Analysis of the relationship between the level of digitalization and the level of quality of life: a regional aspect

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Abstract. In the article, digitalization is considered as the result of the efficient use of labor resources. In turn, for the full use of labor capital, it is necessary to create a certain level of people's quality of life. Therefore, on the example of the Irkutsk region - a subject of the Russian Federation, a relationship was made between these characteristics. The level of quality of life was analyzed for five groups of indicators and each was compared with a growth rate of costs for information and communication technologies, which presumably indicates the level of access to ICT. The main directions for the sustainable development of digital technologies in the region are noted.

1. Introduction

According to the results of 2017, the rating of the socio-economic situation of the constituent entities of the Russian Federation determined the place of the Irkutsk region, assigning it 29th position against 25th position in 2016, 23rd position in 2015 [1, 2].

Obviously, such a decrease in the results of economic security in the region gives the degree of development of the real sector of the economy of the subject of the Federation. The competitiveness of products, the position of the region in high-tech markets that form the prerequisites for sustainable development will depend on the level of digitalization [3-5].

Constraining factors for digitalization for lagging regions are the low level of technology development, underdeveloped infrastructure, which is explained by the inefficient use of production factors, in particular labor resources. Labor resources can be used with the greatest utility at the maximum psychophysiological and intellectual concentration of human properties [6-8]. The development of such properties contributes to an increase in the quality of human life.

The quality of life is considered as a system of indicators characterizing the degree to which people's life strategies are implemented and their life needs are met. The growth of needs should be confirmed by an increase in the ability of people to solve their problems and achieve individual and collective success. Therefore, the desire for change is directly proportional to the willingness of the region's residents to digitalize and obtain its final results. In this regard, the assumption arises that a change in the quality of life of people in the region affects the intensity of the process of digitalization of the region’s economy [9].

In our article, we will try to analyze the digitalization process as a result of the successful development of the region, i.e. in order to increase the efficiency of the economic system, it is necessary to have a skilled, healthy, resource-seeking labor force that can work and manage digital
technologies. However, in most literature, an inverse relationship is indicated: digitalization is accepted as a factor in the effectiveness of a region’s economy, i.e. in order to increase the efficiency of the economic system, digital technologies are needed [10].

2. Methods
The study is based on logical and statistical research methods. As statistical methods, the grouping method, multidimensional comparison, detailing, correlation-regression method, expert assessment method, graphic method were used.

At the beginning of the study, a logical relationship was established between the level of quality of life of people in the region and the level of access to information and communication technologies (ICT) and statistics were collected on the Irkutsk region for 4 years, from 2014 to 2017. To characterize the level of quality of life of citizens of the Irkutsk region, data are grouped on five grounds: level of health, standard of living, level of education, level of consumption, level of development of energy [11, 12].

Each trait was characterized by a set of indicators. The level of health is described by a set of indicators consisting of the birth rate: the number of births per 1000 inhabitants of the region, the mortality rate: the number of deaths per 1000 inhabitants of the region; number of hospital beds: units per 10,000 inhabitants of the region; incidence: the number of registered patients diagnosed for the first time in their lives per 1000 inhabitants of the region. The standard of living is described by a set consisting of the average monthly nominal accrued wages of workers in the economy: rubles per month; gross regional product: in percent, at comparable prices to the previous year; real expenditures of the population for the purchase of goods and payment for services: in percent, in comparable prices to the previous year; benefits and social assistance in the structure of social benefits, as a percentage [13, 14]. The level of education is described by a set of indicators, consisting of the number of state and municipal daytime general educational institutions: units; the number of full-time students at state and municipal educational institutions: people at the beginning of the school year; the number of students at state and municipal higher educational institutions: people per 10,000 people, at the beginning of the school year; the number of students in state and municipal educational institutions of secondary vocational education: people; at the beginning of the school year [15, 16]. The level of consumption is described by a set of indicators, consisting of an indicator of the consumption of milk and dairy products per capita: kilograms per year; actual household final consumption per capita: in rubles; indicator of the structure of the use of cash incomes of the population - purchase of goods and payment for services: as a percentage of the total cash income; Real estate acquisition rate as a percentage of total cash income. The level of energy development is described by a set of indicators, consisting of an indicator: the value of exports of fuel and energy complex products: US dollars; at actual prices; profitability indicator of the sold goods, products (works, services) of mining organizations, manufacturing industries, production and distribution of electricity, gas and water: in percentages; production index by type of economic activity "Production and distribution of electricity, gas and water": as a percentage of the previous year; indicator of the structure of the volume of shipped products (works, services) by type of economic activity “Production and distribution of electricity, gas and water”: in percent, in actual prices.

The level of access to information and communication technologies in the region is described using the indicator of an increase in the cost of information and communication technologies, in fractions of a unit [17, 18].

Then, complex indicators are calculated for five groups by adding, by years of product, the growth rate of the indicator by the weight coefficient: a comprehensive indicator of the level of health, a comprehensive indicator of the standard of living, a comprehensive indicator of the level of education, a comprehensive indicator of the level of development of energy.

The set of indicators in each group of the quality of life and the level of access to ICT is due to the availability of statistical data for the period in question in the studied collections.
The data of the current year indicator are compared with the base year data of the corresponding indicator, finding the growth rate coefficient. For the base year, the year of the beginning of the billing period, i.e. year 2014. The need for this arises in connection with the multidimensionality of indicators and the desire to be able to compare their changes with each other, which may allow an analysis of the dynamics.

Then, weights are determined for each group of indicators by expert means. As experts, employees of the faculty of the Department of Management of the Irkutsk National Research University were invited to assess indicators of the level of quality of life and the level of access to ICT. Next are, by multiplying the corresponding weight coefficient and growth coefficient of the corresponding indicator, quantitative data on the level of ICT and the level of quality of life. They are depicted graphically to demonstrate visual dynamics.

Using correlation and regression analysis, you can find the relationship between several random variables, namely between the level of health, standard of living, level of education, level of consumption, level of energy development and level of access to ICT. This serves as evidence that the level of quality of life directly affects the level of access to information and communication technologies. And the intensity of ICT development will be the result of a change in the quality of life of citizens.

All calculations were carried out using MS Excel software product.

3. Results

So, the application of research methods helps to obtain the following results.

1. The level of health is described using time series since 2014. to 2017 indicators presented in table 1.

Table 1. Dynamics of indicators of the health level of residents of the Irkutsk region for the period from 2014 on 2017.

| Health Level          | Unit                                      | Weight coefficient | 2014 | 2015 | 2016 | 2017 | 2014 | 2015 | 2016 | 2017 |
|-----------------------|-------------------------------------------|--------------------|------|------|------|------|------|------|------|------|
| Birth rate            | births per 1000 population               | 0.1                | 15.3 | 15.3 | 14.8 | 13.4 | 1    | 1.00 | 0.97 | 0.88 |
| Mortality rate        | deaths per 1000 population               | 0.3                | 13.7 | 13.6 | 13.4 | 12.9 | 1    | 0.99 | 0.98 | 0.94 |
| The number of hospital beds | units; at the end of the year; per 10,000 people | 0.4                | 111.1| 106  | 105.4| 103.8| 1    | 0.95 | 0.95 | 0.93 |
| The incidence         | registered patients with a diagnosis established for the first time in their lives; per 1000 population | 0.2                | 955.4| 952.2| 1000.6| 980.9| 1    | 1.00 | 1.05 | 1.03 |
2. The standard of living has been described using time series since 2014. to 2017 indicators presented in table 2.

**Table 2.** Dynamics of indicators of the life level of residents of the Irkutsk region for the period from 2014 on 2017.

| Standard of living | Unit | Weight coefficient | 2014 | 2015 | 2016 | 2017 | 2014 | 2015 | 2016 | 2017 |
|--------------------|------|-------------------|------|------|------|------|------|------|------|------|
| The average monthly nominal accrued wages of workers in the economy | rub | 0.2 | 31408 | 32704 | 35510 | 38086 | 1.0 | 1.04 | 1.13 | 1.21 |
| Gross regional product | %, to the previous year; in comparable prices | 0.4 | 102 | 104.8 | 100.4 | 102.8 | 1.0 | 1.03 | 0.98 | 1.01 |
| Real expenses of the population for the purchase of goods and payment for services | %; to the previous year; in comparable prices | 0.3 | 99.9 | 87.9 | 97.6 | 103.4 | 1.0 | 0.88 | 0.98 | 1.04 |
| Benefits and social assistance in the structure of social benefits | % | 0.1 | 24.1 | 23.3 | 23.1 | 20.4 | 1.0 | 0.97 | 0.96 | 0.85 |

3. The level of education availability has been described using time series since 2014. to 2017 indicators presented in table 3.

**Table 3.** Dynamics of indicators of the level of availability of education of residents of the Irkutsk region for the period from 2014 on 2017.

| Educational attainment rate | Unit | Weight coefficient | 2014 | 2015 | 2016 | 2017 | 2014 | 2015 | 2016 | 2017 |
|-----------------------------|------|-------------------|------|------|------|------|------|------|------|------|
| The number of state and municipal daytime educational institutions | units; at the beginning of the school year | 0.1 | 938 | 919 | 896 | 884 | 1.00 | 0.98 | 0.96 | 0.94 |
| Number of full-time students at state and municipal educational institutions | thousand people; at the beginning of the school year | 0.2 | 271 | 273 | 280 | 291 | 1.00 | 1.01 | 1.03 | 1.07 |
| Number of students at state and municipal higher educational institutions | people per 10,000 people; at the beginning | 0.4 | 341 | 306 | 288 | 284 | 1.00 | 0.90 | 0.84 | 0.83 |
Number of students in state and municipal educational institutions of secondary vocational education of the school year person; at the beginning of the school year

|                      | 2014 | 2015 | 2016 | 2017 | 2014 | 2015 | 2016 | 2017 |
|----------------------|------|------|------|------|------|------|------|------|
| 0.3                  | 40500| 41300| 43100| 43700| 1.00 | 1.02 | 1.06 | 1.08 |

4. The level of consumption is described using time series since 2014 to 2017 indicators presented in table 4.

**Table 4.** Dynamics of indicators of the level of consumption of residents of the Irkutsk region for the period from 2014 on 2017.

| Consumption indicator                                    | Unit          | Weight coefficient | 2014 | 2015 | 2016 | 2017 | 2014 | 2015 | 2016 | 2017 |
|----------------------------------------------------------|---------------|--------------------|------|------|------|------|------|------|------|------|
| Per capita milk and dairy consumption value                | kg per year   | 0.1                | 200  | 197  | 193  | 194  | 1.00 | 0.99 | 0.97 | 0.97 |
| Actual final household consumption per capita              | thousand roubles; | 0.2                | 187.8| 199.1| 201.9| 212.3| 1.00 | 1.06 | 1.08 | 1.13 |
| The indicator of the structure of the use of cash income   | %; of total cash income | 0.4                | 66.9 | 60.6 | 64.9 | 69.2 | 1.00 | 0.91 | 0.97 | 1.03 |
| population is the purchase of goods and payment for services |                           |                    |      |      |      |      |      |      |      |      |
| The indicator of real estate acquisition as a percentage of total cash income. | %; of total cash income | 0.3                | 2.5  | 1.3  | 1.4  | 1.6  | 1.00 | 0.52 | 0.56 | 0.64 |

5. The level of energy development of residents of the Irkutsk region is described using time series since 2014 to 2017 indicators presented in table 5.

**Table 5.** Dynamics of indicators of the level of energy development of residents of the Irkutsk region for the period from 2014 on 2017.

| Energy development indicator | Unit                      | Weight coefficient | 2014 | 2015 | 2016 | 2017 | 2014 | 2015 | 2016 | 2017 |
|------------------------------|---------------------------|--------------------|------|------|------|------|------|------|------|------|
| value of exports of fuel     | m dollars USA;            | 0.3                | 2148 | 1308 | 1202 | 1639 | 1.00 | 0.61 | 0.56 | 0.76 |
the profitability of goods sold, products (works, services) of mining organizations, manufacturing industries, production and distribution of electricity, gas and water production index by type of economic activity "Production and distribution of electricity, gas and water" %; to the previous year 0.2 87.5 93.3 95.5 102 1.00 1.07 1.09 1.16
The indicator of the structure of the volume of shipped products (works, services) by type of economic activity "Production and distribution of electricity, gas and water" %; at actual prices 0.1 94.8 95.1 95.4 96 1.00 1.00 1.01 1.01

6. The values of the obtained complex indicators of the quality level of residents of the Irkutsk region and the level of access to ICT are accumulated, table 6. Having carried out a correlation analysis of the groups of indicators of the level of quality of life and the level of access to information and communication technologies, approximation reliability data are obtained.

Table 6. Comprehensive indicators of the level of quality of life of residents of the Irkutsk region and access to ICT for the period of 2014 on 2017.

| Indicator Name | 2014  | 2015  | 2016  | 2017  | Approximation confidence value |
|----------------|-------|-------|-------|-------|-------------------------------|
| Information and communication technology cost growth rate | 1.8   | 2     | 2.4   | 2.6   | -                             |
| The value of a comprehensive measure of health | 1     | 0.98  | 0.98  | 0.95  | 0.8                           |
| The value of a comprehensive indicator of living standards | 2.9   | 2.5   | 2.8   | 2     | 0.5                           |
| The value of a comprehensive indicator of educational attainment | 1.00  | 0.96  | 0.96  | 0.97  | 0.52                          |
| The value of a comprehensive indicator of the level of consumption | 1.00  | 0.83  | 0.87  | 0.93  | 0.06                          |
| The value of a comprehensive indicator of the level of energy development | 1.00  | 1.00  | 0.92  | 0.93  | 0.16                          |

4. Conclusions
The above calculations prove that:
1. The relationship between the coefficient of growth of costs for information and communication technologies and the coefficients of the level of health, standard of living and educational level exists, and therefore there is a connection between the level of quality of life.
2. This dependence is direct, i.e. with an increase in living standards, ICT costs increase, but the level of education and the level of health change with respect to ICT costs in the opposite direction.
3. If the level of health and standard of living depends on the growth rates of ICT costs, the relationship is quite close since the correlation coefficient is greater than 0.5. With regard to the
dependence of the level of education and the growth rates of ICT costs, a weak correlation dependence should be noted.

4. The level of consumption and the level of energy development do not have the expected impact on the development of ICT, because correlation is small, i.e. the correlation coefficient is less than 0.5.

There are advances in work. It should be noted that the insufficient number of calculated indicators is due to limited statistical data for the period under consideration, which may affect the reliability of the presented analysis.

The calculations show that the insufficient level of digitalization in the Irkutsk region is due to the insufficient level of quality of life. This holds back citizens on the path to introducing new digital technologies, as everyday problems that people have to deal with come to the fore. Based on the conclusions, it should be noted the main directions of bridging the digital divide of the Irkutsk region from the progressive regions of Russia:

- improving health by providing quality health services;
- improving the standard of living, increasing the provision of the population with the necessary material and spiritual benefits for life;
- improving the level of education, providing the provision of quality educational services.

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