



Assessment of Human Capital in the Agricultural Enterprises of the Republic of Kazakhstan

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ABSTRACT

Nowadays for Kazakhstani agricultural enterprises that work in the present conditions the most important is the formation of new and more effective control systems, where the main thing is the correct assessment and subsequent management of human capital. The author assesses the human capital in agriculture in the Republic of Kazakhstan. To assess the level of development of human capital in agriculture, two interconnected blocks of indicators: Indicators of conditions of the human capital and indicators of its operation results have been selected. The authors performed quantitative transfer of characteristic values into their qualitative analogues, did the ranking of areas based on entropy and analyzed by the method of factor analysis the dynamics of human capital development in agriculture.

Keywords: Human Capital, Human Capital Assessment, Production Indicators, Financial Indicators, Social Indicators, Innovation, Entrepreneurship Indicators

JEL Classifications: J24, J43, J50, Q12, O15

1. INTRODUCTION

1.1. Introduction of the Problem

In the transition to the innovative development special importance is given to the management of human capital, especially in the agrarian sector. The effective use of human capital is one of the main driving forces of modern agrarian reform and the objective factor of sustainable development of agricultural production, along with the development of social and labor sphere of agriculture, formation and development of working potential. It must be emphasized that, despite the positive developments in the labor force in agriculture some problems have not fully been solved. With the resumption of economic growth in agriculture many agricultural organizations are particularly experiencing labor deficiency. The problem is amplified by demographic decline, irrational employment of the rural population in the agricultural sector, low wages in agriculture, poor working conditions and living standards

in rural areas, manual work in the agricultural sector (Akimbekova, 2010; Koncevaya et al., 2013). One of the main factors of efficiency of functioning and sustainable development of agriculture is the human potential. It consists of qualified professionals - workers with higher and specialized secondary education. And at this time the aiming of the agricultural sector of the economy for sustainable growth leads to the relevance of the human capital management (Aubakirov and Maidirova, 2002; Klinova and Sidorova, 2012).

At the present stage of social-economic transformation in the agricultural sector it is of urgency to assess the current human capital, because it is labor force which is the fixed capital of the enterprise. Human capital evaluation question was focused on in a sufficiently large number of works, both domestic and foreign. Their analysis shows that there are different approaches to the evaluation of human capital, but there is no complete method, including in connection with the evaluation of human capital in

agriculture. Assessment of human capital in the agricultural sector at all levels should be carried out in dynamics, and it is necessary to identify the factors that have a significant impact on its change, so there is the need to develop methods of factor analysis of human capital dynamics (Loseva, 2010; Epishkin, 2013; Russiyan, 2014).

1.2. Literature Review

The concept “human capital” appeared in the scientific vocabulary in the mid-1960s. Usually, human capital means the calculated resource that is aimed at supporting the functioning of the established economic structures. This understanding of human capital is compared with the Marxist notion of man as a determining productive force of the society. Also this concept includes productive effect of investment in human capital, which leads to the development of the individual as an economic factor (Shingarov, 2012). The Oxford dictionary of business provides the following definition of human capital, ‘the ability and skills, general or specific, acquired by a person in the course of training and work experience’ (Business: The Oxford Dictionary, 1995).

In Kazakhstan scientific space the human capital theory began to emerge in the writings of scholars at the beginning of XXI century. This is due to the adoption of long-term strategies for the country’s development. Thus, Dzhumambaev considered problems of management of the human factor and its role in ensuring the effectiveness of the organization. Particular attention is paid to the problems of human capital by Mukhamedzhanova who proves the importance and priority of human capital for economic development of Kazakhstan (Aubakirov and Maidirova, 2002; Dzhumabaev, 2002). Onyusheva, in turn, believes that knowledge, but not capital and not the means of production have become a major economic resource, determining, ultimately, the competitiveness of the national economy of Kazakhstan (Onyusheva, 2012).

In Table 1 the author collected the basic definitions of human capital, which were given by a variety of domestic and foreign authors.

2. METHODS

To characterize the level of development of human capital in agriculture a system of two interconnected blocks of indicators - indicators of conditions of the human capital and indicators of the results of its operation is required.

The following considerations are taken into account to select of indicators:

- The number of indicators should not be too large not to impede the interpretation and not to increase the complexity of collecting primary information;
- Indicator values should be directly according to statistics agency of Kazakhstan or obtained by calculation from the known statistical indicators;
- Indicators that have the greatest informative value and significance for the formation and development of human capital in terms of its impact on economic growth should be selected;
- It is necessary to use only the relative indicators, as the absolute value may be directly dependent on the region and distort the real assessment;
- Indicators should be interchangeable, i.e., duplicate the semantic content, or should be complementary.

Relevant indicators are shown in Table 2 (Loseva, 2010).

We will consider the ranking algorithm for regions in terms of development of human capital in agriculture.

2.1. Stage I: Transfer of the Quantitative Characteristic Values into their Quality Analogues

Let’s compile Tables 3 and 4, where the columns are numerical values of the above two units interconnected by regions of Kazakhstan indicators where k is a predetermined number of quality levels, which we will set to 10.

Table 1: The results of the study of human capital structure theories

| Theory author | The essence of the author’s approach to human capital theory |
|---|--|
| Shultz (1968) | Human capital is valuable qualities acquired by a person which can be amplified by respective commitments |
| Becker (2003) | Human capital is generated by investment in a human, among which are education, training in the workplace, expenditure on health, migration and the search for information on prices and incomes |
| Tnurow (1970) | The human capital of people is their ability to produce goods and services |
| Sagadiyev (2013) | Human capital is not a virtual concept, not a metaphor, but rather a strict scientific term, which entered the arsenal of modern economic theory, implying “a set of knowledge, skills, abilities and skills embodied in people and enabling them to create personal, social and public welfare” |
| Mukhamedzhanova (2001) | Human capital: <ul style="list-style-type: none"> • Self-expansion of human capabilities, allowing creating value than was originally input in a person • Category of social reproduction, having cyclic form • Objective economic relations occupying a central place in the system of economic relations of society, influencing the pace and direction of technological progress, the efficiency of the production and reproduction process, being a leading factor in economic growth |
| Meldahanova (2010), Kolpakova (2010) | Human capital is a set of accumulated knowledge, education and human resources, professionalism that will improve the productivity in terms of industrial and innovative development of the country and the impact of costs and investments in people, to ensure the competitiveness and sustainability of the national economy to achieve a high quality of life |
| Dobrynin and Dyatlov (Loseva, 2011; Parhomchuk, 2010) | The form of human manifestation of productive forces in a market economy, included in the socially oriented market economy as the leading creative factor of social reproduction |

Source: Made by the author

Table 2: Indicators of the level of human capital development in the regions

| Modalities for the functioning of human capital | The results of the application of human capital |
|--|--|
| 1. Labor market indicators and labor resources <ul style="list-style-type: none"> • The level of employment in agriculture, thousand people • The number of employees in agriculture, people • The number of self-employed in agriculture, people • The immigration rate (in rural areas) The immigration rate of the population is the difference between the number of arrivals to the country of citizens and the number of departures, divided by the total population | 1. Productive indicators <ul style="list-style-type: none"> • Gross labor productivity (the ratio of the volume of agricultural production to total employment) mil/pers. • The total turnover of the implementation cost of livestock crop production in agricultural formations per capita, thousand tenge/pers. • The index of physical volume of gross production (services) of agriculture, % to the previous year 2. Financial indicators <ul style="list-style-type: none"> • The level of profitability (loss) of agricultural production in the agricultural enterprises (percentage) • Ratio of average nominal wage and expenditures for living • The amount of budget expenditures per employee in agriculture, mil/thousand people 3. Indicators of innovation, entrepreneurship <ul style="list-style-type: none"> • Internal costs on R&D in agriculture, thousand tenge |
| 2. Investments in human capital <ul style="list-style-type: none"> • The share of expenditure on science and research and development in the gross output of goods (services) in agriculture, % | |
| 3. Indicators of social sphere <ul style="list-style-type: none"> • Proportion of population with income used for consumption below the subsistence level in rural areas (%) • The depth of poverty in rural areas (%) • The combined share of the coverage of education of the population living in rural areas, aged 6-24 years (%) • The volume of rendered health services and social services in rural areas (thousand tenge) | |

Source: Was done by the authors based on the source (Loseva, 2011). R&D: Research and development

Table 3: Qualitative analogues of the quantitative modalities of indicator values of human capital in agriculture of Kazakhstan

| Regions | The labor market and labor resources | | | | Investments in human capital | Social sphere | | | |
|--------------------|--------------------------------------|--|--|----------------------|---|---|-------------------------------------|--|---|
| | 1 | 2 | 3 | 4 | | 5 | 6 | 7 | 8 |
| | The labor market and labor resources | The number of employees in agriculture | The number of self-employed in agriculture | The immigration rate | The share of expenditure on science and research and development in the gross output of goods (services) in agriculture | Proportion of population with income used for consumption below the subsistence level in the rural area | The depth of poverty in rural areas | The combined share of the coverage of education of the population living in rural areas, aged 6-24 years | The volume of rendered health services and social services in rural areas |
| Akmolinsk | 4 | 6 | 5 | 6 | 5 | 7 | 7 | 7 | 6 |
| Aktubinsk | 6 | 5 | 6 | 6 | 5 | 6 | 6 | 7 | 4 |
| Almaty region | 5 | 4 | 6 | 6 | 6 | 7 | 8 | 6 | 5 |
| Atyrau | 7 | 6 | 6 | 6 | 5 | 8 | 7 | 4 | 5 |
| Western Kazakhstan | 6 | 4 | 6 | 6 | 5 | 6 | 7 | 7 | 6 |
| Zhambyl | 5 | 4 | 5 | 6 | 7 | 6 | 6 | 5 | 5 |
| Karaganda | 6 | 6 | 6 | 6 | 6 | 5 | 7 | 5 | 7 |
| Kostanai | 7 | 5 | 6 | 6 | 6 | 5 | 5 | 7 | 7 |
| Kyzylorda | 4 | 5 | 5 | 6 | 4 | 7 | 6 | 6 | 6 |
| Mangystau | 5 | 5 | 5 | 6 | 3 | 7 | 7 | 5 | 4 |
| South Kazakhstan | 6 | 5 | 7 | 6 | 6 | 5 | 6 | 6 | 6 |
| Pavlodar | 6 | 5 | 5 | 6 | 4 | 5 | 5 | 8 | 5 |
| North Kazakhstan | 6 | 5 | 6 | 6 | 7 | 6 | 7 | 7 | 5 |
| East Kazakhstan | 7 | 6 | 7 | 6 | 6 | 5 | 6 | 7 | 6 |

Source: Calculated and compiled by the authors

Table 4: Qualitative analogues of quantitative modalities of indicator values of human capital in agriculture of Kazakhstan

| Regions | Productive | | | Financial | | | Innovation and entrepreneurial activity |
|--------------------|--------------------------|---|---|--|--|---|---|
| | 1a | 2a | 3a | 4a | 5a | 6a | 7a |
| | Gross labor productivity | The total turnover of the implementation cost of livestock crop production in agricultural formations in per capita | Indexes of physical volume of gross production (services), in agriculture | The level of profitability (loss) of agricultural production in the agricultural enterprises | Ratio of average nominal wage and living expenditure | The amount of budget expenditures per worker in agriculture | Internal costs on R&D in agriculture |
| Akmolinsk | 6 | 5 | 5 | 5 | 4 | 5 | 5 |
| Aktubinsk | 5 | 6 | 4 | 5 | 5 | 4 | 5 |
| Almaty region | 5 | 5 | 4 | 6 | 5 | 7 | 4 |
| Atyrau | 5 | 4 | 4 | 5 | 6 | 5 | 4 |
| Western Kazakhstan | 5 | 6 | 4 | 6 | 5 | 5 | 5 |
| Zhambyl | 4 | 6 | 5 | 4 | 5 | 5 | 7 |
| Karaganda | 5 | 5 | 6 | 6 | 4 | 4 | 5 |
| Kostanai | 4 | 4 | 6 | 4 | 5 | 5 | 5 |
| Kyzylorda | 6 | 5 | 5 | 5 | 5 | 5 | 4 |
| Mangystau | 4 | 5 | 4 | 4 | 5 | 3 | - |
| South Kazakhstan | 5 | 6 | 5 | 6 | 5 | 4 | 5 |
| Pavlodar | 5 | 5 | 6 | 7 | 6 | 5 | 6 |
| North Kazakhstan | 6 | 6 | 5 | 6 | 5 | 5 | 7 |
| East Kazakhstan | 5 | 6 | 4 | 5 | 5 | 4 | 6 |

Source: Calculated and compiled by the authors. R&D: Research and development

1. We find x_{max} and x_{min}

Initially we define the quantified homogeneity (volatility) values of each feature on the coefficient of variation across the regions:

$$V = \frac{\sigma}{\bar{x}} * 100\% \tag{1}$$

Where the numerator is standard deviation, and the denominator is arithmetic average found by the formulas:

$$\sigma = \sqrt{\frac{\sum(x - \bar{x})^2}{n}}; \bar{x} = \frac{\sum x}{n} \tag{2}$$

If $V > 33\%$, then a set is quantitatively heterogeneous and as x_{max} and x_{min} we take accordingly the highest and lowest values of a quantitative trait.

If $V \leq 33\%$, then in this case, variability is slight, for these characteristics we input maximum and minimum boundary ourselves, based on the semantic content of the parameter.

2. We find the length of the quality interval:

$$h = \frac{x_{max} - x_{min}}{k - 1} \tag{3}$$

3. We transfer each quantitative value of the characteristic into its qualitative analog by the formulas:

If “the more, the better” is matching, then,

$$k_i = \frac{x_i - x_{min}}{h} + 1 \tag{4}$$

If “the less the better” is matching, then,

$$k_i = \frac{x_{max} - x_i}{h} + 1 \tag{5}$$

Meantime, the quality values can be expressed as an integer and fractional numbers. But we will take integer values to be definite. Thus, by the characteristic which values were little varying initially, the areas obtain similar qualitative value (for example, in terms of economic activity). If the characteristic’s values differ considerably, then the areas finally are in the qualitative range from 1 to 10 (e.g., internal research costs on research and development [R&D] in agriculture) (Loseva, 2011).

2.2. Stage II: The Ranking of Areas Based on Entropy

We’ll make rankings of areas separately for each block of indicators: The operation conditions and the results of functioning of human capital. This requires determining the integral quality of each area by all indicators included in a particular block.

The basis of the proposed method of ranking is the statement that the successful operation of the system (areas) is largely determined by its stability. Therefore, based on this goal, as a result of the control process facilities system must obtain some balance and stability by all characteristics. A measure of this stability is the entropy of the system, which in its turn depends on the entropy of characteristics that describe the system’s objects.

Meantime, the integral quality of areas (for all n-indicators of human capital) is not an arithmetic sum of the qualities of its characteristics, but the integral sum in the form:

$$S(i) = \sum_{j=1}^n H_j x_j; i = 1, \bar{m} \tag{6}$$

Where H_j is entropy of j characteristic; X_{ji} is qualitative value of j characteristic for i of the same area.

The entropy of a characteristic is defined by Shannon's formula:

$$H_j = \sum_{i=1}^m p_i \ln\left(\frac{1}{p_i}\right) \quad (7)$$

Where p_i is the probability of i characteristic value, and the sum of the probabilities of all values in each characteristic is equal to 1.

The more entropy has a characteristic, the more orderless it is, the more attention must be paid to it by the governing body and the higher its importance at this stage of system's operation. Over the time, the quality values of a characteristic can change therefore, the entropy will change, and the importance of the characteristic as well.

Irregularity of quality assessments by some characteristic is a signal to the management action. Small entropy of a characteristic tells about its stability for all objects. If the qualitative assessment on the basis of stability is high, then the management action is not required, just control is enough. If a stable characteristic takes lower values, in this case as well as for an unstable characteristic, appropriate action is required. On the other hand, it is necessary to monitor entropy of characteristics in time. In some cases, consistently high values of a characteristic may indicate stagnation, and an incentive is required for further development.

So, first we determine the probability of each value of the indicator for each area.

The greater the integral quality of an object, the greater its rating.

In the same way the ranking is done on the second block of indicators - the results of the operation - and in general two blocks of indicators. Based on the identification of areas rated separately for each block one can identify the link between the operation conditions (factor characteristic) and the results of functioning of human capital (productive characteristic) (Loseva, 2011).

2.3. Method of Factor Analysis in Agriculture, the Dynamics of Human Capital Development

For effective management of human capital in the field of agriculture management it is important not just to evaluate its condition, but also to analyze the dynamics of development, and to identify factors that have the most significant impact. With this aim it is proposed to use the index method.

According to the methodology, the change in the level of human capital in agriculture of an area depends on the change of the conditions and the results of its functioning, interconnected with each other, i.e.,

$$I_{HC} = \sqrt{I_{FUNC} * I_{RES}} \quad (8)$$

In its turn, changes in the conditions and the results of functioning of human capital are determined by the change of factors, characterized by the numerical value of P_i . Let's denote the base value of the factor - P_0 , and the current - P_1 . Thus, the change of factor is expressed:

$$I_i = \frac{P_1}{P_0} \quad (9)$$

Which is said to be an individual indicator. Individual indicators are combined into a group, describing some single characteristic of human capital such as demographics.

Thus, the group indicator is a character index:

$$I_k = 1 + \frac{1}{n} \sum S_k \left(\frac{P}{P_0} - 1\right) \quad (10)$$

Where $S_k = 1$, for direct dependence of change of individual and group indices; $S_k = -1$ - for inverse dependence.

Group indicators should only be positive, i.e., connection of their changes with the change in the complex index is direct.

The complex index of human capital in agriculture is determined by the following formula:

$$I_{FUNC} = \sqrt{I_{LM} + I_{IHC} + I_{SS}} \quad (11)$$

$$I_{RES} = \sqrt{I_p + I_F + I_{IEA}} \quad (12)$$

Where I_{LM} is group indicator of the labor market and human resources, I_{IHC} is group indicator of investment in human capital, I_{SS} is group indicator of the social sphere, I_p is production group indicator, I_F is financial group indicator, I_{IEA} is group indicator of innovation, entrepreneurial activity (Loseva, 2011).

3. RESULTS

3.1. Transfer of Quantitative Characteristic Values into their Quality Analogues

Let's set up the Tables 3 and 4, where in columns the numerical values of the above two blocks of related indicators (Tables 3 and 4) for 14 regions and the Republic of Kazakhstan are given.

3.2. Calculate Entropy of Block Indicators "Modalities for the Functioning of Human Capital"

We'll make rankings of areas separately for each block of indicators: Modalities for the functioning of human capital and the results of the application of human capital. To do this, we must determine the integral quality of each area in all indicators falling within a particular block.

Let's take the first indicator "level of employment in agriculture" and determine the probability of emergence of each of its values for the Republic of Kazakhstan and for the 14 areas (Table 5).

We calculate the entropy of the level of employment by Formula 7:

$$H(1) = 0.8 * \ln \frac{10}{8} + 0.3 * \ln \frac{10}{3} + 0.3 * \ln \frac{10}{3} = 0.900898524$$

Similarly, we define the entropy of other indicators included in the first and second blocks. The results are listed in Tables 6 and 7, accordingly.

Table 5: The probabilities of emergence of each value of the indicator “level of employment in agriculture”

| Regions | Quantitative values-“the level of employment in agriculture” | How often this value is found in 14 regions (b) | Probability of emergence of this value P=b/k, k=10 |
|--------------------|--|---|--|
| Akmolinsk | 4 | 3 | 0.3 |
| Aktubinsk | 6 | 8 | 0.8 |
| Almaty region | 5 | | |
| Atyrau | 7 | | |
| Western Kazakhstan | 6 | | |
| Zhambyl | 5 | 3 | 0.3 |
| Karaganda | 6 | | |
| Kostanai | 7 | | |
| Kyzylorda | 4 | | |
| Mangystau | 5 | | |
| South Kazakhstan | 6 | | |
| Pavlodar | 6 | | |
| North Kazakhstan | 6 | | |
| East Kazakhstan | 7 | | |

Source: Calculated and compiled by the authors

Table 6: Entropy of block of indicators “modalities for the functioning of the human capital in agriculture” (the first block)

| Regions | The labor market and labor resources | | | | Investments in human capital | Social sphere | | | |
|--------------------|--------------------------------------|--|--|----------------------|---|--|-------------------------------------|--|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | The labor market and labor resources | The number of employees in agriculture | The number of self-employed in agriculture | The immigration rate | The share of expenditure on science and research and development in the gross output of goods (services) in agriculture | Proportion of population with income used for consumption below the subsistence level the rural area | The depth of poverty in rural areas | The combined share of the coverage of education of the population living in rural areas, aged 6-24 years | The volume of rendered health services and social services in rural areas |
| Akmolinsk | 4 | 6 | 5 | 6 | 5 | 7 | 7 | 7 | 6 |
| Aktubinsk | 6 | 5 | 6 | 6 | 5 | 6 | 6 | 7 | 4 |
| Almaty region | 5 | 4 | 6 | 6 | 6 | 7 | 8 | 6 | 5 |
| Atyrau | 7 | 6 | 6 | 6 | 5 | 8 | 7 | 4 | 5 |
| Western Kazakhstan | 6 | 4 | 6 | 6 | 5 | 6 | 7 | 7 | 6 |
| Zhambyl | 5 | 4 | 5 | 6 | 7 | 6 | 6 | 5 | 5 |
| Karaganda | 6 | 6 | 6 | 6 | 6 | 5 | 7 | 5 | 7 |
| Kostanai | 7 | 5 | 6 | 6 | 6 | 5 | 5 | 7 | 7 |
| Kyzylorda | 4 | 5 | 5 | 6 | 4 | 7 | 6 | 6 | 6 |
| Mangystau | 5 | 5 | 5 | 6 | 3 | 7 | 7 | 5 | 4 |
| South Kazakhstan | 6 | 5 | 7 | 6 | 6 | 5 | 6 | 6 | 6 |
| Pavlodar | 6 | 5 | 5 | 6 | 4 | 5 | 5 | 8 | 5 |
| North Kazakhstan | 6 | 5 | 6 | 6 | 7 | 6 | 7 | 7 | 5 |
| East Kazakhstan | 7 | 6 | 7 | 6 | 6 | 5 | 6 | 7 | 6 |
| Entropy | 0.9008 | 0.9773 | 0.93807 | -0.0471 | 1.5871 | 1.3098 | 1.2452 | 1.4893 | 1.3369 |

Source: Calculated and compiled by the authors

We calculate the entropy of the number of employees in agriculture by Formula 7:

$$H(2) = 0.7 * \ln \frac{10}{7} + 0.4 * \ln \frac{10}{4} + 0.3 * \ln \frac{10}{3} = 0.977380595$$

We calculate the entropy of the number of self-employed in agriculture by Formula 7:

$$H(3) = 0.7 * \ln \frac{10}{7} + 0.4 * \ln \frac{10}{4} + 0.2 * \ln \frac{10}{2} = 0.938076336$$

We calculate the entropy of the immigration rate by Formula 7:

$$H(4) = 0.14 * \ln \frac{10}{14} = -0.047106113$$

We calculate the entropy of the share of expenditures on science and research and development in the gross output of goods (services), in agriculture by Formula 7:

$$H(5) = 0.5 * \ln \frac{10}{5} + 0.4 * \ln \frac{10}{4} + 0.2 * \ln \frac{10}{2} + 0.2 * \ln \frac{10}{2} + 0.1 * \ln(10) = 1.587123557$$

We calculate the entropy of the proportion of people whose income

Table 7: Entropy block of indicators “the results of the application of human capital” (the second block)

| Regions | Productive | | | Financial | | | Innovation and entrepreneurial activity |
|------------------|--------------------------|---|---|--|--|---|---|
| | 1a | 2a | 3a | 4a | 5a | 6a | 7a |
| | Gross labor productivity | The total turnover of the implementation cost of livestock crop production in agricultural formations in per capita | Indexes of physical volume of gross production (services), in agriculture | The level of profitability (loss) of agricultural production in the agricultural enterprises | Ratio of average nominal wage and living expenditure | The amount of budget expenditures per worker in agriculture | Internal costs on R&D in agriculture |
| Akmolinsk | 6 | 5 | 5 | 5 | 4 | 5 | 5 |
| Aktubinsk | 5 | 6 | 4 | 5 | 5 | 4 | 5 |
| Almaty | 5 | 5 | 4 | 6 | 5 | 7 | 4 |
| Atyrau | 5 | 4 | 4 | 5 | 6 | 5 | 4 |
| Western | 5 | 6 | 4 | 6 | 5 | 5 | 5 |
| Kazakhstan | | | | | | | |
| Zhambyl | 4 | 6 | 5 | 4 | 5 | 5 | 7 |
| Karaganda | 5 | 5 | 6 | 6 | 4 | 4 | 5 |
| Kostanai region | 4 | 4 | 6 | 4 | 5 | 5 | 5 |
| Kyzylorda region | 6 | 5 | 5 | 5 | 5 | 5 | 4 |
| Mangystau | 4 | 5 | 4 | 4 | 5 | 3 | - |
| South Kazakhstan | 5 | 6 | 5 | 6 | 5 | 4 | 5 |
| Pavlodar region | 5 | 5 | 6 | 7 | 6 | 5 | 6 |
| North Kazakhstan | 6 | 6 | 5 | 6 | 5 | 5 | 7 |
| East Kazakhstan | 5 | 6 | 4 | 5 | 5 | 4 | 6 |
| Entropy | 0.9008 | 1.2567 | 1.0142 | 1.2845 | 0.6437 | 1.0055 | 1.3114 |

Source: Calculated and compiled by the authors. R&D: Research and development

is used for consumption below the cost of living in the rural area by Formula 7:

$$H(6) = 0.5 * \ln \frac{10}{5} + 0.4 * \ln \frac{10}{4} + 0.4 * \ln \frac{10}{4} + 0.1 * \ln(10) = 1.309864685$$

We calculate the entropy of the depth of poverty by Formula 7 in the rural area:

3.3. Calculate Entropy of Block Indicators “The Results of the Application of Human Capital”

We calculate the entropy of the gross labor productivity by Formula 7:

$$H(1a) = 0.8 * \ln \frac{10}{8} + 0.3 * \ln \frac{10}{3} + 0.3 * \ln \frac{10}{3} = 0.900898524$$

We calculate the entropy of the total turnover of the implementation cost of livestock crop production in agricultural formations in per capita by Formula 7:

$$H(2a) = 0.6 * \ln \frac{10}{6} + 0.6 * \ln \frac{10}{6} + 0.2 * \ln \frac{10}{2} + 0.2 * \ln \frac{10}{2} = 1.256765913$$

Let’s calculate the entropy index of physical volume of gross production (services) of agriculture by Formula 7:

$$H(3a) = 0.6 * \ln \frac{10}{6} + 0.5 * \ln \frac{10}{5} + 0.3 * \ln \frac{10}{3} = 1.014260806$$

We calculate the entropy level of profitability (loss) of agricultural production in the agricultural enterprises by Formula 7:

$$H(4a) = 0.5 * \ln \frac{10}{5} + 0.5 * \ln \frac{10}{5} + 0.3 * \ln \frac{10}{3} + 0.1 * \ln(10) = 1.284597531$$

We calculate the entropy ratio of average nominal wage and the subsistence level by Formula 7:

$$H(5a) = 0.10 * \ln \frac{10}{10} + 0.2 * \ln \frac{10}{2} + 0.2 * \ln \frac{10}{2} = 0.643775165$$

We calculate the amount of entropy budget expenditures per employee in agriculture according to Formula 7:

$$H(6a) = 0.8 * \ln \frac{10}{8} + 0.4 * \ln \frac{10}{4} + 0.1 * \ln(10) + 0.1 * \ln(10) = 1.005548152$$

We calculate the entropy of internal costs on R&D in agriculture by Formula 7:

$$H(7a) = 0.6 * \ln \frac{10}{6} + 0.3 * \ln \frac{10}{3} + 0.2 * \ln \frac{10}{2} + 0.2 * \ln \frac{10}{2} = 1.311462381$$

3.4. Rank Regions Based on Entropy

Thus, the greatest entropy is possessed by “the index of physical volume of gross agricultural production (services),” and the least - by “the proportion of people whose income is used for consumption below the subsistence level in rural areas.” In general, visually uneven distribution of qualitative values for all indicators is observed.

We define integral quality of each area accounting for the entropy of values of all indicators of the first and second blocks by the Formula 6 (S(1) - Akmolinsk region):

$$S(1) = \sum_{j=1}^n H_j x_{ji} = 4 * 0.9008 + 6 * 0.9773 + 5 * 0.93807 + 6 * (-0.0471) + 5 * 1.5871 + 7 * 1.3098 + 7 * 1.2452 + 7 * 1.4893 + 6 * 1.3369 = 58.142$$

Similarly, we define the integral quality of each area accounting for the entropy of values of the first block of indicators by Formula 6. The results are summarized in Table 8, accordingly.

Similarly, we define the integral quality of each area accounting for the entropy of values of the second block of indicators by the Formula 6. The results are summarized in Table 9, accordingly.

$$S(1a) = \sum_{j=1}^n H_j x_{ji} = 6 * 0.9008 + 5 * 1.2567 + 5 * 1.0142 + 5 * 1.2845 + 4 * 0.6437 + 5 * 1.0055 + 5 * 1.3114 = 37.3411$$

The greater the integral quality of an object, the greater must be its rating. Therefore final ranking of the areas takes the form as in Table 10.

$$S_{Akmolinsk} = S(1) + S(1a) = 58.142 + 37.3411 = 95.948285$$

From Table 10 it is clear that the North-Kazakhstan area under the terms of the functioning of human capital in agriculture has the highest rating since the integral quality of the object is the largest among the other objects (103.5804). The lowest rating is in Mangystau region, the integrated quality of which is 74.55515.

3.5. The Factor Analysis Methodology

On the basis of the ranking of the regions separately for each block it can be detected that there is a connection between operation conditions (factor characteristic) and the results of the functioning of human capital in agriculture (productive characteristic).

According to the method of factor analysis in agriculture, the dynamics of human capital development, changes in the conditions of functioning of human capital (factor characteristic) and the results of functioning of human capital of the Republic of Kazakhstan (productive characteristic) are determined by the change of 11 factors/indicators selected in the Table 11, characterized by the numerical value of P_i . Let's denote the value of the indicator P_0 for 2009 and P_i for 2013. Thus, the changes of the individual indicator are determined by Formula 9.

$$I_{\text{The employment level in agriculture}} = \frac{148.9}{153.4} = 0.97066493$$

$$I_i - 1 = 0.97066493 - 1 = -0.02933507$$

Similarly, we define the change factor $I_p, I_i - 1$, each indicator field of the first and second blocks by Formula 6.

Table 8: Integral quality of each area based on the entropy of the first block of indicators “modalities for the functioning of the human capital in agriculture”

| | |
|-------|--------|
| S(1) | 58.142 |
| S(2) | 54.675 |
| S(3) | 58.032 |
| S(4) | 57.287 |
| S(5) | 50.910 |
| S(6) | 53.392 |
| S(7) | 58.207 |
| S(8) | 58.619 |
| S(9) | 52.843 |
| S(10) | 49.239 |
| S(11) | 57.075 |
| S(12) | 52.421 |
| S(13) | 60.432 |
| S(14) | 60.443 |

Source: Calculated and compiled by the authors

Table 9: Integral quality of each area based on the entropy of the second block of indicators “the results of the application of human capital”

| | |
|--------|---------|
| S(1a) | 37.3411 |
| S(2a) | 36.321 |
| S(3a) | 38.0539 |
| S(4a) | 34.1454 |
| S(5a) | 38.611 |
| S(6a) | 38.7782 |
| S(7a) | 37.7335 |
| S(8a) | 34.6562 |
| S(9a) | 36.6734 |
| S(10a) | 25.3165 |
| S(11a) | 38.6197 |
| S(12a) | 42.6223 |
| S(13a) | 43.1488 |
| S(14a) | 37.6324 |

Source: Calculated and compiled by the authors

Table 10: Ranging of the areas on agricultural conditions of functioning of the human capital

| | |
|-------------------------|-------------|
| Akmolinsk | 95.48285 |
| Aktubinsk | 90.99632 |
| Almaty region | 96.08602 |
| Atyrau region | 91.43262 |
| West Kazakhstan | 89.52114304 |
| Zhambyl region | 92.16985 |
| Karaganda region | 95.94072 |
| Kostanai region | 93.27512 |
| Kyzylorda region | 89.51625 |
| Mangystau region | 74.55515 |
| South Kazakhstan region | 95.69489 |
| Pavlodar region | 95.04365 |
| North Kazakhstan region | 103.5804 |
| East Kazakhstan region | 98.07499 |

Source: Calculated and compiled by the authors

3.6. Calculate Group Indicators and Complex Human Capital Index in Agriculture

Now we calculate the group of indicators - $I_{LM}, I_{IHC}, I_{SS}, I_P, I_F, I_{IEA}$; complex index of conditions for the functioning of human capital (I_{FUNC}) and the complex index of the results of functioning of human capital (I_{RES}); index of functioning of human capital

in agriculture - I in all indicators of the first and second block of Akmolinsk region are shown in the Formulas 11, 12 and 10, accordingly. The results are summarized in Table 12.

$$I_{LM} = 1 + \frac{1}{4} * 1 * 0.735535636 = 1.183883909$$

$$I_{HC} = 1 + - * 1 * 0.637034653 = 1.637034653$$

$$I_{SS} = 1 + \frac{1}{4} * 1 * 0.371532293 = 1.092883073$$

$$I_p = 1 + \frac{1}{3} * 1 * 0.694272369 = 1.231424123$$

$$I_F = 1 + \frac{1}{3} * 1 * 1.622842657 = 1.540947552$$

Table 11: Calculation of individual indicators of changes in human capital in agriculture of Akmolinsk region

| Indicator | P_0 | P_i | $I_i = \frac{P_i}{P_0}$ | $I_i - 1$ |
|--|-----------|----------|-------------------------|-------------|
| Modalities for the functioning of the human capital | | | | |
| The indicators of the labor market and human resources | | | | |
| The level of employment in agriculture, th. pers. | 153.4 | 148.9 | 0.97066493 | -0.02933507 |
| The number of employees in agriculture; pers. | 644 481 | 694 413 | 1.07747629 | 0.077476295 |
| The number of self-employed in agriculture, people | 110 116 | 104925 | 0.9528588 | -0.0471412 |
| The immigration rate (in rural areas) | 0.01374 | 0.00362 | 0.26346434 | -0.73653566 |
| Investments in human capital | | | | |
| The share of expenditure on science and research and development in the gross output of goods (services), agriculture, % | 0.133583 | 0.218680 | 1.63703465 | 0.637034653 |
| Indicators of social sphere | | | | |
| Proportion of population with income used for consumption below the subsistence level in the rural areas (%) | 6.1 | 4.3 | 0.70491803 | -0.29508197 |
| The depth of poverty in rural areas (in %) | 0.9 | 0.8 | 0.88888889 | -0.11111111 |
| The combined share of the coverage of education of the population living in rural areas, aged 6-24 years (in %) | 49.8 | 54.8 | 1.10040161 | 0.100401606 |
| The volume of rendered health services and social services in rural areas (thousand tenge) | 5581835.3 | 936254.5 | 1.67732376 | 0.677323765 |
| The results of the application of human capital | | | | |
| Productive indicators | | | | |
| Gross labor productivity (the ratio of the volume of agricultural production to total employment), mil./pers. | 1316.05 | 1555.34 | 1.1818244 | 0.181824399 |
| The total turnover of the implementation cost of livestock crop production in agricultural formations per capita, thousand tenge/pers. | 152.28 | 245.69 | 1.61340951 | 0.613409509 |
| The index of physical volume of gross production (services) of agriculture, in% to the previous year | 145.6 | 130.9 | 0.89903846 | -0.10096154 |
| Financial indicators | | | | |
| The level of profitability (loss) of agricultural production in the agricultural enterprises (percentage) | 14.8 | 25.0 | 1.68918919 | 0.689189189 |
| Ratio of average nominal wage and a living standard | 2.85 | 3.27 | 1.14736842 | 0.147368421 |
| The amount of budget expenditures per employee in agriculture, mil/thousand | 52165.98 | 93183.31 | 1.78628505 | 0.786285046 |
| Indicators of innovation, entrepreneurial activity | | | | |
| Internal costs on R&D in agriculture, thousand tenge | 269 680 | 506441.4 | 1.877934589 | 0.877934589 |

Source: Calculated and compiled by the authors. R&D: Research and development

Table 12: The calculation of group indices of human capital changes in agriculture in the Republic of Kazakhstan

| Regions | I_{LM} | I_{HC} | I_{SS} | I_p | I_F | I_{HEA} | I_{FUNC} | I_{RES} | I_{HC} |
|------------------|----------|----------|----------|-------|-------|-----------|------------|-----------|----------|
| Akmolinsk | 1.18 | 1.63 | 1.09 | 1.23 | 1.5 | 1.87 | 1.28 | 1.52 | 1.40 |
| Aktubinsk | 1.51 | 1.06 | 1.19 | 1.55 | 1.20 | 1.33 | 1.24 | 1.35 | 1.30 |
| Almaty region | 1.29 | 1.35 | 1.19 | 1.32 | 1.74 | 1.04 | 1.28 | 1.34 | 1.31 |
| Atyrau | 1.10 | 1.45 | 1.17 | 1.88 | 2.74 | 1.18 | 1.23 | 1.82 | 1.50 |
| West Kazakhstan | 1.24 | 4.24 | 1.29 | 1.87 | 1.47 | 6.49 | 1.89 | 2.61 | 2.22 |
| Zhambyl | 1.25 | 1.45 | 1.18 | 1.60 | 1.65 | 1.00 | 1.29 | 1.39 | 1.34 |
| Karaganda | 1.17 | 1.06 | 1.05 | 1.92 | 1.42 | 1.47 | 1.59 | 1.09 | 1.32 |
| Kostanai | 1.07 | 2.12 | 1.33 | 1.21 | 1.16 | 1.96 | 1.40 | 1.45 | 1.42 |
| Kyzylorda | 1.36 | 1.30 | 1.18 | 1.49 | 2.47 | 1.66 | 1.28 | 1.83 | 1.53 |
| Mangystau | 1.53 | 2 | 1.62 | 2.25 | 1.98 | 2 | 1.70 | 2.07 | 1.88 |
| South Kazakhstan | 1.03 | 1.14 | 6.37 | 1.82 | 1.89 | 1.84 | 1.96 | 1.85 | 1.90 |
| Pavlodar | 1.00 | 1.55 | 1.19 | 1.50 | 1.83 | 2.37 | 1.23 | 1.87 | 1.51 |
| North Kazakhstan | 1.05 | 1.19 | 1.02 | 1.48 | 1.57 | 1.00 | 1.08 | 1.32 | 1.20 |
| East Kazakhstan | 1.05 | 1.47 | 1.32 | 1.67 | 1.63 | 2.56 | 1.27 | 1.91 | 1.56 |

Source: Calculated and compiled by the authors

4. DISCUSSION

$$I_{HEA} = 1 + \frac{1}{1} * 1 * 0.877934589 = 1.877934589$$

$$I_{FUNC} = \sqrt[3]{1.183883909 * 1.637034653 * 1.092883073} \\ = 1.284242082$$

$$I_{RES} = \sqrt[3]{1.231424123 * 1.540947552 * 1.877934589} \\ = 1.527420653$$

$$I_{HC} = \sqrt[3]{1.284242082 * 1.527420653} = 1.400563415$$

Tables 11 and 12 show that in the Akmolinsk region index of the change of human capital in agriculture is 1.4, i.e., I_{hc} growth makes up 40%, where the special role is played by the index of results of functioning of human capital in agriculture, especially the index of innovation, entrepreneurial activity. That is I_{i-1} on internal costs on R&D in agriculture made up 0.877934589. The growth of this indicator in Akmolinsk region in 2013 compared to 2009 amounted to 236,761.40 tenge, which is approximately 1.877 times higher and which ultimately has a positive effect on the development of Akmolinsk region as a whole. Since the main purpose of the entrepreneurial activity is profit, then achievement of that in practice is possible by ensuring economic stability in a market environment characterized by financial stability, competitiveness of products and technology, production and sales efficiency due to the innovative activity of the entrepreneurs. Innovations serve as a specific tool that is business incentive mechanism, but not innovations as such, but directed organized search for novelties, the constant focus business entities to achieve market competition. Thus, the current economic situation calls for new solutions to use and activate the resource potential at all management levels.

It is necessary to pay attention to the indicators of social sphere (1.092883073), where there is a downward trend, and compared with other indicators they are the lowest. It had a negative trend indicator - the combined share of education of the population living in rural areas, aged 6-24 years, which was 0.100401606 (Table 11). This indicator in 2013 compared to 2009 increased by only 5%, or 1.1 times that in our opinion is a very slight increase. That is, the administration of Akmolinsk region should pay special attention to the education of the population aged 6-24 years, living in rural areas and to take measures that will lead to an increase in this indicator. If possible, more funds should be allocated for education, greater advertising opportunities related to education for young people, etc., which should ultimately lead to an increase in access to education and youth interest in this matter.

3.7. Group Indicators and Complex Human Capital Index in Agriculture

Similarly, we define the group of indicators - I_{LMP} , I_{IHC} , I_{SS} , I_P , I_F , I_{HEA} ; complex index of conditions for the functioning of human capital (I_{FUNC}) and the complex index of the results of functioning of human capital (I_{RES}); index of functioning of human capital in agriculture - I_{HC} all indicators of the first and second blocks of each region are given in the Formulas 11, 12 and 10 accordingly. The results are summarized in Table 12.

4.1. Discussion Group Indicators and Complex Human Capital Index in Agriculture

So, according to the Table 12, the highest index of the change of human capital in agriculture in the Republic of Kazakhstan for 2009-2013 (Table 12) is in West Kazakhstan region being 2.22 and the lowest index of the change in human capital is in the North-Kazakhstan region being 1.20.

This suggests that the maximum increase in the index changes of human capital in agriculture taken place in the West Kazakhstan region amounted to about 127%, while the index significantly influenced the results of functioning of human capital in agriculture, especially in the field of innovation and entrepreneurial activity. That is, it is necessary to pay attention to the index - internal costs on R&D in agriculture, which in 2013 compared to 2009 increased by 6.4 times or by 234,010 thousand tenge. We can say that there is the growth of funding R&D, the idea is that it should lead to the development of new crops, products, etc., causing agriculture to develop, which can lead to the growth of interest on the part of human capital and the possible influx of labor in this sector of the economy. Regarding the indicator - the labor market and labor force, there is a downward trend and this indicator is 1.24. Particular attention the administration of the West Kazakhstan region should pay to the indicator - the number of employees in agriculture, which in 2013 compared to 2009 decreased by 4,332 people (0.73 times). That is, we see a clear trend of human capital outflow from agriculture. This evolution was mainly due to the fact that today, fewer people want to work in agriculture because of poor working conditions, low wages when compared with other industries, poor infrastructure, often seasonal work, etc.

4.2. Discussion Group Indicators and Complex Human Capital Index in Agriculture of North Kazakhstan and Akmolinsk Regions

In the Northern Kazakhstan region the index of change of human capital in agriculture, which has had a significant impact to the index of the results of functioning of human capital in agriculture, especially in the financial sector grew by 20.3%. Financial indicator mainly increased due to the index - the volume of budget expenditure per person employed in agriculture, i.e., in 2013, compared with 2009 it increased by 50,134 million tenge/ thousand people (almost 2 times). Leaders of the region should also pay attention to the internal costs on R&D in agriculture, as there is no reduction or trend growth. Gross internal costs on R&D in agriculture accounted for the decrease in 2013 compared to 2009 by 311 thousand tenge.

In Akmolinsk region (Table 12), the following thing is shown: The index change of human capital in agriculture for 2009-2013 was 1.18, i.e., an increase over a given period of time only by 18%. On the growth of the index in the change of human capital in agriculture of Akmolinsk region generally, a significant impact had indicator of innovation, entrepreneurial activity - 1.87, which includes internal costs on R&D in agriculture, and investment in human capital - 1.63 (share of costs on science, research and

development in the gross output of goods (services) in agriculture). Gross internal costs on R&D in agriculture from 2009 to 2013 increased from 269,680 to 506,441.4 thousand tenge, or 1.87 times, it can be said that the rise in this indicator is almost double. The share of expenditure on science and research and development in the gross output production (services) of agriculture from 2009 to 2013 increased by 0.85097%. The smallest increase is observed in the indicators of social sphere - 1.09, which includes the following indicators: The proportion of people whose income is used for consumption below the subsistence level in rural areas; the depth of poverty in rural areas; combined share of education of the population living in rural areas, aged 6-24 years; volume of services in the field of health services and social services in rural areas (thousand tenge). At the same time the local authorities need to pay special attention to the following indicators: The proportion of people whose income is used for consumption below the subsistence level in rural areas, and the depth of poverty in rural areas. Since on other indicators there is a small increase though, on those indicators there is no growth.

Thus, on the basis of Table 12 the administration of Kazakhstan should pay attention to the indicator of the labor market and human resources, which in most cases is relatively low. This indicator includes the following indicators: The level of employment in agriculture, the number of employees in agriculture, the number of self-employed in agriculture, immigration rate (in rural areas), that is, to improve these indicators in the infrastructure it is necessary to fund more rural areas, raise wages in agriculture, to create privileges and bonuses for young professionals who want to work in agriculture, etc.

5. CONCLUSIONS

Based on personal observations of the author's it is necessary to improve the quality of the following indicators:

- The portion of people whose income is used for consumption below the subsistence level in rural areas. The portion of population with income used for consumption below the subsistence level in rural areas is higher than in the city. On poverty reduction increased income compared to the cost of living, reducing unemployment and the provision of adequate social assistance influences. Constant monitoring the causes of poverty and the assessment of the impact of certain factors on its reduction will make the process manageable and provide itemized achieving the goals of poverty reduction in rural areas.
- The portion of the population's education coverage living in the rural areas, at the age of 6-24 years old.

Dynamic development and improvement of economic relations creates problems for Kazakhstan education system to improve the quality of general education and vocational training of students and, in particular, the maintenance and development of a network of rural educational institutions. By the growth of this indicator the following factors may be caused: Electronic networking of schools and the education of new computer technologies; increase the diversity of types and kinds of schools; the introduction of new forms of organization of the educational process characterized by multifunctionality and integrative educational function.

- The volume of services rendered in the field of health and social services in rural areas. In modern society, the main priority is health because it determines the state of the economic and social status of the country, its role and place in the global community. However, there is a difference in health care organizations in the rural areas and cities, namely a special way of life of villagers, the settlement system, low (compared with the city), population density, poor quality, and sometimes the lack of roads, the specific agricultural labor leave their imprint on the organization system of medical care to villagers.

Development of the primary units of rural health care should be supported by the following main priority actions in the organization and provision of primary health care to the rural population: Comprehensive study of the state of the rural population health by organizing and holding mass medical examination of the villagers in different regions of Kazakhstan to determine the true incidence; the introduction of rural health care via rural family doctor institution must be accompanied by serious preparation for therapy and related disciplines, etc.

The growth of these indicators leads to public interest, and gradually the growth of human capital in agriculture will take place.

Thus, the proposed algorithm in this publication makes it possible to estimate the generalized rating of each region of Kazakhstan in terms of development of human capital in agriculture, as well as the rating of individual components: The block "modalities for the functioning of the human capital" - on employment, social and investment; for the block "results of the use of human capital" - in manufacturing, financial, innovation and entrepreneurial activity. This analysis will help identify the strengths and weakness of the social and economic policy of the region, which indicators have a significant impact on the growth of the index change of human capital in agriculture, and on which indicators attention should be paid to enhance them.

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