Improving Population's Quality of Life and Regional Development

Lev Solomonovich Mazelis, Konstantin Sergeevich Solodukhin, Alena Sergeevna Stepanova

Abstract*: The authors offer conceptual development model of population's quality of life in the region reflecting interrelations between the public and private investments in improvement of quality of life, quality of life, regional human capital, and social and economic development of the region. The peculiarity of the model is its multiperiodicity, which is used to reflect the influence of certain parameters of the system on other parameters in the dynamic mode. The authors distinguish sets of indicators reflecting population's quality of life, social and economic development of the region, regional human capital, and demography of the region, as well as describe the factors influencing the formation of the quality of life in the region, and the factors, which are influenced by the quality of life. The following channels of influence are defined, namely, the effect of different areas of investments on the indicators of quality of life of the population and the region's human capital; the influence of indicators of population's quality of life on regional human capital; the effect of quality of life on indicators of socio-economic development of the region; and the influence of indicators of quality of life and development of the region on demographic parameters of the region. The cluster analysis of the Russian regions in terms of the quality of life of the population is carried out. In total, 32 indicators reflecting the quality of life over 2011-2017 in 81 regions of Russia were used as a data set, which was processed and analyzed by means of STATISTICA software package. The article presents qualitative description of the constructed clusters, defines their characteristic features and differences. In the future, in order to operationalize the conceptual model, it is necessary to carry out a quantitative description of the channels of influence in the form of econometric models.

Keywords* : *population's quality of life, regional human capital, socio-economic development, investments, conceptual model, clustering of regions.

I. INTRODUCTION

The practice of the leading socially developed countries shows that the stronger the economy is focused on meeting the needs and demands of people, the more powerful their creativity and work motivation is, and therefore, the production develops more dynamically. Thus, the effective functioning and socio-economic development of any economic system will largely be determined by the quality of life of the population. In today's world, quality of life determines not just the standard of living of people but is a multidimensional indicator that reflects all aspects of human life. In this regard, improving the quality of life of the country's population affects the status and trends of the demographic situation, general cultural competences of people, their satisfaction with life, psychological status, prospects for development and quality of human capital, as well as economic and social efficiency. In this crucial aspect, the quality of life should be assessed and regulated at the regional level, since it is exactly the mesolevel where the majority of the most important needs of the population are met [1].

In this regard, it is important to develop a set of interrelated economic and mathematical tools that will allow:

– describing functionally the impact of the quality of life on the level of socio-economic development of the region, demographic parameters of the region, and regional human capital;

– forming an optimal action plan aimed at improving the quality of life of the population and, thereby, the socio-economic development of the region.

II. LITERATURE REVIEW

The quality of life of the population is one of the basic theoretical categories and is a complex system consisting of many elements and relationships between them. The study of quality of life is a research area of specialists of a number of sciences, primarily, such as philosophy, sociology, psychology, pedagogy, economic theory, and management theory. The interdisciplinary nature of the quality of life as a concept and the differences in the purposes of scientific research have given rise to a large number of approaches to the definition of the quality of life of the population, as well as its conceptual models. It may even be impossible to achieve unanimity in the definition of quality of life, since people, as unique biopsychosocial products, as well as the communities to which they belong, perceive and interpret the quality of life through a variety of conceptual filters and languages under the influence of environmental factors and individual value systems [2].

The presence of certain differences in the understanding of the essence of the quality of life of the population is quite naturally extrapolated to the structure (both in quantitative and qualitative aspects) of the classifications of the components of the studied category proposed by various scientists and specialists [3].

Accordingly, there is no uniform methodology and tools to assess the quality of life, both at the regional level and at the country level. Thus, the first step in the formation of a system of interrelated methods and development models of quality of

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life consists in evolving a conceptual model that would allow answering the following questions:

– How to assess the quality of life (particularly, answer the question of what the indicators should be taken into account when calculating the integral indicator)?

– How do public and private investments affect the quality of life?

– How does the quality of life affect human capital?

– How do the quality of life and socio-economic development of the region depend on each other?

In the scientific literature dealing with the study of quality of life, among the large variety of definitions describing this concept, there are two main aspects that characterize the quality of life. On the one hand, it is defined as the conditions of human life, i.e. natural, technical, economic, socio-cultural conditions in which a person lives (an objective component of the quality of life, hereinafter referred to as OC). On the other hand, since the level of satisfaction of one person cannot be considered as independent of the level of another person, there are subjective conditions of quality of life associated with psychosocial processes [4]. In other words, the quality of life is closely intertwined with the manifestation of a person not only as a producer and consumer of various goods, but also as an integral personality, who creates his life and the life of his family, society and the country in general (the subjective component of the quality of life, hereinafter referred to as SC).

In order to be able to assess the quality of life prevailing in society, all its elements must be formulated in the framework of the image of the desired standard of living, which must have a generally accepted basic level of satisfaction of personal and social needs with the possibility of its quantitative assessments [5].

The analysis of insights into the quality of life and its components testifies the existence of three formed methodical approaches to its measurement and an assessment.

A. Objectivistic approach

In the framework of this approach, the quality of life refers to the living conditions in which the individual exists and develops. Assessment of quality of life is based on combinations of various statistical information, depending on the set problems and the scale of research.

One of the most common options to assess the quality of life of the population, partly reflecting the economic and social components of sustainable development, is the definition of the human development index of the UN Development Program [6], which includes five components: human capital index, human development index, gender development index, gender inequality index, and multidimensional poverty index. Relevant research on the development of indicators to assess the quality of life is carried out also in Russia.

In the works of S.A. Ayvazyan [7], quality of life is structured according to five key units, comprehensively describing the "environment and system of life support of the population", namely, the quality of the population, population's welfare, quality of social sector, quality of ecological niche, as well as natural and climatic conditions. Rossoshansky A.I. and E.A. Chekmareva [8] propose to consider the quality of life of the population as a system of the four most common and minimum necessary structural blocks, namely, the health of the population, standard of living, the situation on the labor market, and safety of the life-sustaining activity. The authors also consider it necessary to exclude from consideration a component of the population's quality of life such as education, since the proportion of the population with higher education due to its mass distribution shows little evidence about the quality of life in the region. The authors of [9] evaluated quality of life based on its fundamental aspects, such as the quality of population, the level of welfare of the population, the quality of working life, the provision of comfortable housing, health care, public safety, and quality of environmental system.

B. The subjectivistic approach

or perceived quality of life. The latter is expressed by the level of satisfaction with one's life, which is determined by one's own internal judgments about well-being [10].

The World Health Organization (WHO) has proposed a methodology to assess the quality of life, called vitality of peoples. It is based on the assessment of the feelings of individuals in the context of their culture and value system, as well as their personal goals, standards, and interests [11]. The methodology includes indicators of the physical and psychological status of people, the environmental condition, levels of independence, social life, and spirituality. Despite the possibility of international comparisons when using this approach, its focus on the category of health and insufficient attention to other areas does not allow applying such a structure to analyze the quality of life in the socio-economic development of the region.

It is worth noting the study [12], in which it is noted that the system of indicators for measuring the quality of life should cover all socially important areas related to the people's quality of life. The author includes in the list of specific aspects the quality of human capital, the quality of primary social contacts, the quality of the private life-sustaining activity, safety of life-sustaining activity, accessibility and quality of social infrastructure services, and participation in social management.

The authors of [13] propose to assess the degree of satisfaction of respondents' quality of life in the following areas: health, income, family happiness, housing conditions, level and quality of education, peace of mind, independence and freedom, respect of others, secured employment, quality of medical care, confidence in the future, protection against criminal encroachments, favorable environmental conditions, peace and harmony in society, leisure and recreation, the livability of the populated locality, the power, and the religious beliefs.

C. The combined approach

is a synthesis of the first two approaches, namely, it allows considering the quality of life both from the side of objective conditions of existence and in terms of satisfaction of people in these conditions.

The most developed international methodology within the framework of this approach is the methodology proposed by the Organization for Economic Cooperation and Development (OECD) [14]. The study of the quality of life in OECD countries is carried out using the following groups of indicators: health, education, employment and quality of working life, leisure and recreation, social opportunities and social activity, personal security, the state of the consumer market of goods and services, and the environmental conditions.

British research center called the Economist Intelligence Unit, offered own concept of quality of life, which is based on the need to provide the population with a decent and prosperous life. In this case, the structure of the quality of life consists of nine blocks, namely, material well-being, health, political stability and security, family life, public life, climate and geographical location, pledging of job security, political freedoms, and gender equality [15].

In Russia, this approach is used by the All-Russian Research Institute of Technical Aesthetics (VNIITE), the RIA Rating Agency, as well as researchers P.S. Mstislavsky, V.N. Edronova, N.V. Solovieva, and A.M. Nagimova.

Researchers of VNIITE include in the calculation of population's life quality index indicators from four main areas of life-sustaining activity of the social subject: labor, consumer, spiritual, family, and patrimonial [16]. The RIA Rating, when calculating the rating of regions in terms of the quality of life, analyzes 70 indicators, which are combined into following 11 groups: the level of income, employment and labor market, housing conditions, security of residence, demographic situation, environmental and climatic conditions, health and education, provision of social infrastructure, the level of economic development, the level of small business development, development of the territory, and the development of transport infrastructure [17]. In [18] it is noted that actual indicators of life quality should be compared with indicators of human needs. At that, for comparison five structural blocks are considered: the health of people, the scope of their employment, material security with consumer goods, the spiritual realm, and a family.

Table 1 provides an overview of options for structuring the quality of life within existing approaches to its assessment.

Structural blocks of life quality	UN	WHO	The Economist Intelligence Unit	OECD	European System of Social Indicators[19]	A. Bucur	J. Ruževičius [20]	VNIITE	RIA Rating	S.A. Aivazian	A.I. Rossoshansky, E.A.Chekmareva	E.A.Mosyakina	T. Yu.Cherkashina
Physical health	+	+	+	+	+	+	+		+	+	+	+	+
Mental health		+											
Education	+			+	+	+			+				+
Material well-being, the standard of living	+		+	+	+	+	+	+	+	+	+	+	
Working conditions and the labor market			+	+	+	+	+	+	+		+	+	
Security	+		+	+	+	+			+			+	+
Natural and climatic conditions	+	+	+	+	+	+	+		+	+	+	+	
Spiritual and personal development								+					
Family welfare			+		+	+		+					+
Gender equality	+		+			+	+						
Political liberties		+	+	+		+	+						+
Leisure				+									+

Structural blocks of life quality	UN	WHO	The Economist Intelligence Unit	OECD	European System of Social Indicators[19]	A. Bucur	J. Ruževičius [20]	VNIITE	RIA Rating	S.A. Aivazian	A.I. Rossoshansky, E.A.Chekmareva	E.A.Mosyakina	T.Yu.Cherkashina
Social relation	+	+	+	+		+	+		+	+			+

It is worth noting that, despite the focus of some studies on one of the key components of the quality of life (for example, health, social exclusion, safety of residence, work conditions, and nature, etc.), the prevailing part of them recognizes as key the following criteria: health (physical, mental, and social), material security, social relations, comfort and safety of living, determined by the natural, ecological, and social environment.

The purpose of the current study is considering the quality of life in general, taking into account both objective and subjective aspects, rather than focusing on certain life quality component. Thus, the set of indicators should reflect both economic parameters describing the standard of living of the population, and indicators of social development of society. At the same time, the quality of life will be analyzed in its relationship with socio-economic development, regional human capital, public and private investments that implies a clear definition of a set of indicators of the above categories in order to avoid duplication of indicators. Therefore, it is difficult to apply the existing options for assessing the quality of life, and therefore this article presents a system of indicators meeting the above requirements.

Before considering the relationship between quality of life and the socio-economic development of the region, it is necessary to determine, what the socio-economic system of the region is.

Based on the morphology of the term of the socio-economic system, it means the integration and interaction of social and economic systems. The economic system is understood as a complex of production relations corresponding to a certain development stage of the productive forces of society. The social system is a set of social relations, organizations, and forms that determine the relationship between the individual, staff members, organization, and society in general. Hence, the socio-economic system is defined as a holistic set of related and interacting economic and social institutions and entities, as well as relations concerning the production, distribution, exchange, and consumption of tangible and intangible resources and products created using these recourses [21].

Considering the regional socio-economic system as a research object, it is important to define the concept of region. Currently, there is no single definition of this term in the scientific literature that is due to the variety of directions and methodological concepts in contemporary regional studies in Russia and abroad. Some theorists simply assume the a priori existence of a coherent geographic and economic entity known as a region, while others base the theory on more explicit definitions [22].

The most commonly used criteria to determine the concept of the region include geographical, production and functional, urban-planning, and sociological aspects. The diversity of criteria makes it difficult to fully uncover the essence of the region in one definition. After all, the region is both a territorial unit in the organization of the national economy, as well as an element of the social organization of society – the place of all spheres of life support and human activity.

For the purposes of the present study, the authors accept the definition of the region given in [23], which most characterizes the region as administrative space and as an independent socio-economic complex. Region is a single integrated system consisting of cultural and historical, industrial, financial and economic, climatic, scientific and technical, information, infrastructure, and social subsystems interacting with each other in order to achieve a high level of development and reproduction of socio-economic processes, ensuring optimal conditions and quality of life of the population on the basis of interaction of sectoral and territorial division of labor, acting as part of the intrastate territory, and being detailed to the level of subjects of the Russian Federation with regional system of the governing bodies providing efficiency and effectiveness of regional development.

In this context, the regional socio-economic system can be considered as the basis of human activity within a certain territory, and as a consequence, its development can be understood as a cumulative process of transformation of environmental, economic, social, spatial, political and spiritual spheres, leading to their qualitative improvements, and, ultimately, improving the welfare of people living in a particular region.

Based on the definition of socio-economic development of the region, one can define its main elements. The main elements of the social sector include the level and living conditions of the population in the region, the social sector (culture, health, and education), and the environmental component. The sectors of material and intangible production, production infrastructure, as well as production and economic resources in the region are considered the main elements of the economic sphere.

At that, it is obvious that the individual, performing many different roles, is a key link in both the social system (for example, is a part of society, the family, and other social entities) and the economic system (for example, acts as a labor resource). In this regard, it is customary to consider the quality of life of the population as a generalizing, resulting indicator of socio-economic development, since it includes

an assessment of all aspects of human life. In other words, the quality of life of the population is secondary to socio-economic development and is the result of certain comprehensive actions on the part of the government. At the same time it is necessary to highlight the fact that the social and economic spheres have a direct impact on each other. So, the economic sphere is a source of financing of all social projects, while the successful implementation of social policy ensures the inflow of additional revenues to the region.

Returning to the definition of the main elements of the social sector (the level and living conditions of the population in the region, social sectors (culture, health care, and education), and environmental component), it can be noted that all these indicators are the main components of the quality of life of the population that is traced in the works of Russian and foreign scientists (see Table 1).

Based on the above, it can be assumed that in order to assess the influence of the quality of life on the socio-economic development of the region, it is necessary to adopt the concept of quality of life as the main element of the social component of regional development.

An analysis of studies that assessed the relationship between quality of life and socio-economic development allows identifying the following research directions: the definition of quality of life as an indicator of the current level of socio-economic development of the country (regions); identifying areas of concern of economic development and quality of life of the population, and benchmarking (adjustments) socio-economic policy; and interregional comparison of population's quality of life.

So, the authors of [24] assess the impact of the social sector on the population's life quality dynamics and propose the authors' direction of analysis to identify the efficiency of existing infrastructure conditions in terms of achieving the ultimate goal. The study [25] proposes a model to assess the level of satisfaction with the quality of life in order to elaborate the concept of regional development, as well as to assess the level of socio-economic development of regions. Research by M.M. Churakova aims at developing approaches to assess the level of influence of the regional social system (including the quality of life of the population) on all processes of socio-economic development in the system in general [26].

While in the domestic literature most often research is aimed at identifying common patterns, the foreign authors in their works focus on the structural indicators of quality of life and socio-economic development. In [27], when analyzing the differences in the quality of life between the population in cities and regions, the author constructed economic and mathematical models of the dependence of welfare indicators on an urban scale. Wages, per capita income, climatic conditions of the region, and the level of environmental pollution were chosen as indicators of well-being. At that, the author analyzes how the indicators change depending on the social group and population density. The data obtained confirmed that the quality of life decreases with increasing urban scale. In this regard, I. Hook proposed to increase the salaries of city workers to compensate for the low level of life quality. Hamilton B.W. in his work [28] estimated the dependence of quality of life on property tax. The author has emphasized that one of the main factors determining the quality of life in cities is the way of distribution of wealth among its inhabitants by public authorities. At the same time, Hamilton proved that this tax was much more regressive than it was thought. That is, the property tax had negative impact on the quality of life. In particular, it increased housing prices for low-income individuals and lowered housing prices for high-income individuals.

Thus, despite the large number of studies in this area, there are not enough works devoted to comprehensive study of the quality of life at the regional level, which deal with quantitative formalization of the impact of "investment into the quality of life and human capital of the region → quality of life → regional human capital → socio-economic development of the region". Therefore, one can talk about the existing shortage of tools that comprehensively assess the quality of life (OC and SC of life quality), allowing describing these dependencies which can be used to operationalize the conceptual model of the population's life quality.

III. RESEARCH GOAL AND OBJECTIVES

The aim of this work is to elaborate a conceptual development model of life quality at the regional level, reflecting the influence of public and private investments into improving the quality of life, on quality of life, regional human capital, and socio-economic development of the region.

To achieve the set goal the following tasks were defined:

– analyzing the genesis of theoretical approaches to the concept of quality of life and tools to assess its level and development dynamics;

– developing a set of indicators describing the quality of life in the region, and elaborating a model to assess the quality of life on their basis;

– identifying factors affecting the quality of life in the region, and factors influenced by the quality of life;

– clustering of entities of the Russian Federation in terms of quality of life.

IV. METHODS

A. Conceptual development model of the population's quality of life in the regional aspect

To assess the interdependence of quality of life and socio-economic development in the region, as well as their relationship with public and private investments, and regional human capital, it is necessary to have an understanding of the formation process of the population's life quality, as well as the tools that allow quantifying this process. In this regard, there is a need to develop a conceptual model to assess the quality of life and its impact on the socio-economic development of the region, as well as to trace how socio-economic development, in turn, affects the quality of life.

As noted above, there is no universally accepted definition of the quality of life of the population. In this regard, for the purposes of this study, the quality of life is defined as the

complicated socio-economic system, which is part of the socio-economic regional system, and comprehensively characterizes the overall quality status of all aspects of the population's life and corresponds to public perceptions of the necessary level of such quality.

When forming a system of indicators describing the quality of life, it is necessary to take into account the integrated nature of the category of life quality and combine both economic parameters describing the standard of living of the population and indicators of social development of society. It should be noted that the work will assess not only the quality of life of the population but also the regional human capital, which are taken into account by the same basic components, namely, education, health care, and other areas that describe human life. In this regard, note that the indicators reflecting the quality of life will include the parameters of the economic well-being of the individual and social infrastructure, indicators of human capital, i.e. the quality of social development of society. Given these features, the following system for assessing the quality of life can be formulated.

B. Algorithm

There are different approaches to systematize the population's life quality parameters depending on the goals and objectives of the study. In this article, the structural blocks are defined based on the integral properties of the quality of life and make up six basic groups [29]: the quality of the population, welfare, population's living conditions, public awareness, social security, environmental quality, as well as natural and climatic conditions. The list of life quality indicators, presented in [30], is supplemented and used in the framework of the current study. So, the proposed system to assess the quality of life is described in Table 2.

Table 2: Quality of life assessment system

Assessment areas	Assessment indicators
Quality of the population	– average life expectancy (y_1); – infant mortality rate (y_2); – number of people with disabilities in the total population (y_3); – percentage of the working-age population (y_4)
Welfare	– per capita cash income (y_5); – average consumer spending per capita (y_6); – the proportion of the population with incomes below the subsistence minimum (y_7); – the total amount of social benefits (y_8) – average monthly pensions (y_9); – number of registered unemployed (y_{10}); – number of cars per capita (y_{11})
Population's living conditions	– number of 24-hour hospital beds per capita (y_{12}); – number of doctors of all specialties in organizations providing medical services to the population, per capita (y_{13}); – number of places in pre-school educational institutions per capita (y_{14}); – number of places in schools per capita (y_{15}); – number of budget places in universities under the bachelor's program per capita (y_{16}); – availability of teachers in secondary schools (y_{17}); – area of housing per person (y_{18}); – the average cost of housing (y_{19}); – the proportion of home-ownership (y_{20}); – the proportion of dilapidated housing stock in the total housing stock (y_{21}); – number of theatres, libraries, and cinemas per capita (y_{22}); – number of planar sports facilities (y_{23}); – length of roads(y_{24})
Public awareness	– number of mobile phones per capita (y_{25}); – the proportion of the population using the Internet (y_{26})
Security	– number of reported crimes per capita (y_{27}); – number of road traffic accidents per capita (y_{28})
Environmental quality, natural and climatic conditions	– average annual temperature (y_{29}); – average annual precipitation (y_{30}); – the ratio of air pollutants to the total population (y_{31}); – pollution level of surface and groundwater (y_{32})

The subjective component of life quality is assessed based on a survey questionnaire conducted in terms of people's satisfaction with their quality of life and will be further compared with the results obtained by evaluating statistical data to determine future development trends.

Normalization of selected statistical data will be performed by linear scaling method according to the following formulas:

$$I_{in}(t) = \frac{x_{in}(t) - \min_n(x_{in}(t))}{\max_n(x_{in}(t)) - \min_n(x_{in}(t))}, \quad (1)$$

$$I_{in}(t) = 1 - \frac{x_{in}(t) - \min_n(x_{in}(t))}{\max_n(x_{in}(t)) - \min_n(x_{in}(t))} \quad (2)$$

where $x_{in}(t)$ is the i-th index of the n-th region at time point t, i = 1, ..., 32, n = 1, ..., N (N is the number of regions under the study).

Formula (1) is used if the indicator has positive impact on the quality of life. In the case of negative impact, formula (2) is used. Note that if the minimum and maximum values are the same, the value of this indicator will be equal to unity for all regions.

The value of $x_{in}(t)$ is calculated based on official statistics from the resources of federal and regional authorities.

Thus, $I_{in}(t) \in [0; 1]$. Further convolution of the individual indicators into the total indicator is carried out according to the following weighted-average formula:

$$QL_n(t) = \sum_{i=1}^{32} I_{in}(t) \cdot \alpha_i(t), \sum \alpha_i(t) = 1 \quad (3)$$

where $QL_n(t)$ is the aggregate indicator of quality of life at point in time t, $I_{in}(t)$ is the value of the i-th partial indicator at time t calculated by the formulas (1) and (2), $\alpha_i(t)$ is the factor of the importance of the i-th indicator at time t.

Currently, the issue of improving the quality of life is of the utmost importance not only for economics but also becomes the basis of socio-economic policy of both the state and its regions, sets the direction of all strategic decisions, determines the need of formation of economic growth model, which will be based on the conditions leading to improved quality of life, and consequently, to the accumulation and preservation of human capital [31]-[33]. In this connection, each region determines the strategy and socio-economic development program at its level. The achievement of the strategic goal is due to investments aimed at both improving the quality of life of the regional population and the development of very human capital [34], namely, areas such as national economy, education, health care, housing and communal services, social policy, and others. The full list of investment areas is presented in [30]. Improving the quality of life of the population through investments in education, science, ecology, health, infrastructure, etc. is necessary for increasing the regional human capital. At the same time, investments in human capital create new opportunities for people to meet their needs. This provides the greatest return on investment, measured by improving the quality of life [35]. Obviously, the influence of quality of life on the formation and enhancement of human capital is quite visible.

Improving the population's quality of life creates a favorable environment for the development of society and the economy in general, and contributes to the following objectives:

1. Forming a favorable living environment, and, consequently, changing the following demographic parameters of the region [36]:
– mid-year population;
– infant mortality rate;
– natural increase rate;
– the expectation of life at birth;
– marriage/divorce ratio;
– net migration rate.
– demographic load factor;

2. Increasing benefit from the scale of the production function and, consequently, increasing the efficiency of the economy.

3. Increasing the investment attractiveness of the territory that in turn will ensure the flow of additional resources to the region.

So, the hypothesis is developed that the change in the population's quality of life affects the socio-economic development of the region. Given that in the present article the quality of life is defined as the main element of the social component of regional development, in order to avoid duplication, socio-economic development is represented by the following set of indicators:

– resident population;
– mid-year population employed in the economy;
– per capita cash income (per month);
– average consumer spending per capita (per month);
– average monthly nominal salary of employees of the organization;
– gross regional product;
– fixed assets in the economy (at full book value; at the end of the year);
– investments in fixed capital;
– the volume of shipped goods of in-house production, works and services performed by own forces by type of economic activity related to mining operations;
– the volume of shipped goods of in-house production, works and services performed by own forces by type of economic activity related to manufacturing activity;
– the volume of shipped goods of in-house production, works and services performed by own forces by type of economic activity related to production and distribution of electricity, gas, and water;
– agricultural products (total);
– commissioning of residential buildings;
– retail turnover;
– the balanced financial result of the organization.

As a result, socio-economic development affects the growth of public and private funding both directly and indirectly, improving the quality of life in the region and the demographic parameters of the region.

C. Flow chart

A graphical representation of the mutual influence of the conceptual model elements is shown in Fig. 1.

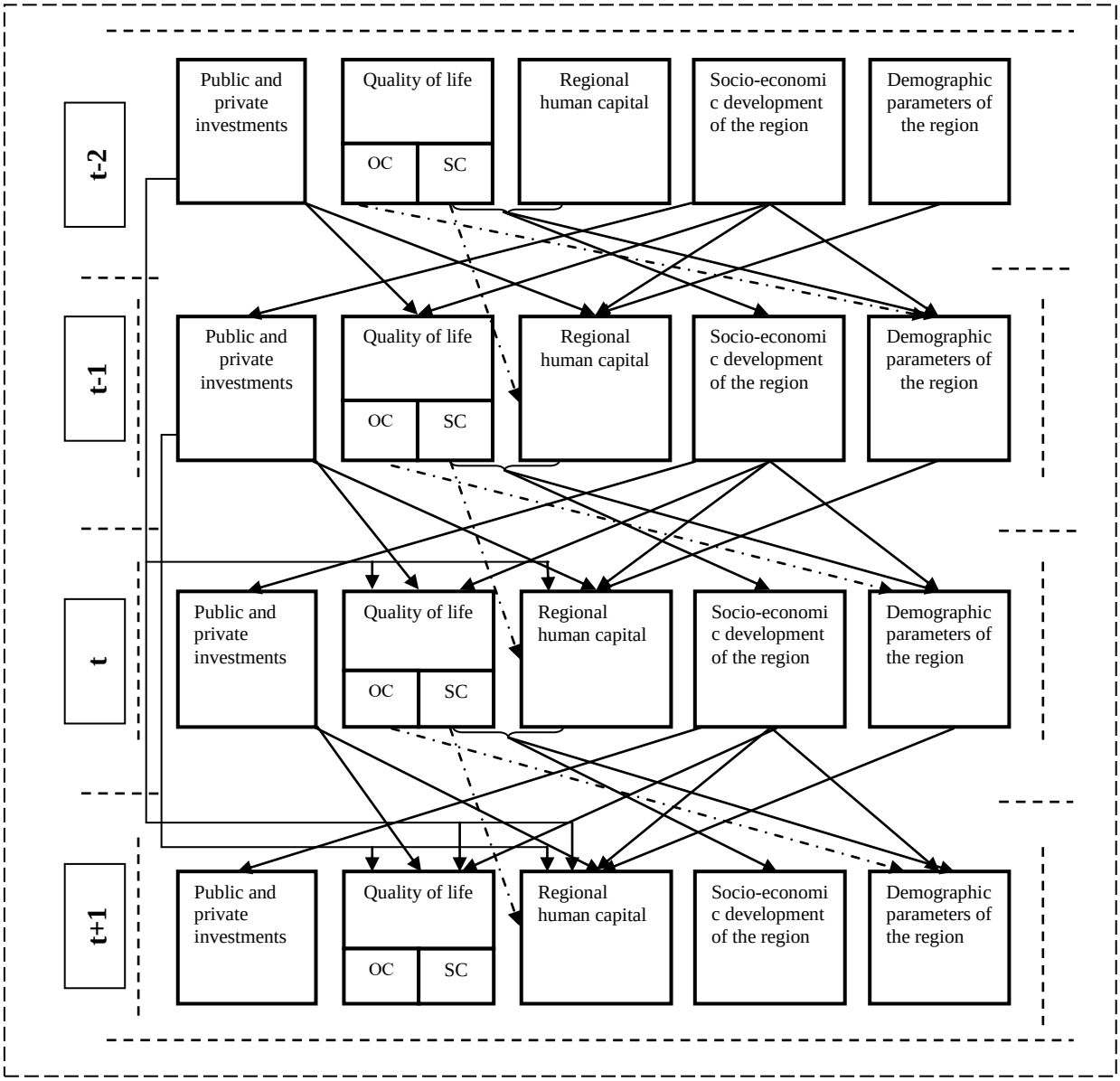

Fig. 1: Conceptual model of the population's quality of life.

The peculiarity of this model is highlighting the four time intervals. This allows reflecting the influence of some parameters of the system on others in time. In particular, quality of life and the level of regional human capital at time t are determined by investments with some time lag.

Note that the assignment of channels of influence (i.e. the effect of various directions of investments on the indicators of population's quality of life and the region's human capital; influence of indicators of quality of life on regional human capital; effect of quality of life on development indicators of the region; influence of indicators of quality of life and development of the region on demographic parameters of the region), as well as their quantitative description in the form of econometric models are necessary for the operationalization of the conceptual model of quality of life.

V. RESULTS AND DISCUSSION

A. Cluster analysis of Russian regions in terms of the quality of life

For formal characterization of the channels of influence in the conceptual model and making decisions to improve the quality of life and related elements, it is useful to divide the entities of the Russian Federation into groups (clusters) depending on the quality of life. As a data set, 32 indicators of quality of life for 2011-2017 were used for 81 regions. It should be noted that the analysis did not include the Republic of Crimea and Sevastopol due to the fact that there were no statistical data for these entities for the entire period of the study. Besides, Moscow and St. Petersburg were not assessed as well. Based on the works of other researchers, it can be noted that these two cities always occupy a leading position in terms of quality of life and often form a separate cluster.

In this work, the cluster analysis of the data under consideration was carried out using the Statistica software package. At the first step, based on the analysis of the hierarchical clustering dendrogram constructed by Ward's method (Euclidean distance was used as a measure of proximity), it was decided to divide the sample for each year into four clusters. Figure 2 shows the dendrogram for 2017.

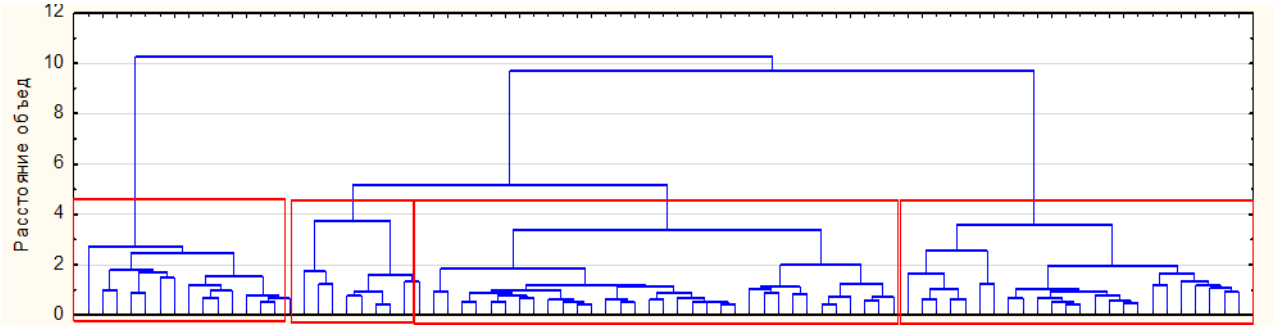

Fig. 2: The dendrogram of hierarchical clustering of regions for 2017.

Further, the k-means method was used to divide the sample into four clusters for each studied year. The composition of clusters for 2017 is shown in Table 3.

Table 3: Composition of clusters for 2017

No of cluster	Regions included in the cluster
1	**22 regions**: Altai Territory, Volgograd Region, Voronezh Region, Irkutsk Region, Krasnodar Territory, Krasnoyarsk Territory, Leningrad Region, Moscow Region, Nizhny Novgorod Region, Novosibirsk Region, Omsk Region, Orenburg Region, Perm Territory, Republic of Buryatia, Republic of Tatarstan, Rostov Region, Saratov Region, Sakhalin Region, Smolensk Region, Udmurt Republic, Chechen Republic, Republic of Altai
2	**26 regions**: Astrakhan Region, Belgorod Region, Bryansk Region, Vladimir Region, Ivanovo Region, Kabardino-Balkaria Republic, Kursk Region, Lipetsk Region, Oryol Region, Penza Region, Republic of Adygea, Republic of Ingushetia, Republic of Kalmykia, Republic of Karelia, Kemerovo Region, Republic of Mari El, Republic of Mordovia, Republic of North Ossetia-Alania, Samara Region, Stavropol Region, Tambov Region, Tver Region, Tyumen Region, Khabarovsk Territory, Chuvash Republic, Chukotka Autonomous Area
3	**23 regions**: Amur Region, Arkhangelsk Region, Vologda Region, Jewish Autonomous Area, Zabaikalsky Territory, Kaliningrad Region, Kirov Region, Kostroma Region, Kurgan Region, Novgorod Region, Primorsky Territory, Pskov Region, Republic of Bashkortostan, Dagestan Republic, Komi Republic, Tuva Republic, Khakassia Republic, Ryazan Region, Tomsk Region, Tula Region, Ulyanovsk Region, Kaluga Region, Kamchatka Territory
4	**10 regions**: Magadan Region, Murmansk Region, Nenets Autonomous Area, Republic of Sakha (Yakutia), Sverdlovsk Region, Khanty-Mansi Autonomous Area, Chelyabinsk Region, Yamalo-Nenets Autonomous Area, Yaroslavl Region, Karachay-Cherkessia Republic

The regions were distributed into clusters in approximately equal numbers, the second cluster is the largest one since it includes 26 entities, while the fourth cluster is the smallest one (10 entities). As can be seen from the results, there is no obvious geographical pattern in the allocation of clusters, since each of them includes regions from different federal districts.

Descriptive statistics were used to assess and highlight the relationships in groups of regions by indicators. The value of the p-level of significance was analyzed. This parameter reflects which indicators are significant when dividing regions into clusters. Besides, sample averages and sample variances of indicators were calculated. Based on these indicators, clusters were rated with respect to each indicator.

Thus, 18 indicators were identified, which actually formed the basis of clustering, i.e. the values of these indicators for different clusters differ significantly, while the remaining indicators have minor deviations from each other. Further, the relative deviations of the average values of the indicators from the average for the entire sample for 2016 were calculated for each cluster using the following formula:

$$\delta_i^k = \frac{\bar{y}_i^k - \bar{y}_1}{\bar{y}_1}, \qquad (4)$$

where $\bar{y}_i^k$ was the sample mean of the i-th indicator for the k-th cluster (k=1.2.3.4; i=1,....32); $\bar{y}_1$ was the sample mean of the i-th indicator for the entire sample.

Table 4 shows the results obtained for 18 selected indicators and the cluster's rating for each of them. The rating value varies from 1 to 4 (according to the number of clusters) and the values of δ_i^k are assigned in descending order starting from 1. At that, if the values δ_i^k of several clusters differ from each other by no more than 15%, then it is assumed that their rating is equal to the arithmetic mean.

Table 4: Rating of clusters in terms of quality of life

Indicators	$\bar{y}_1$	**Cluster 1**		**Cluster 2**		**Cluster 3**		**Cluster 4**	
		Rating	δ_i^1	**Rating**	δ_i^2	**Rating**	δ_i^3	**Rating**	δ_i^4

Indicators	$\bar{y}_i$	Cluster 1		Cluster 2		Cluster 3		Cluster 4	
		Rating	δ_i^1	Rating	δ_i^2	Rating	δ_i^3	Rating	δ_i^4
Average life expectancy (y_1)	0.401	**2**	0.041	**1**	0.292	**4**	-0.177	**3**	-0.156
Number of people with disabilities in the total population (y_3)	0.495	**2**	0.066	**4**	-0.310	**3**	-0.139	**1**	0.383
Percentage of the working-age population (y_4)	0.377	**2.5**	-0.178	**2.5**	-0.177	**4**	-0.335	**1**	0.689
Per capita cash income (y_5)	0.307	**2**	-0.209	**4**	-0.503	**3**	-0.374	**1**	1.087
Average consumer spending per capita (y_6)	0.514	**3**	-0.009	**1.5**	0.247	**1.5**	0.224	**4**	-0.463
Average monthly pensions (y_9)	0.299	**3**	-0.341	**4**	-0.616	**2**	-0.272	**1**	1.229
Number of places in schools per capita (y_{15});	0.198	**1**	1.162	**2**	-0.241	**3**	-0.363	**4**	-0.559
Number of budget places in universities under the bachelor's program per capita (y_{16})	0.249	**1**	1.276	**2**	-0.193	**3**	-0.421	**4**	-0.663
Availability of teachers in secondary schools (y_{17})	0.246	**1**	1.084	**2**	-0.162	**3**	-0.378	**4**	-0.544
The average cost of housing (y_{19})	0.582	**3**	0.077	**1**	0.428	**2**	0.165	**4**	-0.670
Proportion of home ownerships (y_{20})	0.748	**2**	0.112	**1**	0.169	**3**	-0.039	**4**	-0.242
Proportion of dilapidated housing stock in the total housing stock (y_{21})	0.755	**1**	0.161	**2**	0.129	**3**	-0.033	**4**	-0.258
Number of planar sports facilities (y_{23})	0.246	**1**	1.224	**2**	-0.122	**3**	-0.388	**4**	-0.714
Length of roads (y_{24})	0.299	**1**	0.918	**3**	-0.204	**2**	-0.088	**4**	-0.626
The proportion of the population using the Internet (y_{26})	0.421	**2**	0.036	**3.5**	-0.288	**3.5**	-0.282	**1**	0.534
Number of reported crimes per capita (y_{27})	0.465	**2**	0.075	**1**	0.489	**4**	-0.359	**3**	-0.205
Average annual temperature (y_{29})	0.535	**2**	0.109	**1**	0.422	**3**	-0.090	**4**	-0.441
Average annual precipitation (y_{30})	0.440	**3**	-0.091	**1**	0.397	**2**	0.069	**4**	-0.375
Cumulative rating		**34.5**		**38.5**		**52**		**55**	

Table 5 shows by which of the above indicators each cluster is in the lead (rating 1 and 1.5) and lagging behind (rating 3.5 and 4) in accordance with Table 4.

Table 5: Indicators by which the cluster leads or lags

No of cluster	Number of indicators by which cluster leads	Indicators by which cluster leads	Number of indicators by which cluster lags	Indicators by which cluster lags
1	**6**	**Population's living conditions:** – number of places in schools per capita (y_{15}); – number of budget places in universities under the bachelor's program per capita (y_{16}); – availability of teachers in secondary schools (y_{17}); – the proportion of dilapidated housing stock in the total housing stock (y_{21}); – number of planar sports facilities (y_{23}); – length of roads (y_{24})	0	

2	**7**	**Welfare:** – average consumer spending per capita (y_6) **Population quality:** – average life expectancy (y_1) **Population's living conditions:** – the average cost of housing (y_{19}); – the proportion of home ownership (y_{20}) **Security:** number of reported crimes per capita (y_{27}) **Ecology and natural climatic conditions:** – average annual temperature (y_{29}); – average annual precipitation (y_{30})	**4**	**Population quality:** – number of people with disabilities in the total population (y_3) **Welfare:** – per capita cash income (y_5); – average monthly pensions (y_9) **Awareness:** – the proportion of the population using the Internet (y_{26})
3	**1**	**Welfare:** – average consumer spending per capita (y_6)	**4**	**Population quality:** – average life expectancy (y_1); – percentage of the working-age population (y_4) **Awareness:** – the proportion of the population using the Internet (y_{26}) **Security:** – number of reported crimes per capita (y_{27})
4	**5**	**Population quality:** – number of people with disabilities in the total population (y_3); – percentage of the working-age population (y_4) **Welfare:** – per capita cash income (y_5); – average monthly pensions (y_9) **Awareness:** – the proportion of the population using the Internet (y_{26})	**11**	**Welfare:** – the proportion of the population with incomes below the subsistence minimum (y_7); – average consumer spending per capita (y_6) **Population's living conditions:** – number of places in schools per capita (y_{15}); – number of budget places in universities under the bachelor's program per capita (y_{16}); – availability of teachers in secondary schools (y_{17}); – the average cost of housing (y_{19}); – the proportion of home ownerships (y_{20}); – the proportion of dilapidated housing stock in the total housing stock (y_{21}); – number of planar sports facilities (y_{23}); – length of roads (y_{24}) **Ecology and natural-climatic conditions:** – average annual temperature (y_{29}); – average annual precipitation (y_{30})

B. Results and discussion

Analyzing the above, the following conclusions can be drawn:

1. Cluster No. 1 is a Social cluster since the corresponding regions are characterized by a high level of life quality. Most of the regions included in this cluster are large industrial and industrial-agrarian centers of the Russian Federation, namely, Altai Region, Volgograd Region, Voronezh Region, Irkutsk Region, Krasnodar Territory, Moscow Region, Nizhny Novgorod Region, Novosibirsk Region, Omsk Region, and others. These regions occupy leading positions in the fields of mechanical engineering, metalworking, chemical and petrochemical industry, hydropower, forestry, and agriculture. A large number of industrial enterprises in these regions provide high employment. It is important to note that this cluster also includes regions with developed scientific and innovation sectors (Moscow Region, Nizhny Novgorod Region, and Novosibirsk Region). This is evidenced by the leading positions of the cluster on indicators, such as the number of places in schools per capita, the number of budget places in universities under the bachelor's program per capita, and availability of teachers in secondary schools. Also, the socio-economic policy of these regions has a clear social orientation. The cluster is the leading in the number of planar sports facilities, 24-hour hospital beds per capita, etc. In addition, the regions included in this cluster have a low infant mortality rate.

2. Cluster No. 2 is Overpopulated cluster, which includes the regions with a level of life quality above average. Most of the regions in the group are located in the Central, Southern, and Volga Federal districts. The climate in these areas is quite mild, climatic zones vary from continental, and temperate continental to subtropical. This cluster is the leader in terms of natural, climatic and environmental indicators. The noted regions are the most populated in Russia. One of the main reasons for such population density is the high level of migration of people from other parts of the country. This feature causes the fact that this cluster has the highest unemployment rate. But at the same time, the cluster occupies a leading position in terms of the indicators, such as life expectancy, the average cost of housing, and consumer spending on average per capita. However, this group lags behind others in terms of income, pensions, and social benefits.

3. Cluster No. 3 is a Stagnant cluster since it includes the regions with a life quality below average. The cluster lags behind in terms of the proportion of the working-age population and, as a consequence, leads in terms of social benefits. The high proportion of the elderly population is explained by the large outflow of young people from these regions to the central part of Russia, due to the lack of places in schools, universities, and a fairly high level of unemployment. The cluster also has a high infant mortality rate and a high crime rate. It is also worth noting that the regions of this cluster are characterized by the low level of industrial development and environmental pollution.

4. Cluster No. 4 is a Lagging cluster since the regions are characterized by a low level of life quality. This cluster is the smallest one. Almost 80% of the regions are located in the Northern and North-Eastern parts of the country (Murmansk Region, Nenets Autonomous District, Yamalo-Nenets Autonomous District, Chukotka Autonomous District, etc.). A distinctive feature of these regions are severe climatic conditions (the cluster lags behind in terms of temperature and precipitation indicators), and therefore their main problem concerns demography (small population). Despite the fact that the industry of these regions is actively developing and associated with the extraction and primary processing of minerals, which, in turn, creates a large number of jobs, the permanent population in these areas is quite small. This is not only due to weather conditions but also to low living conditions, namely, high housing costs, large percentage of dilapidated housing, lack of hospitals, educational institutions, sports complexes, and places for cultural recreation, high consumer spending, etc. These shortcomings are not compensated by high incomes (the cluster leads in terms of per capita cash income). In this connection, these regions belong to the rotational territories, i.e. regions where the economically active population arrives in for shift work in order to get high earnings.

It should be noted that the high incomes prevailing in these regions due to the indexation of wages of the population for work in the Far North and equivalent territories sometimes form a false idea concerning the quality of life in these regions when clustering. So, in the work [37] some regions from this group, in particular, the Magadan Region, the Kamchatka Territory, and the Chukotka Autonomous District (these regions form the core of the cluster, see Table 3), were attributed to the cluster with the best indicators in terms of quality of life along with Moscow and St. Petersburg.

To identify stable elements of clusters, clusters for 2011-2016 were formed in a similar way. The regions which remained in the same cluster for at least four years can be considered as sustainable cluster cores. The results obtained for sustainable cluster cores are presented in Table 6.

Table 6: Sustainable elements of the cluster.

No of cluster	Regions included in the cluster
1	**17 regions**: Altai Territory, Volgograd Region, Voronezh Region, Irkutsk Region, Krasnodar Territory, Krasnoyarsk Territory, Moscow Region, Nizhny Novgorod Region, Novosibirsk Region, Omsk Region, Perm Territory, Republic of Bashkortostan, Samara Region, Sverdlovsk Region, Tyumen Region, Chelyabinsk Region, Kemerovo Region
2	**12 regions:** Belgorod Region, Bryansk Region, Vladimir Region, Ivanovo Region, Kursk Region, Lipetsk Region, Orel Region, Penza Region, Republic of Adygea, Tambov Region, Tver Region, Chuvash Republic
3	**3 regions:** Republic of Dagestan, Republic of Ingushetia, Chechen Republic
4	**9 regions:** Magadan Region, Murmansk Region, Nenets Autonomous District, Sakhalin Region, Khabarovsk Territory, Khanty-Mansi Autonomous District, Chukotka Autonomous District, Yamalo-Nenets Autonomous District, Kamchatka Territory

In the period from 2011-2014, the cluster has not undergone significant changes (variation was just 2-3 units). Moving regions from one cluster to another was associated, for example, with a new strategy of socio-economic development of the region, new state programs, the creation of new special economic zones in the regions, etc. But over the past few years, in the context of aggravation of the geopolitical situation and the crisis of economic processes (the decline in oil prices, the imposition of economic sanctions against Russia, which were most clearly manifested in the financial sector, etc.), most regions of cluster No. 2, with the level of life quality above the average, moved to cluster No. 3 with quality of life below average (in 2015, the cluster No. 3 consisted of 41 regions, in contrast to the 4-8 regions in 2011-2014, while the number of cluster No. 2 included 9 regions in contrast to 40-43 regions in 2011-2014). Some regions moved to cluster No. 4, namely, Chelyabinsk and Sverdlovsk regions. These regions are included in the core of cluster No. 1, which is the leader in quality of life, but since 2016 they have moved to lagging cluster No. 4. This is due to the fact that in the Chelyabinsk Region, 10 of the 18 indicators listed in Table 4 have decreased in relation to 2015 by an average of 49.4%; in the Sverdlovsk Region, 13 of the 18 indicators had a negative trend, falling on average by 71.8%.

In general, since 2016, the composition of clusters has begun to level out; the transition of regions from one cluster to another now depends on the quality and efficiency of anti-crisis managerial decisions taken at the regional level. This shows that the subjects of the Russian Federation follow the national macroeconomic dynamics, differing only in terms of the depth and degree of decline of individual indicators. At that, the most stable clusters during the entire analyzed period are clusters No. 1 and No. 4 (sustainable cluster elements make up 73.3% and 70.6% of the total number of regions in the corresponding group).

At the same time it should be noted that after selecting sustainable cores of clusters, a kind of territorial pattern was observed in the distribution of regions across clusters. So the core of the cluster No. 1 includes mainly the regions of Central Russia and Siberia, the core of the cluster No. 2 represents the regions of Western and Southern Russia, the core of the cluster No. 3 consists of the North Caucasus regions, while the core of the cluster No. 4 is formed by the Northern and North-Eastern regions.

Summarizing the above, it is worth noting that the Social cluster is the leader in terms of quality of life. In second place is the Overpopulated cluster that is due to the fact that this cluster is characterized by good living conditions of the population, mild natural and climatic conditions, but has a number of disadvantages in terms of welfare. Indicators of the remaining blocks of life quality have values above average. The third place is occupied by Stagnant cluster, which is characterized by the low quality of population and low level of security, while the remaining indicators are below average. The Lagging cluster is in fourth place. Despite the high level of welfare, this group of regions has the lowest indicators characterizing living conditions.

VI. CONCLUSION

1) The analysis of theoretical approaches to the concept of quality of life has been carried out, which was used to form the following authors' interpretation of this concept: the quality of life is understood as a complicated socio-economic system, which is a part of the socio-economic regional system, characterizing comprehensively the overall quality status of all aspects of population's life, which corresponds to public perceptions about the required level of life quality. The existing methods and models, which allow assessing the population's quality of life, are analyzed. Shortages of tools, which take into account both subjective and objective parameters of life quality at its assessment were identified.

2) A list of indicators describing the population's quality of life in the region was composed. This list includes six enlarged groups of life quality components, namely, quality of the population, welfare, living conditions of the population, public awareness, security, ecology, as well as natural and climatic conditions.

3) Developed conceptual model is based on the description of the certain channels of influence, namely: impact of quality of life (taking into account public and private investments) on the development of human capital, and demographic parameters of the region; the cumulative impact of quality of life and regional human capital on socio-economic development of the region; socio-economic development of the region on the amount of public and private investments in human capital, and quality of life of the region's population and demographic parameters of the region; and finely, influence of demographic parameters of the region on the amount of investments in the human capital of the region.

4) The clustering of regions in terms of quality of life was carried out that allowed distinguishing four clusters, thereby highlighting the regions with a high level of quality of life, which were included in the Social cluster, regions with a life quality level above average, pertained to the Overpopulated cluster, regions with the living level below average, related to the Stagnant cluster, as well as regions with low quality of life included in the Lagging cluster. Such clustering helps to understand the uniformity of development ways of certain clusters, as well as their socio-economic specifics of development. This will make it possible in the future to more effectively formulate development programs and socio-economic development strategy for the regions, taking into account their specifications, as well as to determine the econometric interdependences of quality of life, level of socio-economic development, demographic parameters, investments, and regional human capital for each cluster individually.

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