UDC 332.1+314.4

T. M. Tikhomirova, A. G. Sukiasyan

MODIFIED ESTIMATES OF HUMAN POTENTIAL IN THE REGIONS OF RUSSIAN FEDERATION TAKING INTO CONSIDERATION THE RISKS OF HEALTH LOSSES AND SOCIAL TENSIONS[1]

This paper discusses the shortcomings of estimates of the level and quality of socio-economic development of the countries and regions of indicators due to excessive aggregation indicators taken into account that reflect various aspects of the social process. A modified human development index is suggested, which allows more clearly distinguish regions on levels and trends of their development, on the basis of a more complete and detailed calculation of different sides of the social process in its composition. With use of this index of cluster analysis a stable classification of regions of the Russian Federation on the characteristics of human development and their changes for 1994-2012 was obtained on the basis of the published official statistics. On the basis of the results were generated homogeneous groups of regions by values of human development index components taken into account and were identified the most important for their development directions of social and economic policy.

Keywords: regional development, human potential, modified index, risks of health losses, social tensions.

One of the principal indicators of socio-economic development of the country, according to many experts, is the human potential. At the same time, in the scientific community there is still no single approach to its measurement, evaluation, although on the official levels for these purposes is generally recommended using the UN technique of Human Development Index (HDI) estimation. This index, calculated for many countries of the world community since 1990, is determined on the basis of such indicators of social development quality as life expectancy at birth, adult literacy, coverage of the population education, GDP per capita [5]. However, in respect of the HDI is expressed quite a lot of critical remarks related mainly to the fact that the components taken into account are too aggregated and therefore are not able to represent differences in the state reflected by them phenomena, especially in the developed countries, where their values have almost reached their limits [16, 17]. For example, in most of them the life expectancy has exceeded 80 years, the literacy rate is close to 100%.

A similar situation occurs when trying to evaluate the differences in the levels of human development based on HDI within the same country. Fig. 1 shows the results of the ranking the administrative subjects of Russian Federation on the level of this indicator for 2010. It follows from this that with the exception of may be the first and last regions (Republic Tyva) the other 70 are virtually indistinguishable.

In this regard, scientific community seeks to improve the HDI [1, 9, 19, 21]. Organization for Economic Cooperation and Development (OECD) to improve the HDI offers to expand the membership of components taken into account in the index. In particular, it is recommended to allocate six areas on the basis of which the appropriate indicators should be calculated: 1) social; 2) environmental sanitation; 3) economic; 4) energy; 5) housing; 6) sustainability. These recommendations are to a certain extent been taken into account in the development of alternative HDI integral indices [7, 10, 18]. Among them can be distinguished the Genuine Progress Indicator (GPI), proposed to account for the economic results of the negative environmental impacts of industrial

[1]

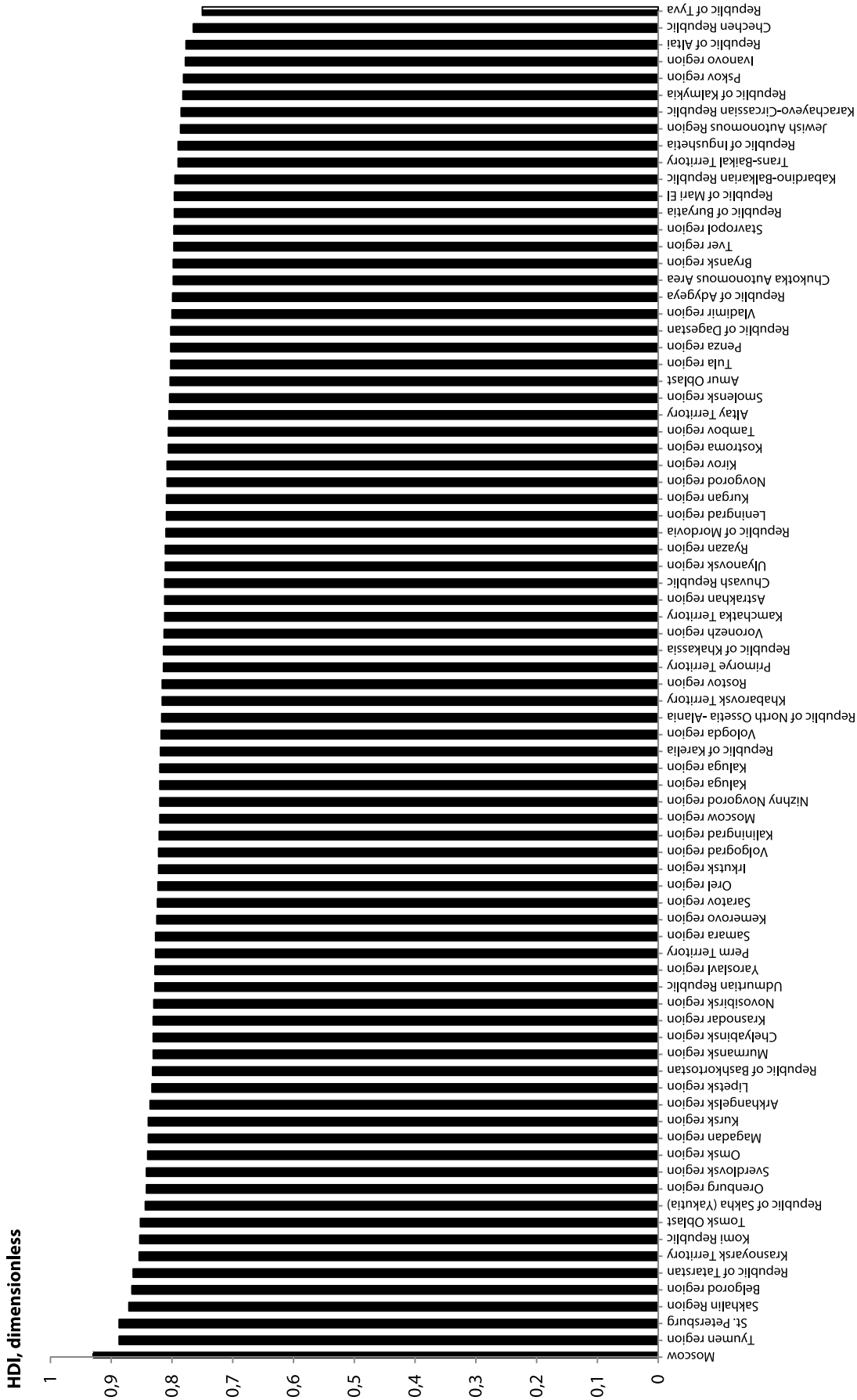

Fig. 1. *Distribution of Russian Federation regions by the HDI rankings calculated by the UN method in 2010*

development and that includes the parameters of the environment.

A number of indexes attempt to take into account in estimates of social development, gender inequality. So, Gender-Related Development Index (GDI) evaluates human potential on the same criteria as the HDI, taking into account differences in its three components for both men and women. Indicator, assessing endowment powers of men and women (Gender Empowerment Measure, GEM), focuses on gender inequality of opportunity. Index is based on indicators of participation in politics, economic activity and statistics of cash incomes of men and women.

The welfare plan of Vanderford Riley (Vanderford-Riley well-being schedule) — indicator of living, is based on the differentiated assessment of various aspects of quality of life. In the U.S., for this purpose, such data as working hours per week, the value of personal property of individuals, the ratio of the number of property owners to non-owners, the ratio of the number of self-employed to the number of employed and the percentage of people able to meet their primary needs.

The Economist Intelligence Unit's quality-of-life index is evaluated on the basis of both objective data from statistical agencies and the results of surveys of the population in terms of its relationship to the various life phenomena in the aggregate for 9 aspects: GDP per capita, life expectancy of newborns, the ratings of political stability and security, the number of divorces per thousand people per year, the activity of communities (religious, commercial and other), mild climate, unemployment indices of political and civil freedom, the ratio of income between men and women. Apparently due to greater differentiation in aspects of social process taken into account in this index, its values in developed countries are characterized by significant differences compared to the HDI as a higher sensitivity to changes in levels of life in general [6].

An attempt to assess the quality of life on the basis of indicators of satisfaction with various aspects was made by L. A. Belyaeva [2]. On the basis of such estimates are put the subjective opinions of society on achieved material standard of living, access to health care, access to education, the social environment, environmental quality, social well-being of the population, etc.

Seems interesting to consider in the value of the index of social development various components of the total social capital. For example, in [3] it is proposed to determine the level of development achieved by countries by consolidation of the estimates of physical, human, social and natural capital. Each of the capitals is represented in the form of a cost. In this case physical capital is measured by GDP, human capital — by the value indicators of fertility, life expectancy, government spending on education and health, suicide; social capital — by the value indicators of unemployment, social stratification (the ratio of income of 10% per cent of the income of the richest citizens to the 10% of the poorest), crime; ecological capital — by the value of the countries' territory, forests and agricultural land, water supplies of fossil fuels (oil, gas, coal) and ores (15 metals). According to available estimates the maximum value physical capital has Luxembourg (on average per capita GDP) and natural — Russia.

Some of the previously discussed indicators since 2010 have been already used by the UN as a supplement to the HDI. In all UN experts have suggested about 50 different indicators for the evaluation of particular aspects of the development rights [20]. However, most of them are poorly adapted to the statistics of particular countries. In particular, it has been estimated that in Russia can be used only a third of them [8]. Even fewer of them takes into account specific regional statistics in individual countries, which complicates the comparison of levels of development of individual regions within a country [4, 10, 11]. Some of the indices used in these indicators into force of excessive aggregation are insensitive to regional specificities. This is largely related to life expectancy, characterizing the "health", and the share of population literacy rate that is used as a measure of their achieved level of education.

Given the diversity, the complexity of the concept of quality of the population, it becomes apparent that its content even at the macro level can not be expressed in one or two indicators such as life expectancy, or the proportion of students and even more so at the meso and micro levels.

In this regard, particular attention should be given to suggestions to improve the content and assessment methods HDI associated with more in-depth detailed elaboration of the individual components, particularly those that express the actual quality of the population. In the work by N.M. Rimashevskaya [15], in particular it is proposed characterize the quality of the population by three components: physical, psychological and social health, that affects not only the physical capacity of citizens, but also on the nature of the processes of demographic reproduction; professional and educational perspective and intellectual potential, including the training of highly qualified specialists engaged in scientific work of

the citizens; social activities of citizens and their social values.

Seem to be interesting the offers of E.V. Kocheva on detailed structure of the indicators of the population quality, adapted to the characteristics of regional statistics Russian Federation [8, 9]. She proposes to establish four units of 18 indicators: demographic characteristics; welfare; education of the population; employment. Notice that each of the units is rigidly attached to the official statistical information which predetermines the possibility of an unambiguous assessment of the whole set of regions of Russia. A certain drawback of this approach is a high correlation between a number of indicators included in various units, which leads during the aggregation to the duplication of information.

In our opinion, an adequate assessment of human potential can be made by taking into account and representation of the most important in its structure spheres of the population dynamics of their development. This will allow not only to compare countries and regions to each other by the reached by their population states, but also by regularities of the variability of these states, which seems essential when assessing the effectiveness and identifying the most effective policies for the human potential development in different territorial formations.

The features of this approach will be demonstrated on the example of a modified human development index, calculated on the basis of Rosstat data for the period 1994 to 2012 [12, 13, 14] and reflecting the changes in the state of basic aspects of social life: economic, education, living standards, demographic, social.

In general, the integral indicator of the human development level of a particular region is calculated as the geometric mean of the aggregated index of the region during the period under:

$$V_i(t) = \sqrt[m]{\prod_{j=1}^{m} V_i^j(t)}, \qquad (1)$$

where $V_i(t)$ — is the evaluation of the level of human development in the i-th region of the Russian Federation; $V_i^j(t)$ — j-th component of the human potential in the i-th region for the year t (dimensionless), $t = 1, \ldots, T$; m — the number of components.

As the components responsible for the economic well-being of the population in the regions of Russia, an adjusted for the cost of living and the core consumer price index value of the average nominal wage per employee for the full range of organizations is used. Their assessment is based on the following ratios:

$$V_i^{ec'}(t) = \frac{X_i^{ec'}(t) - X_{\min}^{ec'}(t)}{X_{\max}^{ec'}(t) - X_{\min}^{ec'}(t)}, \qquad (2)$$

$$X_i^{ec'}(t) = X_i^{ec}(t)\frac{P_i(t)}{P_i(t_0)}, \qquad (3)$$

where $V_i^{ec'}(t)$ — is the economic component in the i-th region in year t (dimensionless); $X_i^{ec'}(t)$ — adjusted for cost of living of the average nominal value of wages per employee for the full range of organizations in the i-th region in year t (Rubles); $X_{\min}^{ec'}(t)$ and $X_{\max}^{ec'}(t)$ — the minimal and maximal values of the adjusted average monthly nominal wage per employee for the full range of organizations, from 1994 to 2012 (Rubles); $X_i^{ec}(t)$ — an average monthly nominal wage per employee for the full range of organizations in the i-th region in year t (Rubles) based on core consumer price index; $P_i(t)$, $P_i(t_0)$ — the cost of the consumer basket in the i-th region in year t and in 2012 respectively (Rubles).

Justification of the choice of adjusted wages as the characteristic of degree of well-being of the population is caused by high correlation of this indicator with other indicators of this process, such as: the volume of paid services to the population, the costs of housing services, the costs of non-food products and others, as well as by the relative simplicity and high reliability of its assessment according to official statistics.

The state of education in every year is estimated at regions on shares of graduates of vocational institutions of primary, secondary and higher education in the total population of the regions according to the following expression:

$$V_i^{ed}(t) = \frac{1}{3}\sum_{l=1}^{3} V_i^{ed^l}(t), \qquad (4)$$

where $V_i^{ed}(t)$ — the education component in the i-th region in year t (dimensionless); $V_i^{ed^l}(t)$ — the proportion of sub-component of the total population completed professional institutions of primary, secondary and tertiary level in the i-th region in year t (dimensionless), $l = 1, \ldots, 3$. Subcomponents $V_i^{ed^l}(t)$ were calculated similar to the expression (2).

The component, reflecting the quality of life in human development index, is represented as consumption characteristics of 9 core products. In our opinion, the level of consumption more adequately reflects the quality of life of the population compared with the indicator of GRP. Its value is determined using the following formula:

$$V_i^{sl}(t) = \frac{1}{9}\sum_{k=1}^{9} V_i^{sl^k}(t), \qquad (5)$$

Table 1

Mortality rates of the Russian Federation population from the main causes of death in the average 1994–2012 per 100,000 people*

Causes of death	The average level		Share in total mortality rate, %		The coefficient of variation by the regions, %
	1994	2012	1994	2012	
Certain infectious and parasitic diseases	19,34	22,42	1,2	1,7	48,3
Neoplasms	209,72	203,02	13,4	15,3	19,5
Diseases of the circulatory system	840,00	737,04	53,5	55,4	27,8
Diseases of digestive organs	44,63	62,09	2,8	4,7	20,3
Respiratory diseases	82,32	49,36	5,2	3,7	30,0
External causes, including	249,70	135,32	15,9	10,2	28,5
Suicides	39,53	20,86	2,5	1,6	44,7
Murders	32,48	10,80	2,1	0,8	58,0
Accidental alcohol poisoning	37,80	10,60	2,4	0,8	58,1
All kinds of traffic accidents	—	21,10	—	1,6	27,5
The others	377,40	460,20	24,0	34,6	22,9
Total	1569,66	1331,12	100	100	20,0

* Compiled by the author using sources [12,13,14].

where $V_i^{sl}(t)$ — is the component of living standards in the *i*-th region in year *t* (dimensionless); $V_i^{sl^k}(t)$ — is the subcomponent consumption *k*-th product in the *i*-th region for the year *t* (dimensionless), namely potatoes, vegetable oil, milk and dairy products, meat and meat products, vegetables and melons, fish and fish products, sugar, fruit and berries, grain products (in kg per year per capita). Each sub-component $V_i^{sl^k}(t)$ in its turn is calculated similar to the expression (2).

Demographic component is defined as the geometric mean of two subcomponents: population health status and fertility:

$$V_i^d(t) = \sqrt{V_i^h(t) V_i^b(t)}, \quad (6)$$

where $V_i^h(t)$ — is the health status subcomponent (dimensionless); $V_i^b(t)$ — the subcomponent of fertility in the i-th region in year t (dimensionless), which is determined according to the expression (2) based on birth rates in the regions of the Russian Federation for a certain period (in %).

The calculation of health status subcomponents in the Russian Federation regions was based on the risk assessments from major causes of death and morbidity risks of the main classes of diseases (infectious and parasitic diseases, neoplasms, diseases of the circulatory system, respiratory diseases and diseases of the digestive organs). Selection of the causes of death and disease classes implemented in terms of the coefficients of variation of mortality and morbidity in regions of Russian Federation, the high values of which indicate the most informative (in terms of regional differences) reasons (see Table 1, 2).

The risks to become ill and to die of the considered causes were evaluated regarding the ratio of the number of cases of diseases and deaths to the total population for each region within a time frame:

$$M_i^j(t) = \frac{d_i^j(t)}{N_i^j(t)}, \quad S_i^j(t) = \frac{g_i^j(t)}{N_i^j(t)}, \quad (9)$$

where $d_i^j(t)$, $g_i^j(t)$ — the number of deaths, diseases from the *j*-th cause in the *i*-th region in the year *t*; $N_i^j(t)$ — the population of the *i*-th region in the year *t*.

To ensure the objectivity in the results of the comparison of the Russian Federation regions through the levels of the risks involved in their existing conditions depending on the age of the population, the measured values of risks were corrected for the average age of the population of regions. For this purpose, the following conversions were used:

$$\tilde{M}_i^j(t) = M_i^j(t) + \beta^j\left(\Delta z_i\right); \tilde{S}_i^j(t) = S_i^j(t) + \gamma^j\left(\Delta z_i\right), \quad (7)$$

where $\tilde{M}_i^j(t)$, $\tilde{S}_i^j(t)$ — are the adjusted for the average age of the population risk to die, get sick from the *j*-th reason in the *i*-th region (per 100,000 people) $\tilde{M}_i^j(t)$, $\tilde{S}_i^j(t)$ — risk to die, get sick from the *j*-th reason in the *i*-th region (per 100,000 people); β^j, γ^j — standardized correction factors for the *j*-th cause; $\Delta z_i(t)$ — deviation of the average age in the *i*-th region of the average level for a certain period, defined as:

$$\Delta z_i(t) = \overline{z}_{RF} - z_i(t), \quad (8)$$

$\overline{z}_{RF}$ — the average age of the population in the regions of the Russian Federation; $z_i(t)$ — the average age of the population in the i-th region.

Correction coefficients β^j, γ^j for the considered causes of death (class of diseases) were obtained from the studies of the results of linear ap-

Table 2

Morbidity rates for major classes of diseases in Russia in the average 1994–2012 per 1000 people*

The classes of diseases	The average level		Share in the general morbidity, %		The coefficient of variation by the regions, %
	1994	2012	1994	2012	
Certain infectious and parasitic diseases	42,50	32,14	6,5	4,0	23,4
Neoplasms	7,77	11,57	1,2	1,5	18,3
Endocrine, nutritional and metabolic disorders	5,03	10,60	0,8	1,3	32,9
Diseases of the nervous system	56,50	16,30	8,6	2,1	22,3
Diseases of the circulatory system	13,69	26,58	2,1	3,3	24,8
Respiratory diseases	283,76	330,89	43,4	41,7	20,6
Diseases of digestive organs	29,25	34,90	4,5	4,4	50,0
Diseases of the skin and subcutaneous tissue	44,72	48,02	6,8	6,0	18,7
Diseases of the musculoskeletal system and connective tissue	27,21	33,19	4,2	4,2	25,2
Diseases of the genitourinary system	26,90	49,60	4,1	6,2	28,2
Injuries, poisoning and certain other consequences of external causes	88,20	93,80	13,5	11,8	21,2

* Compiled by the author using sources [12,13,14].

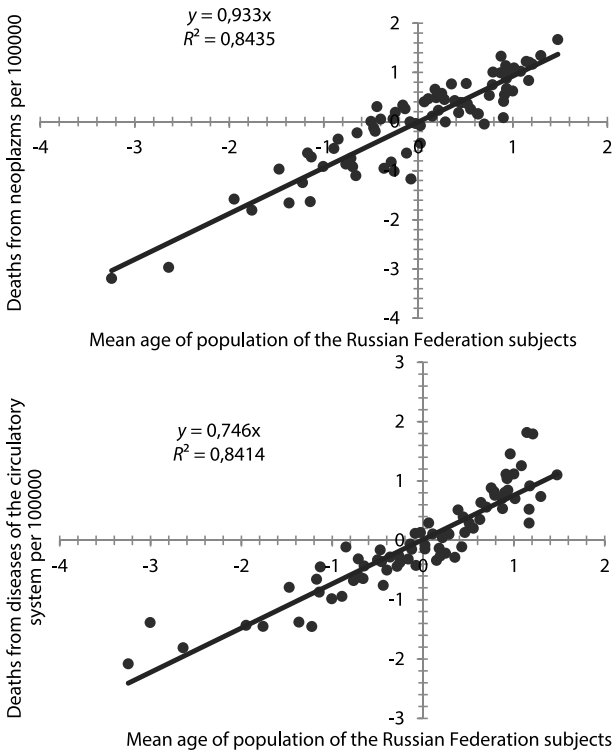

Fig. 2. *Dependences of mortality from all causes on the average age of population in the regions of the Russian Federation for the period 1990 to 2012 (on an example of neoplasms and diseases of the circulatory system)*

proximation of the dependences averaged over the period 1990 to 2012 mortality (morbidity) per 100,000 population from middle-aged by the system of regions of the Russian Federation. Figure 2 shows examples of the dependencies of mortality indicators from certain causes of death on the middle age of population in the regions of the Russian Federation (in the standardized scale).

Correction coefficients β^j, γ^j for the considered causes of death and disease classes are given in Table 3.

In general, the sub-component of health status for each region in a particular year was calculated according to the following expression:

$$V_i^h(t) = 1 - \frac{H_i(t) - H_{\min}(t)}{H_{\max}(t) - H_{\min}(t)}, \qquad (9)$$

where $H_i(t)$ — is an indicator of health status on the j-th class of diseases in the i-th region in year t (dimensionless), $j = 1, \ldots, 5$:

$$H_i(t) = \sum_{j=1}^{5} H_i^j(t); \quad H_i^j(t) = \frac{\tilde{M}_i^j(t)}{\tilde{S}_i^j(t)}, \qquad (10)$$

where $H_i^j(t)$ — the quantities characterizing mortality by primary disease in the i-th region in year t (dimensionless); $H_{\min}(t)$ and $H_{\max}(t)$ — respectively minimal and maximal values of mortality on the considered disease classes in the Russian Federation regions for the period 1994–2012.

Taking into account that the standard of living of population depends also on the security of their life, in the component estimating the social sphere of Russian Federation regions were included indicators that characterize the main risks of social tensions: the risks of crime; morbidity of socially significant diseases such as alcoholism, drug addiction, tuberculosis, HIV infection, etc.; risks of death from unnatural causes (homicide, suicide, alcohol poisoning, etc.) Their levels, adjusted for mean age (Table 3) by region for the period 1994 to 2012 (per 100 000 people), were estimated on the basis of indicators such as the number of deaths from alcohol poisoning, suicide, all kinds of traffic accidents and other social causes

Table 3

Coefficients of dependence of health status indicators on the average age of population in the Russian Federation regions (per 100,000 people)*

Causes	Correction coefficients	
	for risks to die	for risks to become ill
Certain infectious and parasitic diseases	–0,228	–0,507
Neoplasms	0,933	0,378
Diseases of the circulatory system	0,746	0,236
Diseases of digestive organs	0,159	–1,180
Respiratory diseases	0,453	0,167
Contingents of patients with alcoholism and alcoholic psychosis	—	—
Contingents of drug addicts	—	-0,155
Injury, poisoning and certain other consequences of external causes***		—
External causes**, including:	–0,297	
Suicides**	–0,767	
Murders**	–0,035	
Accidental alcohol poisoning**	—	
All kinds of traffic accidents**	—	
The others**	—	
Total	0,943	—

* Compiled by the author: «–» means the absence of dependence on age; ** The reasons are not taken into account for risks to become ill; Classes *** of diseases which are not considered in the risk to die.

(indicator is defined as the difference of the number of deaths from external causes and the number of deaths by cause, left out above); the number of crimes (murder and attempted murder, intentional infliction of grievous bodily harm, rape and attempted rape, robbery, theft, economic crimes, crimes related to drug trafficking); contingents of patients with alcoholism and alcoholic psychosis, drug addiction.

Component, which assesses the state of social life, was calculated as:

$$V_i^s(t) = \frac{1}{k}\sum_{j=1}^{k} V_i^{js}(t), \qquad (11)$$

where $V_i^{js}(t)$ — is the subcomponent of risks of social tensions from the *j*-th reason in the *i*-th region in year *t* (dimensionless); *k* — the number of subcomponents of social tension. Each subcomponent was assessed according to the formula:

$$V_i^{js}(t) = 1 - \frac{X_i^{js}(t) - X_{\min}^{js}(t)}{X_{\max}^{js}(t) - X_{\min}^{js}(t)}, \qquad (12)$$

where $X_i^{js}(t)$ — is the risk of social tensions from the *j*-th reason in the *i*-th region in year *t* (per 100,000 people); $X_{\min}^{js}(t)$ and $X_{\max}^{js}(t)$ — the minimal and maximal values of the of risks of social tensions from the *j*-th reason in the *i*-th region in year *t* (per 100,000 people).

The analysis of the indicators of social tensions in Russia between 1994 and 2012 showed that the largest share in the structure of their risks belonged to risks of crime 49,6–50,3 % (about 1700 cases per 100,000 people) and the incidence of alcoholism and alcoholic psychoses 39,3–43,3 % (about 1300 people per 100,000 population), and the lowest — to risk of all types of traffic accidents — 0,6–0,8 %.

The risk estimates also indicate that, in general in the Russian Federation, as well as in its separate regions, in this period high growth of drug addiction risks were fixed, whose share in the country in 1994 was 0,4 %, and in 2012 increased by 15 times, up to 6 % (~200 cases per 100,000 people). However, this result, in our opinion, can be explained by a more efficient registration of cases in due to the forced diagnostics of this group of patients.

The calculations have also allowed establishing the fact of quite significant differentiation of the Russian Federation regions on the risks of social tension. In particular, the standard deviations in the levels of regional indicators for registered drug addicts was 69,2 %, in mortality from accidental alcohol poisoning — 58,1 %, in the number of murders — 58,0 %, in suicides — 44,7 %, etc.

The greatest risks of social tensions, significantly exceeding the national level, were recorded in the following subjects: the Republics of Altai, Tyva, Samara, Irkutsk, Kemerovo regions, Perm Territory. In these regions, were fixed the maximum by the Russian Federation levels of alcoholism, drug addiction, crime, and the risks of death from all external causes.

Minimal risks of social tensions were observed in the Republics of Kabardino-Balkaria, North Ossetia-Alania, Dagestan and Ingushetia.

All-Russian level of risk of social tension recorded in regions such as Kamchatka, Krasnodar Territories, Nizhny Novgorod, Kostroma, Leningrad, Arkhangelsk, Tver, Pskov, Vologda, Smolensk, Yaroslavl, Kaliningrad regions, the Republic of Bashkortostan.

On the whole for comparison of the Russian Federation regions by the levels and trends of human development for the period from 1994 to 2012 were used generalized characteristics such as the mean value of the modified HDI and its rate of change, which are determined according to the following expressions:

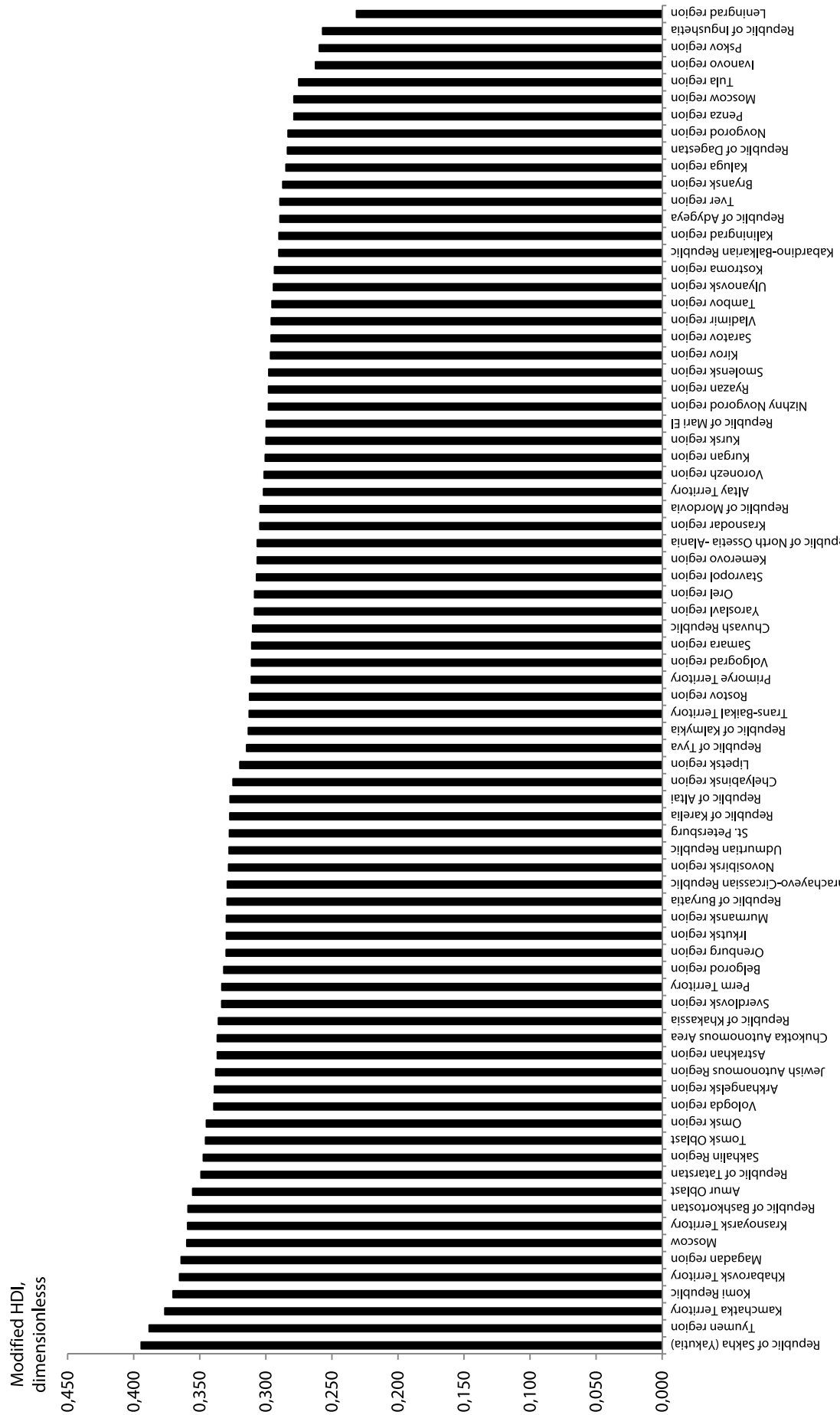

Fig. 3. *Distribution of Russian Federation regions by the modified HDI level, averaged over the period 1994 to 2012*

$$V_i = \frac{1}{T}\sum_{t=1}^{T} V_i(t); \quad (14)$$

$$\lambda_i(V) = \frac{V_i(T) - V_i(1)}{V_i(1)} 100\%, \quad (15)$$

where $V_i(t)$ — modified human development index in region i in year t (dimensionless), $t = 1, \ldots, T$; T — number of years (equal to 18); $V_i(1)$ and $V_i(T)$ — values of modified human development index in region i in 1994 and 2012 respectively; $\lambda_i(V)$ — the growth rate of the modified HDI for T years.

The results of calculations of these indicators are presented in Fig. 3 and 4 as ranked by their values series of regions. These results indicate the presence of significant differentiation of the Russian Federation subjects on the average levels and growth rates of human potential. In particular, the average values of the modified HDI by the groups of regions with high and low levels differ approximately by 1,5 times, and by regions, occupying the first and last positions — by almost 2 times (Fig. 3).

The regions with high levels of human development include the Republic of Sakha (Yakutia), Moscow, Tyumen and Magadan regions, and a number of other regions. In these regions there is the greatest gap between education, economy, health, standard of living, characterized by the highest values, and the minimum risks of social tensions. The lowest level of human development was recorded in the Republic of Ingushetia, Pskov and Leningrad regions, mainly due to a significant lag of educational and demographic components. In regions such as the Republic of Kalmykia, Lipetsk, Samara regions human development level is almost identical to the median value for the Russian Federation.

On rates of growth of the modified HDI the regions of Russian Federation differ the more. Levels of this indicator in groups of regions, occupying the extreme positions in the ranked series of its values (see Fig. 4), differ by more than 3 times. The regions with the highest growth rates of the modified HDI are Moscow and Saint Petersburg, the Republic of Ingushetia, Moscow Region and some other subjects of the Russian Federation. The regions with low levels are Republic of Mordovia, Orel, Tambov regions and some other.

Based on the presented in Fig. 3, 4 distributions it can be concluded that in the Russian Federation regions there is no any significant regularity in the relationships of considered indicators. There are regions with high values of both indicators (Moscow, Magadan regions), with low values (Bryansk, Ulyanovsk region), with the average (Republic of Kalmykia), as well as any other combinations of values. However, provided that there is tendency to levelling the modified HDI in the subjects of the Russian Federation, we would expect that the situation of the regions in the rankings presented in Figures 3 and 4, should be opposed. In other words, regions with a high level of this indicator should have lower growth rates, which is typical of their approach tendencies in the country. However, such regularity in Fig. 3 and 4 is not explicitly visible. This suggests that if the country has any patterns in the distribution of regions on levels and trends of variability of the modified HDI, they are latent.

In such a situation it is advisable for their identification to use more powerful statistical tools. These, in our opinion, should include multidimensional clustering methods that have been applied to identify groups of similar regions of the Russian Federation for the entire aggregate included in the modified HDI characteristics and rates of their variability [19]. The results of the clusterization are presented in Table. 4. The index values and its rate of change in the selected groups of the Russian Federation regions average for the period 1994–2012 are presented in Fig. 5.

The clustering results show that the regions under consideration can be integrated within the three sustained groups with the release of 6 atypical subjects (not included in any of the groups). The greatest number of regions was included in the second group with the average level of human development. In the regions of the first group the HDI components are significantly higher than average values of Russian Federation. The lowest average human development index is recorded in the regions of the third group.

Furthermore regions of the first group are characterized by higher growth rates of the modified HDI compared with the regions of the second and third groups (45,5% against 43,4% and 33,9% respectively). This result is due to a leading growth rate of education component (23,5% against 8,7% and 1,2% respectively), the standard of living (42,3% against 35,5% and 16,6% respectively) and social (11,8% against 10,5% and 5,5%), although growth rates of economic components in regions of the first group are significantly behind (84,4% against 102,8% and 107,8% respectively) (see Table 5).

However, in the regions of the second group demographic component increased with advancing rats. Its rate of growth in the period under review amounted to 69,1% against 61,3% in the first and 51,0% in the third group of regions.

In general, the regions of the first group can be characterized as dynamically developing with

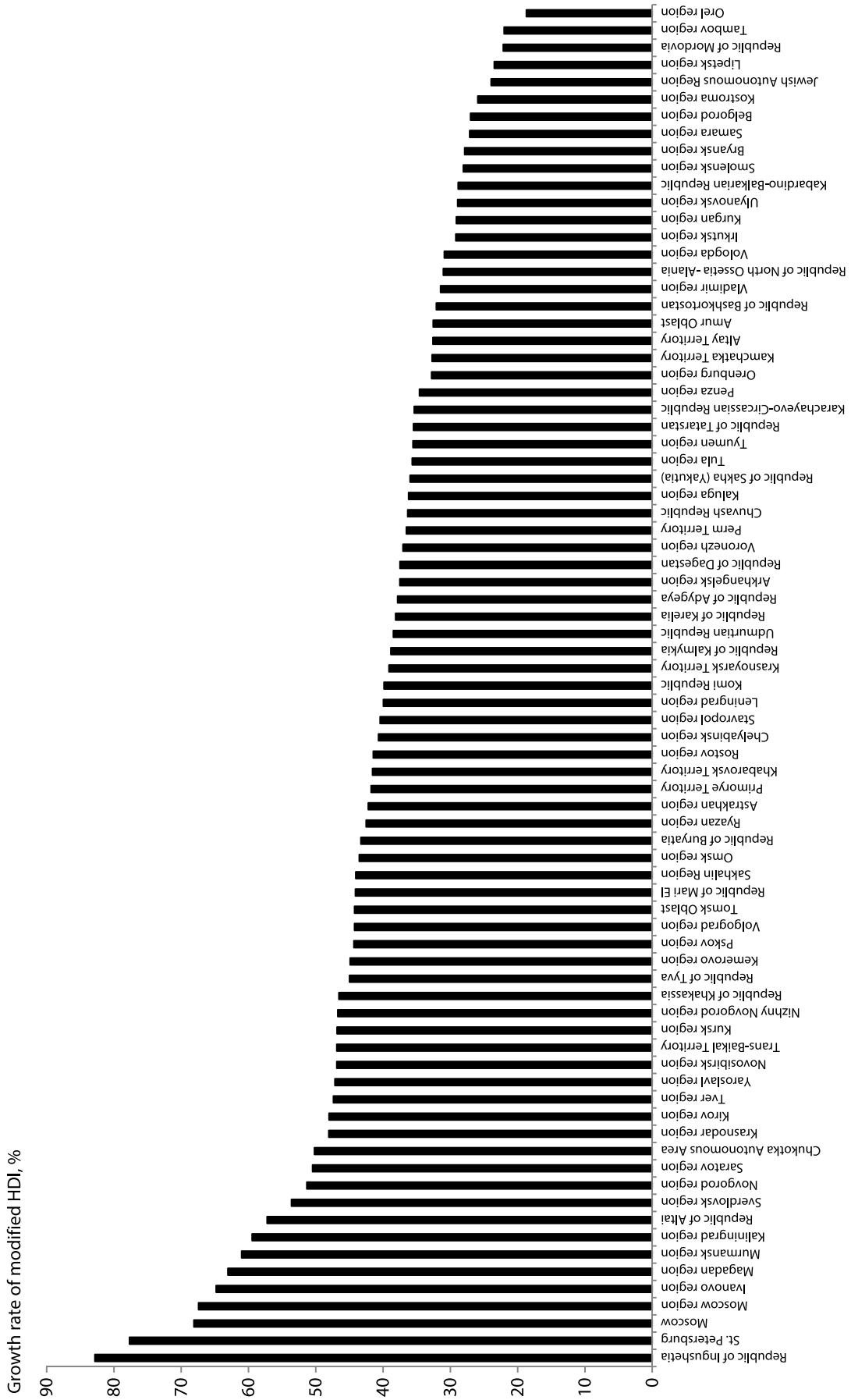

Fig. 4. *Distribution of Russian regions by the change of the modified HDI for the period from 1994 to 2012*

Table 4

The distribution of Russian Federation regions by the modified human development index on average for 1994–2012

Group 1	Chukotka Autonomous Area; Regions: Amur, Arkhangelsk, Astrakhan, Murmansk, Novosibirsk, Omsk, Sakhalin, Sverdlovsk, Tomsk, Tyumen; Republics: Bashkortostan, Buryatia, Komi, Tatarstan, Khakassia; Territories: the Trans-Baikal, Kamchatka, Krasnoyarsk, Khabarovsk
Group 2	Jewish Autonomous Region; Regions: Belgorod, Volgograd, Vologda, Ivanovo, Irkutsk, Kaliningrad, Kemerovo, Kirov, Kursk, Moscow, Nizhny Novgorod, Novgorod, Orenburg, Rostov, Saratov, Tver, Chelyabinsk, Yaroslavl; Republics: Altai, Kalmykia, Karachay-Cherkessia, Karelia, Mari El, Tuva, Udmurtia, Chuvashia; Territories: Krasnodar, Perm, Primorye, Stavropol
Group 3	Regions: Bryansk, Vladimir, Voronezh, Kaluga, Kostroma, Kurgan, Lipetsk, Orel, Penza, Pskov, Ryazan, Samara, Smolensk, Tambov, Tula, Ulyanovsk; Republics: Adygea, Dagestan, Mordovia, North Ossetia-Alania, Kabardino-Balkaria; Territories: Altai
Atypical regions	Moscow, St. Petersburg; Regions: Leningrad, Magadan; Republics: Ingushetia, Sakha (Yakutia)

Table 5

Characteristics of the human development index and its components in groups of the Russian Federation regions for the period 1994–2012

Indicator	1994	2000	2006	2012	Average for the period	Growth rate for the period
Group 1						
Demographic component	0,344	0,343	0,453	0,555	0,423	61,3%
Social component	0,634	0,628	0,587	0,709	0,639	11,8%
Component of the standard of living	0,307	0,321	0,380	0,437	0,357	42,3%
Economic component	0,173	0,132	0,262	0,319	0,212	84,4%
Education component	0,243	0,279	0,366	0,300	0,308	23,5%
HDI	0,297	0,294	0,388	0,432	0,349	45,5%
Group 2						
Demographic component	0,278	0,264	0,360	0,470	0,336	69,1%
Social component	0,673	0,656	0,637	0,744	0,678	10,5%
Component of the standard of living	0,346	0,338	0,408	0,469	0,383	35,5%
Economic component	0,108	0,084	0,181	0,219	0,142	102,8%
Education component	0,241	0,263	0,343	0,262	0,286	8,7%
HDI	0,272	0,260	0,353	0,390	0,314	43,4%
Group 3						
Demographic component	0,288	0,241	0,320	0,435	0,312	51,0%
Social component	0,727	0,697	0,681	0,767	0,717	5,5%
Component of the standard of living	0,379	0,359	0,400	0,442	0,389	16,6%
Economic component	0,090	0,068	0,150	0,187	0,118	107,8%
Education component	0,250	0,248	0,318	0,253	0,273	1,2%
HDI	0,274	0,246	0,330	0,367	0,298	33,9%

high levels of human development. Regions of the second group also achieved significant improvement in all spheres of life, despite the lower levels of HDI. Regions of the third group can be attributed to weakly developing both on values averaged HDI and on rates of its growth.

In atypical regions of the modified index component levels are significantly different from the average for the Russian Federation (see Table 6). Overall, the average level of the HDI, equal to 0,312 (determined from the set of regions of the Russian Federation, excluding atypical subjects) exceeded in four atypical regions — Moscow (~15%) and St. Petersburg (~4%), the Magadan region (~17%) and the Republic of Sakha (Yakutia) (~26%), and was lower than this level in the two regions — the Republic of Ingushetia (~18%) and the Leningrad region (~27%).

However, among these regions the Republic of Ingushetia is the undisputed leader in terms of HDI growth in this period (82.8%). This figure is relatively high and in St. Petersburg (77.7%). The

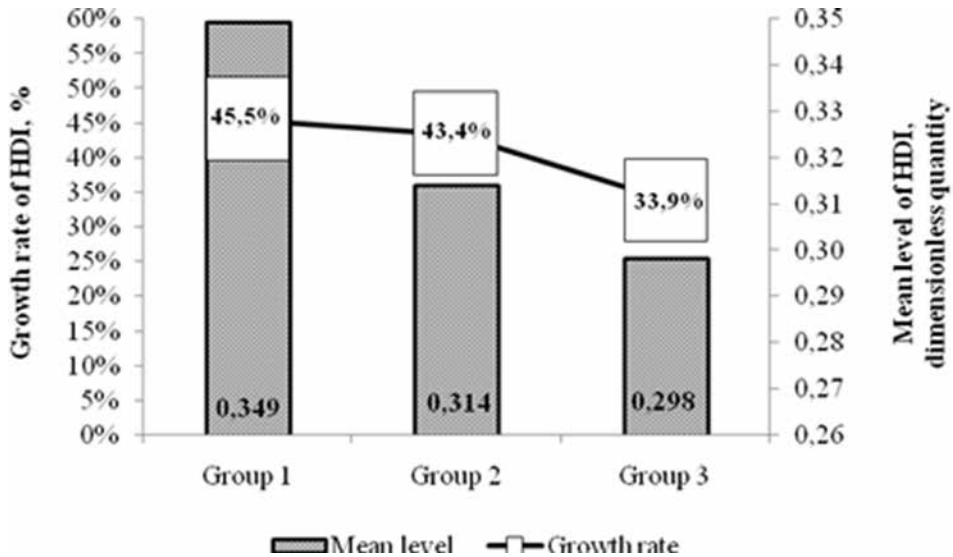

Fig. 5. *Values of the modified human development index and its rates of change in groups of regions on average for 1994–2012*

Table 6

Comparison of the human development index and its components characteristics in atypical regions and the average for the Russian Federation for the period 1994–2012

Demographic component	Russian Federation	Moscow	Magadan region	Republic of Sakha (Yakutia)	St. Petersburg	Republic of Ingushetia	Leningrad region
Growth rate	0,337	0,259	0,348	0,565	0,216	0,723	0,177
	57,3%	118,3%	55,9%	18,0%	148,6%	16,3%	155,4%
Social component							
Growth rate	0,669	0,805	0,595	0,722	0,765	0,958	0,611
	8,7%	10,0%	13,0%	5,3%	24,4%	0,3%	39,8%
Component of the standard of living							
Growth rate	0,369	0,361	0,350	0,366	0,341	0,260	0,391
	26,0%	28,2%	47,5%	28,1%	42,8%	96,8%	15,2%
Economic component							
Growth rate	0,134	0,283	0,337	0,264	0,211	0,083	0,177
	107,9%	214,7%	98,8%	82,9%	162,4%	264,6%	108,8%
Education component							
Growth rate	0,290	0,320	0,277	0,254	0,347	0,091	0,104
	14,6%	38,7%	123,2%	59,8%	24,4%	144,1%	-37,5%
HDI							
Growth rate	0,312	0,360	0,364	0,394	0,324	0,257	0,231
Demographic component	38,9%	68,1%	63,1%	36,0%	77,7%	82,8%	40,0%

level of 60% is exceeded in the Magadan region and the Republic of Sakha (Yakutia). In the other three subjects, this figure does not exceed 40%.

Republic of Ingushetia also leads among those regions by the level of demographic component (0.723), which exceeded the average figure (0,337) more than 2 times. Furthermore the level of this component exceeded more than 1,5 times in the Republic of Sakha (Yakutia) — 0,565. Magadan region is approximately the average level for this component. And the other three subjects are well below it. At the same time in respect of the components in these subjects it can be noted the natural regularity — the higher is its value, the lower is the rate growth (Table 6). So in Republic of Ingushetia demographic growth rate of component characterizing the health and fertility, was 16,3% and in the Leningrad region it exceeded 155,4%.

For other components of this regularity on the concerned subjects is not so clearly evident, with the exception of the Republic of Ingushetia, where their levels, except for the social component, and significantly lower than average indicators and the values achieved in other subjects. However, by the growth rates of these components the Republic of Ingushetia is the undisputed leader. At the same time the level of social component in this republic as well as the level of demographic component is one of the highest in the country at almost zero growth rates of it.

Presented in this paper, the material suggests the following conclusions.

Identifying significant differences in the regional development of the country and, in particular, the level and quality of human potential, suggests the necessity to consider the wider aspects of social process in describing these phenomena indices, as well as indicators of their dynamics. This allows with a greater degree of certainty to evaluate tendencies and regularities associated with deepening or a decrease of differences in regional development, which is an important condition for the justification of regional policy directions on alignment of living conditions in the regions.

An important condition for a reasonable and adequate assessment of the reality of regional development is the ability to provide an objective statistical calculation procedures which characterize its performance, preferably on the basis of official statistics. Improving the quality of the results of the comparative analysis of human development in the regions is also associated with the elimination of the impact on its assessment of certain factors and subjective reasons, and in particular, the average age of the population has a significant impact on economic and social indicators of vital activity in the regions.

In the context of the multiplicity, complexity of human potential index expressed by sufficiently broad set of its components and their rates of change, the differences and similarities of the regions of the country in its level, structure and trends of growth, can be installed and identified on the basis of multivariate statistical analysis, allowing to form homogeneous by the values of these characteristics groups of regions that together at the same time have profound differences.

In general, the proposed approach to the assessment of human potential and the results based on it can be used to identify the most important areas of social-oriented policy providing accelerated development of human potential in various regions of the country.

The article was prepared with the support from the RFH project № 14-02-00437 «The risks of vital activity: assessment and analysis of regional allocations". Research supervisor — Professor T.M. Tikhomirova.

References

1. Akyulov, R. I. (2009). Chelovecheskiye resursy kak kompleksnaya ekonomicheskaya kategoriya [Human Resources as a complex economic category]. *Zhurnal ekonomicheskoy teorii [Journal of Economic Theory],* 4, 7-16.

2. Belyayeva L. A. (2009). Uroven i kachestvo zhizni. Problemy izmereniya i interpretatsii [Level and quality of life. Problems of measurement and interpretation]. *Sotsiologicheskiye issledovaniya [Case Studies],* 1, 33-42.

3. Bushuyev, V. V., Golubev, V. S. & Tarko, A. M. (2010). Natsionalnoye bogatstvo kak potentsial razvitiya i kachestvo zhizni: Mir i Rossiya [National wealth as the potential of development and quality of life: The World and Russia]. *Energeticheskaya politika [Energy Policy],* 1, 29-35.

4. Davankov, A. Yu., Ripka, Ya. V. & Klyuchnikova, V. R. (2014). Metodologicheskiye aspekty planirovaniya regionalnogo sotsio-ekologo-ekonomicheskogo razvitiya [Methodological aspects of the planning of the regional socio-ecological-economic development]. *Vestnik Chelyabinskogo gosudarstvennogo universiteta [Bulletin of Chelyabinsk State University],* 5 (334), 69-73.

5. *Doklad o chelovecheskom razvitii 2011. Ustoychivoye razvitiye i ravenstvo vozmozhnostey: luchsheye budushcheye dlya vsekh: per. s angl. [Human Development Report 2011. Sustainability and Equity: A Better Future for All: translated from English].* Moscow, Ves Mir, 188.

6. Indeks kachestva zhizni po versii Economist Intelligence Unit [Quality of Life Index according to Economist Intelligence Unit]. *Tsentr gumanitarnykh tekhnologiy [Centre for Humanitarian Technologies].* Available at: http://gtmarket.ru/ratings/quality-of-life-index/info (date of access: 06.02.2013).

7. Bobylev, S. N. & Makeyenko, P. N. (Ed.) (2001). *Indikatory ustoychivosti razvitiya Rossii (ekologo-ekonomicheskiye aspekty) [Indicators of Sustainable Development of Russia (environmental and economic aspects)].* Moscow, TSPRP, 220.

8. Kocheva, Ye. V. (2010). Razvitiye chelovecheskogo potentsiala kak obyekt statisticheskogo issledovaniya [Human development as an object of statistical study]. *Vestnik Tikhookeanskogo gosudarstvennogo ekonomicheskogo universiteta [Bulletin of Pacific State University of Economics],* 4, 56, 13-22.

9. Kocheva, Ye. V. & Tupikina, Ye. N. (2010). K voprosu ob otsenke urovnya razvitiya chelovecheskogo potentsiala [On the estimation of the level of human development]. *Vestnik Tikhookeanskogo gosudarstvennogo ekonomicheskogo universiteta [Bulletin of Pacific State University of Economics],* 1, 59-75.

10. Kravchenko, Ye. N. & Sharkevich, I. V. (2013). Novyy podkhod k otsenke razvitiya chelovecheskogo potentsiala v regionakh Rossiyskoy Federatsii [A new approach to the assessment of human development in the regions of the Russian Federation]. *Vestnik Irkutskogo gosudarstvennogo tekhnicheskogo universiteta [Bulletin of of the Irkutsk State Technical University],* 11 (82), 345-351.

11. Kuklin, A. A., Myzin, A. L., Gurban, I. A., Denisova, O. A. & Pykhov, P. A. (2013). *Natsionalnoye bogatstvo regionov Rossii: analiz, problemy i puti resheniya [The national wealth of the regions of Russia: Analysis, Problems and Solutions].* Institut ekonomiki UrO RAN [Institute of Economics RAS], Yekaterinburg, 286.

12. Regiony Rossii. Sotsialno-ekonomicheskiye pokazateli. 2002: Statisticheskiy sbornik [Regions of Russia. Socio-economic indicators. 2002: The Collection of Statistics]. (2002). Moscow, Goskomstat Rossii, 863.

13. Regiony Rossii. Sotsialno-ekonomicheskiye pokazateli. 2007: Statisticheskiy sbornik [Regions of Russia. Socio-economic indicators. 2007: The Collection of Statistics]. (2002). Moscow, Goskomstat Rossii, 991.

14. *Regiony Rossii. Sotsialno-ekonomicheskiye pokazateli. 2013: Statisticheskiy sbornik [Regions of Russia. Socio-economic indicators. 2013: The Collection of Statistics].* (2002). Moscow, Goskomstat Rossii, 990.

15. Rimashevskaya, N. M. (2004) Chelovecheskiy potentsial Rossii i problemy «sberezheniya naseleniya» [Russian Human Potential and Challenges «public savings»]. *Rossiyskiy ekonomicheskiy zhurnal [Russian Economic Journal],* 9-10, 22-40.

16. Tikhomirova, T. M. (2012) *Metody analiza sostoyaniya i poter zdorovya naseleniya v regionakh Rossii: monografiya [Methods of analysis of the status and population losses of health in the Russian regions: monograph].* Moscow, FGBOU VPO «REU im. G. V. Plekhanova», 352.

17. Alkire, S. (2010) *Human development: Definitions, critiques, and related concepts.* UNDP-HDRO Occasional Papers, 54.

18. Anielski, M. & Rowe, J. (1999). *The Genuine Progress Indicator — 1998 Update.* Redefining Progress. San Francisco, CA, 67.

19. Biswas, B. & Caliendo, F. (2002) A multivariate analysis of the human development index. *Indian Economic Journal,* 49, 4, 96-100.

20. Chakravarty, S. R. (2003) A generalized human development index. *Review of development economics,* 7, 1, 99-114.

21. Palazzi, P. & Lauri, A. (2013) The Human Development Index: suggested corrections. *PSL Quarterly Review,* 51, 205, 193-221.

Information about the authors

Tikhomirova Tatiana Mikhailovna (Moscow, Russia) — Doctor of Economics, Professor, Department of Mathematical Methods in Economics, Plekhanov Russian University of Economics (36, Stremyanny per., Moscow, 117997, Russia, e-mail: t_tikhomirova@mail.ru).

Sukiasyan Ani Gagikovna (Moscow, Russia) — Teaching Assistant, Department of Mathematical Methods in Economics, Plekhanov Russian University of Economics (36, Stremyanny per., Moscow, 117997, Russia, e-mail: ani.sukiasyan@bk.ru).