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Modeling the Management of the Economies of Developing Countries†

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Abstract: In the present, the issues of algorithmization of the tasks of sustainable development of the economies of developing countries of the world are considered. The final result of the work is represented by a system of models for analyzing the development of the country's economy and the development of the well-being of its population, which is compared with FAO models to ensure the productive security of the countries of the world proposed by the UN World Bank, as well as the OECD management criteria system. The basis for constructing the proposed system of models was actually the achieved level of human capital development. As a result, a new base has been created for assessing the contribution of the country's scientific and technological potential to the development of the productive power of labor, which is determined by the difference between labor productivity by income and labor productivity by the total labor input. And the total financial and economic capacity of a country is measured by the product of the number of man-hours spent in a calendar year by the achieved level of growth of the productive power of labor in the country's economy.

Keywords: potential, productivity, strength, labor, income, FAO , model, technology.

1. A NEW ECO-ECONOMIC SYSTEM OF COMMODITY-MONEY MANAGEMENT

Strategic planning for the development of market forces for developing countries relies on the old interpretation of the Direct Costing system. [1] Thus, the process of determining net present value (NPV) is based on the Direct Costing system, which was designated for accounting direct production expenditure by American Scholar D. Harris. According to this system, direct production expenditure is divided into two parts: that which is fixed and that which is variable. [2]

In Kazakhstan, with the help of the system developed here fixed expenditure includes expenses related to administrative and management activities aimed at the sale of output products. Here, market research, commercial and general-administrative expenses are

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included. The variable expenditure includes expenses related to changes in the output volume of production: materials, energy and fuel, salaries for employees and engineers.

As a result, the sum of direct and fixed costs represents the prime operating costs of the output. The amount of prime operating costs and depreciation of fixed assets of the enterprise, including taxes, determine the total key cost of production. As a result, the cash flow in terms of enterprise development years is calculated according to the formula:

$$NPV = REV - (OPER + \sum TAX + \sum CR), \quad (1)$$

where REV stands for the revenue from the sale of commodity ore in the reference year; $OPER$ the operating costs (filled by the prime cost) in the reference year; $\sum TAX$ the tax paid in the reference year; and $\sum CR$ the credit repayment in the reference year (including the interest on credit).

Hence, the net present value - $NPVO_{(i)}$ - is calculated according to the next formula:

$$NPVO_{(i)} = \frac{NPV_{(i)}}{(1+II_1)*(1+II_2)*(1+II_3)*\ldots*(1+II_{н+1})}, \quad (2)$$

where $NPV_{(i)}$ stands for the cash flow of the reporting year i in million dollars, II_i the inflation index of year i in %.

Finally, the present value, considering the discount coefficient, is calculated according to the formula:

$$NPV_{(i)} = NPVO_1 \cdot (1+r)^1 + NPVO_2 \cdot (1+r)^2 + \cdots + NPVO_n \cdot (1+r)^n, \quad (3)$$

where r is the discount rate (money devaluation rate), indices 1, 2, 3, ..., n the discount intervals: years, quarters, months, days.

In real-life applications, accounting and analysis based on the Direct Costing system revealed great opportunities to set tight connections between production volumes, gross and net profits, prime costs and gross revenues. They allowed practical use in the works of mathematical economists, production function methods, econometrics and regression analysis.

However, any initiative becomes “a dead dogma”, if it does not continuously develop and does not find new arguments for the development of its viability. This point of view, focused on the continuous development of human capital, objectively determines the strict correspondence of the methods of market relations management with the level of development of labor and capital productive forces in the market-oriented economy of any country in the world. Hence, in determining the break-even point of development according to the Direct Costing system, variable costs include salaries for workers and engineers, and fixed costs include salary costs for personnel employed in marketing, general and administrative divisions of an enterprise. It means that this system, which was developed in the 1940s under the conditions of tough competition between the economies of the Soviet Union and other developed countries of the world, did not take into account the development of human capital. Such theoretical deficit hampers opportunities for the development of the working man himself, his creative, scientific and technological potential: the rich grow richer, the poor become poorer.

In general, the Direct Costing system specifically limits the creative initiatives of employees' participation in the production of goods and services. It determines employment,

income and pricing indicators by including in the fixed and variable costs of production, the remunerations of people employed by an enterprise in the economy. However, the main drawback of this system is that it contradicts the macroeconomic approach of the quantitative theory of money, which describes the development of the market forces of the modern world economy and the globalization. That is, there is an objective need for us to develop management methods appropriate for the ecological and economic systems of developing countries of the world. Such methods need to be adequate for the current level of forces underneath the productivity development. They need to ensure a mutual correspondence between monetarism macroeconomic indicators and the microeconomic indicators that measure the use efficiency of the local ecological and economic resources.

In addition, the research results of the post-Harris period, especially those related to the development of input-output tables by L. Kantorovich and T. Ch. Koopmans, Nobel laureates in 1975 [3], as well as the fundamental work of Michael Porter "Competition" in 2001 [4], allow for consistency and assess the competitiveness of firms and enterprises on the productivity of local environmental and economic resources. Both these works are unidirectional, are consistent with Milton Friedman's [5] quantitative theory of money, and ensure that microeconomic indicators are comparable with macroeconomic ones. Additionally, more related works should be added. For example, U. Nordhaus and P. Romer, who made a step back towards accounting of the use effectiveness of local ecological and economic resources, initiate an evaluation of scientific achievements[6]‡.

In recent years, thanks to the initiatives of Astana Economic Forum, large-scale global researches have been carried out in Kazakhstan. Among them, the works of S. Baizakov, Ye. Utembayev, N. Akimov, N. Sagadiyev, M. Amrenov, and K. Berentayev [7] are considered important. These works are supported and responded by analysts from the developed Western countries.

Ragnar Bentzel was right in his presentation of the works of Kantorovich and Koopmans, as a representative of the Royal Swedish Academy of Sciences, by noting the obvious that "the main economic problems can be studied in a purely scientific sense, regardless of the political organization of the society in which they are studied" [3].

In general, new horizons are opened up for the development of the scientific and technological bases that will be useful for recording and analyzing production, employment, incomes and prices. Therefore, the time is ripe for us to overcome the shortcomings of the Direct-Costing system in terms of the development of human capital and the initiative of the busiest person in the economy. To this end, firstly, it is necessary to ensure that the methods developed for managing the evolution of human capital, as a key component within the advance of the productive forces of developing countries of the world, are in line with the conditions for the development of human capital in the developed countries.

Secondly, it is recommended that in any strategic perspective the objectives of an operational planning are consistent with the long-term, sustainable development goals. Thirdly, there is a need to identify key operators that allow the integration of commodity and financial markets through the evolutionary development of Keynesian and monetarist theories. And fourthly, there is a need for a new multiplier developed for scientific and technological progress so that capital development models in their commodity and monetary forms can be integrated into the system of market relations.

‡ The Swedish Academy, in its message on the laureates, explains that U. Nordhaus and P. Romer created economic models which explain how the merket economy interacts with nature and knowledge. Thus, P. Romer in his works showed how knowledge could serve as an engine for long-term economic growth. While the works of U. Nordhaus describe the interaction between society and nature.

2. SETTING THE TASK OF DIGITIZATION OF SUSTAINABLE DEVELOPMENT GOALS AND THE MAIN OPERATORS OF THE ALGORITHM FOR ITS IMPLEMENTATION

At the last Astana Forum (Astana, June 2017), President of the state N.A. Nazarbayev stated "the need for new methods for calculating indicators that measure the country's wealth and the well-being of citizens, as the frequently used indicator of GDP has a number of significant flaws. GDP does not reflect the long-term nature of economic activity, does not take into account damage to the environment, including the depletion of natural resources. In addition, it does not reflect the quality of life in a particular country, GDP per capita does not show the real well-being of citizens, does not consider the income stratification of the population. What I say is, the world community can adopt an updated methodology for calculating GDP on the basis of "green" GDP and such indices as the human development index, the OECD Better Life Index. It should adequately reflect the need for a balanced development of countries" [8]. Back in 2009, the President of the state wrote about this in the articles "Keys to the Crisis" and "The Fifth Way" [9-10], and in his address to the people of Kazakhstan in 2018, he indicated specific ways to implement his project on a new model of economic growth [11].

Algorithmizing the task of sustainable development of developing countries at the Economic Research Institute is carried out by a limited number of operators. It allows policy makers to effectively manage the mutually agreed movements of indicators of economic and financial markets up to the implementation of their goals.

Setting up the task of achieving the goals of sustainable development and the operator tool for its algorithmization are aimed at implementing a transfer of national moneys of developing countries to their dollar equivalents. It uses, on a parity basis, the whole arsenal of analysis and forecasting methodology developed by international organizations, such as UN and OECD. Such a formulation of the task and the chosen tool for its implementation, according to the developers, proceeds from the objective need of ensuring parity of the national moneys of developing countries with the national currencies of developed countries that effectively interact with the world reserve currency, represented by the U.S. dollar.

The main tool chosen for solving this problem allows developing countries to ensure the commensurability of their moneys with their dollar equivalents. This warrants the alignment of the development methodology of the managerial economics of all countries in the world. That is, each country on a parity basis can use innovative technologies proposed by international organizations and other tools for the effective and sustainable management of its national economies and finances. At the same time, a condition is created for the mutual coordination of the economic interests of local populations, businesses and regions of each country based on the development of human capital and effective use of local ecological and economic resources. In such a case, high rates of economic growth and intended goals of increasing the well-being of citizens are ensured in the most efficient way.

3.KEY OPERATORS THAT INTEGRATE PRODUCT AND FINANCIAL MARKETS THROUGH DEVELOPING THEORIES OF KEYNESIANISM AND MONETARISM

Our proposed operators are based on the qualitative theory of money developed by S. Baizakov [12]. This theory was built by the evolutionary development of economic laws, identified by supporters of the macroeconomic theory of J. Keynes [13] and the quantity theory of money of M. Friedman [5]. And the corresponding system of models of the qualitative theory of money

is built on the basis of the conceptual idea of the President of Kazakhstan N.A. Nazarbayev, set out in "The Fifth Way"[10].

The algorithm for solving the problem of the sustainable economic development of developing countries ensures the commensurability of national moneys of developing countries with those of developed countries by establishing their true dollar equivalences. This algorithm consists of the following operators, accompanied by the functions they perform in accordance with their economic purposes.

The microeconomic operator for determining the multiplier of the productivity of resource costs at the enterprise level is

$$\mu = NGDP/QP, \tag{4}$$

where $NGDP$ is nominal GDP, QP the local ecological and economic resources consumed for the production of nominal GDP.

The macroeconomic operator for determining the multiplier of scientific and technological progress at the country level is

$$c = \mu/(1 + \mu). \tag{5}$$

The macroeconomic operator for determining the GDP deflator (inflation multiplier) is pb. According to the monetary policy methodology,

$$pb = NGDP/RGDP, \tag{6}$$

where $RGDP$ is real GDP determined by the same monetarism methodology.

The microeconomic operator for determining the value multiplier of the U.S. dollar (pp) as a reserve currency is

$$pp = c/pb. \tag{7}$$

The macroeconomic operator for determining the purchasing power of the national money, which is expressed as a multiplier of the dollar equivalent of the aggregate of the true prices of goods and services of the developing country is

$$pc = 1/pp. \tag{8}$$

The inter-sectoral operator for determining the true price of each product or service in a developing country is given by calculating the savings in working time, determined by the labor equivalent t_i, the direct costs of local ecological and economic resources for producing a product i, and labor equivalents T_j, and total production costs of the same product.

The macroeconomic operator for determining the goods and services actually consumed in a developing country for consumption and accumulation in physical units is calculated on the dollar equivalent of their money

$$FGDP = c \times RGDP, \tag{9}$$

where according to the current monetarism model $RGDP = NGDP/pb$.

The macroeconomic operator for determining the goods and services actually consumed in a developing countries for consumption and accumulation is calculated in national money in their dollar equivalent

$$FGDP = pp \times NGDP, \tag{10}$$

where according to the current model of monetarism $NGDP = \frac{1}{pp} \times M$, the mass of national money in circulation.

4. SYSTEM OF OPERATORS OF DEVELOPING COUNTRIES AS A TOOL FOR FURTHER LIBERALIZATION OF THE WORLD ECONOMY

Based on the above system of operators, a developing country can fully establish the dollar equivalent of its money. As a result, it can apply the existing international experience and positive practices of other countries on a par with the developed countries in managing its economy. Moreover, to analyze and forecast the development of any developing country, such international organizations as the UN and the OECD countries can use analogues to assess key indicators determined by the multipliers of scientific and technological progress and the productivity of local ecological and economic resources.

Thus, the first operator for determining the productivity of local ecological and economic resources was used by representatives of the UN's World Bank and consultants working in Kazakhstan through the TACIS of the Economic Commission for Europe in 1999-2004. The Ginsim models (United Kingdom) for analyzing the economics of enterprises were particularly valuable in Kazakhstan [14]. The results of these works were published in Kazakhstan in 2002 under the scientific editorship of S. Baizakov, and are used in the practical work of the Economic Research Institute [15]. According to the results of research presented by Kateryna Schroeder (World Bank), the World Bank is still currently using the multiplier of the productivity of local ecological and economic resources. So, according to K. Schroeder, this multiplier is developed in its original form by assessing the effectiveness of domestic spending on the resources of developing countries in Central Asia when exporting agricultural products to China (DRC) [16]:

$$DRC_{ij} = \frac{c_{ij}^{d}}{\left(p_{ij} - c_{ij}^{f}\right)}, \tag{11}$$

where c_{ij}^{d} and c_{ij}^{f} represent, respectively, the domestic and foreign costs of input products "i" in the country.

In the case of export of meat, for example, from the countries of Central Asia to a specific country (China), if the multiplier $DRC_{ij} < 1$, this exporting country "i" has a "comparative advantage" in the production of good "j" compared to China; that is, its good (meat) costs less than the same good in China (in the production of one dollar). Accordingly, the smaller the indicator DRC_{ij} in Central Asian countries, the greater the comparative advantage of these countries will be.

As can be seen, the constant for evaluating the efficiency of exports of developed countries is the dollar, not the dollar equivalent of the national moneys of developing countries. In the economies of developing countries, not all goods and services aim at fulfilling the purpose of export. And, not all of their goods consumed domestically are imported from other countries. For example, the entire consumption fund and gross accumulation of these countries turn around by means of national moneys, which are the same goods as other goods – in our case, the tenge (not an international reserve currency) is itself a commodity. This means that national moneys of developing countries become lightly liquid commodities and determine the value of the nominal volume of production of the final product. This nominal volume is the nominal gross domestic product (NGDP) in the current prices of national money, determined in terms of the dollar.

At the same time, its physical volume, that is, the real volume of the final product, called the real gross domestic product (RGDP), is determined by means of the GDP deflator (inflation). According to the common practice of the world, in analyzing the development of economies of developing countries, World Bank experts use this indicator of real GDP (RGDP). However, real GDP (RGDP) is not able to assess continuously the productivity of

local ecological and economic resources used to produce the nominal GDP (NGDP). Without such an assessment, as shown by the multiplier of K. Schroeder, a representative of the World Bank, it is not possible to determine the effectiveness or impact of any innovative solution.

So, the reciprocal of the multiplier of K. Schroeder, represents the value (productivity) of a country's local ecological and economic resources used to produce one-dollar equivalent of this commodity ($1/DRC_{ij}$):

$$1/DRC_{ij} = \frac{(p_{ij}-c_{ij}^{f})}{(c_{ij}^{d})} = \frac{p_{ij}}{c_{ij}^{d}} - \frac{c_{ij}^{f}}{c_{ij}^{d}}. \quad (12)$$

This indicator $1/DRC_{ij}$ is in fact an indicator "μ" – that is, an indicator of the productivity of ecological and economic resources in the regions of this country. For this reason, it suffices, for example, to replace in the last multiplier $c_{ij}^{f}\ to\ c_{ij}^{d}$. As a result of this replacement, we get an analogue of the multiplier "μ" for any country in the world that can be employed to conduct a comparative assessment of the effectiveness of its exports:

$$\mu = \frac{(p_{ij}-c_{ij}^{f})}{(c_{ij}^{d})} = \frac{p_{ij}-c_{ij}^{d}}{c_{ij}^{d}}. \quad (13)$$

The above model of the multiplier of the UN representative K. Schroeder is a very valuable tool for analysis, as it expresses the production and economic relationship between producers of goods and ecological and economic factors of its production. The most important thing about it is that it reflects the relationship between microeconomic indicators and macroeconomic indicators. Moreover, this model has been used in assessing the comparative advantages of more than 30 commodity positions of enterprises in Kazakhstan. This work had been done by a group of Kazakhstan experts under the methodological guidance of European expert Jean Michel, now an employee of the World Bank of the UN. The results of this work are also presented in the book [14, p. 41-78].

Along with J. Michel, the methodological basis of S. Baizakov's model can be seen in the Ginsim model (UK), the software product of which was developed by the Maxwel Stamp company [ibid., p. 111-144]. In particular, the nominal rate of protection (NRP), determined by using both the Schroeder multiplier and the Ginsim project model, shows how much the price of local goods (Pd) increases compared to the world price (Pw) for the same product due to establishing custom duties [ibid, p. 133]:

$$NRP = [(Pd - Pw)/Pw] \times 100. \quad (14)$$

Despite the possibility of integrating microeconomic indicators with macroeconomic ones, individual representatives of the World Bank, when analyzing the sustainability of transition countries, limit themselves to assessing fluctuations of real GDP without considering studies, in particular, K. Schroeder's work on the cost intensity of the obtained final product or the productivity of ecological and economic resources. To this end, in Table 1, the analysis of Kazakhstan's data was conducted by non-authors of the article Having cited this table, the authors refer to the work of the Representative of the World Bank in Kazakhstan, who studied the state of Kazakhstan's economy in 2016. Footnote to Table 1 indicates this source.

Table 1. Contribution to real GDP growth, 2013-2016 (in percentage points, unless otherwise indicated)

	2013	**2014**	**2015**	**2016 estimate**
Real GDP growth (in percent)	**6.0**	**4.2**	**1.2**	**1.0**
Domestic demand	6.9	3.8	2.7	1.3
Private consumption	5.1	0.7	1.0	-0.3
Public consumption	0.2	1.0	0.3	0.3
Gross capital formation	1.6	2.1	1.5	1.3
Net export	-1.0	0.1	-1.2	-0.2
Exports of goods and services	1.1	-1.1	-1.2	-1.0
Imports of goods and services	-2.1	1.1	0.0	0.8
Statistical discrepancy	0.1	0.3	-0.3	-0.1

Source: World Bank calculations based on the data published by the Committee on Statistics (Some figures may not be accurate due to rounding)

Table 1 reflects only the abstract contribution of all participants, first of all, the real and monetary and financial sectors of the economy of Kazakhstan, without detailing the contribution of each of them. That is, there is a need for such details on the basis of identifying the causes. According to W. Leibniz, whose name was used in the name of the famous institute of Hannover, "Reality can be understood for its reasons". Therefore, the establishment of causes will be the basis for making new managerial decisions that improve the health of the economy.

The second operator, according to S. Baizakov, seems to be a multiplier of scientific and technological progress. It is essentially macroeconomic; and by its nature, scientific and technological progress is the main engine of innovation in managing not only the development of the real and monetary and financial sectors, but also in the managerial economic sector [17].

In the Western economic literature, the STP multiplier is known by the name of "TFP" only as an indicator of the level of technological progress. According to K. Marx, "the first most important of the innate properties of matter is motion, not only as a mechanical and mathematical motion, but even more as aspiration, life spirit, tension or, using the expression of Jacob Boehme, suffering [Qual] of matter" [18].

The driving force – the vital spirit of an economy – is any desire of the three afore-mentioned sectors of the economy. It is called scientific and technological progress. However, the most commonly used models of econometrics and the concept of production functions do not fully reflect the scientific and technological progress (STP). Such progress is scientific and technological because technology is being improved not only in the real sector of economy, but also in all three managerial sectors: real, financial and managerial.

A piece of research work is considered fruitful only if all three sectors As the ten-year work of the Astana Economic Forum (AEF) showed, such is, for example, the concept of the "Fifth Way" of the President of Kazakhstan N. A. Nazarbayev [9-10], which, by the level of debatability, relates to world problems.

To assess the applicability of this concept of a three-economy, you can refer to the work of the Frenchman Lionel Guy Stoléru, which serves as its counterpart and is connected with a specific example of cars, where the market value of the car production increases 90 times, the price of one car increases 3 times, and the overall index prices increased 5 times. Then the final results of the three prices differ so much that one cannot ignore these differences and not recognize their objectivity[19]:

1. the growth index of the nominal value of products - $i_1 = \frac{p_{jt}q_{jt}}{p_{j0}q_{j0}} = 90$;

2. product growth index in physical terms - $i_2 = \frac{p_{j0}q_{jt}}{p_{j0}q_{j0}} = \frac{q_{jt}}{q_{j0}} = \frac{90}{3} = 30$;
3. price increase index in constant French francs at relative value:

$$i_3 = \frac{\pi_{jt}q_{jt}}{\pi_{j0}q_{j0}} = 30 * \frac{3}{5} = 18,$$

where p_{jt} and q_{jt} accordingly, the price and quantity of goods j during the period t, and J - all the many benefits, the dynamics of which are studied in time 0 before t. π_{jt} good j - relative price.

Indeed, L. Stoléru is right, it would be a gross mistake to measure and assess the level of "real" growth on the basis of two, nominal and real growth indices. It is the third index of balanced economic growth, which expresses the inter-branch nature of the sphere of production, and is the carrier of feedback between the sectors of the real economy.

Thanks to the third index of assessing the real value of goods and services, it will be possible to assess the gaps in the development of the real and financial sectors of the national economy. In fact, this third index is the main key to relieve economic and financial shocks.

The book by P. Sraffi "Production of goods through goods" (1999) also explored the triple connection between individual product prices and market prices for goods and services. To explore the relationship between the two, Sraffa introduces a new measure of the value "standard output" and "standard product" [20].

Thus, taking the produced annual cumulative product for a standard equal to one, it determines the share of wages in the value of the "standard output":

$$C+V+M=1. \quad (15)$$

And, having accepted the produced national income as a standard product equal to one, he studies in it the ratio of wages and profits:

$$V+M=1. \quad (16)$$

The first of these expresses the basis of the cost method, defined by the labor theory of value (X = C + V + M), and the second, the income method, determined by the quantity theory of money (Y = V + M). The cost method, except for wages (V) and profits (M), takes into account the total costs of labor, representing the real costs of production (C). Another standard in his theory is determined by equality according to work:

$$La + Lb + ... + Lk = 1, \quad (17)$$

where La, Lb, ..., Lk - the annual amount of labor, respectively, employed in industries producing products A, B, ..., K

Important is the result of the work of Sraffa in determining the productivity of intermediate consumption goods by dividing the annual income generated (Y = V + M) by the total labor input used for its production (X = C + V + M).

In this context, Alisher Tleubayev, a doctoral candidate at the Leibniz Institute of Agricultural Development in Transition Economies (Germany), presented the denominator of the TFP model, not in the former two-factor form of the production function, but in a qualitatively new form, namely in the form of the STP multiplier [21]:

$$TFP = \frac{Y}{A(t) \times K^{\alpha} \times L^{\beta} \times M^{\gamma}}. \quad (18)$$

This multiplier of technological progress (in his other article, jointly with I. Bobojonov, one of the leaders of the Leibniz Institute [21]), in fact, is the multiplier of scientific and technological progress, given in the second operator of the qualitative theory of money of S. Baizakov.

Now, the multiplier of scientific and technological progress, which is supported by such an authoritative institute named after W. Leibniz (represented as the TFP model in terms of the interpretation of Tleubayev-Bobojonov), confirms the emergence of S. Baizakov's new qualitative theory of money. In fact, this new qualitative theory of money has been developed through the evolutionary development of the quantitative theory of money of M. Friedman, that is, by complementing it instead of denying it. Thus, in calculations and theoretical studies of Bobojonov and Tleubayev, the numerator of the TFP technological progress indicator is expressed by the "Y" indicator, which is the nominal GDP of the second Baizakov operator ($Y = NGDP$), and the denominator of the TFP indicator is determined not by two, but by a three-factor production function in the approach of Bobojonov-Tleubayev. In this case, the information base for the forecast of the TFP indicator itself is the dynamics of the relationship of the final product Y to the total cost of ecological and economic resources X, and the integrator of three factors (L-labor, K-capital and M- current cost of local ecological and economic resources).

In general, the TFP technological progress indicator can be predicted based on the release of the system of national accounts. Respectively, parameters α, β and γ represent the elasticities of the above three factors. Thus, the Bobojonov-Tleubayev's model can be used in predicting the system of the UN sustainable development goals [21]. The advantage of their model is that technological progress is expressed by the production attitude not of two factors, but of three factors: labor, capital and natural matter. Due to the lack of such a three-factor approach, which is systemic, Kazakhstan and other developing countries suffer a shortage of analytical and forecasting tools for long-term forecasting.

As far as short-term forecasting is concerned, Kazakhstan's interpretation of the multipliers of scientific and technological progress was previously described in the article by Baizakov and others (2014) [22]. Unlike the multiplier TFP, by Baizakov and others forecast model (2014) is designed for short-term planning of up to three-five years. And it is implemented according to the reported data of the statistical authorities of each country. Therefore, for the model of forecasting the economic performance for the long-term perspective up to 2025–2050, it is proposed, mainly, to be based on the dynamics of the STP multiplier and other related progress multipliers.

In general, this Baizakov's and others forecast model, as well as S. Baizakov's multiplier of scientific and technological progress, are being developed in the name of the Bobojonov-Tleubayev's (Germany) long-term model and other models of developed countries and international organizations such as the human development index and OECD indicators.

5. STP MULTIPLIER: THE KEY TO INTEGRATE DEVELOPMENT PATTERNS OF CAPITAL IN THEIR COMMODITY AND MONETARY FORMS INTO A SYSTEM OF MARKET RELATIONS

As is known, according the definition of the value of a dollar using a macroeconomic textbook (reprinted in Russia more than 13 times), "value of money is the amount of goods and services that can be exchanged per unit of money (dollar); and the purchasing power of a monetary unit is the reciprocal of the price level" [21]. This means that the purchasing power of the US dollar (pp), as the price of a reserve currency is determined by the formula:

$$pp = \frac{c}{pb}, \tag{19}$$

where pb is the growth rate of the GDP deflator, c is the growth rate of the multiplier of scientific and technological progress.

This relation shows that the growth rate of the GDP deflator is decomposed into two indicators:

$$pb = \frac{c}{pp} = c \times pc, \tag{20}$$

which implies

$$pc = \frac{1}{pp}, \tag{21}$$

where pc is the true price of a national money in circulation, the market price of which is determined in the currency market of the country (*M*).

But how is the supply of money in circulation determined? According to the basic economic law of the quantity theory of money, the following equality takes place:

$$v = NGDP/M, \tag{22}$$

where v is the velocity of money circulation.

According to this theory, not only the cost of nominal GDP (NGDP) is circulated, but also the cost of the volume of total costs for its production (X):

$$v_x = X/M, \tag{23}$$

where v_x is the velocity of money circulation. That is, we have [21]:

$$v = \frac{NGDP}{M} = \frac{\mu}{1+\mu} \times \frac{X}{M} = c \times v_{\text{x}}, \tag{24}$$

where $\mu/(1+\mu) = c$ is the multiplier of scientific and technological progress, and v_{x} is the multiplier of the total costs of producing the nominal GDP.

Since $v = c \times v_{\text{x}}$, the money supply M is determined by the formula:

$$NGDP = (c^{*}v_{\text{x}}) \times M, \tag{25}$$

where $pc = 1/pp = (c \times v_{\text{x}})$ is the true price of deficiency of the dollar equivalent of a national money, as a liquid commodity, in relation to reserve currencies.

That is, in the case of Kazakhstan, the policy of the National Bank should not focus on inflation targeting, but on reducing the deficit of the supply of money in circulation. It is this multiplier "$c^{*}v_{\text{x}}$" that should become a guideline for setting the discount rates of the Central Banks of developing countries around the world.

As a result, the nominal GDP in the current national money will grow indefinitely, and the national money itself will depreciate indefinitely. This conclusion in relation to Kazakhstan, as an intensively developing country, with the intention to enter the 30 best economic performing countries in the world, according to its economic development, makes it possible to argue that the current focus on the nominal GDP indicator is necessary but not sufficient. And, therefore, relying directly on the real GDP indicator obtained from the nominal one distorts the true rates of economic growth.

The World Bank report (2017) mentions that the development of the political system of Kazakhstan indicates the transfer of activity on economic policy management from the Administration of President to the structures of the Government and Parliament and the expansion of powers of local executive bodies. Kazakhstan has announced an increase in the competitiveness of its economy – Modernization 3.0 – and the implementation of five priorities for technical modernization, the business environment, macroeconomic stability, improving the quality of human capital, strengthening security institutions and measures to combat corruption [23].

However, the implementation of the Super-program of Modernization and the five priorities faces an imbalance on the part of the readiness of state (heads of the economic bloc of the government, the National Bank) and market institutions to synchronize their actions with the problem of human capital development. This imbalance has led to a rather unexpected for outsiders' view, but an absolutely adequate response on the part of the authorities to the demands of society, namely focusing on one of the five priorities - the development of human capital. This was announced by the President of the state this year, noting the need to implement the Five Social Presidential Initiatives (mortgage "7-20-25", student housing, etc.) [11].

At the same time, it should be assumed that the potential of these five initiatives will be difficult to assess and maximize in all spheres of the country's activities without an appropriate methodology. Such a methodology should be based both on the existing traditional indicators and on the new three multipliers associated with the implementation of science and technology in the life of every citizen of the country. As a result, they are aimed at improving citizens' well-being by increasing human capital and harmonizing relations in the following three chains: "man-science" (STP/TFP multiplier), "man-man" (multiplier of socio-economic progress), as well as "man-society" (multiplier of socio-political progress).

According to the comparative analysis, the Baizakov's model is not aiming at increasing the money capital, which, unfortunately, is happening now in Kazakhstan. But it is aiming at the development of human capital, which is the most important among all tasks related to the well-being of humanity. It also is confirmed by the UN Human Development Index, and is being transferred to the OECD countries. Therefore, the use of the Baizakov's model means that in developing countries the passion for speculative capital ceases to exist, and it is not the subjective propositions of the quantitative theory of money that is working at present, but the objective laws of the qualitative theory of money.

6. EXPERIMENTAL CALCULATIONS FOR THE ANALYSIS OF THE COMPARATIVE EFFECTIVENESS OF INNOVATIVE PROJECTS

Initial conditions of the comparative analysis. The initial base was the information of the consolidated balance of SSGPO for 2016, as an example for carrying out experimental calculations. It is supplemented with a forecast for 2017 and an expected estimate of data for 2018. For the forecast of the development of SSGPO for 2019–2030, a database of project data for its operational and investment development, exclusively defined in conventional numbers, has been used. Consequently, the analysis presented below has only an experimental character for testing the algorithm for solving the problem according to the model of S. Baizakov [24].

The analysis was carried out by identifying the causes of risks and risk management in the real sector. The level of innovativeness of technology in each version of the real sector is determined by the cost effectiveness of current material resources (which are used to produce the final product). And the function of scientific and technological progress is defined as the result of the productivity of material resources.

Thus, Table 2 shows the calculation scheme for determining the function of scientific and technological progress in one of two options by year of the analytical period, where its last columns express the indicators of the second option for 2018 (idle) and 2028 (forecast) years. According to a given database of design data, the Baizakov's calculation work algorithm is able to assess any prevailing macroeconomic or microeconomic situation.

Table 2. Evaluation of the scientific technological potential of SSGPO

Algorithm	The name of indicators	Unit.	2016 (fact)	2028 (forecast)
NX = NGDP + QP	Scientific and technological potential of SSGPO in value terms	thousand.tg	183 963 219,0	302 054 905,9
μ = NGDP / QP	Productivity of variable costs excluding payroll components	tg/tg	2,85	0,98
c = NGDP / NX = μ/(1+μ)	The multiplier of scientific and technological progress on the productivity of variable costs without wages	tg/tg	0,74	0,49
	Same percentage	%	100,00	66,74
NGDP=μ/(1+μ)* NX	The algorithm for calculating the NTP multiplier: 1% NX provides μ / (1 + μ)% NGDP	thousand.tg	136 140 105,9	149 191 474,1
NX=TW+TR+QP	Total consumption of resources for the production of rational consumption in SSGPO	thousand.tg	183 963 219,0	302 054 905,9
NGDP=TW+TR	NGDP – GVA SSGPO, analogue of the nominal GDP of the country	thousand.tg	136 140 105,9	149 191 474,1
NGDP=μ*QP	NGDP – GVA SSGPO, analogue of the country's nominal GDP	thousand.tg	136 140 105,9	149 191 474,1
NGDP= =μ/(1+μ)*NX	NGDP – GVA SSGPO, analogue of the nominal GDP of the country nominal GDP	thousand.tg	136 140 105,9	149 191 474,1

7. ANALYSIS OF THE INNOVATIVENESS OF PROJECTS (AND OPERATIONAL PLANS) IN THE FINANCIAL SECTOR AND THE ASSESSMENT OF THE COST EFFECTIVENESS OF THEIR IMPLEMENTATION.

The analysis was performed by identifying the causes, as sources of risk and risk management in the financial sector of the economy. The innovativeness of technology in the economy of the financial sector is determined by the productivity of investment costs and the development of human capital (TW) in the form of normal profits (TR).

As you know, the normal profit is determined relative to the wage fund, and it serves as one of the main sources of savings and, consequently, gross accumulation. In a civilized world focused on the development of human capital, the spiritual and creative potential of the person himself, all other conditions being the same, the level of the human development index should constantly increase and, at least, should not decrease

In general, the function of socio-economic progress is defined as the result of the productivity of expenses for normal profit, defined as an indicator of rational savings. Thus, Table 3 shows the calculated scheme for determining the function of socio-economic progress by the years of the analytical period in our conditional example, in SSGPO, where the last

columns express changes in the indicators for 2018-2028 according to the same option 2. Table 3 as table 2 is compiled by method of determining the multiplier S. Baizakov, and the sources of the data used are the same.

Table 3. Assessment of the socio-economic potential of SSGPO

Algorithm	The name of indicators	Unit.	2016 (fact)	2028 (forecast)
η = TW/TR	Productivity of expenses in SSGPO on normal profit in the short-term period	tg/tg	0,39	0,23
q=η/(1+η)	The multiplier of socio-economic potential in SSGPO,	tg/tg	0,28	0,19
q=η/(1+η)	Same percentage	%	100,00	67,33
TW=η/(1+η)*NGDP	Algorithm for calculating the effect of the multiplier of socio-economic potential in SSGPO	thousand .tg	38 044 699,7	28 070 475,5
NGDP/L=φ	Average annual labor productivity per worker in SSGPO	thousand .tg	7 318,9	11 387,7

8. ANALYSIS AND ASSESSMENT OF SOCIO-POLITICAL PROGRESS IN THE DEVELOPMENT OF THE MANAGEMENT ECONOMY SECTOR

The innovation of technology in the economy of the management sector is determined by the product of the multipliers of scientific and technological progress and socio-economic progress (c * q). Innovation in the present means both the innovation itself, the innovation, and the process, that is, the potential capable of introducing, say, the economy of the real, financial and managerial sectors of something new, spiritually enriched with the desire not only of a human entrepreneur, but also as simple worker to progress.

For example, new technology, or new technologies, patent inventions, or ideas for making management decisions in all the above areas of their activities. But as a potential, not every innovation contributes to an increase in the efficiency of production of goods and services, which are currently in demand and are supplied by demand from consumers.

That is, innovation does not necessarily provide a comparative or absolute increase in the efficiency of production of the final results of intellectual activity, its imagination, creative process, discoveries, inventions and rationalization. The fruit of this aspiration of a person of labor and management is the synergistic effect associated with the productivity of the country's local ecological and economic resources and the multiplier of scientific and technological progress, determined on its basis.

But the socio-political progress in the development of the managerial economy sector is connected not only with the harmonization of the development of commodity and financial capital. It is also connected with the development of the main component of the development of the productive forces of the country, the spiritual and material development of its human potential. Such a three-level system means that the corresponding function of socio-political progress is harmonized with the scientific, technological and socio-economic progress. Thus, the following table shows the calculated scheme for determining the function of socio-political progress over the years of the analytical period, and the last columns express the indicators for 2016-1028. Table 4, as tables 3-4 compiled by the algorithm for determining the multiplier S. Baizakov, on the basis of the previous information of option 2.

Table 4. Assessment of the social and political potential of the SSGPO

Algorithm	The name of indicators	Unit.	2016 (fact)	2028 (forecast)

TW/L= *w*	The basic level of the average annual wage per worker in SSGPO	Thousand tenge	2 045,30	2 142,62
NGDP/L=φ	Basic annual average labor productivity per worker in SSGPO.	Thousand tenge	7 318,97	11 387,79
w=μ/(1+μ)*η/(1+η)*ψ	Basic level of average annual wage per one worker at full costs in SSGPO	Thousand tenge	2 045,30	2 142,62
ψ	Basic annual average labor productivity at full cost, per worker in SSGPO	Thousand tenge	9 889,96	23 055,87
c= φ/ ψ=μ/(1+μ)	The basic level of the multiplier NTP and SSGPO	tg/tg	0,74	0,49
	Same percentage	%	100,00	66,74
c*q=μ/(1+μ)*η/(1+η)*	Multiplier of social and political potential in SSGPO	tg/tg	0,21	0,09

Comparative analysis of two project options for innovative development of SSGPO (with all other conditions being the same).

Table 5. Comparative analysis of innovative development projects of SSGPO

Algorithm	**The name of indicators**	**Unit.**	2028 (option 1)	2028(option 2)
NX = NGDP + QP	Scientific and technological potential of SSGPO in value terms	thousand.tg	302 054 905,9	302 054 905,9
μ = NGDP / QP	Productivity of variable costs excluding payroll components	tg/tg	0,98	0,98
c = NGDP / NX = μ/(1+μ)	The multiplier of scientific and technological progress on the productivity of variable costs without wages	tg/tg	0,49	0,49
	Same percentage	%	68,39	66,74
NGDP=μ/(1+μ)* NX	The algorithm for calculating the NTP multiplier: 1% NX provides μ / (1 + μ)% NGDP	thousand.tg	136 140 105,9	149 191 474,1
L	Increase in the number of employed	person	-	-53
ψ=NX/L	Productivity gains at full cost	t/person	-	+95,5
NPV	Gain net present value	thousand.tg		+ 926939.0
NPV	Gain net present value	thousand. dollars		+ 1806.4

As can be seen from the comparative analysis, the Baizakov model is not aimed at increasing the money capital, which, unfortunately, is happening now in Kazakhstan. And on the development of human capital, which is the most important of the tasks of the well-being of humanity, which is confirmed by the UN Human Development Index, and which are being transferred to the OECD countries.

Therefore, the application of the Baizakov model means that in developing countries the passion for speculative capital ceases to exist, and it is not the subjective propositions of the quantitative theory of money that begin to work, but the objective laws of the qualitative theory of money.

In conclusion, it should be noted that the theory of preserving the quality of money without applying the gold standard and in the context of globalization and digitalization is called the qualitative theory of money by analogy to the quantitative theory of money by M. Friedman. The obtained practical results on the qualitative theory of money make it possible to bridge the gaps between:

- micro and macroeconomic indicators;
- the theory of marginal utility and labor theory of value,
- short-term budget management plan and long-term strategic planned management tool;
- tools for assessing the effectiveness of investments in the accounting system of cost accounting of the "direct costing" resources of microeconomics and the productivity of current environmental and economic resources in applied models of trade and investment policy;
- using Cobb-Douglas-type macroeconomic production functions and estimating payback period based on net present value (NPV) at the microeconomic level;
criteria for managing human development in the real and financial sectors of the economy.

9. CONCLUSIONS ON THE QUALITY OF NATIONAL MONEY AND ON THE ASSESSMENT OF THEIR IMPACT ON ECONOMIC GROWTH

1. The proposed methodology for the qualitative theory of money, which further develops the theory of Keynesianism and the quantitative theory of M. Friedman and is successfully applied in the practice of analyzing macroeconomic indicators of production, exchange, distribution and consumption. Hence, the basic equation of a balanced economic growth assessment of the real final product - FGDP fully has the form of a single cube:

$$1*FGDP = pp*NGDP = c*RGDP, \quad (26)$$

where NGDP and RGDP are respectively nominal and real GDP, pp and c are respectively indicators of the quality of national money (NGDP), which are in circulation and real GDP (RGDP). Thus, a comparison of the growth rates of Russia and Kazakhstan with the corresponding indicators of four developed countries of the world is given in Table 6.

Table 6. Dynamics of changes in the parameters of balanced growth and equilibrium in the economy of Russia and Kazakhstan compared to the developed countries of the world in 2010-2015.

	NGDP	RGDP	FGDP	FGDP/ NGDP	FGDP/ RGDP	1*FGDP=0.76*NGDP=1.02*RGDP
Russian	526.9	107	294.5	0.56	2.75	1*294.5=0.56*526.9=2.75*107=**294.5**
Kazakhstan	1572.5	92.7	224.2	0.14	2.42	1*224.2=0.14*1572.5=2.42*92.7=**224.2**
Germany	173.1	160	183	1.06	1.14	1*183=1.06*173.1=1.14*160=**183**
France	179	167	168	0.94	1.01	1*168=0.94*179=1.01*167=**168**
USA	176.2	160	149	0.85	0.93	1*149=0.85*176.2=0.93*160=**149**
Great Britain	175.1	130	133	0.76	1.02	1*133=0.76*175.1=1.02*130= **133**

Source: World Development Bank Database, the analysis was specially conducted over the three five-year plans (2000-2015), on the basis of which, according to the technical task of the project program of the Science Committee of the Republic of Kazakhstan, a forecast for 2020 will be made.

2. Taking into account the coefficients of bringing them into a single standard form of FGDP, these six countries of the world will be ranked in the order indicated in Figure 1.

Russia 2000-2015 (2000=100%) **Kazakhstan 2000-2015 (2000=100%)**

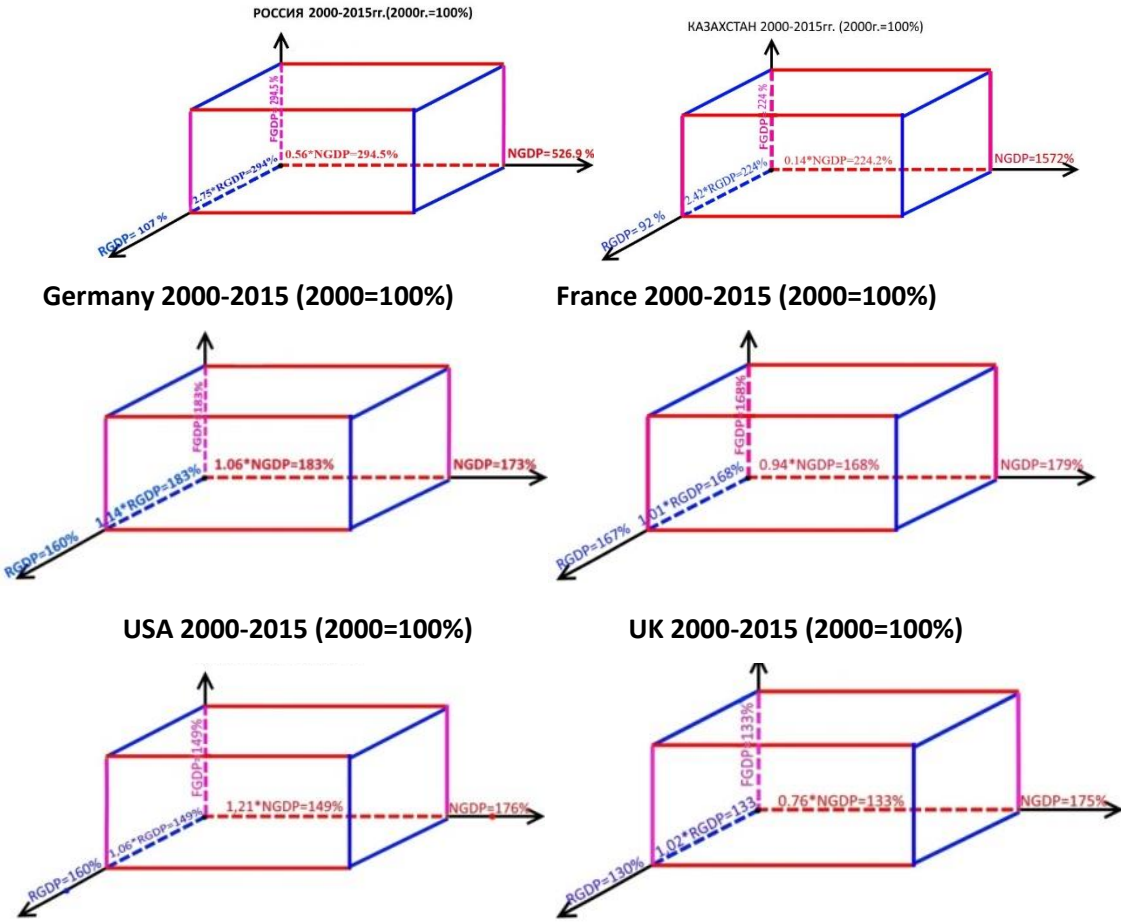

Fig. 1. Rating assessment of the growth rate of the actually used final product (FGDP) in six countries of the world.

3. Based on the calculations made for these six countries of the world, the following conclusions can be made:

3.1. Three-dimensional development figures of six countries of the world are constructed by reducing the three-dimensional measurement parameters to a one-dimensional standard measurement (FGDP). In terms of the growth rate of this key parameter of the economy, over the past five years, Russia (294%), Kazakhstan (224%), Germany (183%), France (168%) ranked second, and the United States (149%) ranked second.), United Kingdom (133%).

3.2. The growth rates of the scientific and technological potential of each country in the world allow deciphering the growth rates of the socio-economic potential in the simplest form, as is the case for calculating TW = q * NGDP. But the actual final consumption product (FTW) created in the country is FTW = c * TW, and the actually created accumulation fund is equal to FTR = c * TR.

3.3. Finally, the final result of the development of the economy of each country in the world is actually created by its socio-political potential, which, thanks to its system of sustainable development models, allows us to build a human development index.

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