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WORKING PAPER

**ANALYSIS OF EFFECTIVE UTILIZATION
OF HUMAN CAPITAL (BY EXAMPLE
OF THE RUSSIAN OIL AND GAS COMPANIES)**

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Abstract: Human capital is one of the most important intangible assets of modern companies. In this paper, the human capital is considered in terms of microeconomic approach as a set of knowledge and skills of the worker, which influences the level of productivity and well-being of the company. The paper presents results of empirical research on evaluating the effectiveness of the use of human capital in the Russian oil and gas sector of the economy.

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Contents

Introduction

One of the outstanding subjects under discussion in labor and personnel economics academic community is a human capital theory. In contemporary knowledge economy the interest to the notions of human capital theory is deepened: human resources and knowledge become the key intangible asset which strengthens company's value and enables to the unique competitive advantages in the market and stable leadership position.

In the present paper we attempt to evaluate human capital efficiency in Russian companies from oil and gas industry[1].

Conceptual frameworks of human capital theory

Evolution of views on the human capital nature and essence in the works of New Classical Economics representatives.

Human capital is "a specific reserve of health, knowledge, skills, capabilities, motivation generated by the investments and accumulated by individual. It is appropriately used in this or that area of social reproduction, contributes to employee qualification growth, promotes to labor productivity and quality growth and thereby influence the salary growth of the particular individual" [Dyatlov, 1994, p. 83].

By now there is no common approach to the definition of human capital. It is mainly caused by the fact that human capital and its properties are considered by researchers in 2 dimensions:

- macroeconomic (human capital as a source of common weal);
- microeconomic (human capital as a source of particular firm welfare);
- individual (human capital as a source of particular and his/her family welfare).

B.M. Genkin correctly notes that "human capital is a set of qualities which impact on labor productivity and could become a source of income for individual, household, enterprise and society" [Genkin, 2007, p. 97]. Yu. Korchagin also stresses the interpretation breadth of human capital: "it is the intensive production factor of economic, society and household development which includes educated one part of labor resources, knowledge, intellectual and management instruments, habitat and labor environment that provide efficient and rational functioning of human capital as a productive factor of development" [Korchagin, 2009].

In this paper we will use the working definition of human capital from the microeconomic point of view: human capital is "any stock of knowledge or characteristics the worker has (either innate or acquired) that contributes to his or her "productivity" [Acemoglu, Autor, 2010, p. 3].

The standard approach to human capital as a set of skills, abilities and knowledge strengthening labor productivity is sufficient for the most number of cases for applied use.

According to the basic human capital theory, the sources of human capital differences are [Acemoglu, Autor, 2010, p. 6]:

1. Innate ability;
2. Schooling;
3. School quality and non-schooling investments;
4. Training;
5. Pre-labor market influences.

Organizations can develop its human capital using internal training activities. At the same time organizations don't have access to other sources. Nevertheless forming up the recruitment and hiring policies organization can make the requirements to the particular education and minimum acceptable knowledge, skills and abilities.

It might be supposed that individual continues to invest in his/her human capital after job placement. These investments usually mean training activities which are organized by the employer (on-the-job training) and accepted by the employee (and firm) by means of professional development programs.

Following this approaches, there are some features of the training process [Borisov, 1998]:

1. The most number of skills and knowledge acquired by employee during the training process are highly specialized and could not be widely applied in comparison with skills and knowledge acquired during secondary and higher education.

2. The most number of training costs consists of lost production and other expenses made by the employer himself. Therefore training costs should be considered as the combined investments of organization and employee and in many cases the decisions about training should be made by firm rather than by employee.

The first property means that there are two types of human capital investments in a training context:

1. *Specific training* gives the capabilities for employee which are useful only in a particular workplace of the certain employer and correspondingly improve labor productivity in a current position.

2. *General training* increases the utility of employee in industry. Employee's labor productivity is steadily increasing and doesn't depend on employment experience in particular firm.

The second property means the key role of firm in decision-making process concerning employee's training. Our focus in the paper relates to organization and its strategy in training; that is why we assume that the investment decisions about training are made by the organization.

One of the actual streams in contemporary studies is human capital measurement and evaluation of its significance for organizational efficiency. The research of Saratoga Institute, provided in the middle of 1990-s with a sample of more than 1000 companies aimed to identify human resource management practices which differentiated leading companies from outsiders. The very interesting and important results were received: the most profitable enterprises didn't use any specific HR programs, but actively used HR data, which consisted of quite extensive list of factors [Fitz-enz, 2006, p. 47]. The equilibrium between financial and human values was also permanently maintained.

The next step was to make the tools to operate with "human values" and connect them with financial metrics. The elementary one metric was the coefficient called "Human Capital Revenue Factor" or in other words labor productivity. Simultaneously Human Capital Expense Factor and Human Capital Income Factor are calculated. These are the simplest one organizational efficiency metrics linked with a human capital. Nevertheless this approach is reductive and it is difficult to draw much conclusions on basis of these metrics [Fitz-enz, 2006, p. 49]. There are a lot of factors which could impact on the coefficient's meaning: labor productivity could rapidly grow because of price fluctuations and other factors which are weakly-connected with human capital activities in organization. Therefore it is not entirely correct to conclude how the human capital is operated on basis of meanings of stayed metrics.

Nevertheless there is another point of view concerning effective utilization of human capital in organization. It is shown by two metrics: Human Capital Value Added and Human Capital Return on Investment. These metrics could fairly evaluate the useful human capital functioning. Human Capital Value Added shows how much value is created by one employee. Human Capital Return on Investment shows how the investments in employee are compensated.

<div align="center">**Research methodology**</div>

Design equations of human capital.

Organizational effectiveness

In 1999 Saratoga Institute together with Jak Fitz-enz in the annual "Human Resource Financial Report" published the list of standard metrics on the basis of which HR specialists could conclude about their performance [Fitz-enz, 2006, pp. 52-61, 191-195]. The list consisted of 30 metrics combined into the following 7 groups:

1. Organizational effectiveness;
2. Human resources structure;
3. Compensation;
4. Benefits;
5. Separation;
6. Staffing;
7. Training and development.

The basic idea was to give for HR manager the commonly held view on applied tools to analyze human resource management processes in the company.

For our research we chose one group of metrics «Organizational effectiveness». This group was conditionally separated into preliminary and primary metrics.

Preliminary metrics:

1.   Human Capital Revenue Factor, HCRF.

$$HCRF = \frac{Revenue}{FTE}$$

where:
- FTE – full-time equivalent.

HCRF determines labor productivity. It shows how much revenue was produced per one employee in organization. Sales per employee is the standard measure used by the federal government and most business media.

2.   Human Capital Expense Factor, HCEF.

$$HCEF = \frac{Operating\ Expence}{FTE}$$

It shows total expenses in a company. HCEF shows how much expenses in operations activity of a company fall to one employee on average.

3.   Human Capital Income Factor, HCIF.

$$HCIF = \frac{Revenue - Operating\ Expence}{FTE}$$

HCIF determines operational effectiveness of labor. It shows how much operating profit fall to one employee.

Determined factor analysis

On the basis of formulas above we can create the following equality:

HCRF = HCIF + HCEF

According to the equation there is one variable which is depended on two other variables. This fact enables us to provide the determined factor analysis. For easy of reference let's transform the additive model into multiplicative model:

$$HCIF = HCRF \cdot X$$

where "x" is a share of operating profit in the revenue structure. Thus, operating effectiveness depends on labor productivity and "X" factor. We can examine how labor productivity could impact on the current activity effectiveness. Meanwhile the changes in a Human Capital Revenue's meaning could be connected not only with the human factor.

Primary metrics

The following formulas are more important in comparison with preliminary metrics.

4.   Human Capital Value Added, HCVA.

$$HCVA = \frac{Revenue - (Operating\ Expence - [Compensation\ Cost + Benefit\ Cost])}{FTE}$$

HCVA shows the profitability per average employee. In other words it means how much value the individual creates in his/her work shown in money equivalent.

5.   Human Capital Return on Investment, HROI.

$$HROI = \frac{Revenue - (Operating\ Expence - [Compensation\ Cost + Benefit\ Cost])}{[Compensation\ Cost + Benefit\ Cost]}$$

HCROI is the coefficient which shows how much income could be received per one dollar invested in employee's compensation (salary and benefits).

Having monitored HCVA and HROI, organization can control human capital effectiveness.

Training and Development.

Investments in training are the only option for organization to develop its human capital inside. Therefore after considering organizational effectiveness metrics it is necessary to focus on HR training and development data. Saratoga Institute proposed the following metrics which should be traced in the firm:

- Employee trained percentage is the proportion of employees trained to total head count. The analogues of this metric could be the average number of training hours per employee, the proportion of courses' number per employee to total head count. Any metric from this group is to identify the involvement level.
- Training cost factor is the proportion of total training cost to the number of employees trained. Calculating costs it is necessary to keep in mind the lost production opportunities. For example, if an employee is studying and needs to leave his/her workplace, an organization has losses because of idle time which should be compensated.
- Training cost percentage is the proportion of total training cost to operating expense. It is reasonable to know the comparative level of costs in the industry or region. For instance, if company's cost level exceeds competitor's one and profitability is not obvious, managers should think about the effects from implemented training programs.
- Training investment factor is the proportion of total training cost to total head count.
- Training staff ratio is the proportion of FTE (full-time equivalent) to training staff FTE.
- Training cost per hour is the proportion of total training cost to total training hours.

These metrics are the tools to monitor "Training and Development" sub-function of HRM department. The other metrics which are not presented in this list are the specific measures formed by HRM department depending on industry and business needs.

Adjustment of conceptual mechanism

The design equations of human capital are based on indices measurement according to the International Financial Reporting Standard (IFRS). In order to use them in Russian conditions it is necessary to clarify the definitions of some terms, used by J. Fitz-enz. There are some complaints to the translation of Fitz-enz's book "The ROI of Human Capital: Measuring the Economic Value of Employee Performance" made by M.S. Menshikova and Yu.P. Leonova edited by V.I. Yarnikh. For example, the term "revenue" is not translated completely correctly translated from English into Russian taking into consideration the accounting standards.

Full-time equivalent

Full-time equivalent is the ratio of the total number of paid hours during a period (part-time and full-time) by the number of working hours in that period. If the employee is part-time, 0.5 points are added to the average number of employees in full-time equivalent. Such calculation becomes more popular and reasonable because of freelance, flexible working time, part-time work.

According to Russian accounting standards, companies have to announce the average number of employees. The calculation approaches include the specific way to evaluate the average number of part-time employees. They are calculated proportionally time worked. Thus, we can evaluate the data from the companies in their annual reports as a reliable.

The procedures in Russian accounting standards and IFRS are different, thereby could not be compared.

Operating expenses

Fitz-enz's metrics are adjusted to IFRS. There are the following items in the consolidated total profit statement: "revenue" and "operating expenses and costs" on the basis of which the profit and expenses factors could be calculated.

In conditions of Russian accounting standards it is necessary to adjust "operating expenses" term: it means the sum of items "net cost", "commercial expenses" and "management expenses".

Hypothesis: *The company which utilize its human capital in the most efficient way will have maximal profit.*

Oil and Gas industry review

General information

Oil and gas is one of the most important industries in Russia. Oil and gas extraction is the part of Russian power complex (30 % of GDP share, 50 % of tax proceeds and 70 % of export) [Novak, 2014, p. 2]. Russia has the first place in the world (with Saudi Arabia) for oil and natural-gas condensate extraction and has 12.2 % of world's market share.

Oil extraction [Riareiting, 2014, pp. 9-16].

The industry has the low rates of oil extraction growth. In 2010 there was extracted 505 million tons of oil with natural-gas condensate. In 2012 the rate increased to 515 million tons. Such stability caused by oil capacities decrease in old oilfields which are partly compensated by new oilfields in Eastern Siberia. Nevertheless there oilfield will also show its maximal level. Technological innovations enable to increase oil extraction thereby improving oil recovery. According to the forecast of Russian Ministry of Energy by 2020 there will be extracted 524 million tons of oil with natural-gas condensate annually in Russian Federation. Additional extraction increase could be in case of reservoir engineering of hardly-extracting sections where the reserves are substantial. But this activity is highly expensive and it could be implemented by oil companies in case of government support. Government bodies

cooperate with companies and try to encourage investments in the industry. For example, in 2012 some incentives were introduced to dues from exported oil.

There is neither increase nor decrease in dynamics in regions apart from Krasnoyarsk region and Yakutia where the extraction is increasing due to Sredne-Botuobinskiy and Talakanskiy oilfields. The Nenets Autonomous Area and Sakhalin region cut its potential and the dynamics there is decreasing.

In 2012 the oil market was divided by oil companies by the following shares in extraction volumes:

Table 1. Oil extraction volumes in 2012 .

Name of oil and gas company	Oil extraction in 2012 (in thousand tons)	Share of oil and gas companies in the total extraction volume %
Rosneft	117 473,051	22,70%
Lukoil	84 619,858	16,30%
TNK-BP Holding	72 451,602	14,00%
Surgutneftegas	61 405,140	11,90%
Tatneft	26 306,853	5,10%
Slavneft	17 863,864	3,40%
Bashnest	15 436,615	3,00%
Gasprom	14 543,453	2,80%
Russneft	13 871,905	2,70%
Novatek	4 203,836	0,80%
Others	58 216,388	11,20%
Totally:	**518 042,549**	**100,00%**

Oil refining [Riareiting, 2014, pp. 17-25].

The volumes of primary oil refining increased slightly from 240 million tons in 2010 to 270 million tons in 2012. These trend stressed the export supplies increase, meanwhile the internal consumption decreased. Oil product manufacturing (motor petrol, diesel fuel and fuel oil) was stable. Thus, in spite of companies' attempts to implement technological innovations there were no observable returns in operations.

Oil refining industry in Russia is highly consolidated. About 90 % of oil refining capacities are under control of 10 companies which also specialize in oil extracting (vertically integrated).

Table 2. Oil refining volumes in 2012.

Name of oil and gas company	Refining volumes (in millions tons)	Share in total refining volume %
Rosneft	78	29%
Lukoil	46	17%
Gazpromneft	32	12%
Bashneft	26	10%
Surgutneftegas	22	8%
Gazprom	16	6%
Slafneft	14	5%
Russneft	9	3%
NK Alliance	4	2%
TNK-BP	---	-
Others	22	8%
Totally:	**268**	100%

Gas extraction [Riareiting, 2014, pp. 26-38].

Gas extraction dynamics is not so well-defined: in 2010 it amounted 650 milliards cubic meters, in 2011 in increased to 660 milliards cubic meters and in 2012 it decreased to the former meanings. The extraction of accompanying petroleum gas is steadily increasing because of the legislative requirements to 95 % recycling from total extraction. Gas extraction is increasing in all regions apart from the Nenets Autonomous Area.

This market niche is under control of Gazprom and Novatek where the Gazprom's share is predominant. The other companies have minor share here. In 2012 Gazprom extracted 480 milliards cubic meters of gas, Novatek – more than 55 milliards cubic meters of gas.

Human Resources

According to annual questionnaires of top-managemers in oil & gas sector, conducted by Delloite, shortage of highly qualified human resources is a typical problem for the industry. In 2010, 39% of companies have called this problem substantial for their business, in 2011 this number dropped to 17% and for the next year increased to 20%. Moreover, in the ranking of problems, the shortage of staff stands at 2-5 places [Deloitte, 2010-2012].

Investments in education are discussed in the oil & gas sector from different angles – despite the recognition of the problem of personnel shortage, only a quarter of the companies in 2010 and 2011 increased the investment in training, half of the market players in the segment did not change significantly investments, and the remaining quarter cut expenditures on education. In 2012, the situation has changed; every second company reviewed education policy and tended to increase funding in this area. This can also be explained by the fact that increased the share of companies implementing technological innovation in the workplace that reduced costs only on 5%.

In the oil & gas sector companies do not believe that any strategic initiatives directly related to the staff management can help to maintain competitive advantage. Basically, the company called the sources of competitive advantages the introduction of new technologies and innovations, efficient portfolio management and reduction of production and administrative costs. Only in the first case, we can indirectly consider the role of human resources in increasing companies' efficiency. And, as has been said, in this regard, companies increase their expenditures on education, thus investing in the human capital of the organization.

Companies

The study involved 27 companies in the oil & gas industry. The list was formed based on the rankings "Capitalization-200"[2] and "Expert-400"[3] for 2013, held by "Expert RA". Both rankings represent companies registered in the Russian Federation.

The first list ranks companies by the highest market value (capitalization) at the end of 2012. Second – ranks the largest players of the Russian Federation market by the cost of sales (revenue) for the year 2012. "Capitalization-200" includes 16 companies from the oil & gas sector and "Expert-400" – 18 companies:

Table 3. Company and their places in the rankings

№	Company	Place in the rankings	
		Capitalization-200	Expert- 400
1	Aliance	-	78
2	Antipinsky Refinery	-	141

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[2] RA Expert: List of largest companies by market value (capitalization). [Electronic source]. – The rating agency "Expert", 2013. – Mode of access: http://www.raexpert.ru/rankingtable/?table_folder=/expert400/2013 / tab2. - Caps. from the screen.
[3] RA Expert: Rating of the largest companies in terms of sales. [Electronic source]. – The rating agency "Expert", 2013. – Mode of access: http://www.raexpert.ru/rankingtable/?table_folder=/expert400/2013/main. – Caps. from the screen.

3	Bashneft	16	-
4	Varyeganneftegaz (Rosneft)	92	-
5	Gazprom	1	1
6	Gazprom neft (Gazprom)	11	-
7	Zarubezhneft	-	219
8	Irkutsk Refinery	-	147
9	Kuzbass Refinary	102	-
10	Lukoil	4	2
11	Mariyskiy Refinary	-	353
12	NefteGasIndusty	-	104
13	NOVATEK	5	36
14	Novoshahtinsky Refinery	-	144
15	Rosneft	2	3
16	Rostovoblgas (Gazprom)	165	-
17	Rusvyetpetro	-	305
18	Russneft	-	48
19	Slavneft	-	40
20	SN-MNG (Slavneft)	49	-
21	SN-YANOS (Slavneft)	80	-
22	Surgutneftegas	6	8
23	TAIF Refinery	-	62
24	Tatneft	15	16
25	TNK-BP Holding	7	6
26	Chernogorneft	196	-
27	Yatek	93	-

Some companies in this list are subsidiaries or joint venture. All kind of affiliations are shown below.

Table 4. Companies' affiliations

№	Company	Affiliations
4	Varyeganneftegaz (Rosneft)	Rosneft
6	Gazprom neft (Gazprom)	Gazprom
16	Rostovoblgas (Gazprom)	Gazprom
17	Rusvyetpetro	Joint Venture of Zarubezhneft and PetroVietnam
19	Slavneft	Joint Venture of TNK-BP Holding and Gazprom neft
20	SN-MNG (Slavneft)	Slavneft
21	SN-YANOS (Slavneft)	Slavneft
26	Chernogorneft	Part of the holding TNK-BP

It is worth noting that the company TNK-BP Holding (№25) was absorbed by Rosneft (№15) March 21, 2013 and was renamed in the RN Holding. Nevertheless, during the research period, it was functioning as an independent structure. Therefore, we will consider these two companies separately.

Also, October 10, 2013 Open Joint Stock Company "Rostovoblgaz" (№16) was renamed to Open Joint Stock Company "Gazprom gas distribution Rostov-on-Don." In this paper, for the identification of the company the old name is used.

In this paper we use the abbreviated names of the companies and their assigned numbers according to Table 3 "Companies and their place in the rankings."

For the purposes of this study, this sample is sufficient: it presents the most efficient and \ or capitalized companies which main activity in the oil & gas industry. All together they realize more than 88% of oil & gas recovery, as well as its refining. Therefore, we can say that the processes taking place in these companies represent the situation in the industry. In fact, analysis of the human capital allows us saying that a set of trends occurring in these enterprises can be called industry trends.

The results of research on the effectiveness of using human capital in the Russian oil & gas companies

Limitations of the study

Main activities of companies
    Activity
    The following table presents the classification of types of companies' activities:

Table 5. The degree of vertical integration

№	Company	Vertical Integration
1	Aliance	+
2	Antipinsky Refinery	oil refining
3	Bashneft	+
4	Varyeganneftegaz (Rosneft)	oil and gas recovery
5	Gazprom	+
6	Gazprom neft (Gazprom)	+
8	Irkutsk Refinery	oil recovery
10	Lukoil	+
12	NefteGasIndusty	oil refining
13	NOVATEK	+
14	Novoshahtinsky Refinery	oil refining
15	Rosneft	+
16	Rostovoblgas (Gazprom)	gas transmission
18	Russneft	+
19	Slavneft	+
20	SN-MNG (Slavneft)	oil recovery
21	SN-YANOS (Slavneft)	oil refining
22	Surgutneftegas	+
23	TAIF Refinery	oil refining
24	Tatneft	+
25	TNK-BP Holding	+
27	Yatek	+

The following list contains only main companies without representatives of subsidiaries. As can be seen, mainly companies are vertically integrated: process includes oil recovery and \ or gas recovery, refining and distribution of petroleum products. Four companies engaged only in oil refining, which also includes further distribution: for example, the TAIF-NK has a network of gas stations and it buys crude oil from Tatneft at market prices. All companies are currently operating in the recovering and \ or refining of oil and gas, except Kuzbass Refinery (№9). The latter specializes in the extraction and processing of natural coal, although the agency "Expert" defined it as the oil industry and oil & gas industry. Due to the fact that we restrict our sample only within the same industry, Kuzbass TC is excluded from the observed companies. The same kind of "claims" are presented for "Chernogorneft" (№26). As one of the subsidiaries of TNK-BP Holding, its activity has become more specialized and not related to oil & gas industry. According to the company's

annual report: "...company does not have productive activities. The main activity is the lease of property, the realization of property and other assets."

Geography of activity

The main activity should be carried out on the territory of Russia. In another way, we can formulate this constraint as follows: the bulk of the company's staff must be located within the country. This condition is satisfied by all companies except Zarubezhneft (№9). More than half of existing assets of this company are located outside the territory of the RF and about 80% of the staff working in foreign affiliates.

Reputation

This requirement may seem a bit specific. However, the company must have a certain reputation in the market, so that the results of their operations and performance were considered plausible and gave an objective assessment of the business. This raises the question of the relevance of being in the research sample of "Mariyskiy Refinery", which in early 2014 announced bankruptcy. In 2013, the director of the bank VTB Andrei Kostin accused the head of the plant in the speculative nature of the enterprise's activities and in the withdrawal of funds from the company. It raises the question of the reliability of published financial information of the company. Thus, Mariyskiy Refinery was recommended for exclusion from the list of companies.

Openness of information

This point is slightly ahead of the logic of presentation of the study on the effectiveness of the human capital. For more information about openness and accuracy of the information collected can be read in the following subsection. Nevertheless, despite the requirement of the Federal Tax Service of the mandatory disclosure of average number of personnel for all companies, regardless of the number of the current workforce, it is impossible to find reliable data on the average number of employees for the company "Rusvyetpetro" (№17).

The following table summarizes the mentioned above in this section:

Table 6. List of companies excluded from the studies and reasons

№	Company	Reason of exclusion
7	Zarubezhneft	80% of employees are working in foreign branches
9	Kuzbass Refinary	Activities are not related to the oil & gas industry
11	Mariyskiy Refinary	Suspicion of speculative activity. Bankrupt.
17	Rusvyetpetro	The lack of reliable information on the average number of personnel
26	Chernogorneft	Activities are not related to the oil & gas industry, non-profit company

Availability of information collected

Preliminary metrics

The ideal representation of this study is to analyze all 7 groups of benchmark indicators of Saragota Institute (organizational effectiveness, the structure of human resources, compensation, benefits, layoffs, staffing, training and development). With the availability of information on each index of each group, it is possible to carry out detailed quality and factor analyzes that identify the main factors of development of human capital in the oil & gas industry and look for each group of functional responsibilities of human resource management department in order to detect the best practices within each group.

In terms of restrictions, to access the information is needed, it is impossible to achieve this goal: even for joint-stock companies there are no requirements to disclosure such kind of specific data. In other words, in the public domain, namely through the quarterly and annual financial statements, it can be guaranteed access to the following information:

- as the part of the information disclosed in the profit and loss statement: annual *revenue, cost of sales, selling and administrative expenses*;
- in the annual and quarterly reports: the annual average number of personnel.

With the above-mentioned data, it can be created a factor of profit, costs and revenues related to the group of "organizational effectiveness".

To calculate the value added of human capital and the return on investment in human capital, which also relates to organizational effectiveness, it is needed the information about the costs of compensation and benefits. By Russian standards there are no disclosure requirements of this information. Only five companies disclose this information (Gazprom, Rosneft, Bashneft, Gazprom Neft, Yatek, etc.). Thus, to calculate the results for the remaining metrics of organizational effectiveness of human capital is not possible for the entire industry.

Relative to other groups of benchmark indicators, data collection is even more complicated. There are no standards for disclosure of the information on both RAS and IAS. For example, collecting information for the indicators of the "Education and Development", it appears that some companies reveal information about the number of trained personnel (for example, Surgutneftegaz, Gazprom Group and TNK-BP Holding), and some publish information in man-courses (for example, Rosneft). Comparing such data is not possible. And that's just about the companies that publish the data. Even fewer companies disclose the cost of training, and again, every company here can choose the format of provided information.

Thus, having a fairly wide range of instruments, lack of information on most of the investigated metrics significantly limits our research ability, and we able to calculate only three factors: factors of profits, costs and revenues.

Key metrics

Among all organizations the calculation of value added and cost-effectiveness of human capital can be realized only for five companies: Gazprom, Rosneft, Gazprom Neft, Bashneft and Yatek. This is due to the fact that in addition to the original data referred to preliminary metrics, the information on personnel costs is needed. As part of the published financial statements and other reports, data on the costs of staff is revealed only by these five companies. So we will have to build the whole analysis of the effectiveness of human capital based on these organizations.

Thus, the situation in the industry as a whole can not be displayed, only for its individual representatives.

Compatibility standards

As was already mentioned, the sources for gathering information – financial statements of companies formed under RAS. The list of the studied companies contains two companies, the information on which under RAS cannot be obtained or it is not suitable for analysis.

The first case related to the inability to obtain information – associated with Slavneft Group. This group consists, inter alia, of Slafneft Yaroslavnefteorgsintez, Megionneftegaz, the parent company of "Slavneft Refinery" and smaller members. Financial information is not published by RAS, it is possible only to trace the individual financial results of some participants (already mentioned two major subsidiaries and the head office). In this regard, the company's performance for the study will be calculated by the standards of the US (2010) and IAS (2011-2012), which are available for the group.

The second case is related to the unsuitability of information for analysis that is associated with the Lukoil company. The problem is that the vast amount of the company's revenues under RAS is reflected in the item "Income from participation in other organizations." Therefore, the items of revenue, production costs, selling and administrative expenses reflect only the results of the head company, but not of the group. For this reason, as well as for Slavneft, we will calculate the figures according to IAS.

Comparing the factors of human capital, calculated on the basis of different accounting standards is not possible: the formation of the profit and loss statement occurs on different principles and it cannot be considered as identical. In this regard:

- groups Slavneft and LUKoil will participate in the study, but the comparative analysis with other companies is impossible. So they will be a kind of "outsiders." They are part of the industry, but the factors of human capital are not identical to other companies;
- when calculating the values of industrial factor instead of the Slavneft group, will be considered subsidiaries Megionneftegaz and Yaroslavnefteorgsintez.

The accuracy of the information collected
The average number of personnel

By the same lack of standards for disclosure, companies publish information on the average number of employees in different formats. More precisely, the organization in different ways round numbers – someone discloses information in too imprecise values. For example, in the annual report for the year 2011, Russneft reported an average number of employees in the form of the phrase "about 16 thousand," and in 2012 as "more than 16 thousand." The following table shows the degree of accuracy of information on the average number of employees for each company:

Table 7. The accuracy of the information collected on the average number of personnel

№	Company	Accuracy
1	Aliance	1
2	Antipinsky Refinery	100
3	Bashneft	1
4	Varyeganneftegaz (Rosneft)	1
5	Gazprom	100
6	Gazprom neft (Gazprom)	1
8	Irkutsk Refinery	100
10	Lukoil	100
12	NefteGasIndusty	100
13	NOVATEK	1
14	Novoshahtinsky Refinery	100
15	Rosneft	100
16	Rostovoblgas (Gazprom)	1
18	Russneft NefteGasIndusty	1000
19	Slavneft	1
20	SN-MNG (Slavneft)	1
21	SN-YANOS (Slavneft)	1
22	Surgutneftegas	1
23	TAIF Refinery	1
24	Tatneft	100
25	TNK-BP Holding	1000
27	Yatek	1

Only 12 companies provide information without rounding, 8 – rounded to the hundredths, and two organizations provide only approximate information – Russneft and TNK-BP Holding. For Russneft maximum deviation from the real value is 2.9%, for TNK – only 0.7%. These evident deviations were not significant because of the absolute value of the average number of employees of these companies.

The more serious situation is with companies, where the number of employees is small and at the same time it is rounded to hundredths. Possible maximum deviation from their real values is given in the following table:

Table 8. Average maximum possible deviation of the average number of personnel

Company	The average number			Average maximum deviation from the real values
	2010	2011	2012	
Irkutsk Refinery	2 500	2 500	2 500	2%
Novoshahtinsky Refinery	1 500	2 000	2 000	3%
NefteGasIndusty	900	900	985	4%
Antipinsky Refinery	600	600	691	6%

Antipinsky Refinery has the most problematic situation with precision of figures: the average number of employees there is no more than 700 people, but the data for 2010-2011 is only rounded to the nearest hundredth. The situation is a bit saved by the fact that in 2012 Antipinsky Refinery and Neftegazindustry reported exact numbers of employees, however doing a data analysis in the dynamics during the analyzed period is worth making a stipulation on the accuracy of the data.

Financial performance of companies

All the necessary for calculations financial information from the profit and loss statements was collected through an electronic information resource "SCREEN Enterprises", where all the items of the report presented to the rounding up of thousands of rubles. Errors of this group information are negligible.

In all, as to the accuracy of the information collected, some difficulties were encountered with the data on the average number of personnel, and with the financial data there are no problems detected.

Data on preparatory metrics

Since the factors of revenue, expenditure and income of human capital cannot give acceptable information to confirm hypotheses, we will not use them as evidential base. Nevertheless, they provide a very interesting and exemplary picture of what is happening in the industry. Further, it is considered the case of each factor.

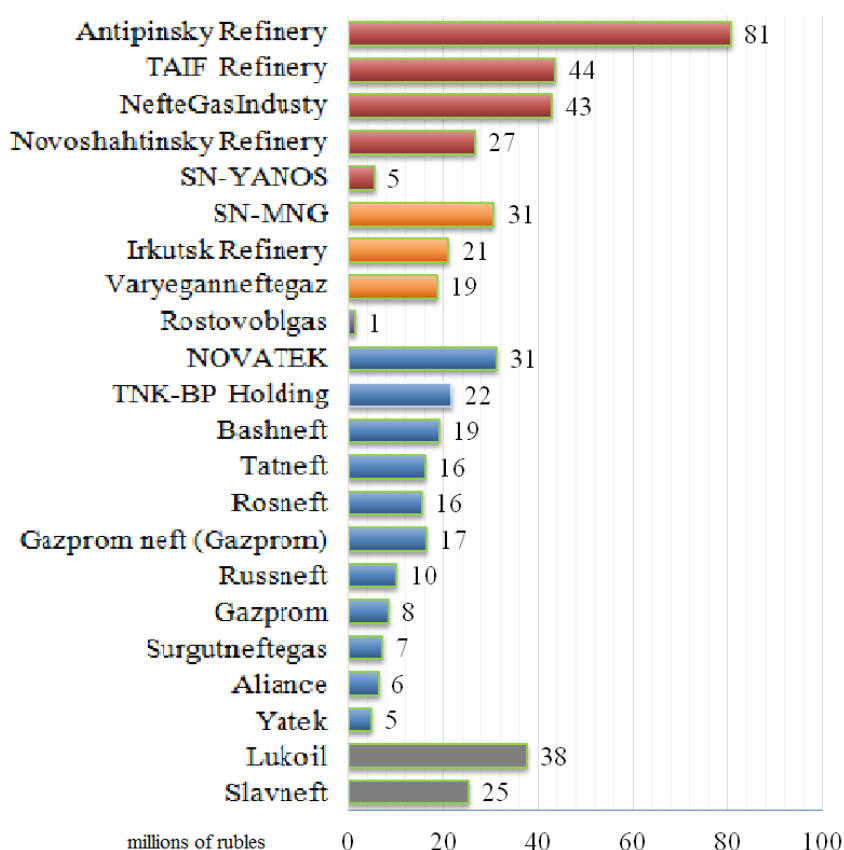*Revenue factor of human capital*

Fig. 1. Revenue factor of human capital (labor productivity) at the end of 2012.

Orange color means companies engaged in oil refining, green – oil production, yellow – transportation, and blue – vertically integrated companies. Data are presented for the year 2012.

Maximum productivity is achieved by Antipinsky Refinery – 80 603 thousand rubles in revenue per staff member. The minimum value states for Rostovoblgaz that operates in transportation and distribution of gas. Note that the minimum value of the index is 54 times lower than the maximum. This is a very great distribution. More stable situation is in vertically integrated companies, where it can quite clearly be divided into 3 groups of companies, depending on their performance. The first group includes only the leader by a prominent gap – Novatek. The second group consists of organizations with average efficiency values from 16 to 22 million of rubles and the third group is a company whose labor productivity was distributed between 5 and 10 millions of rubles per employee.

Flow factor of human capital

It is very difficult to interpret this factor not relating it to the performance of companies. In other words, it is pointless to conduct any analysis of this factor, without data on productivity or revenue. Thus, it is more appropriate to analyze the share of income factor to the revenue factor of human capital. So, firstly, we will have an idea of the share of costs in the company's revenue, and even get rid of the human factor in this metric, and thus establish a multiplicative factor model between labor productivity and operational efficiency (for more details – p. 2.1.1. "Organizational Effectiveness").
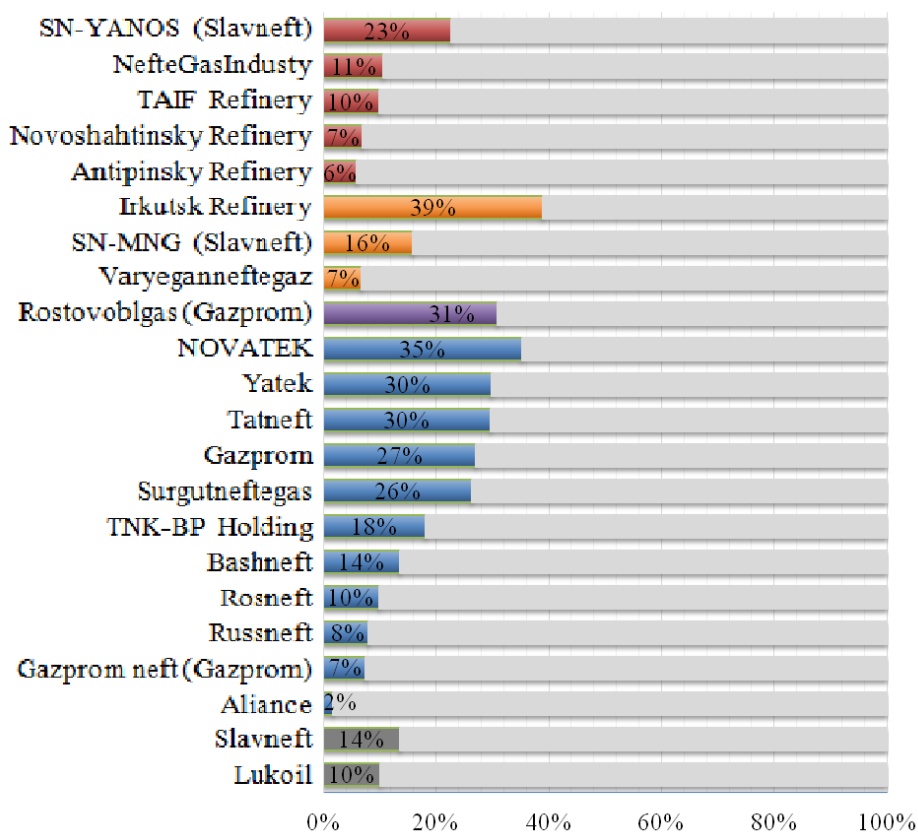
18

Fig. 2. The share of income factor in the profit factor at the end of 2012.

As in the previous situation, vertically integrated companies are clearly drawn three groups. NOVATEK is again leading alone. The second group includes companies with a share of 26% to 35%. The third group is outsiders with shares below 18%. In companies related to oil recovery there is no particular trend – the value of all three is quite different. In oil refining companies there is a clear leader named Slavneft, and the rest have quite similar results.

Group by companies' effectiveness

Ranked companies by a factor of revenue and the share of income factor in the profit factor and summing obtained places in the rankings, we can get the total rating of companies according to two factors:

Table 9. Ranks of companies by efficiency

Company	Profit factor		Human Capital Income factor		Sum of ranks	Group of efficiency
	Value	Rank	Value	Rank		
Lukoil	37 733	1	10,1%	2	3	1
Slavneft	25 329	2	13,7%	1	3	1
Aliance	6 343	10	1,7%	11	21	3
Bashneft	19 258	3	13,6%	7	10	2
Gazprom	8 486	8	27,1%	4	12	3
Gazprom neft	16 515	6	7,5%	10	16	3
NOVATEK	31 224	1	35,3%	1	2	1
Rosneft	15 627	5	9,9%	8	13	2
Russneft	10 175	7	8,1%	9	16	3
Surgutneftegas	7 173	9	26,4%	5	14	3
Tatneft	16 216	4	29,6%	3	7	2
TNK-BP Holding	21 687	2	18,1%	6	8	2
Yatek	4 932	11	29,9%	2	13	2

Rostovoblgas	1 434	1	31,0%	1	2	1
Varyeganneftegaz	18 675	3	6,9%	3	6	2
Irkutsk Refinery	21 107	2	39,0%	1	3	1
SN-MNG	30 691	1	15,8%	2	3	1
Antipinsky Refinery	80 603	1	5,9%	5	6	1
NefteGasIndusty	42 875	3	10,7%	2	5	1
Novoshahtinsky Refinery	26 644	4	6,9%	4	8	2
SN-YANOS	5 405	5	22,8%	1	6	1
TAIF Refinery	43 563	2	9,9%	3	5	1

Based on the "rating" of companies, we define groups of efficiency. This action does not results in important conclusions. But, after assessing the added value and return on human capital of organizations, we are going to compare to what efficiency groups these companies belong to. This will allow us to see relationships between the preliminary and the main factors.
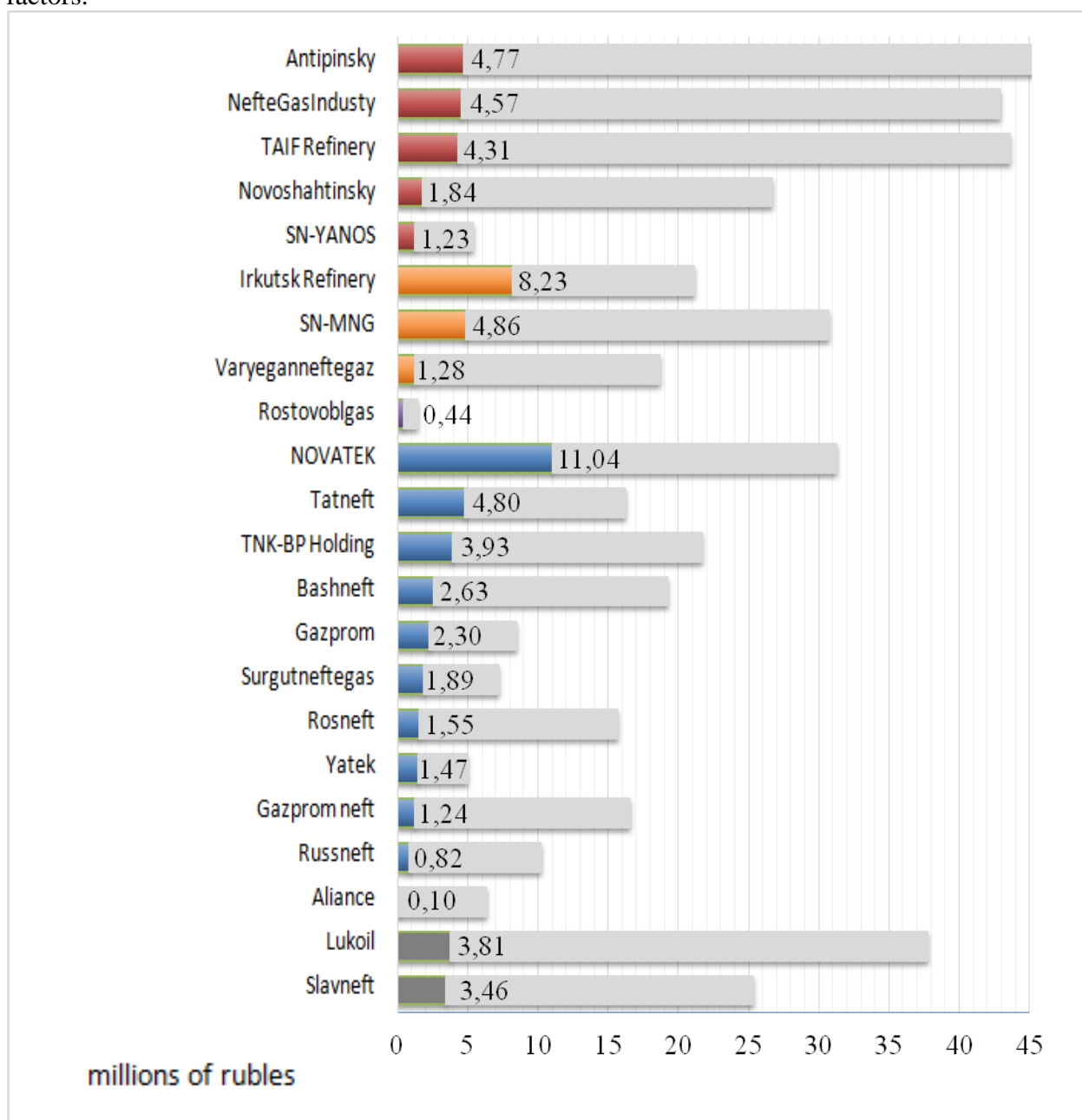
Fig.3. Human Capital Income factor (operations profit per employee) at the end of 2012

In the case of the operational efficiency we have a more "peaceful" situation. Virtually, none of the organizations overcome the threshold of 5 million rubles per employee, except for leading by all factors Novatek and Irkutsk NK. Even Antipinsky refinery, which had a huge advantage in productivity, is now unlikely to somehow show off their superiority: high costs made it quite typical in oil refining

The dynamics of the factors for the period of 2010-2012 years

Another point of exploration of what is happening in the company is change of the factors during the study period from 2010 to 2012.
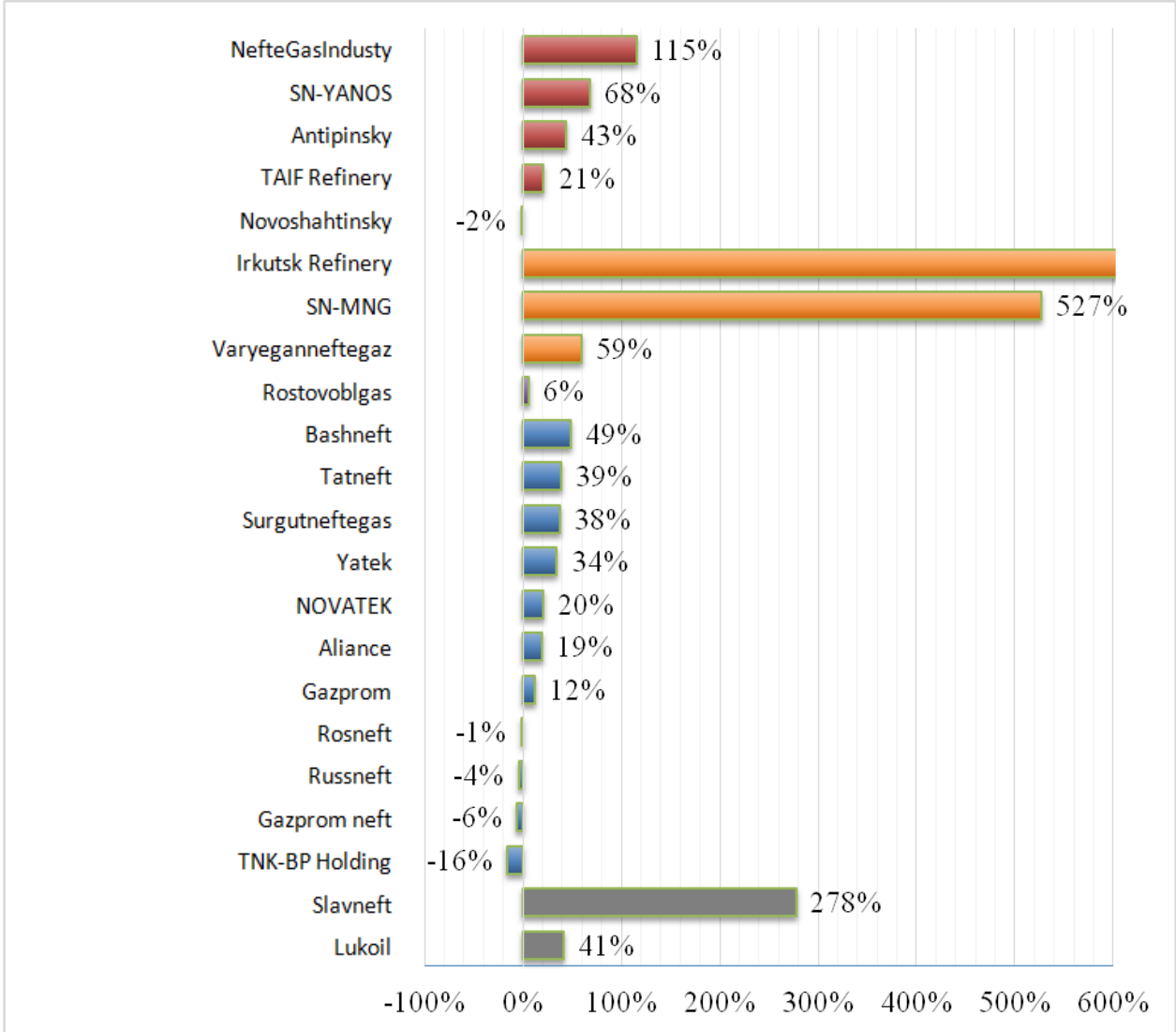
Fig. 4. Human Capital Income factor (operations profit per employee)
for 2010-2012

Human Capital Income factor isl also useful as the additional information to the key metrics - it can explain how the effectiveness of human capital management changed as a result of certain actions of training and development and the whole human resources management policy.

The graph shows the dynamics of the two-year period, and we can see the major differences between the results of companies - gas production showed a tremendous increase operational efficiency, while oil production is more stable in this respect: the maximum change in efficiency Neftegazindustriya (2 times). In vertically integrated companies growth

21

potential is significantly smaller. The most successful company, Bashneft, showed a growth rate of 1.5 times, and such "giants" of oil and gas sector, as Rosneft and Gazpromneft, showed a negative result.

By applying deterministic factor analysis, we can explain specific effect of labor productivity on the operating efficiency:
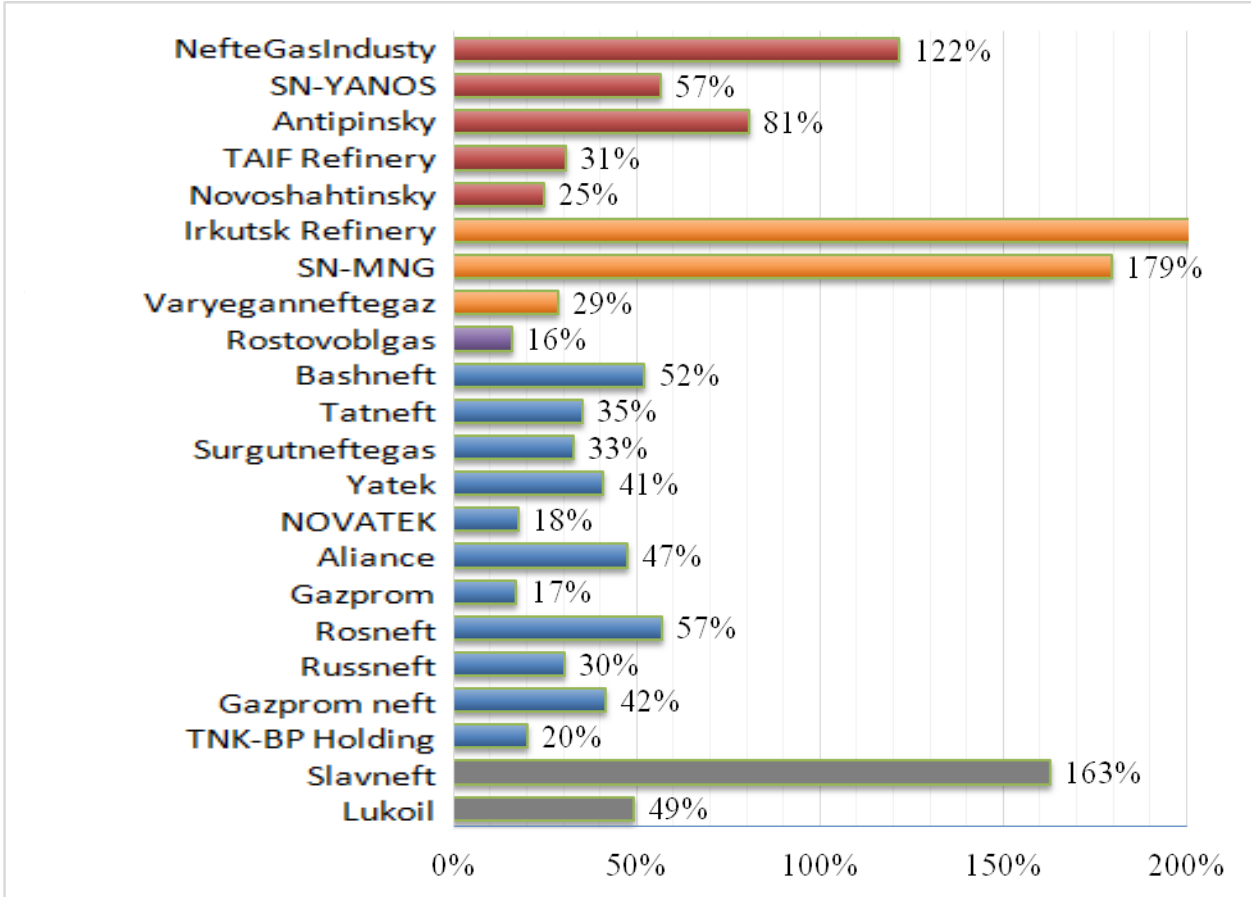

Fig. 5. The change in operating efficiency due to labor productivity
for period of 2010-2012

Data on the key metrics

Human Capital Value Added

Human Capital Value Added shows the value created by an average worker.
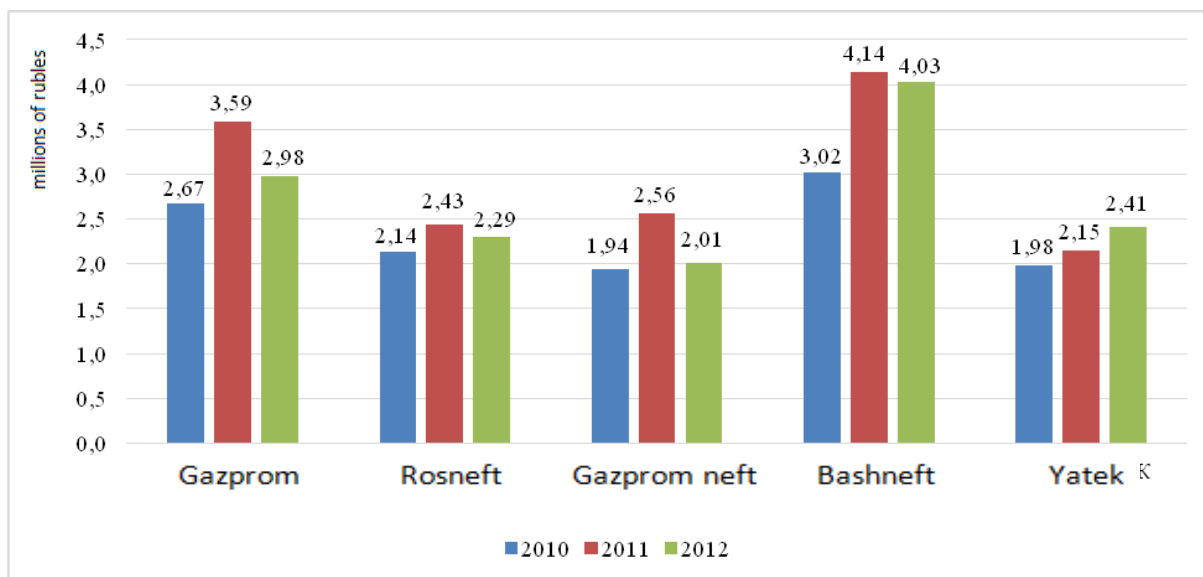
Fig.6. Human Capital Value Added (thousands of rubles).

The graph shows the Human Capital Value Added for the period from 2010 to 2012 for the companies for which it was possible to collect information on personnel costs. All organizations are vertically integrated, that provides an opportunity for comparisons of the companies with each other. It is worth mentioning that Bashneft, Rosneft and YATEC belong to the second group of efficiency based on the results of the preliminary metrics, when Gazprom and its daughter Gazpromneft - belong to the third group. As can be seen, such comparison cannot be conducted based on the Human Capital Value Added factors. We can distinguish a confident leader (Bashneft) and the second result (Gazprom). The other three organizations have approximately the same results. Also, for all companies except for YATEC there can be observed an obvious decline in efficiency of Human Capital use in 2012. We can assume that this is because of, as mentioned in the description of the industry, on the one hand, the exhaustion of oil and gas fields, on the other hand, the process of modernization of facilities (for example, technology of production of hard-to-reach oil). In other words, Human Capital Value Added in companies decreased because of the decrease of the significance of the market knowledge and experience. YATEC might have overcome this due to the small size of the company in comparison with the market.

Based on the information received about the Human Capital Value Added, we can conclude that "One employee of Bashneft brings value to the company twice as much as the GazpromNeft employee does (4.03 million versus 2.01 million rubles)". Due to limitations of this inquiry, it is difficult to say how well companies manage human capital in comparison with the industry (comparison with industry averages). However, this sample includes organizations occupying more than25% of the oil market, and 75% of natural gas. Therefore, let assume that the results are"near" the average value for the oil and gas sector. In other words, there are no outlier companies observed in the sample.

Return on investment in human capital

Return on investment in human capital shows how beneficial to the organization its human capital- what is the return on investments in employees (for the average employee).
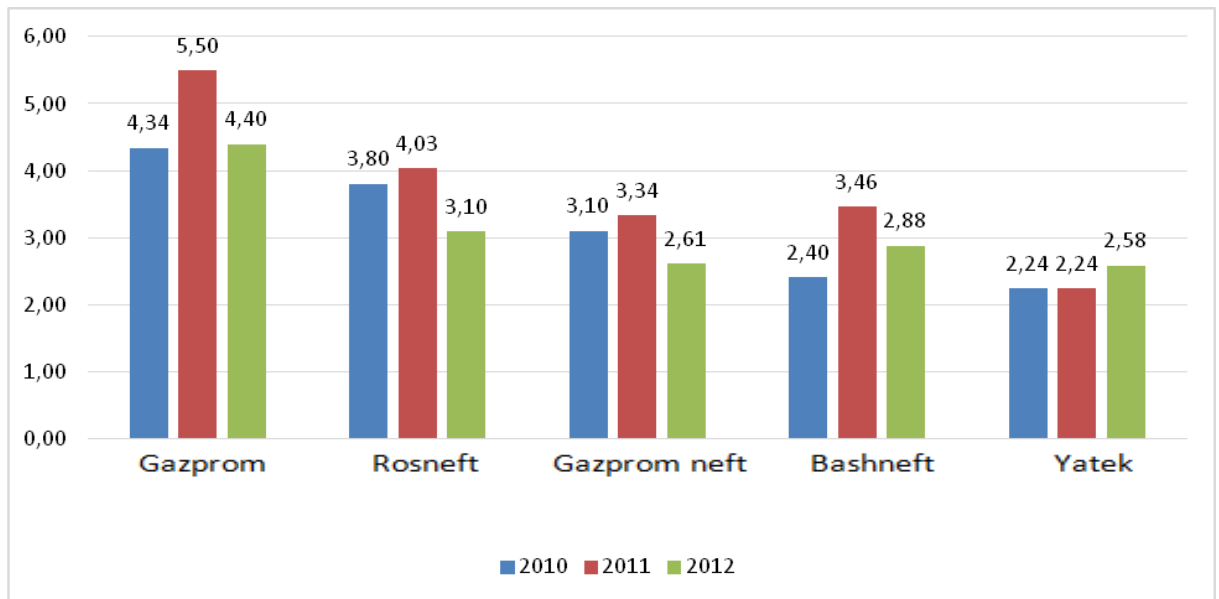
Fig.7.Return on investment in human capital.

The results measuring the ROI in Human Capital are shown by the same companies for which Human Capital Value Added indicators were calculated, as it requires similar primary data. According to the current figure we observe a new leader, Gazprom. Other organizations do not show significant differences in values. There is also the process of reducing the Return on investment in human capital in the year 2012, similar to Human Capital Value Added tendency. This may be the result of technology and knowledge aging. It is worth mentioning Gazprom result with this respect. Gazprom is included in the final, third efficiency group. However, according to the ROI of human capital it exceeds the second result (Rosneft) by an average of 30% over the past three years. This means that one ruble invested in employee results in benefits that exceeds the nearest competitor by thirty per cent. Payback of other companies is of minor differentiation.

Hypothesis testing

Having calculated preliminary and, most importantly, the basic metrics, we are now able to check the validity of the hypothesis put forward in the current paper that companies most effectively used the human capital will have the greatest profit.

Evaluation of the effectiveness is made through:
• Human Capital Value Added
• Return on investment in human capital

It was assumed that information will be available for all 22observable units that will ensure statistical significance in the correlation and regression models for the industry (one for each year of the study). As a result, it was only possible to calculate the basic metrics for only five companies, which is definitely not enough to confirm the assumption of validity of the hypothesis from the standpoint of mathematical language. Nevertheless, a certain amount of information allows us to if not speak about the results strictly, but at least find the "general trends."
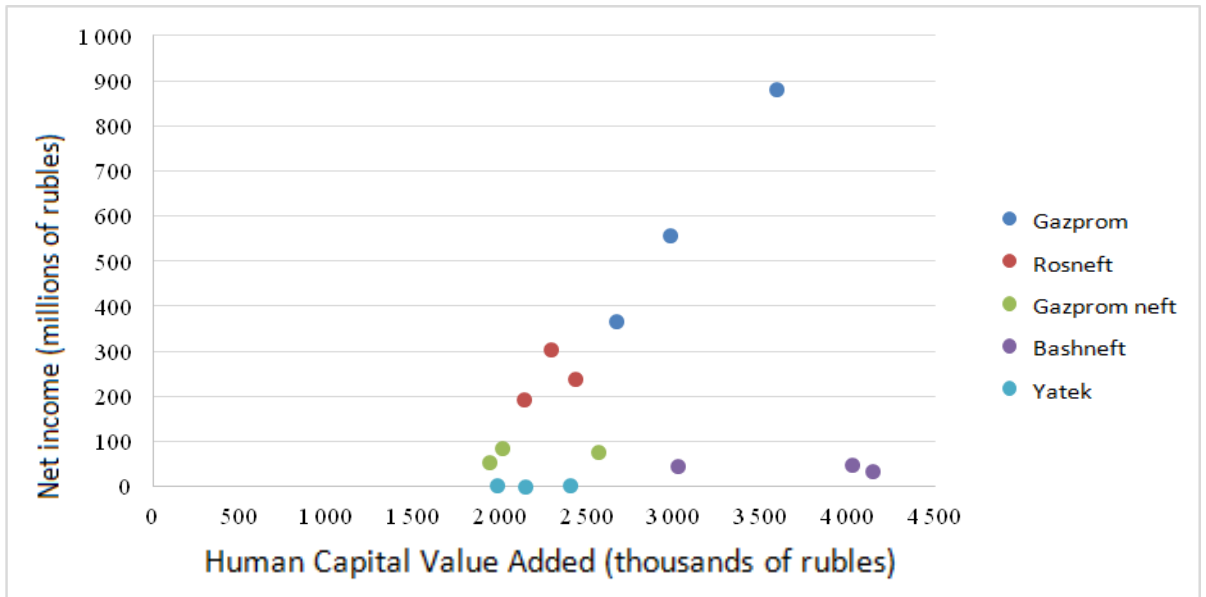
24

*Fig. 8. The relationship between the net profit
and Human Capital Value Added*

As it is shown by the graph, there is a positive relationship between the net profit and Human Capital Value Added. Gazprom is the striking example of such relationship. Data from the other companies are grouped and are not "mixed" with the others. However, the general positive trend can be traced. Bashneft stands out its "right inclination." It is worth mentioning that this company is a leader in terms of growth of oil produced during the study period. Perhaps if the hypothesis sounded not in terms of absolute values (the higher the human capital efficiency - the higher profits), but in relative terms (the higher the human capital efficiency - the higher the profit growth, for example), we would probably never have seen such effects. Nevertheless, within the framework of the chosen hypothesis we have such outliers.
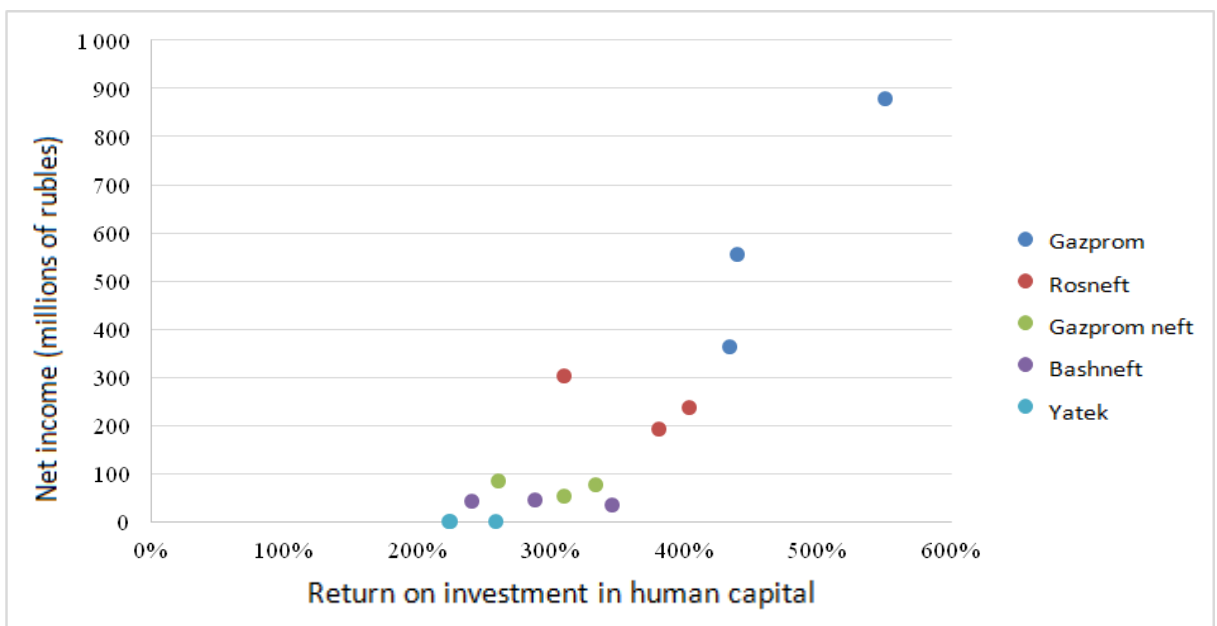

*Fig. 9. The relationship between the net profit
and Return on investment in human capital*

The relationship between net profit and Return on investment in human capital is stronger than with the Human Capital Value Added, as it is shown in the figure 9. Bashneft shifted to the left, positions of the companies are also grouped and not combined. The relationship is definitely positive. If we included in the chart only the average values of the net income and Return on investment in human capital in three years, the company with greater ROI in human capital would have strictly higher values of net profit. Moreover, all companies except YATEC would have these values located almost on the same line.
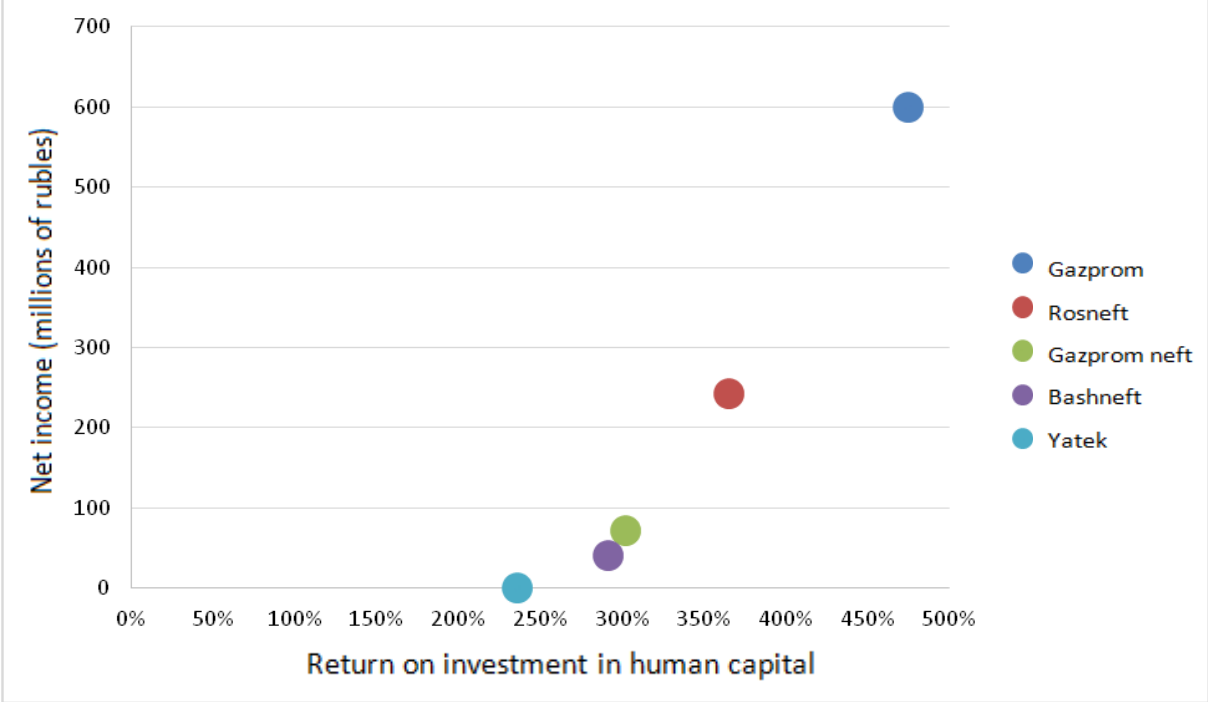

Fig. 10. The relationship between the net profit (average over 3 years) and Return on investment in human capital (average over 3 years)

Thus, using data on five companies for three-year period, we can conclude that at the level of trends the company with highest use of human capital is going to have the greatest net profit:
• in terms of Human Capital Value Added;
• in terms of Return on investment in human capital.

Moreover, the relationship between net profit and Return on investment is stronger than that of Human Capital Value Added and net profit.

Correlation-regression models
It was impossible to build correlation-regression model for the oil and gas sector of the Russian economy because of the unavailability of information on Return on investment in human capita and Human Capital Value Added for most companies in the industry. It also had an impact on the final conclusion regarding testing the main hypothesis. There we can only emphasize its relative confirmation.
Yet, we have calculated the basic metrics for five companies. We can assume that since they published the information necessary for calculations in 2010-2012, it is likely that in previous years, they also published such information. If it is possible to collect information on a sufficient number of time periods, we can build a correlation-regression models for individual companies. Thus, we shift the focus from the analysis of the impact of the efficiency of human capital for the entire oil and gas sector, to analyze the nature of the Human Capital influence in specific companies. In other words, we can build a correlation-

regression models for each company and calculate a measure of the impact of Human capital indicators on the financial results (net profit). This however does not influence the result of this work, as the conclusion regarding the hypothesis testing has already been made. However, this step may slightly expand very limited understanding of how human capital in oil and gas industry.

Indeed, for four of the five companies it was possible to collect information for the calculation of the basic metrics for a greater number of years:

Table 10.The study period for the company

Company	Period
Gazprom	2002-2012 (11 years)
Rosneft	2006-2012 (7 years)
Gazprom Neft (Gazprom)	2005-2012 (8 years)
YATEC	2006-2012 (7 years)

However, all companies except for Gazprom do not fit the significance model test. With this regard there are two possible explanations: either there are not enough data to analyze the phenomenon or there are incorrect model parameters that have been chosen.

Table 11.Significance of correlation-regression models (Fisher test)

Company	The significance of the company's F		Conclusion
Gazprom	0,0204	less than 0.05	model is adequate and can be used for analysis
Rosneft	0,3057	more than 0.05	Model is inadequate
Gazprom Neft (Gazprom)	0,1700	more than 0.05	Model is inadequate
YATEC	0,1796	more than 0.05	Model is inadequate

Thus, for further analysis, we can only use Gazprom data. The degree of accuracy of the model (R-squared) is 0.62, which indicates a significant approximation accuracy. In assessing the significance of the coefficients, we obtained the following results:

Table 12.The coefficients of correlation-regression model for Gazprom

Variable	Coefficient	P-value	Conclusion
Y-intersection	-2 206 261	-	-
Human Capital Value Added	183 511	0,05 (not greater than 0.05)	can be considered non-zero
Return on investment in human capital	-214 010 192	0,26 (greater than 0.05)	can be considered zero

Hence the equation of net profit for Gazprom company depending on the Human Capital Value Added (HCVA) and Return on investment in human capital with certainty of 62% can be formulated as follows:
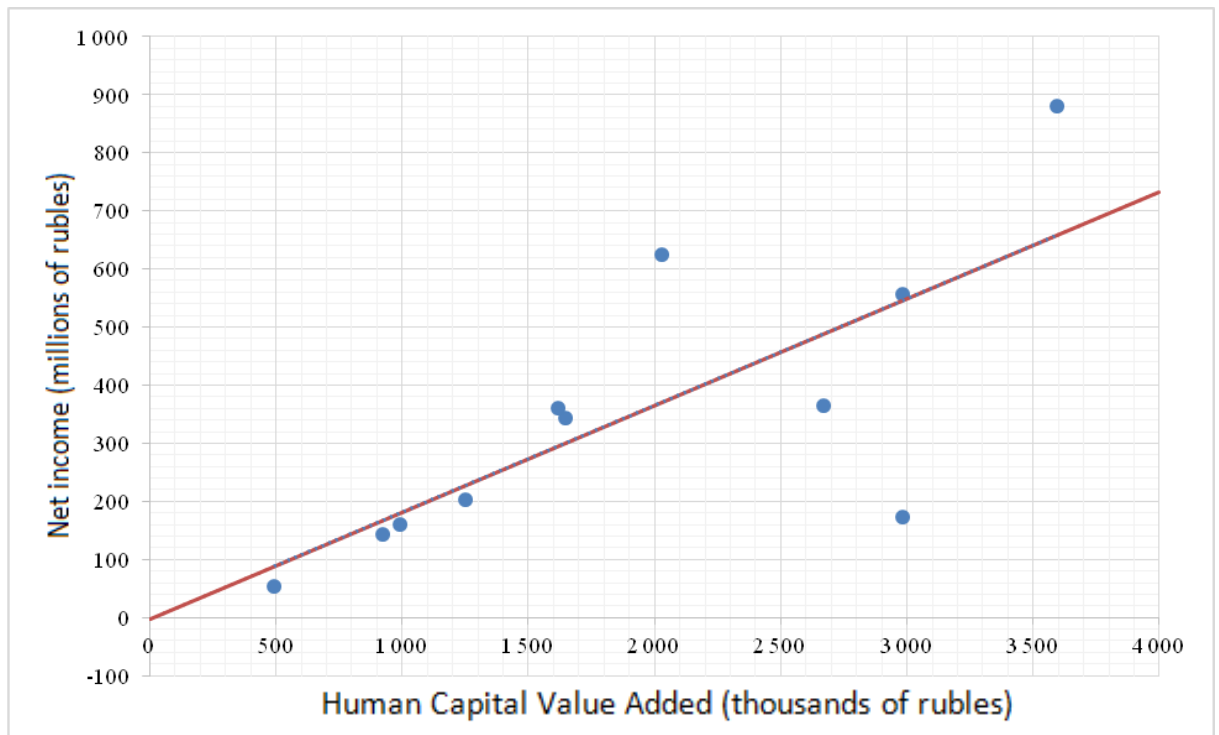
Net profit = -2 206 261 + 183511 * HCVA

27

Fig. 11. Graph of the regression model for Gazprom and the distribution of actual values.

So, the regression model for Gazprom company was built. It shows that an increase in Human Capital Value Added by one ruble results in the company increasing its profit by 183 511 rubles. Also, we can conclude that, at least in Gazprom company efficiency of human capital usage affects the company's financial results. In other words, the market appreciates and considers important the human factor in the oil and gas sector on the example of Gazprom company. Such an addition to the already formed conclusions made in the paper is very valuable and expands our understanding of how the human capital functions in the studied sector.

Conclusion

To evaluate the efficiency of the use of human capital the methodology developed by Jak Fitz-enz and Saratoga Institute was analyzed in the current paper.

The study involved 27 companies in the oil and gas industry from the list of ratings "Capitalization-200" and "Expert-400" for the year 2013, prepared by "Expert RA" company.

The results of the study conducted in the current paper are the following:

The primary data necessary to calculate estimates of the effectiveness of the use of human capital were collected. The information on 22 companies for period of 2010-2012 was collected to calculate the preliminary metrics. This information includes the following indicators: the average number of employees, revenue, operating costs (production costs, selling and administrative expenses).

For the calculation of the basic metrics, the information on five Russian companies (Gazprom, Rosneft, Gazprom Neft, Bashneft and YATEC) was collected. It includes personnel costs as an addition to the previous list indicators.

Also, in order to test the hypothesis the information on financial performance (net profit) of companies for the past five was found.

An assessment of the availability of data was conducted. The lack of information influenced significantly the research design of the study. The information on key metrics was only available for five companies, which made impossible to obtain mathematical confirmation (or rejection) of the hypothesis and the effectiveness of the human capital in terms of Human Capital Value Added and Return on investment in human capital for the whole oil and gas sector.

It is even more difficult with the development of human capital in the companies - it was impossible to produce a systematic collection of primary data for the calculation of relevant metrics for "Training and Development" group of indicators.

Also, due to the incompatibility of indicators calculated on the basis of Russian Accounting Standards and IFRS, it is also impossible to make a comparative analysis of the effectiveness of the human capital of Russian and international oil and gas sector.

It should be concluded that the culture of the use of information regarding human aspect in the Russian oil and gas sector is underdeveloped.

The calculation and analysis of the data; conclusion on the level of development and efficiency of human capital use

The preliminary metrics for 22 companies were collected. These companies were divided into three groups of efficiency based on the results of the metrics. Although this action does not have a specific analytical value, in comparison with the results of the main metrics it can bring more clarity to the understanding of how human capital functions in the industry. The key metrics for five companies were collected. The first metric is Human Capital Value Added, which shows what value is being created by one average worker. The second metric is return on investment in human capital that shows in how many times investments in employees (average per employee) return to the company.

After having calculated the basis for testing the hypothesis, the authors evaluated the relationship between net income of the company and the relevant human capital performance indicators . The evaluation was based on an analysis of the graphical representation of data.

Thus, the hypothesis was confirmed in the following form:

"At the level of trends it can be concluded that the company, that uses human capital most efficiently, is likely to have the greatest profit:
• in terms of the Human Capital Value Added;
• in terms of Return on investment in human capital.

Moreover, the relationship between net profit and Return on investment in human capital is stronger than that of Human Capital Value Added and net profit.

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