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A NEW APPROACH TO MEASURING HUMAN CAPITAL AND BUSINESS PERFORMANCE IN CHEMICAL AND PETROCHEMICAL ENTERPRISES[4]

The paper proposes a new approach to measuring the quality of human capital in chemical (petrochemical) industry enterprises. At present, various qualitative and quantitative methods are presented in academic literature. However, measuring human capital quality in the case under consideration is complicated due to certain industry-specific features including difficulties in obtaining statistics.

The methodology presented in this research is an assessment of human capital based on the weighted factors that have the strongest impact on the formation of enterprise personnel according to the authors and further comparison of final indicators with the quality rating table. Thus, the given technique has a comparative nature and can be applied to rank enterprises that operate in the industry analyzed in the study. In general, the theoretical part of the methodology may include n factors.

Thus, to test the methodology, the factors mostly affecting human capital formation as well as available in terms of collecting the statistical data are considered. Those factors include: the share of internal R&D expenditures, the share of personnel who attended advanced training, the share of personnel with higher education, and the share of personnel with secondary vocational education.

Keywords: human capital; R&D (research and development); qualification; higher and secondary vocational education; assessment; rating; weighting factors
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1. Introduction

The problem addressed in this paper covers the issues related to the development of the methodology for measuring the quality of human capital in the chemical (petrochemical) industry's enterprises. One of the priority industries in the Kazakhstani economy is the chemical (petrochemical) industry. That's why the mentioned industry was chosen for the study. The study proposes a comprehensive framework that assesses the human capital quality and identifies the enterprise personnel weaknesses, on the one hand, and has a comparative character and allows to rank enterprises within the industry, on the other.

The quality of human capital has the most direct impact on the enterprise's efficiency. Indeed, this is the personnel resources quality that determines the perspective performance indicators of an enterprise. This, in turn, justifies the need to develop a methodology that allows for a comprehensive assessment of enterprise personnel using an integrated approach based on a single index that adequately assesses the level of human capital quality in an enterprise.

2. Literature Review of Methods for Measuring Human Capital Quality

The traditional work in the basics of human capital research includes the scientific work of the 1992 Nobel Prize winner in Economic Science G. Becker (Human Capital, 1964) and the 1979 Nobel Prize winner in Economic Science T. Schultz (Investment in Human Capital: The Role of Education and of Research, 1971; Human Capital: Policy Issues and Research Opportunities, 1972).

Further, learning costs along with the direct costs (tuition fee, dormitory expenses, etc.) include "foregone earnings" as a major element, which are earnings students forego over the years of study. In essence, foregone earnings measure the value of a student's time spent on the learning and can be viewed as opportunity costs of its use. At the same time, T. Schultz promotes the idea of educational capital, an offshoot of the concept of human capital, relating to the investment made in education (Schultz, 1971).

According to Schultz, education makes people more productive, and good healthcare saves investment in education and provides opportunities to produce. The economist's most important contribution to science is *The Theory of Human Capital*, which in the 1980s initiated intense activity in motivating the investment in vocational and technical education from Breton-Woods international financial institutions, such as the IMF and World Bank.

Ogundari and Awokuse believed that human capital covers all investments aimed at improving human skills, including education, healthcare and vocational training/experience. Good education and improved health can lead to high labour productivity, as well as a decrease in inequality will be facilitated by the introduction of technologies into production and an improvement in the demographic situation (Ogundari, Awokuse, 2018).

Human capital is defined by the Organization for Economic Cooperation and Development (OECD) as "knowledge, skills, competencies and attributes embodied in the individual" that facilitate the creation of personal, social and economic well-being (OECD, 2001).

Laroche, Meret and Ruggieri (1999) further expanded the concept of human capital. They stated it should include the innate abilities of the man himself (Laroche et al, 1999).

S. Marginson described human capital as education, through which a person acquires knowledge and skills. This knowledge and skills can increase its productivity in the workplace. This increased productivity will bring higher wages to the individual, since a person's wages in an ideal labour market are determined by a person's productivity. Therefore, people will invest in education to a point where the private benefits of education are equal to the private costs. Considering this set of assumptions, the logic of the theory of human capital becomes clear in that education and training increase the quality of human capital and this leads to increased productivity, which in turn leads to an increase in the salary of the person himself (Marginson, 1992).

Human capital is very difficult to measure. Most studies use formal education to assess the impact of human capital on economic growth. This stems from a general understanding that education is essential to sustainable economic growth. Lucas argued that there were two main components formulating the country's human capital: education and learning. Employees devote part of their time to work and the rest to on-the-job training (Lucas, 1988).

G. Becker was the first to carry out a statistically correct calculation of the economic effectiveness of education: "Training costs should be included in any study of the relationship between wages and productivity." (Becker, 1964, p. 13).

Thus, human capital includes investments such as education, empirical learning, and vocational training that enhance a person's skills. This is much broader than just the level of education. It also includes an important component, like health.

To determine the income from higher education, for example, the lifetime earnings of those who did not go beyond high school were deducted from the lifetime earnings of those who graduated from college. Costs of education, along with direct costs (tuition fees, hostel, etc.), contain "lost earnings" as the main element, that is, income not received by students during the years of study. Essentially lost earnings measure the value of the student’s time spent on the learning and are the alternative costs of using it.

At the same time, Schultz promoted the idea of educational capital – an offshoot of the concept of human capital – in the field of investment in education (Schultz,1972).

In 2001 Simon S. Kuznets developed a method that became later one of the main analytical tools in the field of labour economics. The work developed the concept of human capital using which the differences in the average salaries of representatives of different professions were explained (Kuznets, 2001).

American economist E. Denison develops a classification of factors of economic growth. The author highlights twenty-three factors, including four factors related to labour, the other four are referred to capital, one is to land, and fourteen characterize the contribution of scientific and technological progress. According to Denison, the economic growth is defined more by the quality of the factors and their improvement rather than by the number of expended factors. And the quality of the labour force is viewed to be primary by Denison (Denison, 1974).

Analysing the economic growth of the USA for 1929-1982, E. Denison infers that education, which is the most important component of human capital, is the key factor of labour productivity growth. It is important to note that various methodological approaches to estimate the value of human capital exists.

J. Kendrick proposes a cost-based method to measure human capital – that is, to estimate it as an accumulated value of investment into a person based on statistical data. The given framework is quite efficient when applied to the USA since extensive and reliable statistics are available. According to J. Kendrick expenses incurred by families and society to raise children up to working age and obtain an occupation, expenses on retraining, advanced training, healthcare, labour force migration etc. are referred to be an investment in human capital (Kendrick, 1976).

Further, he includes investments in housing, expenditures for durable goods, stocks of goods in households, and R&D. As a result, J. Kendrick finds that in the 1970s human capital accounts for more than half of the accumulated national wealth of the USA. J. Kendrick's method allows us to assess human capital accumulation by its full "replacement cost"; however, it does not allow us to estimate the "net value" of human capital (accounting for its "depreciation").

J. Mincer in his study assesses the contribution of education and the duration of labour activity to human capital. Based on the USA statistics of the 1980s, the author finds that human capital efficiency depends on the number of years of general education, professional training, and the employee's age (Mincer, 1994).

It should be noted the study by C. Mulligan and S. Martin (Mulligan, Martin, 1995), where the authors propose a methodology for assessing the stock of total human capital using a system of indices. It can be noted here that the S index of science and synergy was included as one of the sub-indices, which was calculated according to the following formula: $S=(1+10N+W)$, where N is a gross domestic investment in science in R&D, W is the share of the country in total global investment in science.

Further, N. Sailaubekov et al. (Sailaubekov et al., 2018) develop a model for assessing university ranking based on lecturers' motivation. These factors are grouped into several blocks: material and monetary, material and non-monetary, and non-material. The study demonstrates that systematic and timely use of the approach improves the quality of human capital and contributes to the increase university's competitiveness.

A different approach is presented in the study by F. Milost, who considers human capital to be an important element of the business process; however, unlike the asset captured in the balance sheet, it cannot be valued using classical approaches. He classifies all the methods into monetary (involving a monetary valuation) and non-monetary (not involving a monetary valuation). By studying various methods for assessing human capital, he divides them into those that evaluate intellectual capital as a whole and those that evaluate human capital as part of intellectual capital. At the same time, he examines the essence of human capital – whether it has the attributes of an organization's asset or not, and the methodological base changes accordingly (Milost, 2014).

A. Sakalas and Z. Liepe define human capital as a combination of knowledge, as well as the acquisition of appropriate skills, specific abilities, and competencies by employees, who are the source of economic growth and competitive advantages of a country or organization (Sakalas, Liepe, 2011).

Sam-Ho Lee believes that it is important to distinguish the concepts of education and socialization when defining human capital. Various approaches towards its valuation will be formulated based on that (Kang, Lee, 2015). The author bases the research on the comparison of the concepts and approaches to human capital assessment in the USA and in the countries of Southeast Asia. In the USA, socialization skills are more imperative, whereas, in Southeast Asia, academic performance is prioritized. This difference defines the entire system of evaluating human capital and its management techniques, including such aspects and factors as entrance tests, general training, job interviews and future salaries.

Of great practical importance is a joint study of the US National Science Foundation and the Organization for Economic Cooperation and Development that assesses the contribution of science (R&D) to human capital. The experts elaborated a system of indicators of scientific and technological progress, including R&D expenditures. This Frascati Manual now serves as an international standard for comparative analysis of research results. The manual sets out a methodology for assessing current and accumulated R&D expenditures as intangible capital and economic growth factor (OECD, 2015). The given methodology is based on the detailed information on R&D expenditures in the USA since 1920, and accounts for the time lag between the period when R&D takes place and the period when it is translated into the accumulated human capital as an increase in the stock of knowledge and experience.

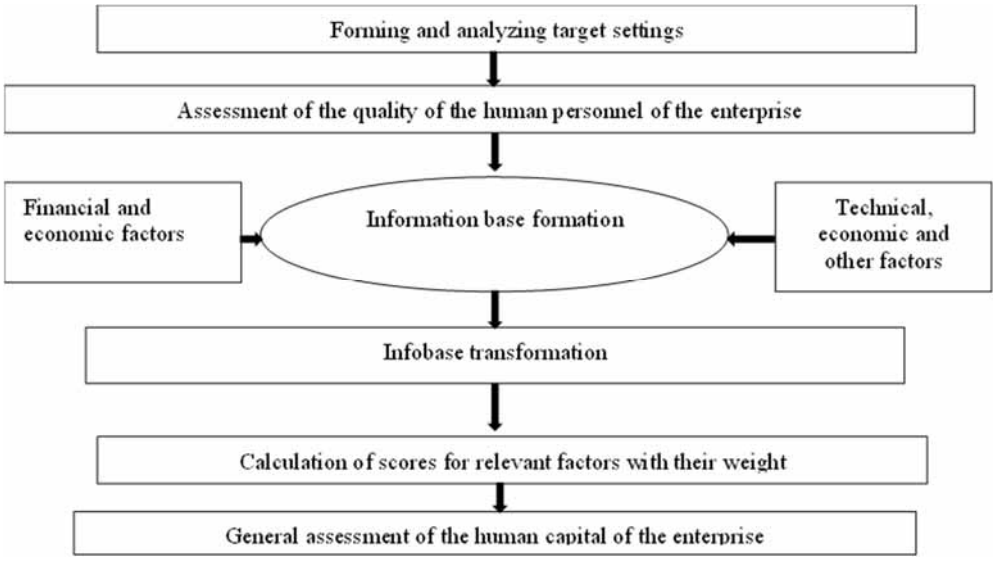
The alternative model proposed by the researchers from the University of Michigan represents a model of the individual value of employee that is based on the concepts of conditional and realizable values (Flamholtz, 1985). According to this framework, the individual value of an employee is determined by the volume of services that she is expected to provide or sell while working in the organization. This determines the expected conditional value of an employee. At the same time, the individual value depends on the expected likelihood that the employee will remain on site and fulfil her potential in a given organization. Thus, the conditional value includes all the potential income that the employee can earn for the organization assuming she works for it for the rest of her life. The value of an employee, given the likelihood that she remains in the organization for some time, determines the expected realizable value. In this way, the expected realizable value consists of two elements: the expected conditional value and the likelihood of continued membership in the organization. The last expresses management's expectation of how much income will be realized in the organization before the employee leaves.

The World Bank analysts made a significant contribution to the development of an extensive concept of national wealth that incorporates the contribution of human capital. They published a series of works substantiating this concept. The World Bank methodology summarizes the results and methods for assessing the human capital that belong to various schools and authors. Given methodology considers the accumulated knowledge and other components of human capital. Thus, the assessment is closely related to the level of education of employees.

3. Methodology

The approach presented in this paper is comprehensive and systemic. By comprehensiveness of the assessment of human capital, we understand the multidimensional nature of the proposed methodology, i.e., the assessment should consider various factors/groups of factors. Further, the methodology is systemic due to the development and application of the composite analytical measure. It is estimated as a convolution of several indicators. In this context, the convolution implies the generalization of indicators of one dimension to obtain a composite measure of the same dimension. Therefore, the model is as follows:

Figure 1. Model for the assessment of human capital at the enterprise



Source: Authors.

Data collection and methodology of human capital formation

According to the specified model, we present a methodology for measuring the quality of human capital that comprises the following steps:

Step 1. Collection and analytical processing of baseline information that include adjusting the data to a single measurement system. Procedure for assessing sustainability by a block of business activity indicators for the analysed enterprises for the period 2018-2020. The base year is 2018.

Step 2. Estimation and determination of the weights of analysed factors: The share of internal R&D expenditures; The share of personnel who attended advanced training; The share of personnel with higher education; The share of personnel with secondary vocational education.

Step 3. Estimation of indicators for corresponding factors based on weights.

Step 4. General assessment of enterprise human capital.

Further, we discuss each of the steps in more detail.

3.1. Collection and analytical processing of baseline information

Economic and statistical as well as technical indicators of the enterprise may serve as factors affecting its activity. In general, we assume that the number of such factors is n. Since indicators have different measurement units (percentages, shares, number of pieces, etc.), they should be normalized. For this purpose, the most used linear ten-point scale transformation is applied:

$$y(x) = 10\,[x-x(min)] / [x(max)-x(min)] \quad (1)$$

where x is the value of the baseline indicator, y is a normalized value of x.

If the initial value of the indicator is greater than the maximum, then the normalized value of this indicator will be considered equal to 10. If an increase in x describes both an increase in the severity of quality A and a decrease in quality B, then the difference $Y=1-y$ can serve as a normalized measure of quality B.

3.2. Estimation and determination of the weights of analysed factors

To estimate the weight of each factor, the method of expert assessments is used, which allows to rank of the degree of the importance of factors based on stakeholders' preferences (Sailaubekov, 2011).

As a part of the study, we interview the experts who are invited to consider the abovementioned factors that affect the assessment of human capital to rank their degree of importance. In accordance with this method, each expert should list the factors according to the degree of their importance.

The results of the expert analysis are as follows:

$$B_1 \succ B_2 \succ \ldots \succ B_n \quad (2)$$

where: B_1, B_2, ... B_n – are the factors affecting the assessment of human capital. $\succ$ – preference sign.

When ranking factors by degree of importance, there may be cases when a strict ratio of preferences is not achieved. But the methodology for assessing the weight of the corresponding factor does not change (Sailaubekov, 2009)

Based on preferences (2), a matrix of paired comparisons of factors affecting human capital is constructed (Table 1).

Table 1. Matrix of paired comparisons for estimation of factors weights

Factor	B_1	B_2	...	B_n	Total	Weight
1	2	3	...	4	5	6
B_1	1		1	1	*n*	*2/(n+1)*
B_2	0	1		1	*n*-1	*2(n-1)/n(n+1)*
…			…			...
B_n	0	0		1	1	*2/n(n+1)*
Total			…		*n(n+1)/2*	1

Source: Sailaubekov, 2011.

Further, if one of the factors is preferable to another, then we put 1 in the corresponding cell of the paired comparisons matrix, otherwise, we put 0. Thus, the cells of the matrix are filled according to the following specification:

$$m_{kj} = \begin{Bmatrix} 1, if\ B_k > B_j \\ 0, if\ B_k > B_j \end{Bmatrix} \quad (3)$$

where *k* is a row (factor) number, *j* is a column number

The comparison values are then added by row and recorded in column 5 of Table 1.

The weight of the corresponding factor affecting the assessment of human capital is determined using the following formula:

$$\mu_k = \frac{\sum_{j=1}^{n} m_{kj}}{\sum_{k,j=1}^{n} m_{kj}} \quad (4)$$

Thus, the weights for each factor are obtained using the formula (4). Estimations are recorded in the corresponding cells of column 6 of Table 1.

3.3. Estimation of indicators for corresponding factors based on weights

Estimates of factors based on weights (K_k) are determined using the following formula:

$$K_k = \mu_k * y_k \quad (5)$$

It should be noted that the obtained calculations can be considered as one of the approaches to implement the weighted sum model (WSM), which is also called the weighted linear combination (WLC) or simple additive weighting (SAW).

3.4 General assessment of enterprise's human capital

The general assessment of enterprise human capital (R) is estimated using the following formula:

$$R = K_1 + K_2 + ... + K_n \quad (6)$$

Formula (6) defines the general (rating) assessment of enterprise human capital and considers the significance of the factor by incorporating weight indices to differentiate the assessment (Fishburn, 1967).

To rank and analyse enterprises under the study, we offer the rating system for the assessment of personnel quality presented in Table 2.

Table 2. The rating of enterprises based on the assessment of human capital

Rank	Quality	Rating value	Threshold values	
A	A+	High	8.1-10.0	9.5-10.0
	A			9.1-9.5
	A-			8.1-9.0
B	B+	Satisfactory	5.1-8.0	7.1-8.0
	B			6.1-7.0
	B-			5.1-6.0
C	C	Poor	0-5.0	0-5.0

Source: Sailaubekov, 2011.

The main features of the proposed methodology for rating enterprise human capital include the following :

- the proposed method is based on a comprehensive approach to assess human capital.
- the rating is performed based on enterprise activity data.
- the rating is comparative.
- a flexible estimation algorithm is used to obtain a rating score for human capital.

4. Results

Further, we apply the above methodology to assess human capital in KazAzot JSC and KazMunayGas JSC and test the hypothesis that the assessment of human capital, and hence its quality, increases with the amount of funds invested in R&D (research and development). Moreover, the assessment may depend on such factors as the level of employees' qualification and advanced training.

Thus, the model for assessing personnel quality comprises the following factors (n = 4), (Table 3):

x1 – is the share of internal R&D expenditures, %

x2 – is the share of personnel who attended advanced training, %

x3 – is the share of personnel with higher education, %

x4 – is the share of personnel with secondary vocational education, %;

x5 – assessment of the enterprise stability by the block of business activity indicators.

Table 3. Enterprise input data

Enterprise	The share of internal R&D expenditures, %	The share of personnel who attended advanced training, %	The share of personnel with higher education, %	The share of personnel with secondary vocational education, %	Sustainability assessment
	x1	*x2*	*x3*	*x4*	*x5*
KazAzot JSC	1	19	34	44	0,6429
KazMunayGas JSC	0,1	92	45	55	0,7124

Source: reports of KazAzot JSC and KazMunayGas JSC for 2018.

Since indicators may have different measurement units (percentages, shares, number of pieces, etc.), they should be normalized using the formula (1) (Malczewski, Rinner, 2015).

It is important to set the minimum and maximum values for each indicator. For *x1* the minimum value is 0, and the maximum is determined as the average value of this factor in developed countries and is equal to 2.5% (given that the indicator is equal to 3.5% in the USA, 2.4% in France, and 1.4% in Spain (R&D spending as a percentage of GDP, https://w3.unece.org/SDG/ru/Indicator?id=123)).

For *x2* the minimum value is 0, and the maximum value is 20% (the requirement to attend advanced training at least once every five years is incorporated for this factor) (Churchman et al, 1954).

For *x3*, the minimum value is 0 as well, and the maximum value is determined as the average value of this indicator in developed countries and is equal to 60%.

Discussed values and data correspond to innovative enterprises in developed countries and thus, may serve as a benchmark for the chemical (petrochemical) industry of the Republic of Kazakhstan.

Separately, in a brief form, will be given a procedure for assessing sustainability by a block of business activity indicators for the analysed enterprises for the period 2019-2020.

The necessary estimates are made based on the dynamic normative method, detailed in (Jumadilova et al., 2013), and includes the following steps:

Step 1. First, it is necessary to form a normative matrix of the business activity block, the construction of which is based on the growth rate of financial and economic indicators used to calculate these coefficients (Table 4).

Step 2. Based on the initial data of the balance sheet items and the income statement, an actual matrix of pairwise comparisons of the growth rates of financial and economic indicators corresponding to the block of business activity is built (Triantaphyllou, 2000).
For this purpose, the growth rates of appropriate indicators are calculated (Table 5).

Table 4. Normative model for assessing the financial condition of an enterprise by a block of business activity indicators

Indicators	RSP	B	NCA	CR	CA	AR	I	FA	CGS	Sum
RSP	0	1	1	1	1	1	1	1	1	8
B	-1	0	0	-1	-1	-1	0	-1	0	5
NCA	-1	0	0	-1	0	0	0	0	0	2
CR	-1	1	1	0	0	0	0	0	0	3
CA	-1	1	0	0	0	0	0	0	0	2
AR	-1	1	0	0	0	0	0	0	0	2
I	-1	0	0	0	0	0	0	0	-1	2
FA	-1	1	0	0	0	0	0	0	0	2
CGS	-1	0	0	0	0	0	1	0	0	2
										28

* RSP-revenue from sales of products; B-balance; NCA- non-current assets; CR-capital and reserves; CA-current assets; AR-accounts receivable; I-inventory; FA-fixed assets; CGS-cost of goods sold.

Source: Sailaubekov, 2011.

Table 5. Calculation of growth rates of indicators for KazAzot JSC

Indicators	2019 (tenge)	2020 (tenge)	Growth rate in 2020	Rank 2020
RSP	40 878 255	48 868 415	1,1955	3
B	96 513 889	109 854 609	1,1382	4
NCA	76 278 025	82 419 002	1,0805	6
CR	60 136 431	65 276 329	1,0855	5
CA	20 235 864	27 435 607	1,3558	2
AR	3 583 235	2 973 868	0,8299	9
I	6 594 530	6 715 969	1,0184	8
FA	61 551 398	64 440 835	1,0469	7
CGS	13 740 638	20 753 280	1,5104	1

Source: Authors.

Next, we build a matrix of actual ratios of indicators by growth rates for 2020 (Table 6).

Table 6. Matrix of actual ratios of indicators by growth rates of KazAzot JSC for 2020

Indicators	Fact rang	3	4	6	5	2	9	8	1
RSP	3	-0	1	1	1	-1	1	1	-1
B	4	-1	-1	1	1	-1	1	1	-1
NCA	6	-1	-1	0	-1	-1	1	1	-1
CR	5	-1	1	1	0	-1	1	1	-1
CA	2	-1	-1	1	1	0	1	1	-1
AR	9	-1	-1	-1	-1	-1	0	-1	-1
I	8	-1	-1	-1	-1	-1	1	0	-1
FA	7	-1	-1	-1	-1	-1	1	1	-1
CGS	1	-1	1	1	1	1	1	1	0

Source: Authors.

Coincidences' matrix for KazAzot JSC in 2020 is given in Table 7.

Table 7. Match Matrix for 2020

Indicators	Number	1	2	3	4	5	6	7	8	9	Sum
RSP	1	0	1	1	1	0	1	1	1	0	6
B	2	1	0	0	0	1	0	0	0	0	2
NCA	3	1	0	0	1	0	0	0	0	0	2
CR	4	1	0	0	1	0	0	0	0	0	2
CA	5	0	1	0	0	0	0	0	0	0	1
AR	6	6	1	0	0	0	0	0	0	0	1
I	7	7	1	0	0	0	0	0	0	1	2
FA	8	1	0	0	0	0	0	0	0	0	1
CGS	9		0	0	0	0	0	1	0	0	1
											18

Source: Authors.

Step 3. A generalizing assessment of the financial condition of KazAzot JSC is calculated according to the specified block of indicators, which characterizes the degree of approximation of the actual matrix to the normative one:

Y^{2020} (АО «KazAzot») = 188/28 =0.6429

where Y is an assessment of the financial and economic stability of KazAzot JSC by the block of business activity indicators.

The corresponding assessment of the stability of KazMunayGas JSC enterprise by the block of business activity indicators takes the following value:

Y^{2020} (АО «KazMunayGas») = 14/28 =0.0714

The quality of human capital for KazAzot JSC and KazMunayGas JSC can now be estimated.

Table 5 presents the normalized values of input data of analysed enterprises.

Table 8. Data for human capital assessment

Factors	The share of internal R&D expenditures	The share of personnel who attended advanced training	The share of personnel with higher education	The share of personnel with secondary vocational education	Sustainability assessment
	y1	*y2*	*y3*	*y4*	*y5*
KazAzot JSC	4	9,5	8,50	7,33	6,43
KazMunayGas JSC	0,4	10	10,00	10,00	0,71

Source: reports of KazAzot JSC and KazMunayGas JSC for 2020

The weight of each factor is determined considering that n=5.

We assume the following order for the factors affecting the quality of human capital.

$$y1 > y2 > y3 > y4 > y5$$

where the “greater than” sign implies greater weight of the factor (The choice of this ranking is hypothetical).

The matrix of paired comparisons is constructed to estimate the weight of indicators (Table 9).

Table 9. Matrix of paired comparisons for estimating factors' weights

Factors	*y1*	*y2*	*y3*	*y4*	*y5*	Total	Factor Weight
y1	1	1	1	1	1	*5*	*0,333*
y2		1	1	1	1	4	0,267
y3			1	1	1	3	0,200
y4				1	1	2	0,133
y5					1	1	0,067
						15	*1,0*

Source: Authors.

The general assessment of KazAzot JSC human capital quality:

$$R1=Y1*v1+Y2*v2\ldots\ldots\ldots+y5*v5=$$

$$4*0,333+9,5*0,267+8,5*0,2+7,33*0,133+6,43*0,067=\mathbf{6,97} \quad (7)$$

The general assessment of KazMunayGas JSC human capital quality:

$$R1=Y1*v1+Y2*v2\ldots\ldots\ldots+y5*v5=$$

$$=0,4*0,333+10,0*0,267+10,0*0,2+10,0*0,133+ 0,71*0,067=\mathbf{6,18} \quad (8)$$

5. Discussion

According to the results, the quality assessment of KazAzot personnel based on a ten-point system is 6.97, whereas for KazMunayGas JSC the score is 6.18. In line with the classification presented in Table 2, both analysed enterprises are ranked as B, which implies that the quality of human capital in these enterprises is average or satisfactory.

The most important factor that drags down KazMunayGas JSC rank is R&D (research and development) and sustainability assessment (dynamic assessment of the business activity of the enterprise).

As for KazAzot JSC, this is a qualification of mid-level professionals and sustainability assessments that turns out to be a bottleneck. Although for all factors except R&D, the ratings are higher for KazMunayGas JSC, the overall score is higher for KazAzot JSC.

This is since the weight of the factor characterizing the share of enterprise R&D expenditures is taken as the greatest of all factors under consideration.

We make this assumption in the first place, since according to the experts of the US National Science Foundation and the Organization for Economic Cooperation and Development, R&D is one of the most significant factors affecting the quality of human capital. Indeed, a company's further development to a large extent depends on the way it manages R&D.

Thus, the R&D factor hampers the quality of human capital in KazMunayGas JSC. Even though KazMunayGas JSC is one of the largest companies in the oil and gas and

petrochemical industry, its investment in R&D is identified to be a great issue in the formation of its human capital.

To ensure stable development in the future, the company must pay great attention to the improvement of personnel quality through increased funding of R&D.

As for KazAzot JSC, the research results indicate that the qualification of mid-level professionals is one of the gravest weaknesses of human capital formation and has potentially great implications for the enterprise's further development.

6. Conclusion

The assessment of human capital in enterprises of the Republic of Kazakhstan is in the process of formation. Therefore, there is not much literature and research on these issues.

The model for evaluating human capital developed in this study is an attempt to fill the gap. The proposed model is based on the group of indicators for a comprehensive and systemic assessment of enterprise human capital and in general, may include up to *n* parameters.

Testing is performed for characteristics that reflect the state of such parameters as the share of internal R&D expenditures, the share of personnel who attended advanced training, the share of personnel with higher education and the share of personnel with secondary vocational education.

Thus, the research paper presents a methodology for developing a comprehensive and systemic approach towards human capital assessment.

The authors demonstrate step-by-step assessment for analysed enterprises and discuss the issues related to the quality of human capital in these enterprises.

Further research could expand the number of model parameters and incorporate such factors as personnel age structure; the average length of specialized service; staff turnover; cost of personnel training, healthcare and safety costs, and others.

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