

INSTITUTES OF SOCIAL DEVELOPMENT AND THEIR EFFICIENCY ESTIMATION

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Abstract

Estimation problems of social development institutes' efficiency, such as educational system and human capital are considered in the article. A number of social efficiency criteria is introduced together with the known approaches, models which expand interpretation of social efficiency and help consider institutional features and the effects of separate social systems organization, and, in particular, education, etc. are offered. The problems of social development are considered in terms of academic aspects, the author mentioning the stands which are considered poorly within the limits of certain criteria. Efficiency criteria of institutional systems are suggested and social effect estimation of innovative development is given.

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1. Social efficiency criteria

Social and economic development is rather contradictory. To predict its results is difficult enough. However, it is possible to say with confidence that, at least, three major determinants define the vector direction of social development or, anyway, they give a certain characteristic to this development. First, changes in the technologies resulting in change of technical and economic paradigm of development, replacement of the basic production assets, intelligence and knowledge. Secondly, the effects of various kinds of power concentration, especially economic power over the market. Thirdly, social structures of accumulation and distribution of the created welfares, including the intellectual product, connected with the respective changes of labour markets.

Wealth accumulation by any means, egoistic behaviour, getting pleasures here and at once – these are the ordinary models of modern life behaviour which are appreciated as correct ones by the majority of people living nowadays. It is an attribute of present sociality which forms stereotypes of economic behavior as well. The respect for the elders, family relations, worship of other informal norms are pushed to the sidelines. Disappearance of the system of values, undermining of faith and generally accepted standards and ideas are the expression of modern economy “sociality” sharp crisis and social factors exhaustion of the development, their replacement by the market and business culture which becomes bright expression of “electronic culture”. There is a replacement of customs and traditions which have been developed in a previous social epoch by the new values which are not connected with a spiritual life and the communal structure in any way. M. Mohamad and S. Ishihara (1995) presented the similar point of view in the book ‘The Voice of Asia’.

As the first president of Singapore Lee Kuan Yew marks, in this case unlimited economic growth becomes extremely dangerous to the development of public structures (Coker, 2000, p. 205). Cancer also can grow in a human body, but this growth finally leads to destruction of the whole biological system. Besides, the brain of the person does not signal him about this growth until there is painful sensation, and at this stage of growth it is usually impossible to help him. It is only possible to prolong a little the functioning of the organism. The given analogy is rather

useful. Really, the appearance of new values and relations changes the social structure and the content of "social question", but it does not mean at all, that new values are not connected with the spiritual life. They simply represent a new spirituality, a new basis of "sociality". And this is the essence of the change of social structures and institutes of economy development. Hereinafter, not only laws, guidelines, codex, constitutions (formal rules), customs, behaviour stereotypes (informal rules) in standard neo-institutional context will be understood as institutions of social development, but in a wider sense (in the traditions of the old institutional school). It will include public subsystems - education, public health services, organizations and structures, and, besides, initial condition of human potential. It is functioning efficiency of the named social systems/institutions that composes a trajectory of successful economic development of large economic system.

If the institutions' operating system makes life unprofitable and does not allow providing a set of useful functions, then it is possible to say that economy growth does not solve the problem of social life satisfaction. Thus, certainly, it is necessary to take into account, that the absence of growth could strengthen this dissatisfaction. At the same time, the problem is a bit different - whether a society needs the new spirituality, new culture; how productive it is; whether it is possible to put a question in such a way in general; and how the changes in the base institutions are reproduced by economic growth, technical and technological changes. The last ones are more transient and demonstrate cumulative effect more vividly than the changes in customs and traditions.

Under these conditions "without modern scientific ethics knowledge can turn out to be evil". Therefore, the first condition of scientific success is the acceptance of "modern values" including truth, confidence, honesty and the right to disagreement. In a society where such values are neglected, their establishment acts as the main task, otherwise the system of reproduction and knowledge diffusion cannot function (Ibid, c. 232). As we see, the problem is reduced to the search of estimation criterion of social development efficiency.

For example, besides indicators of profitability and financial indicators, the concept of motivational or organizational efficiency is used as the development efficiency criterion of the firm. If the actual costs of the firm for the given volume of production are more than the minimal possible average costs, there appears a so-called X-inefficiency which reflects "internal" inefficiency, that is, poor management of functioning system. This value can be a characteristic of relative organization level of the operated system and can specify the bottlenecks in the management awaiting elimination or updating. Thus, it can be an original efficiency criterion of any social structure.

The principles resulting from economic benefits found out by the researcher and awaiting quantitative measurement, in particular, from the comparison effects of well-being or incomes standards of various levels of population can act as the criterion of social efficiency. It is tools powerful enough for the estimation of social efficiency, as the concept of "social efficiency" exists in a relative, that is, a comparative context. For example, the so-called "demo effect" (offered by R. Nurkse), was used by Duesenberry J. S. in the research of consumer behaviour. In 1948 he developed one of the first theories of consumer behaviour, based on the hypothesis of relative income according to which current consumption depended on the consumption in the previous periods and relative income. Thus, the consumption level, according to this approach, was defined by two major factors: competition in the social group and the "demo effect" which represented imitation of the standard of living by one group to another one, including consumption quality, and, simultaneously, the general aspiration to higher living standard. As a result, individual consumption became the function of consumer's relative income, that is, his position on incomes scale. Negative meaning of "demo effect" can be viewed regarding the countries catching up modernization. The difference in productivity, resulting from scientific-technological backlog, relative the countries of pioneer modernization predetermines a chasm in incomes and, accordingly, in consumption. But the desire to live the way the rich countries do, fixes vicious social and economic structure because the attempt to undertake serious measures to overcome the status quo,

encounters this reason besides others. Mass cognitive dissonance is resolved by the inability to refuse the imitation effect and the last one appears to be the psychological determinant of poverty vicious circle, fixing the developed social structure and not allowing raising economic efficiency.

Economic systems of western type have been developing on the basis of ideas about desirability of economic growth for a long time and the specified paradigm was dominating extending its influence on the economy control system. There was a substitution of the social development purposes by the purposes of some macroeconomic parameters increase, in particular, gross product and national income per capita. There was even a special term of “gross national product cult”, introduced into scientific usage thanks to J. K. Galbraith (2008). This phenomenon is based on the idea of two most important social effects, having paramount value from the point of view of modern economy development characteristic.

First, there is a change of competitive process owing to the fact that managing subjects and consumers do not solve the problem of profit and utility maximization accordingly. The effects resulting from the manifestation of power over the market become defining. Large business by means of psychological influence methods, for example, advertising, programs individual requirements and practically creates the demand for the welfares assumed to be produced. Thus “affluent society” becomes frigid towards social requirements and public welfares. Secondly, technological progress plays the role of the social changes generator, aggravating property and management division. Economic decisions are made by technostructure which chooses not profit maximization aim as the basic one, but a system of purposes. Realization of these purposes defines the quality of economic system. These may be the following: survival provision, safety, risk insurance upon some kind of activity, achievement of a certain living standard, etc. To provide progress in the advancement to target points, the volume of gross national product should be constantly growing. Otherwise the resource basis of the purpose is sharply reduced and the purpose becomes unattainable. This generated stereotype is reflected in moral public maxims, “gross national product cult”. The specified concept can be used as a criterion of low level of social economy development, that is, the more the cult of gross national product and the more distinctly the aim to provide a steady economic growth is proclaimed, the more confidently it is possible to assert that the given process will occur to a considerable damage in relation to current social structure. The ideal variant of such events development is concentrated in Smith’s effect according to which economic growth in the developed market economies occurs due to essential, and sometimes sharp, increase of the social stratification established on the Gini coefficient (also known as the Gini index).

2. Social efficiency estimation

Concepts of economic and social efficiency are different ones in economic science, “social efficiency” being much more poorly explained in the theory. From the point of view of orthodox science, efficiency means how well the limited resources are used and what return they make. Measuring the return per unit of the spent resource, we get the indicator characterizing system’s effectiveness. Social efficiency can’t be defined so easily. It is possible to consider it as the parameter describing the degree of solvability of “social question” on the agenda. However, in this case “social efficiency” as an indicator will be not only dynamic, but will also have constantly changing content, because the content of “social question” changes with the historical economy development. Therefore, it is better to measure social efficiency according to the criterion reflecting the change in the real social parameter or several parameters. “Index of human development” acts as such indicator representing integrated indicator estimating gross domestic product per capita, the expected lifetime and society’s educational level. It is considered, that this indicator gives much more accurate idea about economy’s development in comparison with the gross national product as the expanded set of the most essential social functions providing life quality and social stability is estimated. The income per capita defines the level of economic well-being; life expectancy is an indicator of public health services development, environment protection and

besides reflects the general living standard. Educational level reflects how the processes of knowledge reproduction and transfer are organized in the economy, how generations replace each other and what quality human capital finally is. The index of human development is defined as the arithmetic mean of three specified indicators-indexes: average lifetime, per capita income and educational level. Each of the three specified indexes is calculated on the basis of the available statistical data according to the corresponding formulas. Here is the relation for each index separately and for human development index:

$$\begin{aligned} K_h &= (K_d + K_g + K_o) / 3, \\ K_d &= (K^* - K_{min}) / (K_{max} - K_{min}), \\ K_g &= (L^* - L_{min}) / (L_{max} - L_{min}), \\ K_o &= (2 \times (Q - Q_{min}) / (Q_{max} - Q_{min}) + d) / 3, \end{aligned}$$

where:

K_h - human development index;

K_d - per capita income;

K_g - lifetime index;

K_o - educational level index;

K^* - real actual income per capita (at par of purchasing capacity);

K_{min} , K_{max} - minimum and maximum real incomes per capita;

L^* - lifetime expectancy at birth;

L_{min} , L_{max} - minimum and maximum lifetime at birth;

Q - literacy among the adult population;

Q_{min} , Q_{max} - minimum and maximum literacy among the adult population;

d - general share of pupils at the age from 6 till 24 years in the cumulative country's population of the given age (Suharev, 2004).

In my opinion, the amount of people living below the poverty line, defined by the relation of agents' number conducting a beggarly way of life to the general population of a given economic system is an important indicator of social development level. Besides, it is possible to use the indicator of poverty defined by the rupture between agents' income living below the poverty line and the income, defining the poverty line to the general income created in the country. Certainly, the first and the second indicators are in essence institutional settings as the poverty line is established legislatively. At the same time, this indicator has also an objective basis which is connected with the possibility of consumption of a certain number of welfare (foodstuff) a day for a certain amount of income. When income does not allow consuming elementary amount of welfare necessary for normal working capacity, but only supporting agent's viability, then we speak about a life below the poverty line.

Social development quality is estimated according to the qualitative parametres of condition in education and public health services sectors and other indicators taking into account the dynamic changes in the development of human capital. Within the limits of the United Nations Development Programme activity) reports on human development under conditions of economy globalization are developed. It is generally accepted, that if the value of human development index makes 0,8, the country is considered to be economically developed. If the index fluctuates between 0,5 and 0,8, it is the country with the average level of human development. For underdeveloped countries the index value makes less than 0,5.

However, this system of efficiency estimation indicators of social development has the following shortcomings. First, the integrated indicator includes three heterogeneous indexes describing different economic subsystems and processes, that is, it is based on the principle of mathematical aggregation and adapted for the estimation of social system as a whole. Internal distributive effects and motivational efficiency in the explicit form are not considered within the limits of the given index, to say nothing about the qualitative estimation of education, public

health services and social protection system. Secondly, human development index is based on the indicator of gross product/income with its serious inherent shortcomings. In particular, ecological consequences of social development, dynamics of non-material assets and the value added created with their help are not reflected in this indicator. Besides, there are statistical errors of gross national product registration and national income when part of incomes is not considered, and the other part is considered twice. The tax system can seriously distort gross national product calculation.

Thirdly, there is a certain limitation in calculation of the components of human development index, indicators of life expectancy and educational level. It is in the fact that it is impossible to ascertain confidently the correlation between social development quality and life expectancy and educational level. The matter is that high value of "educational level" index does not mean high quality of education at all the stages of educational ladder. Experts in the sphere of education confirm, and it is necessary to agree with it, that the continuity and omnitude of education act as the major conditions of its efficiency. Erudition level can be rather high due to the general education, but higher educational system cannot provide training of the highly-skilled personnel in the necessary volume, making the most essential contribution to the development of information economy, based on knowledge and "high technologies". The same concerns the "life expectancy level" index which can be rather high, for example, with considerable children's death rate or with very low indicators of birth rate. Similar regularities also create the problem of ageing of many economically advanced states, which die out in essence. Then how we can speak about effective social development if the created welfare and living standard refer to reduced national-cultural population.

Fourthly, the largest shortcoming of the indicators is that they do not consider, in what degree the functions of social structures are accessible to various segment of the people, and what share of personal income these functions demand to be executed.

Fifthly, the condition of social sphere and corresponding structures is defined by the general development of social infrastructure, crediting peculiarities of its objects, and by the level of state and private expenses necessary for the development of the social sphere. There is a natural decrease in the qualitative parametres of concrete social system with the reduction of monetary support level. That is why, politician establish standards on the level of expenses of "social spheres" and the branches creating public goods having no special theoretical knowledge about the arising dysfunction of operated system due to absolute or relative decrease in its monetary support. This refers to defence, public health services, science, education and culture. Relative share growth of these expenses becomes a symbol not only of public sector expansion, but also of successful innovative-technological development of the country, its dominating role in the market of hi-tech production and guarantee of competitiveness in the world market.

Thus, human development index represents corrective indicator of gross national product allowing, in a manner, considering the contribution of non-material factors in the creation of national wealth. This criterion of social efficiency is an original "gross national product of social development", that is, a very rough and general estimation of social productivity. 'The main defect' of gross national product indicator and human development index is in the fact that high accident rate of the economy, control of mass diseases, deforestation, repair of the failed funds, lawyers' rivalry, indemnity for any loss, for example, for flood, earthquakes - all these will work towards gross national product increase and, consequently, the human development index through the income parametre per capita as the lifetime index and erudition level will not essentially change.

An interesting definition of efficiency is given in the report of E. von Weizsaecker, A. B. Lovins and L. H. Lovins (1999, pp. 596-625) to the Roman club "Factor 4. Doubling Wealth - Halving Resource Use" in 1997. The development strategy which does not cause regrets is understood as efficiency. From this point of view economic growth and economic efficiency associated with it are an outdated strategy as the steady society demonstrating long-term viability is interested not in the physical and material expansion but in the provision of development quality. Approving the purposes of economic policy in the form of growth support, first of all it is necessary to

find out, what this growth is necessary for, what purposes it pursues, what it will result in and how long it will last (Ibid., p. 628).

From this point of view economic efficiency is a means, but not a purpose as markets' efficiency and distribution of welfare are only a part of social development general efficiency, and rather a small part. Economic efficiency is a means, and social development efficiency becomes the purpose. Certainly, from the positions of scientific logic the criterion or the criteria assuming the use of quantitative indicators and indexes is required for its measurement. As social development is multidimensional, social development general efficiency will be supported at high level if the following problems are posed and solved: improvement of life quality, environmental contamination and exhaustion of resources reduction, financial resources economy, control over the market, business activation, security enforcement, equality and employment, multicircuit use of available resources, etc. However, many of the specified problems which were reflected in the report "Factor 4" are mutually conflicting due to the fact that current structure of economic institutions and economic policy model are just focused on the forged purpose of economic efficiency provision at the expense of growth, but not on the purpose of social development. So the quantitative logic prevails over qualitative with the resulting impossibility of the designated purposes attaining in the full volume.

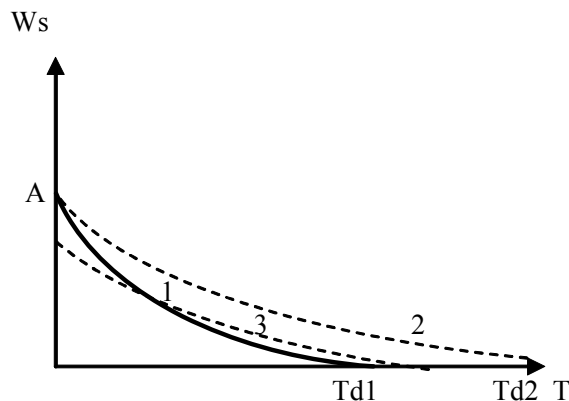
To learn to measure social development and to replace rather narrow concept of "economic efficiency" in the economic analysis with the other concept of "social efficiency" it is necessary to introduce the criterion which would define this "new efficiency". Such criterion was offered by Clifford W. Cobb and the Stockholm Ecological Institute and was called "Index of Sustainable Economic Welfare", ISEW. This criterion makes an alternative to gross national product as it measures real wealth but not the results of economic activities fixed by the amount of expenses in the economy. The ecological load on the economy is reflected by gross national product growth, and ISEW will be reduced. And this indicator will similarly react to criminality growth, to increase of informal sector, inequality increase, exhaustion of resources passed on to the future generations (Ibid.). The distinction between gross national product and ISEW in the system of wealth accounting is a derivative of the function of the stated indicators. However, it is very important to note the divergence of their dynamics. If according to gross national product there is an economy growth, the index of sustained economic welfare shows the growth of disappointment by social conditions of life in spite of the fact that on a long historical trend success in social development, especially in the developed countries, are simply stunning. This paradox arises because of the fact that development speed has increased which makes time and access to welfare important limiting parameters of a concrete individual existence, defining his requirements and preference.

It is possible to present social efficiency through the efficiency of concrete social sectors: education, public health services, and infrastructural sectors - informational, social security and labour relations. By the way, the level of bureaucratism and "shadow" economy will also influence the general value of social efficiency. Here we will present the estimation method of public health services effectiveness. A separate paragraph will be devoted to educational system. To estimate the efficiency of such system as public health services, it is necessary to wonder, what this system is necessary for, that is, what function it carries out. System's effectiveness change is the change of this function, from the positions of its qualitative and quantitative execution. In other words, the dynamics of efficiency is an expansion or contraction of system's dysfunction.

Public health services efficiency is estimated within the limits of the model "expenses - processes - results". And the result is rescue of human lives, prolongation of this life and its activity, decrease of the level of physical inability and disease of social system's agents. Such result is attained by both preventive actions, and especially by medical way. However, the result depends on the initial nation's health, ecological situation, the demand for medical services, supply of medical technologies, social insurance mechanisms, and even education, etc. From the point of view of the agent, health is the welfare whose value increases with age and the total cost decreases, and in a point of death of the agent health as the welfare is equal to zero (Figure 1).

Expenses for health support are investments into creation of the future income as with health loss labour productivity decreases, there appear losses of working hours connected with invalidity or "slack" work that lowers the income taken by the agent. Health decrease with age is compensated partially by the growth of expenses for healthcaring actions. We will show the curves of health reserve changes of two agents who were born with different initial reserves of health (for example, this divergence can be genetically predetermined, or was caused by a mode of bearing and birth).

Figure 1. Dynamics of the Function of Agent's Health Reserve



As we can see in Figure 1, function of health reserve for agents 1-2 originates in one point A, in case 3 the initial health reserve of agents differs. If the reserve is identical, the agents can all the same live for different periods - Td1 and Td2 accordingly. The situation with curve 3 shows, that agent 3 having lower health reserve in relation to agent 1, will live a little bit longer, but less than agent 2. Such function dynamics of health reserve says that the agents have different ways of socialization, various incomes which allow them to liquidate the dysfunctions of their organisms and, finally, affect life expectancy. Here the function of health reserve which can become equal to zero owing to accident is not considered. For example, agent 1 studied perfectly well, that demanded considerable efforts, room work, eyes and nervous system load. Agent 3 studied in the open air, quickly got the job which is useful for organism. Intersection of curves 1 and 3 gives the point in which their health potentials are equal, and then there is different dissipation of health reserves. So, the first agent defends the thesis for a doctor's degree at young age. If there is no stimulus for such trajectory of development in the economy, he will pay off for such desire with his health. Besides, connecting his work with science, agent 1 gets low income, and agent 3 controls construction of objects in a forest zone that promotes health strengthening and guarantees, at least, in the Russian economic system, higher income. Agents invest a part of the income in their health, and every year they do it in larger amounts, but generally the investment share of income in such welfare as health is not usually identical and is defined by agents' preferences to make such expenses (Suharev, 2009).

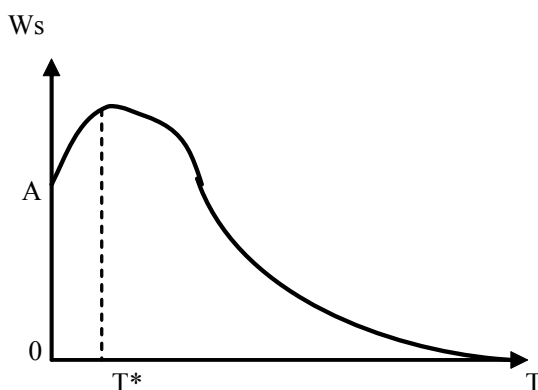
When it moves to the right on the time axes, the value of health for each agent will increase in any case, as well as the function of expenses – investments, if initially psychologically healthy agents are considered. Otherwise, the function of value and health reserve can have absolutely different appearance. The number of diseases (dysfunctions), and death rate will increase with the age of agents, the specified investments (expenses) resisting this growth that it could be.

J. R. Hick is remembered to mention, that capital heterogeneity is its major property. It is this very property that economic science cannot disclose and explain. As for the human capital, to estimate its efficiency is even more difficult, because it is extremely heterogeneous. One of the factors and one of the reasons of this heterogeneity is unequal function of health reserve which

predetermines agent's possibilities on the trajectory of his movement on the phases of development and ageing (life cycle). It is possible to add the function of initial and obtained abilities and knowledge and the function of needs and motivation to include the model of a person completely into the economic analysis by means of these functions. Now, it is quite appropriate to note the following: obviously these functions are very similar in the social groups (strata), as they depend on the amount of average income per capita, that is, living standard. Using decil or quintil distribution of agents on the level of income per capita and, having shown empirically established functions for every decil (quintil), having found the difference between neighbour groups for each group of agents of the given age on these functions, it is possible to roughly establish quantitatively the rate of heterogeneity of human capital for economic system. Certainly, it will differ from the usual heterogeneity on income - inequality. As we see, heterogeneity is defined by many factors, including per capita income which is in essence heterogeneity derivative. The size of this per capita income defines agent's possibilities in the sphere of public health services, training, legal safety, etc. Economic democracy, if to be strict, becomes literally economic, it is attached to the income function. Both the agents' rights and their possibilities and needs are defined by cash income. From these positions there is a monetary democracy in today's world, that is, democracy which is determined by the size of per capita income.

If to be strict, the curve of health reserve should have a little bit other appearance, than it is presented in the previous figure. The function of health reserve will have an increasing part, which is connected with accumulation of health reserve and formation of p health potential at children's age (Figure 2) on the part $[0; T^*]$. The period from the beginning of T^* is a junior age of the agent. Up to the contact of x-axis from moment T^* the function of health reserve behaves in the same way as it is shown in the Figure above. Hence, while calculating it is possible to consider function W_s permanently decreasing on which the ledges connected with waste of health reserve can be observed, or with the restoration of health reserve depending on the situation, condition of public health services and corresponding state policy in this sphere in the country.

Figure 2. Shape of the Function of Agent's Health Reserve



The main criterion for efficiency estimation of medical actions is expenses level (both social and private), connected with implementation of these actions taking into account their probable consequences. It is possible to present it in such a way:

$$S = Pm + S_e - S_{pe}$$

where

S - cost of medical action,

Pm - the price of the suggested medical action equal to its cost price, S_e - cost of side effects,

S_{pe} - cost of the prevented adverse medical consequences.

In the economy of public health services two criteria of efficiency estimation are often used:

- Years of a life with the adjustment for disability;
- Years of a life with the adjustment for life quality.

The first indicator is calculated as the quantity of future years of life without disability and functional infringements (at a dysfunction minimum) which could have been lost as a result of early death or disability in a current year. The second indicator represents a quantitative estimation of lifetime growth with the account of life quality, this growth being provided by the work of public health services. In other words, both indicators give intergrated estimation of disease decrease, on the one hand, and on the another hand, they estimate lifetime increases at the quality level not decreasing as a result of medical actions and special medical and social programs application.

Cost estimation of human life is economically important as only then it will be possible to estimate the efficiency of medical actions truthfully enough. The question of economic estimation of human life cost was being solved as far back as by W. Petty , and then later by W. Farr. Today approaches of human life cost estimation on the basis of human capital estimation are known. Certainly, discounting methods are convenient for such estimation, but how to estimate current cost, not applying discounting for the time being. Obviously, it is appropriate to consider, that agents do not differ in costs of their lives, that is, this parametre is identical for all the agents. If to accept a different position assuming distinction in life cost, then there will be a differentiation on the fundamental right for life, and this will undermine the democratic foundations resulting from the principle of natural right.

Cost of human life, from the point of view of medicine, will be equal to the difference of expenses for life and benefits provision which this life brings to the general number of the rescued years of life. It is possible to accept one more criterion: to estimate benefits, certainly, discounted, which could be received if a person lived, and then to subtract the expenses connected with the maintenance of agent's viability parametres in the limits admissible for life. But, thus, the criterion becomes negative for pensioners, and it is difficult to count up benefits or expenses for a child as it is still not clear, what social niche he would occupy in future, what trade and what income he would have. The problem of inheritance and income registration brought by such asset is also important here. Besides these ways, it is possible to estimate human life by the criterion of readiness for the expenses reducing death probability.

It is interesting to notice, that, for example, having established organism dysfunction of the agent, physicians can suggest the treatment which would liquidate this dysfunction or considerably lower its depth, restoring the majority of functioning parametres of an organism to the required norm or acceptable values. However, the fact whether the nature of such dysfunction occurrence will disappear is absolutely unknown. Then, without understanding of the dysfunction nature, for how long time the organism will be safely functioning. It can be a month, a year, three, five years, etc. What does this term depend on? Most likely, on the dysfunction depth in the initial point, on the accuracy of the selected treatment and on how much drugs casually or intentionally influence the nature of chemical processes in a human body, or how much they launch parallel processes worsening conditions of given dysfunction and its further development and deepening. The efficiency of treatment is defined in this case by the given term. The optimum result of practiced medical actions in this case is connected with the fact that at a minimum of the used exposures having medical effect and minimum expenses for the patient, the dysfunction of the given kind does not arise any more (without a repeated course, or correction of errors at the first course of treatment). Certainly, such result depends on the perfection of diagnostic technique and doctors' qualification, that is, on their vocational training and the provision of the branch with necessary technologies and medicinal and auxiliary drugs, that is, on pharmaceutical industry, etc.

Thus, estimation of human life cost is assumed as the basis for all subsequent estimations of public health services performance, and besides provides control, including prosecutor's one and judicial decisions in this branch. In other words, usual comparison techniques of expenses and benefits which are given by medicine are insufficient, that is, the measure of budgetary efficiency is necessary, but insufficient.

3. Efficiency of education as a social system

Efficiency of educational system represents a combination of several kinds of efficiency. Organizational, administrative, motivational efficiencies influence heavily the system effectiveness as a whole. Probably, it is possible to describe educational system integrally as an indicator of synergetic efficiency or adaptive efficiency. But in a generalized way the following criterion can become an efficiency indicator: the system of higher education should provide a high rate of specialists whose professional parameters would be competitive in the modern labour markets and set higher standard for the development of these markets. Thus, educational system should provide access to the suggested functions to as many citizens as it is possible. And it is necessary, that the bottom steps of educational system (comprehensive secondary school, the system of technical schools, vocational schools) should stimulate pupils to continue education (Ibid.).

Besides efficiency criteria while estimating complex systems functioning and comparing their results, it is useful to use criteria or principles which symbolize inefficiency and which are sometimes easier to establish or to calculate. With reference to educational system and to the intellectual capital of firms (organizations) such criteria can be: a) absence of motivation for training and professional development, b) discussion of past results and merits, c) exaggerated self-assessment and conceit of the agents participating in the production of welfare or services.

Finally, the level of experts' training defines skill level and success of various decisions (technical, administrative, organizational, etc.). If to consider the decision giving the greatest return (value) of effect as the optimum decision, effective decision as the one, giving a certain positive effect and inefficient as the one, giving a negative effect, then on the prevalence of each variant of decisions, it is possible to estimate indirectly the system's effectiveness which reproduced the specialists, making such decision. From the methodical (procedural) point of view, to make such estimation is difficult enough. At the same time, the given approach can be applicable to small, in particular, to regional or corporate structure where the types of decisions can be traced and estimated. Usually, different decisions adjoin with each other. It is impossible to make only these or those decisions. However, if it is possible to estimate the effect from each decision, it is not reasonable at all to add the effects, as the decisions are, for certain, interconnected parameters for the given object - system.

Efficiency of educational system is defined by the skill level of pedagogical personnel, efficiency of the learning process organization, and efficiency of the training. These are direct factors setting the general system's efficiency. However, such factors as propensity for training, motivation of training, prestige of separate professions, labour market condition, the amount of scholarship, payment of training at the paid form of training and availability of credit define the demand for education and educational services. With reference to firm, education efficiency depends on the need for training and the desire of workers to study. The named conditions are defined by how the wage of a worker will change before and after training and how much its productivity will increase. That is, how much training will be justified for the firm and contributes to the general results of economic activities, to functioning efficiency.

Let's single out and set forth three base approaches to the estimation of educational system effectiveness (Ibid.) here: a) investment (the pure discounted cost of training and a payback period), b) qualitative, c) external. Let's consider the content of each approach in series.

A. The approach based on the estimation of investments efficiency into human capital, allowing estimating the effectiveness of educational system (Suharev, 2004).

Measuring instrument of the impact on the system of investments into human capital can be presented by the following indicator:

$$K_{Ropt} = \frac{Z_{max}}{D_{max}},$$

where

K_{Ropt} - net profit ratio of investment in human capital;

Z_{max} - maximum expenses for investment in human capital; D_{max} - maximum received income.

We also suggest expressing averaged estimate of efficiency coefficient of the human capital investments in the formalized way:

$$\bar{K}_{EIH} = \frac{\sum_{i=1}^n \bar{z}_i^j}{\sum_{i=1}^n \bar{d}_i^j},$$

where

\bar{K}_{EIH} - estimate of efficiency coefficient of investments into human capital;

\bar{z}_i^j - average expenses of i- family of j- decil group; n - number of families in the sample;

\bar{d}_i^j - the average income of i-family of j-decil group,
 i - family number in the sample from n families;
 j - number of decil group.

If we apply the first formula of general profitability to the definition of efficiency of the human capital investments, having made the sampling from families of various social groups (suppose, that such decil groups will be ten), we can get the following expression:

$$K_{REIH} = \frac{\sum_{j=1}^{10} \sum_{i=1}^n \bar{z}_i^j}{\sum_{j=1}^{10} \sum_{i=1}^n \bar{d}_i^j}$$

It is possible to note, that the period for which means invested in a person are paid off, depends on economy branch where the person will work after training. The remuneration of labour is different in different branches; hence, it is possible to speak about time distinction for which investments will pay off. I believe, this problem should trouble the state as branches with the highest level of remuneration cannot provide everyone with work, so it is necessary to actively pursue adjustment of prices policy concerning different kinds of capital, taking into account the substitution effect, including cost evaluation of labour capital, wage. Payback period in each separate case should be defined proceeding from the equality of the discounted capital costs in educational system and the value of economic results achieved by t-year. Mathematically it will assume the following form:

$$\sum_{t1}^{t2} (R_t - Z_t) \cdot \alpha_t = K_d^{T=t2-t1},$$

where:

R_t - economic results achieved in t;

Z_t - expenses in t-year, without capital investments;

α_t - discounting factor;

K_d - the sum of the discounted capital investments for the payback period $T = t2 - t1 \rightarrow$ min.

Efficiency estimation of investments into a person according to the offered coefficients is necessary, but insufficient condition for the provision of estimation completeness from the methodical point of view. The analysis of payback period is necessary as the basic indicator of efficiency estimation of investments into human capital. The reason is that investments into a person have a long-term character, and this effectiveness ratio efficiency reflects the time aspect poorly as at long-term stages both expenses and incomes should be discounted. And discounting should be carried out according to different "analytical schemes" and it always has a high element of inaccuracy. The longer is the time interval, the higher is the discrepancy. Both income and expenses in the presented expressions should be subject to discounting.

By means of the factors suggested above it is possible to estimate investments dynamics into a person depending on the influence of various factors evaluated on the change of expenses and incomes.

Any system develops by certain stages. For a person as a socio-biological system the life cycle is also characteristic, therefore, it is possible to assume, that investments in a person are subject to change depending on these stages, that is, at different stages the size of invested funds is different. Thus it is possible to consider, that investment in a person and the effect from this process are defined by the life cycle of a person. That is, if we accept the quantity of years for t , and invested funds a year i for I_i , then expression

$$\sum_{i=1}^t I_i$$

can define the sum of invested funds at each stage of human life.

The question concerning quality of educational system as a whole, of all its structures, is very important, beginning from the primary level and up to the governmental bodies supervising and regulating educational system in the country. It is interesting to note, that calculation (estimation) of separate quantitative and qualitative indicators can testify that the system functions as though effectively. Actually, general efficiency will be rather low because institutionally the system will be imperfect, it can be based on corruption contracting, having quite different principles and motives. For example, the motive of getting a diploma and the motive of training a highly competent specialist are, in practice, two converse motives. The first motive can be provided by superficial and bureaucratized education, low qualification of teaching staff and corruption, and the second motive can be realized only by a different educational system when its three main elements, qualification of pedagogical personnel, efficiency of learning process and education itself radically differ from the first variant.

B. The "qualitative" approach assumes quantitative estimation of qualitative changes in the system.

For estimation of respective alterations in system's effectiveness parametres, it is important to estimate the change of workers' wages in the general expenses of the system, and also the share of wages costs of those occupied in research and development in the general wages expenses. Labour-intensiveness decrease per unit of production and output and the general growth of labour productivity act as an important indicator of efficiency.

Educational system or the training system of personnel can be estimated by the following quality indicators (Suharev, 2009):

- knowledge increment (on the basis of the use of the agents' tests who were trained). It is a share of excess of the weight average right answers after training over the weight average answers before training among the weight average answers before training (tested group of agents should be the same to keep cleanliness of measurement);

- the quality of education measured by the level of training of those who carries out education and digestion of new knowledge level. For this purpose the following indicators can be used: share of new knowledge digestion in the course of training in the total amount of knowledge in this branch of science, specialty, subject; the volume of methodical support of one subject; number of professors per one trainee; professors' level of proficiency (volume of annual

scientific publications); quality estimation of the trainee's work before and after training; demand for graduates of high schools in the labour market, etc.;

- information capacity of active job. How the volume of relevant information has increased and average expenses for getting a unit of such information per unit of produced product (income), or per unit of educational service cost have decreased;

- the quality of production measured by use value rate of products, or by the ratio of actual losses due to rejects of finished goods and intraproductive rejects to valid production, or by number of complaints accordingly.

The educational system promotes professional development, increases standards of economic system controllability, raises labour productivity (reduces labour-intensiveness). Besides, education improves moral and psychological climate, which is expressed in improvement of solidarity indexes, group interaction, integration (the ability to maintain structure due to the low level of proneness to conflict) and so on [8].

Turnover of staff in educational system, absenteeism norm, intensity of personnel dropout because of age (age structure), the number of free vacancies, and besides professors' employment in different high schools are the characteristics of process of training quality. At least, they expressly or by implication influence educational system quality. The same refers to a firm which requires educated specialists.

Turn-out of appropriate specialists can be defined roughly on the average score of the diploma:

$$S = \sum_{i=1}^N \frac{b_{ai} \alpha}{100},$$

where:

S - average score of the diploma;

b_{ai} - average score of the diploma in i-speciality,

N - number of specialities,

α - unit weight of the given speciality to aggregate number of trainees.

Such approach can be used for the estimation of a system's skill level including educational system. It is only necessary to estimate specialists, teachers, associate professors and professors instead of trainees and, certainly, to calculate the indicator for the system as a whole, for example, for a corporation.

C. "External" approach is in the estimation of additional positive effects which are provided by educational system and personnel training.

It is possible to present educational system effectiveness as the relation of cumulative positive external effect to the general expenses for maintenance of its functioning during the training period (five years for high school, eleven for school, 3-4 years for technical school, 2-3 years for vocational school):

$$E_o = \frac{\sum_{i=1}^T E_{+i}}{Z_{i+n}}$$

where:

E_o - educational system effectiveness;

Z - expenses of educational system during studies;

E_{+i} - positive external effect in i-year on time interval T until it is exhausted, as in due course without interior and professional development the given effect for the agents who were trained on interval $i+n$, where n - training period, by the time T it can become equal to zero.

However, in my opinion, external effect should be estimated from the moment of studies start till the moment of the retirement of the trainees as economically active agents. But even

being on pension, not working, educated people provide positive external effect in their households. Thereby, this circumstance should be considered at calculations.

If training reduces production rejects, then the effect is measured by costs economy connected with the decrease in reject level as a result of training. At decrease in labour-intensiveness resulting from training, when the equipment is not changed, it becomes clear that only training could produce such effect. Hence, to take efficiency increase into account in this case is not difficult. Similarly, it is possible to measure the effect of increase of such economic system's social indicators, as its accident rate, institutional infringements (opportunism), as a result of training and rise of education level and qualification of economic agents.

For the estimation of human capital and educational system efficiency, various models are used. In particular, in the R. M. Solow's model of economic growth production function is used, population growth, technical progress are considered, investments and savings equality and a constant rate of capital dropout are accepted. And the expansion of R. M. Solow's model (1956), undertaken by R. E. Lucas, introduces efficiency (productivity) function of training in the explicit form. In D. Romer and N.G. Mankiw's model [9], human capital per unit of effective work is considered. Mathematically these three models of base production function which allow defining created product growth assume the following form:

$$1) Y(t) = A(t)K^\alpha(t)L^{1-\alpha}(t),$$

$$2) Y(t) = K^{1-\alpha}(t)\{lH(t)L(t)\}^{1-\alpha}h^\beta(t),$$

and:

$$\frac{\partial H}{\partial t} = \lambda H(t)[1 - l(t)]$$

$$3) Y(t) = K^\alpha(t)H^\beta(t)[A(t)L(t)]^{1-\alpha-\beta},$$

having introduced

$$y = Y/AL, k = K/AL, h=H/AL,$$

we will receive:

$$y = k^\alpha h^\beta.$$

where:

Y (t) - gross product;

K (t), L (t) - physical and labour capital;

l - a share of labour expenses for creation of human capital;

H (t) - human capital reserve;

h (t) - average level of human capital in the economy;

λ - education efficiency;

α, β - rate of substitution of production factors included into production function,

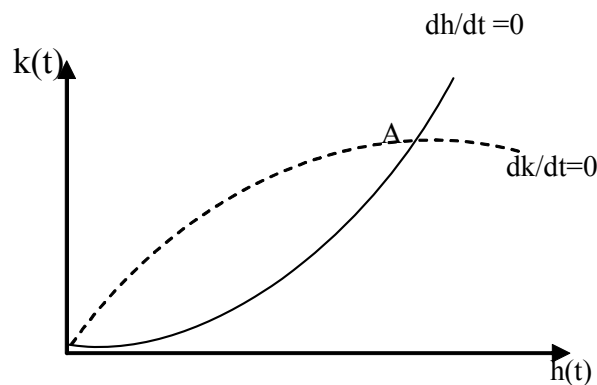
k, h, y - physical, human capital and product per unit of effective work.

In R.Lucas's model the growth rate of gross product is defined entirely by the growth of human capital, but because of external effect economy as though falls short of efficiency.

Models of economic growth of S. Strumilin, T. W. Schultz, E. F. Denison¹ consider human capital, representing the process of influence of this capital on the growth by stages, to be more precise, by objects of its formation. In other words, return from investments at the levels of primary, secondary and the higher school is considered. At model level it is possible to present economic system as consisting of two sectors: material and intellectual. And the last one includes science and education. Then, using the analogy from chemical kinetics, the development of this system from two sectors is possible to present as a certain interaction with the reverse speeds. One speed means disintegration of intellectual sphere, obsolescence of knowledge, and the other speed means augmentation (acquisition) of new knowledge. In the co-authorship (Suharev, Shmanev, 2007, pp. 100-114), the macroeconomic model realizing the given assumption was suggested and approved. It is made on the equations for streams' speeds of chemical reaction taken from the section of chemical kinetics. This model shows how material and intellectual sectors of economy co-operate and how they define the dynamics of each other.

Proceeding from the model of Romer-Mankiw it is possible to define the point of global stability of the system where physical and human capital values per unit of effective labour are equal (see the Figure). It corresponds to point A in Figure 3.

Figure 3. Global Stability Condition of Economic System according to the Growth Model of Physical and Human Capital per Unit of Labour



Production function for human capital, according to T. W. Schultz, can assume the following air:

$$Y_{Ht} = A(Z_t \cdot K_t)^{\beta_1} C^{\beta_2},$$

where

Y_{Ht} - volume of the produced human capital;

t - time period;

A - factor describing the ability to increase human capital;

Z_t - share of human capital which is used to produce this capital;

K_t - general value of the available human capital;

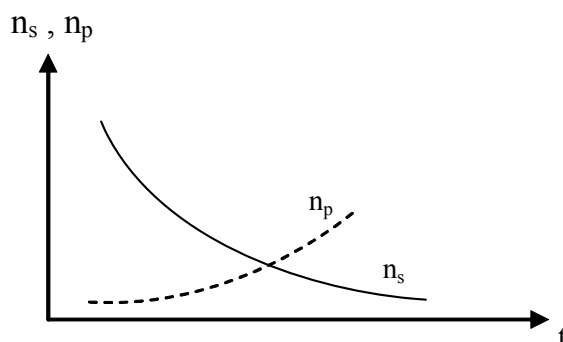
C - repaid investments; β_1, β_2 - positive elasticity coefficients of the resources, showing by how many percent the volume of the produced human capital will change when the resource increases by 1 %; $\beta_1 + \beta_2 < 1$.

¹ In detail see: Sukharev O.S. The Economy of Technological Development. - M. Finance and Statistics, 2008.

This approach to the production of human capital allows considering the condition of educational system and its possibility. The parametre describing the ability of the agent/system to increase human capital, and the amount of capital which is spent for reproduction of the next portions of capital, actually describe the contribution of educational system in the human capital increment.

The important trend of the analysis with reference to educational system is the relationship of the state and private education, and comparison of efficiency of these two educational models and their contribution to public product. Here two circumstances are important: whether educational system and higher education give the possibility to get higher future income, that is, how private and social benefits-costs vary with education after it is finished and the agent begins his labour activity. It is a particular question when education is provided in the course of agent's labour activity. It is possible to judge about the condition of educational system and its influence on the development of economic system (contribution to economic growth) by the rupture value between private benefits-costs and social benefits-costs. For the efficiency characteristic it is possible to introduce social and private rate of educational system return. Then it will be logical to consider the relation of private costs to private benefits as private rate, and the relation of social benefits to social costs as social rate of return. Social benefits are a value of positive externality plus direct social benefit, deep down. For example, from specialist training for public sector, defensive complex, etc. And it is possible to consider state expenses for educational system as social costs. We will present a possible change of key parametres of educational system's effectiveness depending on the years of training (time parametre).

Figure 4. Social (n_s) and Private (n_p) Return Norm of Educational System



If to proceed from the fact that social institutions are arranged in such a way, that they provide higher income for higher education (more years of training) during the life cycle of the agent, then the recoument of the higher and post-graduate education for the society will demand more time. For an individual agent the number of years of recoument of his investments in the equivalent kinds of education will be lower as its income will be considerably higher at once, as well as the extended possibilities in getting well-paid job. And far as the society is concerned, positive external effect of such training of one agent will be relatively lower and will affect economy appreciably in a considerable time interval. In this connection, all other things being equal, the social rate of return will decrease with time increase, and the private rate of return will increase. The graph will preserve its shape (Figure 4) if the state market share is shown on x-axis. With its increase which corresponds to higher education demanding larger, ever-growing state investments, the norm of social return usually decreases a little, and the rate of social return owing to quicker recoument of private investments increases. However, it is fair, only if base institutions provide higher income to higher educational level during all the life cycle of the agent. Otherwise, if higher income does not correspond to higher education, dynamics character of both private and social return will be a little bit different (Suharev, 2009).

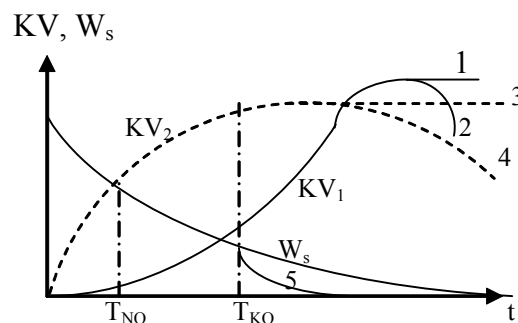
As more capable agents provide larger contribution to production of human capital and output aggregate production, it is necessary to adjust the process of these agents' selection for

educational system, science and high-tech production effectively. Moreover, it is necessary to provide them with the best conditions of training, that is, on budgetary basis with the further employment or in free form, or to suggest them working for the state (defence, fundamental science).

If private costs surpass private benefits from education in all its forms, it means that incomes level of such country does not allow providing proper education privately. Such countries are the poorest. Generally, the level of private benefits surpasses the level of private expenses, and the rupture between these values is reduced with the increase of educational level. The situation when private costs are more than private benefits at elementary school level is possible, but then private benefits from getting higher education and postgraduate studies sharply increase. It corresponds to the situation when school education should be provided by the state, and getting it privately with the termination of further study does not pay off because of great difference in earnings between the agents, having higher, post-graduate and elementary education. Such state of affairs is characteristic for economy in which the wages differentiation between simple and complex (skilled) labour is high. Basically, both developing and developed countries can be referred to this group if labour there is highly automated, mechanized and requires long training and high qualification. Then it is not profitable to stop education process and stay at the bottom level. Social benefits can essentially exceed social costs during the studies beginning at school and up to the postgraduate education. A variant, when social costs of educational system are larger than its social benefits during the whole period of training, demonstrates high system's inefficiency, its dysfunction. In this case, education is conditionally-unprofitable for the society and economy. But it can be profitable for private agents. However, in any case if such situation arises or educational system is coming nearer to such condition, it is an indicator of dysfunction increase, sharp system's degradation, high costs, low qualification of trained specialists. Besides the system of elite private education can function rather successfully in the economy which will provide sharp excess of private benefits over private costs.

The relation of private costs-benefits and social costs-benefits will define the sectors of the state and private education relation. At the same time, qualifying requirements can be defined only by the government proceeding from the estimation of positive external effect and the forecast of necessary experts' qualification for the future. Though the private system can be guided by its own standard which will exceed the government standard.

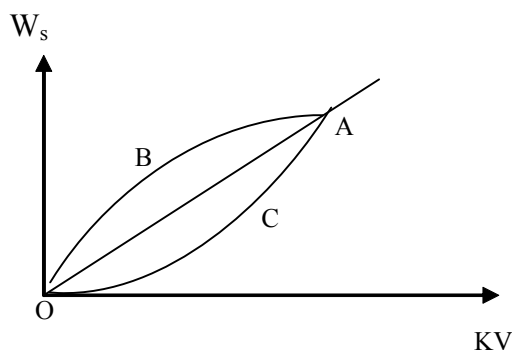
Figure 5. Dynamics of Skill Level and Health Reserve Depending on the Agent's Age



During training, the skill level in effective educational system should increase. However, if we compare any training disregarding its quality, the increment of knowledge will be available comparing with the initial level of the agent before training. Therefore, the estimation of the degree of growth of the skill level in the course of training is important. In connection with everything told above, it is possible to introduce specialist's qualification function (competence level) and to compare the dynamics of this function in the period of training and during all the agent's life with the functions of health reserve W_s. Before the training period T_{NO} qualification function can incre-

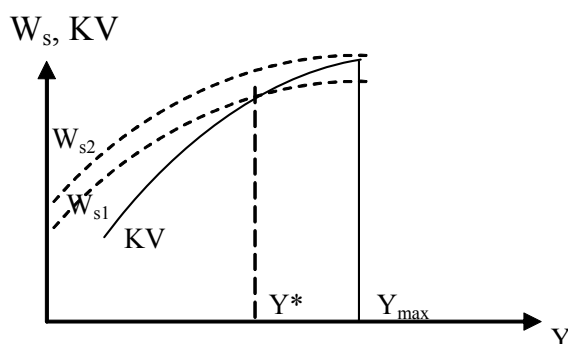
ase depending on the character of preschool education and knowledge of the world around, time spent for the child in the family, initial level of income, parents' abilities, including the abilities of children's upbringing. On the sector of training $[T_{No}, T_{Ko}]$, health reserve is reduced, and qualification function grows. Then, after the basic training the following scenarios are possible: a) qualification increases inertially at the expense of experience accumulation by the specialist and with years is stabilized at one level (line 3), or by the life's end is reduced (line 4); b) qualification grows inertially at the expense of experience perfection, retraining and skill conversion (professional development, study courses, etc.) in the following years, reaching peak by the life's end and being stabilized (line 1), or reducing a little (line 2). The health reserve steadily decreases, though the function can reflect a more sharp (quick) decrease right after or even during studies (line 5), Figure 5. Because of health loss qualifying skills can be lost as well (Figure 6, lines ABO, ACO, and AO). The character of change is defined by the speed of health reserve reduction with the following reduction of qualifying skills and knowledge level. Qualification function of the agent then will depend on the health reserve function. Besides, qualification will depend on the abilities of the agent, including its genetics, and also from the initial income level, or the available or inherited asset which is bringing in return.

Figure 6. The Function of Qualification Reserve Depending on the Agent's Health Reserve



Depending on the income level of the agent, it is possible to present the function of health reserve and skill level function (Figure 7).

Figure 7. The Function of Health and Qualification Reserve Depending on the Income

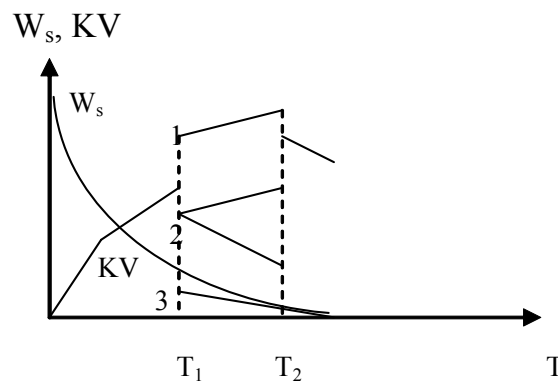


Let's admit that health reserve is higher than qualification reserve for the same income level. Both functions grow at decelerating speed, but beginning from some value of national/per capita income Y^* qualification reserve grows more greatly than health reserve, and then this growth at Y_{max} stops at all. From moment Y^* qualification becomes more significant. Its further

growth, which can be connected with technological breakthrough, can provide the movement of curve W_{s1} to position W_{s2} , thereby, health reserve for the given income level will increase. Affixment of health reserve function and qualification affixment to income level allows to formulate the problem of rupture finding between two functions and optimum distribution of investments between preservation, restoration or increase of health reserve, or advanced training and capital supplies augmentation. In short, human capital augmentation by means of training and advanced training is accompanied by its obsolescence, real physical deterioration expressed in deterioration of health reserve and working capacity and productivity decrease.

It is possible to present the change of qualification function according to the development periods of the agent. Then at moment T_1 due to study courses and advanced training this function is shifted to position 1 (Figure 8), but the disqualification situation is possible, for example owing to illness (curve 3 - a part of function W_s) which can be described by curve 2 going downwards (degradation), or upwards (partial restoration of qualification). Age reduction of qualification will be observed since age moment T_2 .

Figure 8. Change of the Qualification Function



Thus, economic agent's dysfunction (DF_A) is, in essence, a set of health (D_{W_s}) and qualifications (D_{KV}) dysfunctions. Qualification dysfunction is a disqualification which is expressed in the loss of necessary knowledge, or inability to apply this knowledge at the agent's disposal. It is possible to present the dysfunction itself according to each component through the functions of health and qualification reserve. Certain parts of these functions will correspond to dysfunction. Then we will write down:

$$DF_A = D_{W_s} + D_{KV}$$

Then macroeconomic policy should proceed from the necessity of this function minimization, or it is required to set the task in other way, to present well-being function (SFW) in the form of the sum of functions of health reserve (W_s) and skill level (KV). And the problem of global maximum search for the whole system will be formulated. However, nobody prevents to preserve this formulation for microeconomic level:

$$DF_A \rightarrow \min, \quad SFW(t) = W_s(t) + KV(t) \rightarrow \max$$

Function of dysfunction symbolizes a minimum of losses while achieving concrete maximum, as there can be several movement trajectories as well as maxima (a maximum for each trajectory). Probably, it would be necessary to build empirically each function, taking into account agents' age structure of economic system, as this structure will influence the type of corresponding functions greatly. As it has been shown on the theoretical graphs, functions can have a broken appearance because they have their own elasticity (Ibid.) for the given time periods.

Different qualifications and specialists number of each qualification have its importance in economy regarding their contribution to the rate of economic growth and to the increment in

the national income. The problem of definition and forecast of economy's qualifying matrix according to the contribution of each professional group in the development, therefore, makes sense. In such statement of a question the given problem, having been solved, will allow to operate educational system as well as labour markets and the development in general.

Prosperity of the agent is made up of health reserve and accumulated qualification (Ibid.). Actually, it is possible to present it as the sum of two functions: $B_i(t) = W_{si}(t) + KV_i(t)$. The available resources, projected institutions, accumulated physical reserve of capital (dwelling, infrastructure, working areas/capacities, etc.) serve these base functions and provide, or do not provide, their increment.

The so-called qualifying approach can be applied to educational system estimation. In this case mathematical model describes the skill level dynamics:

$$\frac{\partial k}{\partial t} = f(k) + Z(t), k(t=0) = k_0$$

where:

$k(t)$ – specialist's qualification or educational capital (competence) accumulated as a result of training;

k_0 - qualification before training, at a certain initial time period;

$Z(t)$ - function of educational system expenses.

The solution of this differential equation² depends on function selection $f(k)$, and on the assumptions defining a material's digestion in the course of training, use of the given qualification in the economy, etc. It is important to take into account how accumulated experience defines the dynamics of qualification when training has been finished for a long time. The same refers to labour market condition and economy as a whole which can or cannot claim specialists of this or that level. In other words, competences cannot find practical application and approbation.

With accumulation of operational experience the qualification of trained specialists should grow, instead of decrease or being stable. With modern competition it actually means qualification decrease. It is an optimum variant. In other words, educational system should provide further development of specialists with the qualification increment if it is effective.

Reduction of health reserve or as we sometimes say, "nation's health" decrease, as a macroeconomic indicator affects the possibility of knowledge production and skill level which goes down. As a result, productivity, technological level of production is reduced. The quality of life also decreases.

On the assumption of the facts stated, we will present the functions of health and qualification reserve in the analytical form in conformity with the graphic dependences given above. Then, it is possible to write down:

$$W_s = a_1 - a_2 e^{-\beta_1 y}, \quad KV = b_1 - b_2 e^{-\beta_2 y}$$

Having differentiated it according to the level of per capita income, we will receive:

$$\frac{\partial W_s}{\partial y} = c_1 e^{-\beta_1 y}, \quad \frac{\partial (KV)}{\partial y} = c_2 e^{-\beta_2 y}$$

² The solution of the similar differential equation with different restrictions for higher school is given by S.P.Kapitsa, S.P.Kurdjumov and G.G.Malinetsky in the paper «Synergetics and future forecasts». - M.: URSS, 2001. - p. 144-154. In my opinion, these solutions can be interpreted only as approximate as, first, they do not take into account institutional quality and the effects connected with it, secondly, they depend on the selection of the specified function, thirdly, they, for example, assume "lifeless" assumptions, such as: constant intensity of expenses function, linearity of function $f(k)$, heavy use of specialist leads to his disqualification, instead of increase of skills and accumulation of larger experience, etc.

It is possible to present the dependence of the function of health reserve and skill level in the following two ways:

$$W_s = a - be^{-\alpha KV}, \quad \frac{\partial KV}{\partial t} = AKV_0 e^{\mu W_{sw}}$$

Then:

$$\frac{\partial W_s}{\partial t} = c_3 e^{-\alpha KV}; \quad \frac{\partial W_s}{\partial t} = \frac{\partial W_s}{\partial t} \frac{\partial y}{\partial y} = \frac{\partial W_s}{\partial y} \frac{\partial y}{\partial t} = c_1 e^{-\beta_1 y} \frac{\partial y}{\partial t},$$

from which it follows, that

$$\frac{\partial y}{\partial t} = c_4 e^{\beta_1 y - \alpha KV}$$

Having expressed qualification function, we will receive:

$$KV = \frac{\beta_1}{\alpha} y - \frac{1}{\alpha} \ln \left[\frac{1}{c_4} \frac{\partial y}{\partial t} \right]$$

Having substituted this expression in the function of health reserve, we will receive:

$$W_s = a - \frac{b}{c_4} \frac{\partial y}{\partial t} e^{-(1+\beta_1 y)}$$

Thus, the solution, as well as the type of functions of qualification and health reserve will depend on dynamics representation of y-gross product (per capita). A different way is to set the function of qualification and the intensity of educational system expenses, that is, to use the equation type as:

$$\frac{\partial KV}{\partial t} = f(KV) + Z(t), \quad KV(t=0) = KV_0$$

Having accepted $f(KV) = \phi KV$ ($\phi < 0$ - indicator characterizing knowledge perception, that is, efficiency of digestion (speed) of knowledge) and $Z(t) = Z_0$, we will receive:

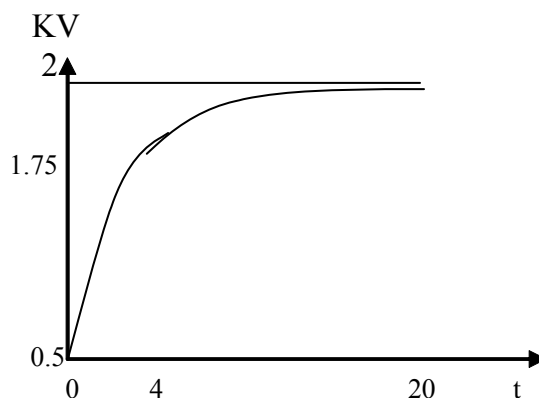
$$\frac{\partial KV}{\partial t} = \phi KV + Z_0$$

The solution of the given equation in a general form is the expression:

$$KV(t) = -\frac{Z_0}{\phi} + \left(KV_0 + \frac{Z_0}{\phi} \right) e^{\phi t}$$

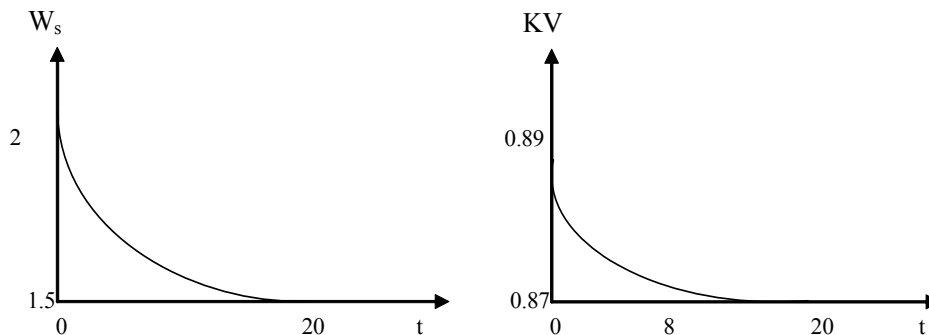
Having accepted $KV_0=0,5$, $Z_0=1$, $\phi =-0,5$ we will receive: $KV(t) = 2 - 1,5 e^{-0,5 t}$. The graph will reflect qualification increase depending on time (Figure 9).

Figure 9. Change of Qualification Function



If we accept $KV = a - b e^{-\alpha W_s}$ and $W_s = b_1 + b_2 e^{-\beta t}$ and having accepted $a=1, b=0,2, \alpha=0,3, \beta=0,5, b_1=1,5, b_2=0,5$, we will receive $W_s=1,5+0,5 e^{-0,5 t}$. And then graphs for function of health reserve and qualification will have the form they are shown in Figure 10.

Figure 10. Change of the Function of Health and Qualification Reserve



As it is seen from Figure 10, decrease of health reserve can, though slightly, lower the possibilities of advanced training at the used values. Qualification function decreases the same way as the function of health reserve. Such change differs from the model presented above where a certain constant intensity of expenses for education Z_0 was set.

Thus, at macroeconomic models formation it is necessary to consider the action of various factors and interconnection of various systems. Otherwise the result will actually be set by the type of mathematical function, or limited by the conditions of functioning of a considered subsystem, educational system in this case. However, with reference to systems where the health of population is extremely low, or the population in general starves, no import of education can cardinaly change the situation till function of health reserve will allow doing it. Naturally, it is necessary to consider the function of advanced training. In other words, it is necessary to invest in economy so that final products and consumption refer to two sectors, providing health and education, the output in which would have application within the limits of concrete national system. Only thus it will be possible to break off a vicious circle of poverty or backwardness of any stability. To lift upwards the decreasing curve of health reserve and to extend it to the right so, that its crossing with x-axis would occur as late as possible is an absolutely rational aim. Agents wish to live as long as possible and to retain labour activity or vital activity. Such purpose is righteous from the point of view of "the social state" and corresponds to economic policy, and together with the necessity of education and qualification extension, it can be reached. Thus, qualifying level increase will act as one of the tools of its achievement and health improvement will simultaneously provide motivation for training.

Introducing the share of investments directed to health and education d_1 and d_2 accordingly, and the share of savings from wages and profit s_1 and s_2 accordingly, having accepted, that investments into economic system can be reduced to two components, to investments into education (knowledge, technology) and to public health services (it is possible to consider investments into capital funds as new technological possibility and as a kind of knowledge), it is possible to receive the following simple macroeconomic model of system. For this purpose we will write down:

$I(t) = \alpha(t) S(t)$ - investments in general case are not equal to savings;

$Y = S + C, Y = w + p$ - income will be presented as the sum of savings (S) and consumption (C), because revenue earned is used for consumption or it is saved. It can also be presented as the wages sum (w) and profits (p);

$I = d_1 w + d_2 p = d_1 w + d_2 (Y - w) = w(d_1 - d_2) + d_2 Y.$

$\alpha(t) S(t) = w(d_1 - d_2) + d_2 Y,$

$\alpha(s_1 w + s_2 p) = w(d_1 - d_2) + d_2 Y.$

Having substituted $p = Y - w$ and having expressed Y , we will receive:

$$Y(t) = w(t) \frac{(d1 - d2) - \alpha(t)(s1 - s2)}{\alpha(t)s2 - d2}.$$

On the assumption of received above expressions, we have:

$$y = c_4 \int_{t1}^{t2} e^{\beta_1 y - \alpha K V} dt$$

Having expressed $y(t)$ through wage and parameters of investment and savings processes, it is possible to solve the reduced equation in relation to qualification function, having the dependence on wages and given institutional parameters of “investment-savings” process in macroeconomic. In a generalized form the training effectiveness can be estimated by means of knowledge comparison – competences before and after training. Then it is possible to judge how effective/ineffective the methods and ways of training were. Efficiency presupposes the criterion for estimation, taking into account the purposes of system’s development, set of alternatives (trajectories) of development and decision-making within the limits of the system, restrictions and stability range and system’s viability. Training effectiveness can be estimated by the relation of the sum of grades after and before training $R = \Sigma R_p / \Sigma R_d$. Or, proceeding from the competences calculation method, it is possible to present indicators of the general effectiveness of educational system as follows:

$$R = \frac{r_{ip}}{r_{id}},$$

$$R_{\Sigma} = \frac{\sum_{j=1}^n a_j r_{jp}}{\sum_{j=1}^n a_j r_{jd}},$$

where:

R, R_{Σ} - indicators of general efficiency from separate competence training and the whole set of competences training accordingly;

r_{jp} - estimation after training, or “ideal” competence level according to each j -competence;

r_{jd} - estimation before training, or competence level after training (if there is the “ideal” value in the numerator);

a_j - specific weight of j -competence in the model according to the number of competences - n .

The skill level is defined by the agent’s competence in this or that professional questions, in the solution of this or that problems. Therefore, qualification is defined through competences. Advanced training and competence reproduction are a product (task) of educational system. In turn, advanced training leads to agent’s competitiveness growth in the labour market. Hence, proceeding from the experience and empirical data, it is possible to introduce flexible standards of skill level according to the requirements of the labour market and competences and to use the suggested instrument for estimation of education quality change. The need of personnel for required qualification is formed by the economic system, and educational system should satisfy this need taking into account the state component, because the government can order educational system specialists of other qualification, than it is required on the labour market.

If there is a situation of markets failure in the economy, including the labour market, reacting to the situation correspondingly, the educational system is capable to train personnel "failure" in the period ahead, with a certain lag equal to the period of specialist's study and training. The Russian example is a vivid proof of this fact. In 1990s the system of vocational schools did not train specialists of working trades as the markets were contracted; the workers lost their jobs and left the enterprises for trade and small-scale business. As a result they were disqualified. Years later the workers absence is the factor limiting growth in many sectors of Russian economy. Hence, educational system is a special sector of economy which should not react to market fluctuations, and should be guided by the prospect solving the problems of personnel reproduction for the economy. That is, it should be guided by the economy's future and its need in a certain skill level. Another danger is that the estimation of this future can be overestimated and the personnel so well prepared will simply be not absorbed by the economy. For example, the level of competence and knowledge will not correspond to the available fund or laboratory base. And then the best workers, scientists, engineers will search for jobs in corresponding conditions. Thus, educational system can work for specialist training for other economic systems. In Russia all recent years the percentage of entrants the specialities connected with foreign languages studies is extremely high. And the share of girls is very high. The life style created in the country focuses them on the search of husband-foreigner or work abroad. The result is a great demand for the specified specialities in high schools. Beauty, appearance, intelligence and love are the objects of purchase and sale. Russian educational system as though indulges it. Arranged study courses, exchange of experience, trips on interuniversity exchange only promote stuff leak. Elementary analysis connected with the estimation of those who passes such training and then leaves Russia for abroad, whether to get married or to work, is not conducted. Although, it is the simplest qualitative comparison. If Russian labour markets and life style cannot place such specialists in a job in the country, it means, that economic policy should change the situation, either for the account of creation of corresponding conditions in the economy, or for the account of introduction of certain standards which would allow educational system getting resources from such sale of experts. Will it work free!? Thus, the policy within the limits of a concrete subsystem of the economy can essentially raise its efficiency and keep this parametre within the necessary framework. Institutional and administrative decisions play an important role here.

4. Social value of innovative activity

Economic agent has the image of either "innovator" or "conservative", or combines these two images depending on the circumstances. Economic model change of agent's behavior is, first of all, the psychological change occurring due to the individual perception of current social and economic parametres, significant for him and defining his decision. Besides, the agent can be genetically predisposed to such transformations. Besides the specified factors regulating the number of "innovators" and "conservatives" in the economy, unpredictable shifts in the institutional structure and economic policy actions influence this process greatly. It is because the monetary component becomes defining at innovation realization and organizational form of financing influences its efficiency. In essence, efficiency of contracting concerning financing pre-determines further allocative and then adaptive efficiency.

In macroeconomic meaning innovation can be subdivided according to the elements of national wealth. The question is how to attach innovations to these elements. That is, some innovations raise the efficiency of use of natural resources; others raise physical and human capital accordingly. Ultimately, innovation can raise not only efficiency of these national wealth use, but also provide their increment. Actually, interaction of "innovators" and "conservatives" ensures this process. Hence, macroeconomic efficiency of each type of innovations can be defined as reciprocal to the relation of full expenses for the given innovations type to the increment of corresponding national wealth element. And one and the same innovation can contribute to the increment on each element of national wealth. However, probably, it is possible to single out the basic contribution of this or that innovation to a concrete element of national wealth. If summarily the

element of national wealth is reduced, then it will be introduced into the form for efficiency calculation as signed minus and the efficiency of the given innovations type will be negative. Though individually, from the point of view of the means of production owner or proprietor, or firm's manager, the specific innovation can benefit and be quite profitable. This situation confirms our axiom formulated above, that efficiency of system's separate elements or even all the elements of the system does not mean that the system is effective. Mathematically the expression will be:

$$E_{I,II,\dots,N} = 1 : \frac{Z_j}{\Delta\Psi_j},$$

where:

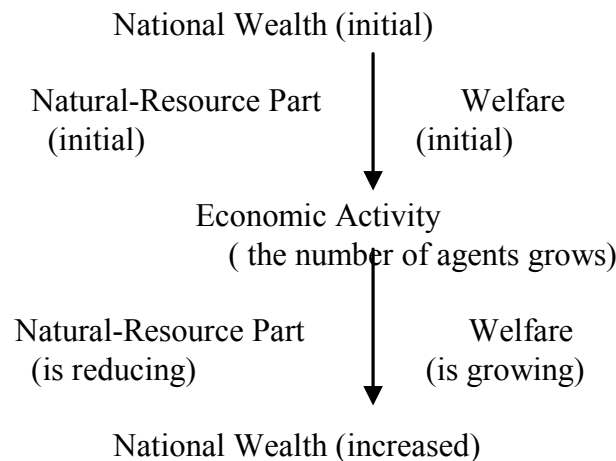
$E_{I,II,\dots,N}$ - innovation efficiency I, II, ... N - type according to N - elements of national wealth;

Z_j - full expenses for realized innovations of j-type, for the moment of time T;

$\Delta\Psi_j$ - increment of the element of national wealth (physical, natural, human, information, technological, institutional, etc.).

National wealth can be subdivided into two components – natural resources and welfare which is measured by the value of the created income, productivity, technologies (innovations) and other parametres. Then it is possible to present economic development process by elementary scheme.

Figure 11. Modern Economic Development (Logical Diagram)



As it is seen from Figure 11, economic activity, including innovations, is reduced, in essence, to population growth, to increase of the agents' number. The saved initial welfare and natural resources are used for this purpose. Thus natural resources are being reduced, and welfare, according to present paradigm of economic growth, should grow to provide at least not a decrease, and as a better variant - increase of social standards for living agents. But welfare growth does not compensate the reduction of natural resources, because here the problem is in the time of estimation. While the resources are rather rich, their reduction is dangerous, but the fear is not felt, as human life is final and not very long, and the resources surpass this duration several times. It is not the fact, that this growth is fair and steady. It does not absolutely mean that it is not carried out for the account of any other economic system and that the product of this growth is distributed to everyone in equal shares according to their contribution. One more question is also interesting: what for is such growth necessary?

All the original wealth, natural resources, is reduced, you know. Thereby the growth of welfare expressed in duplicating food fetishes becomes illusory. In this connection it is possible to set absolutely other goals of the development: economic activity without growth of agents' number (with preservation of simple reproduction of the population) with alignment of access to the provided welfare and social functions with exclusion of reductions of natural resources. In other words, it is necessary to focus all types of innovations on the effective result of natural resources use and create the same organizational and economic conditions for this purpose. Costs of economic growth high rate, burden of this rate are the responsibility of future generations. High rate policy and the desire to catch up somebody is a policy undermining national wealth. Resources should be saved not to create welfare growth of the future generations, but to provide equal access to them. Thus, it is necessary to raise innovations efficiency saving and accumulating natural resources (a part of national wealth), and the efficiency of institutions responsible for distribution of both the created current product, and the elements of national wealth. From these positions, such institutions already represent in themselves the element of national wealth as they can make economic activity more effective.

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