.

20. See: K. Marx, op. cit., pp. 671 - 672.

21. Ibid. p. 661 and Capital, vol. III, part I, Warszawa 1957, p. 154.

22. See: A. Müller, Postęp techniczny a wydajność pracy /Technical Progress and the Labour Efficiency/ in Ekonomia Polityczna Socializmu /Political Economy of Socialism/, M. Pohorille /ed./, Warszawa 1968, pp. 193 - 194.

23. "The given product may be usually produced by means of diversified technologies, i.e., as we say, by means of diversified technical processes. Any of these processes is characterized by a respective vector of unit outlays /co-factors of production/. If the given product may be produced by means of r various technical processes, the situation may be presented in a simplified form in the following table:

$$\begin{bmatrix} \frac{L_1}{P} & \frac{L_2}{P} & \cdots & \frac{L_r}{P} \\ \frac{Q_1}{P} & \frac{Q_2}{P} & \cdots & \frac{Q_r}{P} \end{bmatrix}$$

... We call such table a matrix of technology." O. Lange, op. cit., vol. 2, pp. 93 -94.

24. The notion of effective and ineffective methods was introduced into the economic analysis by O. Lange. See: O. Lange, op. cit., vol. 2, pp. 98 - 99 and O. Lange, Relacje ilościowe w produkcji /Quantitative Relations in Production/, "Ekonomista", No. 4, 1964, p. 693; see also: A. Müller, Postęp techniczny a wydajność pracy, ed. cit., p. 197.

25. The "production curve" understood in this way should not be mistaken for the, so called, pseudo-function of production which was criticized, among others, by Joan Robinson; See: J. Robinson. Economic Heresies. Some Old Fashoned Questions in Economic Theory, New York 1971.

26. On the question of construction of the, so called, production curve see: A. Müller, Postęp techniczny a wydajność pracy, ed. cit., pp. 197 - 205.

27. For dependencies between the rate of growth of the national income, the rate of investments and the capital intensity level see: A. Müller, The Application of the Theory of Growth in Socialist Economy to Developing Countries, The Institute of National Planning, Feb. 1977, Memo. No. 1192, pp. 2 - 14.

23. "The analysis of investments being a part of processes taking place in economic systems /or subsystems/ as a whole induces to discard the view that the precondition to undertake an investment is solely the expected rate of

profit from the invested capital. The contemporary capitalist enterprises, in certain circumstances, have to invest in order to achieve an economic growth and technical progress even if the direct rentability of these investments were low; as it is a condition to solve the internal and external contraditions or even to stay alive." B. Minc, Kapitalizm współczesny /Contemporary Capitalism/, Warszawa 1971, p. 235.

29. See: A. Müller, Wybór technik produkcji a problem optymalizacji konsumpcji w krótkim i długim okresie /Choice of Technology and the Problem of Short- and Long-term Optimization of Consumption/ in Problemy optymalizacji gospodarki socjalistycznej /Problems of Socialist Economy Optimization/, B. Minc /scient. ed./, Warszawa 1976, pp. 176 - 177.

30. "To consider the choice of technology, we have to look not at the total resource of capital goods which represents the totality of points on the pseudo-function of production, but at the investment plans prepared at every moment." J. Robinson, Economic Heresies, ed. cit. ch. 7., para. "Choice of Technologies".

31. For this problem see: M. Dobb, An Essay on Economic Growth and Planning, London 1960; A.K. Sen, Choice of Techniques, Oxford 1960; Z. Dobrska, Wybór technik produkcji w krajach gospodarczo zacofanych /Choice of Technologies in Developing Countries/, Warszawa 1963; A. Müller, Kierunki optymalizacji technik produkcji w krajach słabo rozwiniętych /Optimization Direction of Technologies in Developing Countries/, Warszawa 1966; A. Müller, The Theoretical Aspects of the Choice of Techniques Problem in Developing

Countries, The Institute of National Planning, Cairo, Feb. 1977, Memo. No. 1158, pp. 4 - 7.

32. This problem was mentioned by J. Robinson who indicated that "The most important factor influencing the choice of technology is not the most of financial means nor "prices of the factors of production" but the size of investment in relation to the disposible labour... The situation is completely different in nearly full employment. A big businessman whose plant employs a considerable share of labour in the region will have to take into consideration how much of the labour will he be able to obtain while planning his investments. It usually turns out that it would be necessary to, at least, partially increase the investment outlays for labour." J. Robinson, Economic Heresies, ed. cit., ch. 7.

33. For the problem of technology level in small business see: A. Müller, Wybór metod wytwarzania w rolnictwie krajów ekonomicznie słabo rozwiniętych /Choice of Technologies in Agriculture of Developing Countries/ in A. Müller, A. Woś /ed./, Rolnictwo a wzrost gospodarczy /Agriculture and Economic Growth/, Warszawa 1966, pp. 373 - 383.

34. The "Dobb-Sen model" is presented in a number of works including: M. Dobb, An Essay in Economic Growth and Planning, London 1960; A.K. Sen, Choice of Techniques, Oxford 1960. Works of Polish authors, apart from those mentioned in footnote 31, are: A. Müller, Perspektywy rozwoju Trzeciego Swiata /Third World Development Perspectives/, Warszawa 1975; M. Kalecki, Zarys teorii wzrostu gospodarki socjalistycznej /An Outline of the Theory of Growth of the

Socialist Economy/, Warszawa 1963, ch. 11, pp. 99 - 108. The model was criticized by M. Kalecki in this book and by Z. Dobrska in Wybór technik produkcji w krajach gospodarczo zacofanych, ed. cit. The Theoretical Discussion on the subject conducted in the 'sixties revived recently on the grounds of experience gained during the second decade of the Third World Countries Development and was enriched with problems of the theory of "import substitution" and "export diversification" in developing countries and also with a group of concepts connected with "transfer of technology."

35. The criticism of the Dobb-Sen model was conducted by M. Kalecki and Z. Dobrska in works mentioned in footnotes 31 and 34. See also: A. Müller, The Theoretical Aspects of the Choice of Techniques Problem in Developing Countries, ed. cit., pp. 17 - 23.

36. An outline of the combined technology concept was given by A. Müller in the work quoted above. The author is aware of the flaws of such presentation of the problem but is of the opinion that this direction of solutions may prove useful and creates grounds for a further rafinement of the concept.

37. One of the examples of such technologies is the large carrying system which represents a very modern transport technology in sea and water inland transportation. There are modern capital intensive elements in this system, however, in case of need, automation can replaced with manual labour in loading and unloading of the barges. It creates considerable possibilities of utilizing the system

in transportation to developing countries and in river transportation there.

38. Among Polish economists, Z. Dobrska first turned the attention to the problem in a review of one of my works.

39. See: A. Müller, Consumption-Expansive Model of Growth of the Less Developed Countries, "Economic Papers", No 4, Warsaw 1976, pp. 72-79.

40. Ibid., pp. 79-97.

41. It may result, for example, from deficiencies of supply of certain products on the market, from import difficulties, the necessity to control the social demand or the policy of the richer classes of the population income drainage. See: M. Rakowski, O rachunku ekonomicznej efektywności inwestycji /On the Economic Effectiveness of Investment Calculus/ in zagadnienia ekonomii politycznej socjalizmu /Problems of the Political Economy of Socialism/, Warszawa 1960, p. 543.

42. Ibid. p. 544.

43. Two effectiveness criteria are usually encountered in the theory of economy - minimization of outlays to achieve the given result and maximization of use-effects from the given outlay. Both criteria differ in essence from each other and may be appied depending of the point of view in the given economic conditions; the first is connected with the principle of saving the labour otulays, the second - with limited investment resources.

44. We distinguish gross currency effect, i.e. the total currency inflow /or saving/ and net currency effect, i.e. gross currency effect less currency butlays necessary to

achieve the planned effect on the grounds of imported components of exported products.

45. In most African countries, in India and in many other Third World countries the rate of growth of new work places in industry is still too low which causes that in spite of a certain progress in development of industry the absolute number of unemployed is regularly increasing.

46. Let us assume that the outlays in the separate investment variants are: I_1 = 12,000,000 and I_2 = 10,000,000 while the envisaged annual exploitation costs are K_1 = 600,000 and K_2 = 800,000. We calculate: $I_1 - I_2 = \Delta I = 2{,}000{,}000$

$K_2 - K_1 = \Delta K = 200.000$

therefore $t = \frac{\Delta I}{\Delta K} = 10$, which means that the additional investment outlay could be recuperated in 10 years thanks to savings on the annual exploitation cost.

47. Denoting by t_e the exploitation period of the project and by t the individual gestation period we may determine the net saving on exploitation cost in the course of the t_e period amounting to $/t_e - t/ \cdot \Delta K$.

If the exploitation period were shorter than the individual gestation period /i.e. $t_e < t$/ a loss would emerge resulting from the additional investment outlays designated for achieving a higher level of mechanization of the project.

48. The general indicator of the annual exploitation cost of the given project covers the planned outlays for labour in the given investment variant, expenditures for raw materials, materials, semiproducts, fuel and power according to the consumption plans of the designed technology, expenditure for auxiliary materials and depreciation.

Depreciation was excluded from the exploitation costs during a period of time in the Polish practice and included in the general economic norm of effectiveness. See: M. Nasiłowski /ed./, Ekonomia polityczna socjalizmu /Political Economy of Socialism/, Warszawa 1974, pp. 186-187.

49. "Means designated for investments are of the social character and should be divided according to general social advantage criteria. The possibility of utilising this additional investment outlay I in other branches of production where the economic effect in the form of a decrease of own costs would be much greater should be taken into consideration. An important conclusion results from that, and namely, that it is not enough to use the maximum decrease of production cost which may be achieved in the given investment project as a guidance in the economic calculus, but also the, so called, alternative cost or, as it is called sometimes, the cost of opportunities lost". M. Nasiłowski /ed./, Ekonomia polityczna socjalizmu, ed. cit., p. 189.

50. It should not be understood that the marginal gestation period means the period during which the investment outlay is recuperated. The recuperation of the investment outlay takes place during the planned period in the form of depreciation. The marginal gestation period does not concern the whole outlay but only the a d d i t i o n a l outlay designated for the raise of the mechanization level in alternative project solutions.which enables to achieve the intended savings in the level of exploitation costs.

51. M. Nasiłowski defines the indicator as follows: "The marginal

situation when projects necessary for the economyand its development were carried out, the overall interest often being predominating over the social cost of investment. In the 'sixties when the economic effectiveness calculus was applied, the marginal gestation period was assumed T = 6 years /$\frac{1}{T}$ = 16.6 per cent/. In the 'seventies, in

face of labour resources shrinking and the necessity of a rapid modernization of the economy, the indicator was raised to 8 years which meant $\frac{1}{T}$ = 12.5 per cent. The interest on investment outlays was, therefore, decreased. It was intended to increase savings of labour and to raise mechanization.

58. See also: Guidelines for Project Evaluation, ed.cit., pp. 107-114.
59. J.H.P. Paelinck, Prüfung einer neuen Investitioustheorie, "Karlsruher Baiträge zur Wirtschaftspolitik und Wirtschaftsforschung", Heft 6, Karlsrube 1977, pp. 1-17.
60. See etal.: I.M.D. Little, J.A. Mirrlecs, Social Cost-Benefit Analysis, Manual of Industrial Project Analysis in Developing Countries, DECD Development Centre, Paris 1969.
61. Examples of a calculus of this type could be found in Guidelines for Project Evaluation, ed.cit., Part IV, Case Studies, pp. 263-383 where evaluations of various investment projects in developing countries were presented.
62. See: Instrukcja ogólna w sprawie metodyki badań ekonomicznej efektywności inwestycji /General Instructions on the Methodology of Research into Economic Effectiveness of Investments/, Warszawa 1962 and Efektywność inwestycji /Effectiveness of Investments/, joint publication, Warszawa 1963.