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**STUDY OF LIFE QUALITY INDICATORS INFLUENCE ON**  
**RURAL POPULATION MIGRATION**

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***Abstract***

The problem of life quality and, the current life conditions impact on the rural population redistribution in the region is studied. Rural working age population migration growth (decline) and intraregional migration in rural areas are examined. Using empirical data for Krasnoyarsk region municipal districts rural territories, selected indicators of life quality affecting the rural residents migration are defined. To determine the causal relationships between life quality and migration the method of constructing a decision tree for the machine learning algorithm C4.5 was used. The main reasons for rural residents migration of working age are seeking work (without reference to specific income), housing improvement (the desire to achieve minimum compliance with city housing and welfare standards), and health maintenance. Intra-regional migration of rural areas influences the rural economy state, the infrastructural development level, and the health service situation. The threshold values of life quality individual indicators making rural areas attractive for migration in the current socio-economic conditions are identified. The unemployment rate should be less than 6.2%, the share of the housing stock equipped with sewage system needs to be more than 40.86%, the share of residential fund wear more than 65% and should not exceed 40.4%, the share of paved roads in total road length needs to be more than 64.65%, gross municipal product per capita should be above 148.5 thousand rubles, and the number of newly registered diseases cases per 1000 people - below 322.6.

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## 1. Introduction

The quality of life is a complex category and can be used as an indicator of the state socio-economic policy effectiveness. To analyse the life quality, objective indicators of an economic, social, environmental nature are used, measured quantitatively, as well as data for assessing the subjective perception by society of the degree of self-satisfaction of material, cultural, spiritual, and other needs.

Migration refers to a group of demographic indicators, by which we can conclude about the current quality of life of the population. Relatively high values of well-being stimulate the influx of population and vice versa. At the same time, the structural composition of migration should be analysed and compared with the economic and social parameters of the development of territories.

A separate area of research may be intraregional migration of the rural population. Rural territories, as well as the population living there, have specific characteristics that distinguish them from the urban environment. It is necessary to take into account the rural lifestyle peculiarities and the existing system of values and preferences. In addition, the level of development of agricultural production as a system-forming activity for rural areas has a significant impact on the quality of life of the rural population.

## 2. Problem Statement

As the results of modern research (Bondarenko, 2017; Koloskova et al., 2019) show, the problems of rural areas include increased imbalances in socio-economic development, income inequality of urban and rural population, significant differences in the state and availability of social and engineering infrastructure, and spatial development of urban and rural habitats. As a result, there is a steady downward trend in the rural population, both due to increased mortality (low living standards negatively affect the health of the population), and due to migration. These conclusions are confirmed in the works of Blinova (2018), Nefedova and Mkrtychyan (2017). The study of the relationships between quality of life and migration requires clarification of the following issues of applied and practical nature:

- The choice of indicators characterizing the life quality of the population, taking into account the rural lifestyle specifics.
- Clarification of the motives of the migration behaviour of the villager.
- Identification of specifics and directions of migration for rural areas.

### 2.1. Choice of indicators characterizing the population life quality, taking into account the specifics of rural lifestyles

To obtain objective characteristics of the life quality, a complex of macroeconomic, statistical, and sociological methods should be used. Such recommendations can be found in the works of Deaton (2013) or Rimashevskaya (2012). The combination of the analysis of macroeconomic data (gross product of the territory, unemployment rate), statistical and demographic parameters (living conditions, health, mortality, etc.), as well as empirical sociological research data (self-assessment of living standards and emotional state) make it possible to obtain an objective comprehensive assessment the achieved state of well-being of the population (Ayvazyan, 2012; Bobkov et al., 2015). An integrated approach to assessment allows us

to identify factors that increase the level of social inequality and the growth of poverty within a particular region.

## **2.2. Clarification of the migration behaviour motives of the villager**

It should be understood why a villager is ready to change the usual way of life. Investigating individual studies (Eldyaeva & Kovanova, 2017; Kovanova et al., 2019; Rybakovsky, 2017), the authors identify the following motives. The first is the necessity to look for work and income to meet basic needs. The second motive can be formulated as the need for additional social benefits that it cannot receive in the rural environment. Another motive may be the unfavourable environmental situation in the territory of residence.

Ultimately, clarification of the standards for providing the rural population with the services of social, engineering and information and communication infrastructure, taking into account the new value system in rural society is required. Standards of well-being should create incentives for the able-bodied rural population to rural work, through the alignment of current imbalances in the consumption of material goods, services, and information.

## **2.3. Specificity and direction of migration processes between rural areas**

Among the main specific trends, the connection between migration and the dynamics of agricultural production is highlighted (Nefedova & Mkrtychyan, 2017). Limited rural employment opportunities are a key cause of dependency. The driving force behind the migration outflow is the working-age population. Gradually, labour resources in rural areas are being replaced by migrants from the former Soviet Union countries. According to the results of Efremov's (2016) research, with the intensification of the development of natural resources of the Far North, seasonal labour migration of the rural population, especially men of working age, intensified. The authors conclude that seasonal work or shift work of the rural population reduces the labour potential of rural areas but provides an inflow of income that stimulates the consumption of material goods within these territories.

## **3. Research Questions**

The study addressed the following issues:

- What differences in the life quality determine the motivation of the villager to migrate within the region?
- What is the current migration situation in rural areas and what living conditions are most attractive for rural migration at working age?

## **4. Purpose of the Study**

The purpose of the study was to establish the regional specifics of migration and redistribution of the rural population of working age by identifying the most significant indicators of the life quality that determine the motivation of a villager to relocate within the region.

## 5. Research Methods

In this study, indicators of interest were intraregional migration growth in the rural areas and migration of the rural population at working age. The object of the study was the rural territories of the municipal districts of the Krasnoyarsk Territory. The districts of the Far North were excluded from 44 municipal districts: the Taimyr Dolgan-Nenets district, the Evenki district, the Turukhansky district, and the North Yenisei region. These territories have a special status, have specific conditions for conducting economic activity, focal and focal-tape type of settlement, shift method of development, a special national composition, as well as extreme climatic conditions. Our own research of these territories (Nevzorov et al., 2017; Parshukov et al., 2019) allows us to conclude that the listed features make them unique relative to other municipal regions of the region and dictate the need for a separate study.

For the study, individual indicators were selected, which, according to the authors, can have a direct impact on the decision of the villager about the need for resettlement. Data was collected for the period 2016-2018, the characteristics of the original data array are shown in table 01.

**Table 01.** Statistical characteristics of the original data array

Groups	Indicators	Designation	Statistical indicators			
			Average	Maximum	Minimum	Variation
Group "Economics"	Gross municipal product (GMP) per capita, thousand rubles	X11	451.2	3528.0	38.3	1.6
	Per capita annual income, thousand rubles	X12	149.1	658.2	31.0	0.8
	Unemployment rate, %	X13	11.8	23.3	3.4	0.4
Group "Development"	Living space per 1 inhabitant, square meters	X21	24.9	31.1	10.2	0.2
	The proportion of housing stock equipped with central heating, %	X22	19.5	72.0	0.3	0.8
	The proportion of housing stock equipped with sewage, %	X23	28.8	82.9	0.2	0.6
"Water Supply" Group	The proportion of housing stock equipped with water supply, %	X31	45.3	84.0	2.6	0.4
	The proportion of the population provided with water of standard quality, %	X32	69.8	99.2	18.9	0.3
"Ecology" Group	Total amount of pollutants emanating from all stationary sources per capita, tons per 1 inhabitant	X41	406.3	9019.5	0.0	3.6
	The percentage of captured and neutralized pollutants of the total amount of pollutants from stationary sources, %	X42	26.5	86.1	0.0	0.9

“ Infrastructure” Group	The share of health facilities in disrepair, %	X51	18.0	63.5	0.0	1.1
	The share of paved roads in the total length of roads, %	X52	69.9	100.0	28.9	0.3
	The share of housing stock with depreciation of more than 65%	X53	28.5	67.5	3.7	0.5
“ Health” Group	The total mortality rate, ppm	X61	16.3	20.2	10.9	0.1
	The number of cases of newly registered diseases per 1000 people, units	X62	632.2	1138.3	228.6	0.3
Criteria Variables	Migration growth (outflow) of the working-age population per 1000 inhabitants of working age, people	Y1	-4.29	24.99	-26.13	-1.92
	Migration growth due to intraregional migration per 1000 inhabitants, people	Y2	-5.97	25.37	-28.07	-1.48

There is no single methodology for calculating the gross municipal product, therefore, in this study it was defined as the amount of value added received by the enterprises of the municipal district for the following activities: agriculture and food production, industrial production, retail, paid services to the population, banking services and insurance, freight transportation. The total number of objects of observation is 120, data for 40 regions for 2016, 2017 and 2018. The size of the initial matrix of indicators of life quality is 120 by 15. To determine the decisive rules, we used the method of constructing a decision tree using the C4.5 machine learning algorithm. In accordance with the initial conditions for applying this method, it is necessary that the set of objects (observations) be divided into classes with a qualitative (linguistic) scale (Table 2). To fulfil this condition, the following scale was introduced for the criteria variables.

**Table 02.** Scale for characterizing the migration situation and classification of municipal areas

The value of the indicator Y1, Y 2	Characteristics of the migration situation (classes)
More than 5	Positive (class 1)
0 to 5	Satisfactory (class 2)
-5 to 0	Unstable (class 3)
-10 to -5	Negative (class 4)
Less than -10	Crisis (class 5)

On this scale, the initial array of observations contained:

- 12 observations by Y1 criterion and 8 observations by Y2 criterion with a positive migration situation;
- 10 observations with a satisfactory migration situation for each of the criteria;

- 39 observations by criterion Y1 and 35 observations by criterion Y2 with an unstable migration situation;
- 40 observations by Y1 criterion and 38 observations by Y2 criterion with a negative migration situation;
- 19 observations by criterion Y1 and 29 observations by criterion Y2 with a crisis migration situation.

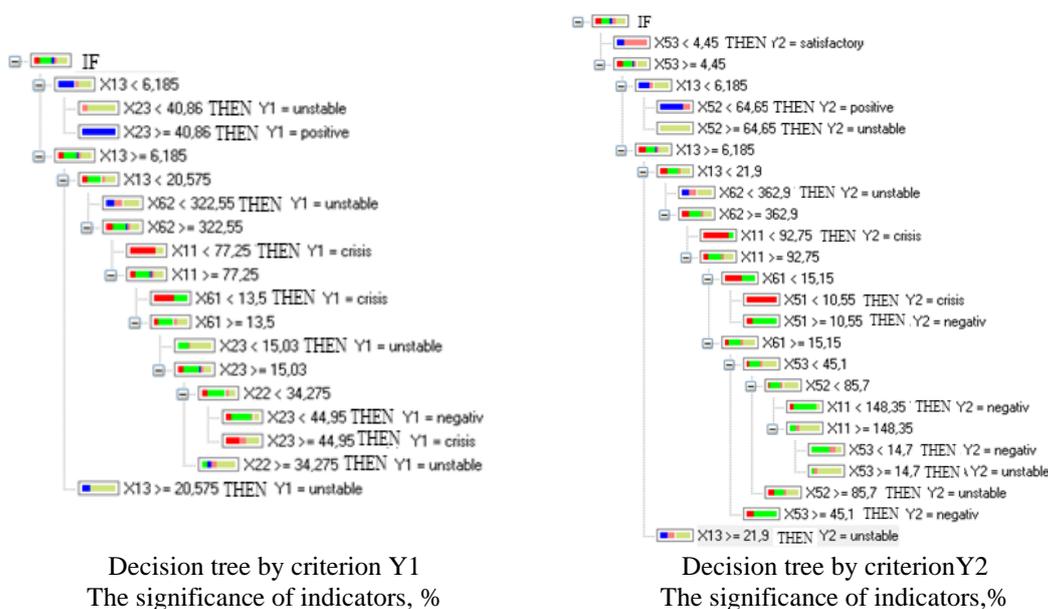
A decision tree was built for each criterion variable, the significance (contribution) of the quality of life indicators for the initial classification was determined, decision rules were formulated to explain the selected indicators of rural population migration (Nikolaeva & Pokrovsky, 2019).

## 6. Findings

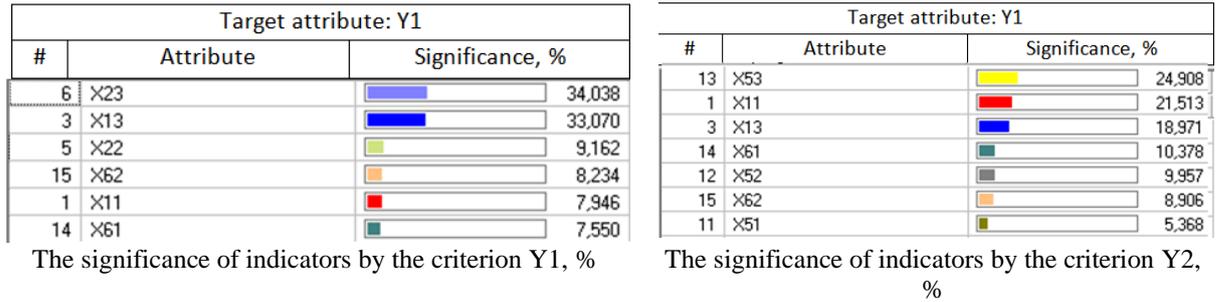
The decision tree according to the C4.5 algorithm for determining labour migration conditions is shown in Figure 1. Each tree is supplemented by the significance of the attributes (indicators of life quality) that make the main contribution to the classification (Figure 2).

The most significant attribute for determining the migration situation with an increase (decrease) in the working-age population (criterion Y1) are indicators X13 (unemployment rate) and X23 (specific share of the housing stock equipped with sewage). Their total contribution to the current classification is 74.1%. Among the significant indicators, the following are highlighted: VMP per capita (X11), the proportion of housing stock equipped with central heating (X22) and health indicators (X61 and X62).

Internal regional migration between rural areas is described by the indicators of the Infrastructure group (total contribution - 41.1%), "Economy" (total contribution - 40.3%) and "Health" (total contribution - 19.6%). The largest contribution is made by X53 - the share of housing stock with depreciation of more than 65%, then X11 (GMP per capita) and X12 (unemployment rate).



**Figure 01.** Decision trees for determining the migration situation dependence on the life quality in rural areas of the Krasnoyarsk Territory using the C4.5 algorithm



**Figure 02.** The impact of life quality indicators on rural migration

Moving through the nodes of the tree, it is possible to determine the conditions for achieving (decision rules) migration of the rural population. The most characteristic rules generated during the implementation of the algorithm are presented in Tables 3 and 4.

**Table 03.** Conditions of the rural population labour migration

Condition	Consequence (Y1)	Support		Credibility	
		%	The number of observations of the trained set	%	The number of observations of the test set
Unemployment Rate <6.185% The proportion of housing stock equipped with sewage >= 40.86% Housing stock with depreciation over 65% <40.4%	Positive	6.4	6	100	6
6.195% = <Unemployment Rate <18.435 GMP per capita> = 84.9 thousand rubles 281.5 cases = <The number of cases of newly registered diseases per 1000 people <553.85 cases	Satisfactory	6.4	6	83.3	5
Unemployment Rate > 6.185 The proportion of housing equipped with sewage <40.86 The number of cases of newly registered diseases per 1000 people >= 322.55	Unstable	6.4	6	83.3	5
6,185 = <Unemployment Rate <20.575 The number of cases of newly registered diseases per 1000 people >= 322.55 VMP per capita >= 77.25 Total mortality rate >= 13.5 The proportion of housing stock equipped with sewage >= 15.03 The proportion of housing stock equipped with district heating <34.275 The proportion of housing equipped with sewage <44.95	Negative	54.3	51	58.8	30
6,185 = <Unemployment Rate <20.575	Crisis	21.3	20	85	17

The number of cases of newly registered diseases per 1000 people > = 322.55 VMP per capita > = 77.25 Total mortality rate <13.5 The proportion of housing stock equipped with district heating <34.275					
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**Table 04.** Conditions for intra-regional rural migration

Condition	Consequence (Y2)	Support		Credibility	
		%	The number of observations of the trained set	%	The number of observations of the test set
Unemployment Rate <6.185 The share of paved roads in the total length of roads is > 64.65	Positive	4.3	4	75	3
6.185 <Unemployment rate <9.6 Housing stock with depreciation over 65% <4.45 GMP per capita > 148.5	Satisfactory	4.3	4	75	3
Unemployment Rate > = 6.185 The number of cases of newly registered diseases per 1000 people > = 362.9 VMP per capita > = 148.35 thousand rubles Housing stock with depreciation of more than 65% > = 14.7	Unstable	21.3	20	75	15
Unemployment Rate > = 6.185 The number of cases of newly registered diseases per 1000 people > = 362.9 VMP per capita > = 92.75 Total mortality rate <15.15 The share of housing stock with depreciation of more than 65% > = 45.1 The proportion of health facilities in disrepair > = 10.55	Negative	14.9	14	78.6	11
Share of housing stock with depreciation over 65% > = 44.45 Unemployment Rate > = 11.485 The number of cases of newly registered diseases per 1000 people > = 362.9 VMP per capita > = 92.75 Total mortality rate <15.15 The proportion of health facilities in disrepair > 19.65	Crisis	11.7	11	90.9	10

A favourable situation with an increase in the working-age rural population is observed in municipal areas for which the unemployment rate is below 6.2%, more than 40% of the housing stock has centralized sewage, and the share of housing stock with depreciation of more than 65% does not exceed 15-20%. The

overall positive migration growth due to internal migration is observed in municipal areas, where in addition to the indicated unemployment rate, the share of paved roads is higher than 65%.

A satisfactory situation with the migration of the rural population at working age is typical for municipalities with a per capita GMP above 84.9 thousand rubles and where the number of cases of newly registered diseases per 1000 people is below 553.85. If we consider the situation in the context of intraregional migration, then for a satisfactory migration situation it is necessary to exceed the permissible per capita migration of 148.5 thousand rubles.

A decline in the working-age population is typical for rural areas with deteriorating living conditions to the regional average and exceeding the unemployment threshold of 6.2%, as well as exceeding the number of cases of newly registered diseases per 1000 people in 362.9 cases.

The negative situation with labour migration is typical for rural areas with low values of indicators of housing conditions (heating, water supply, sewage, and wear). The threshold value of GMP per capita in such territories is reduced to 77 thousand rubles.

A critical decline in the working-age population and relocation to other municipalities is observed when the share of the housing stock exceeds 65.5%, the threshold is 44.5%, the unemployment rate exceeds 11.5% and the share of the housing stock equipped with central heating is less than 34.25%.

## 7. Conclusion

Summing up, the authors conclude that the motivation of a villager to migrate within the region is to seek work (without reference to a specific income), improve housing conditions (the need for minimal compliance with urban standards of housing well-being) and better medical care. Indicators such as the environmental situation, water supply and water quality or increased demands on the state of the infrastructure do not play a decisive role. The results obtained are of an intermediate nature and may be in demand for researchers in this field, as well as taken into account when developing municipal and regional rural development programs in the Siberian Federal District. The next step in the continuation of the study will be to conduct a sociological survey and questionnaires of various categories of the rural population to identify subjective opinions about their own level of material well-being and the quality of rural life.

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