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Studying the Impact of Intellectual Capital at Industrial Enterprises on Their Market Capitalization

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Abstract

The study sets a task of identifying the impact of intellectual capital structure components on the significance of capitalization of industrial sector enterprises of the Russian Federation.

The bottom line of the predicted data by method of indicators is:

- Human capital has no significant effect on qualitative characteristics of fuel and energy, metallurgic and food industry enterprises.
- Customer capital, less than other factors, has an impact on the capitalization of electric power complex, machine building and construction sectors. It is in these sectors that the negative values of variables are recorded.
- Least of all structural capital components impact the indicators of mining, metallurgic and electric power enterprises. Maximum value, and hence the influence, the structural capital exerts on construction sector enterprises.

This study is a great asset to make up the programmes for effective resources management of non-material character for managers of the enterprises of industrial economic sector.

Keywords: intellectual capital, capitalization of enterprises, industry

1. Introduction

Intellectual capital theory (IC) originated and started its development since the second half of the 20th century. Under the new tendencies in the development of the world economy the views of leading theorists and practitioners have brought about some significant changes in the understanding of economic progress and social evolution factors. According to post-industrial development concept, along with material and non-material constituents, human (intellectual) resource also belongs to national wealth.

"Brainpower", the work by Thomas A. Stewart, has become a catalyst for mastering intellectual capital by management theorists and practitioners. The author identified the intellectual capital as the company employees' expertise providing competitiveness (Stewart, 1991). Further evolution of this term has been in a helically-formed way integrating obtained results while shifting the view from one intellectual capital element (human, organizational, market) to another. Theoretical and practical issues of using and developing intellectual capital have been carried out by both Russian and western academics.

So, among the western academics actively dealing with theoretical and practical issues of studying and evaluating enterprises' intellectual capital we can name Edvinson L., Thomas Stewart, Smith G., Sakaya T., Desmond G., Tobin J., and others (Sayfullina, 2010; Sakaiya, 1999; Dolgopyatova, 2002; Sergeyev, 2005; Postalyuk, 2005).

Among national academics and experts engaged in the issues of subject-matter, structure and particularities of using and developing intellectual capital, intellectual resources management systems it is worth mentioning such academic economists as Bagov, V. P., Inozemtsev V. L., Klimov S. M., Kozyrev A. N., Makarov V. L., Olkhovsky V. V., Pavlova A. V., Pankrukhin A. T., Postaluk M. P., Puzynya N. Yu., Saifullina S. F., Seleznev, E. N., Sergeev A., and others (Bagov et al., 2006; Novenkova et al., 2013; Nonaka & Takeuchi, 2003; Inozemtsev, 1998; Klimov, 2002; Kozyrev & Makarov, 2003; Olkhovskiy, 2007; Pavlova, 2010; Ismagilova et al., 2014).

This study sets a task of identifying the impact of intellectual capital structure components on the significance of capitalization of industrial sector enterprises for the economy of the Russian Federation. It is customary, that tangible assets of an enterprise, especially physical assets and business capital, were considered the most essential resources of the enterprise. They were in the basis of achieving sustainable competitive edge and creating value. By all means, these resources are still of great value for the enterprise security or well-being. However, under the conditions of vigorous and permanently volatile environment, in order to have an upper hand over the competitors, it is advisable to zero in on creating intangible assets as well, those that consist of the products of intellectual work. Below you can find the data on the degree of impact of each intellectual capital element using one of the procedures for statistical data processing.

2. Methodology

There is quite a large multitude of indicators characterising a particular component of intellectual capital, with their choice being subject to a variety of factors, such as the company's internal objectives, available information based on basic data, etc.

When analysing the indicators, it has been revealed that the most widespread indicators objectively reflecting the situation of influence on the analysed argument are those listed in Table 1.

Table 1. Indicators used in the research

Intellectual capital elements	*Indicator*
Human capital	Payroll fund
Relationship (clients') capital	Proceeds
Organisational (structural) capital	Expenditures/Number of employees

The statistical data for testing the hypotheses are a sampling population of Russian issuing companies. This research employs the data of consolidated financial reports by the companies in 2008-2012 publicly available at the companies' official websites. The total sampling coverage is 170 firms/years (34 companies during 5 years). Source information on the market capitalisation of the companies under study has been obtained from websites of the Russian Trading System (RTS) and the Moscow Interbank Stock Exchange (MICEX).

The application of mathematical modelling methods in the research, in particular, a multiple regression method, is due to the possibility of approximating and modelling the variants of studying alternately one parameter for the resulting sign. In addition, by studying separate static objects it becomes possible to obtain some useful information about them and to describe them in terms of standard indicators.

Thus, the regression model in this case would reflect the dependence between the market value of assets (P_a) and separate elements of the intellectual capital: value of human capital (*HC*), market (*RC*) and structural capital (*SC*). Besides, to solve a problem of heteroscedasticity, i.e. heterogeneity of survey, we should add a "company assets" variable (*TA*).

The market value of the company can be described by the following dependence:

$$P_a = P_e + P_d \tag{1}$$

Where P_e, P_d are the market values of equity capital and debt, respectively. Considering the fact that the market value of equity capital is the market capitalisation (C_{ap}), and the market value of debt is usually supposed as being equal to its book value (*D*), the equation (2) can be rewritten in the following format:

$$P_a = C_{ap} + D \tag{2}$$

Thus, the market value of assets for calculating the model is defined as a trading-volume weighted average value of market capitalisation in the accounting period.

The model that characterises the above dependence can be presented as follows:

$$P_a = \beta_0 + \beta_1 HC + \beta_2 RC + \beta_3 SC + TA + \varepsilon \tag{3}$$

Where β_0, β_1, β_2, β_3 are parameters of the regression equation; ε is a casual member.

2. Findings

To solve the presented regression equation common statistical characteristics of the analyzed sampling population should be formed. (Table 2).

Table 2. Common statistical characteristics of the whole sampling population

Indicator name	Average	Median	Standard deviation
Market assets value, mln. rub	452,325.65	80,165.5	909,806.208
Human capital value, mln. rub	64,147.89101	11,309.6	133,058.8822
Relationship (clients') capital value, mln. rub	321,301.4211	62,556	664,986.0244
Organizational (structural) capital value, mln. rub	5,715,489.996	3,755,539.425	5,639,622.656
Book value, mln. rub	519,853.99	87,851.85	1,167,707.88

Here are the evaluation results of the regression model at the first stage of the study with reference to the whole sampling population of analyzed issuing companies.

Model (3) analysis results in the following. Determination coefficient and standardized determination coefficient are of relatively high value of 0.8569523 and 0.8124578 respectively. This value is indicative of the fact that at the Russian industrial production market the commercial value of assets accounts for the significance of the three elements of intellectual capital by 85.69%, calculated by method of indicators. This being said, should the variable of book value be excluded from the model, then sample determination coefficient shall still be of high value (0.745896).

To check the significance of explanatory variables, included in the model, let us hypothesize the following:

$$\begin{aligned} &H_0{}^1 \div \beta_1 = 0, H_0{}^1 \div \beta_1 \neq 0 \\ &H_0{}^2 \div \beta_2 = 0, H_0{}^2 \div \beta_2 \neq 0 \\ &H_0{}^3 \div \beta_3 = 0, H_0{}^3 \div \beta_3 \neq 0 \\ &H_0{}^4 \div \beta_4 = 0, H_0{}^4 \div \beta_4 \neq 0 \end{aligned} \quad (4)$$

Table 3. Results of model (4) statical evaluation for the whole sampling population

Indicator name	Evaluation of regression coefficients			
	HC	*RC*	*SC*	*TA*
Coefficient before the explanatory variable	*-0.71254*	*0.62587*	*-0.39856*	*0.69854*
Standard error	*0.2123*	*0.0924*	*0.0147*	*0.0554*
t-statistics	*-1.25*	*7.02*	*-2.36*	*10.24*
*t-critical (5% significance level)**	*2.037*			
Conclusion of zero hypothesis following t-test results	*to be rejected*			
Credible interval (5% significance level)				
• *Lower limit*	*-1.152*	*0.5003*	*0.0452*	*0.5478*
• *Upper limit*	*-0.325*	*0.8654*	*-0.0148*	*0.8547*
F-statistics	*0.1421*			
*F-critical (5% significance level)***	*2.145*			
Conclusion of zero hypothesis following F-test results	*to be rejected*			
Determination coefficient				
• *optional* R^2	0.8569523			
• *adjusted* R^2_{norm}	0.8124578			

*-indicator critical value complies with tabular value of Student criterion for the level of α significance and n dimension.

**-F-indicator critical value complies with tabular value of the criterion for the level of α-significance and n-dimension.

On the basis of calculated indicators, model (3) shall change as follows:

$$P_A = 89252.164 - 0.71254\,HC + 0.62587\,RC - 0.39856\,SC + 0.69854\,TA \quad (5)$$

Should the zero hypothesis be rejected and alternative hypothesis accepted, then the company commercial value is

supposed to depend on three constituents of intellectual capital.

To analyze the significance of explanatory variable, t-test (Student criterion) is used, whereas F-test (Fisher criterion) is used for model verification.

Should the equation $-t_{crit} < t < t_{crit}$ not be valid, then the zero hypothesis should be rejected whereas alternative hypothesis, accepted. It implies that the company value depends on considered intellectual capital elements. When carrying out F-test, given that inequation $F_{estimated} < F_{tabular}$ is valid, then it can be asserted positively by 95%, that the considered dependence is a statically significant one, otherwise it is not. Sampling population in table 3 is the result of statical evaluation of model (3).

3. Discussion

Inasmuch as all dependent equations of regression are accepted as significant and relevant, it can be stated that this model demonstrates the following dependence: the level of a company's balance sheet value (0.6985) exerts the most influence on its market capitalization, in other words, the aggregate of current and non-current assets of the company, as well as the volume of borrowed attracted funds. A little lesser but still strong influence is exerted by components of clients' capital (0.62587). This indicator implies strong interrelation in the influence of consumers, suppliers, as well as other external counteragents, viz. competitors, public bodies, local authorities etc. Relationship capital significantly impacts social bonds of a company and sets business basic social goals. Components of human capital as well as structural capital exert but lesser influence on the enterprises of industrial sector.

Inasmuch as it is referred to industrial production, it is clearly seen from production estimation that greater influence on the market-based valuation of the company shall be exerted by 1 piece of facilities, invested into either fixed assets or current assets, which is no wonder for industrial sectors of economy.

On the basis of the research, when components of intellectual capital impact a company's capitalization, it has become clear that:

The most influence of the three factors on the considered argument is exerted in the machine-building and metallurgic sectors of economy. In these sectors determination coefficient value makes up 0.9569 and 0.9523 respectively, which from statistical point of view equals 95.7% and 95.23%. According to our estimate, the least influence of intellectual capital structural components is exerted in construction operations (0.23547), in other words, the market capitalization level depends on the intellectual property items by 23.55% only, whereas the rest 76.45% is defined by other factors.

Besides, it is worth mentioning that out of 8 sectors of national economy which are under consideration, zero hypothesis is rejected on 4 economic sectors, viz. fuel and energy complex, electric power industry, metallurgic industry and construction operations industry, in other words, approximated regression model meets significance requirements, hence can be considered as the relevant one. At that, it should be emphasized that lack of significant bond between variable and argument in other sectors can be indicative of shortage of experimental findings to prove the possibility of such bond, or else such bond could exist, but due to the influence of certain random variables the bond failed to be identified.

Table 4. Integrated data results of regression analysis broken down by industries

Sector of industry	*Evaluation of regression coefficient*			
	HC	*RC*	*SC*	*TA*
Fuel and energy complex	*-0.12544*	*0.5577*	*0.61856*	*0.3124*
Electric power industry	*2.9705*	*-2.7613*	*-1.0714*	*0.8576*
Mining industry	*0.7828*	*0.7593*	*-0.0510*	*0.5763*
Food industry	*-8.71254*	*0.62587*	*1.39856*	*-0.69854*
Metallurgic industry	*-3.4804*	*3.6293*	*-6.9427*	*-0.2258*
Machine-building industry	*1.254*	*-0.62587*	*0.9856*	*0.69854*
Construction	*0.8654*	*-2.0145*	*6.5412*	*8.2541*
Chemical industry	*1.254*	*0.587*	*3.9856*	*6.9854*

The testing of the adequacy using Fisher's ratio test (F) and deviation of the zero hypothesis in all the branches is a real witness of the fact that all branches have established the dependence of different levels and orders of

interference that constitute intellectual capital for market capitalisation. Furthermore, the alternative hypothesis of the F-test indicates that there exists a specified predictive relationship between variables x and y. Consequently, the parameter y is not a purely random value and depends on at least one of the variables x.

For the sake of easy evaluation and analysis of prediction results according to the level of influence by various factors, the results shall be broken down by sectors and presented in Table 4.

4. Conclusion

Summing up the results of the predictions made by method of indicators, it can be noted that

- Human capital has no significant influence on qualitative characteristics of fuel and energy, metallurgic and food industry enterprises. However, by efficient management of knowledge, capabilities and employees' motivation it can considerably improve its foothold at the market of electric power industry.
- Relationship or clients' capital less than other factors influences capitalization of electric power, machine-building and construction industry enterprises it is in these industries that negative value is identified. However, individual components of clients' capital as specially developed programmes and conditions for a company's customers can significantly improve qualitative indicators of metallurgic industry enterprises.
- Structural capital components least of all influence performance indicators of mining, metallurgic and electric power industry enterprises. The peak value, hence influence is exerted by structural capital on construction industry enterprises.
- Fixed assets of an enterprise exert the least influence on the food and metallurgic industry enterprises, while construction and chemical sectors being affected to the full.

This study is of great asset to make up the programmes for effective resources management of non-material character for managers of the enterprises of industrial economic sector.

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