Modification of Calculated Intangible Value Model to Evaluate the Use of Companies' Intellectual Capital

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Abstract: - Currently, there are lots of methods to assess the company's intellectual capital. The paper paid attention to the modified model of Calculated Intangible Value (CIV), because it allows you, on the one hand, to make calculations based on the financial reporting, on the other hand – to adjust the value of the net assets depending on the use of intellectual capital. The aim of this study is substantiation of possibility of Calculated Intangible Value modified model use, based on intangible assets fundamental value calculation, to evaluate the use of companies' intellectual capital. The results allows to argue that the quantitative factor - the net asset value - does not affect the performance indicator of intellectual capital, since a change of this factor is completely offset by the change in quality factor - a comparative measure of return on assets.

Key-Words: - intellectual capital, Calculated Intangible Value, the fundamental value of intangible assets

1 Introduction

In the innovation economy the issues related to the formation and use of intellectual capital is getting more actual. The basis of intellectual capital is the knowledge, however, it is more than just 'knowing', as it includes not only mental skills and human ingenuity, but also intellectual property, business relations with partners, etc. Effective use of intellectual capital provides a competitive economic systems, allows you to get additional profit due to unique competitive advantages [4].

Theoretical and methodological approaches to the study of intellectual capital can be divided into two groups. The first group includes researchers who hold the resource approach, involving consideration of intellectual capital as an important resource of the company. So, T.Styuart consider intellectual capital as a set of knowledge and competencies of employees that can bring the company additional competitive advantages [13]. L.Edvinsson and M.Maloun, by expanding the definition of T.Styuart, perceive the intellectual capital as the possession of applied knowledge and experience, professional skills, organizational technology, communication with customers, which together provide the company with a competitive advantage in the market [5]. According to S.Albert and K.Bradley intellectual capital is "the transformation of knowledge and intangible assets

into useful resources that give competitive advantages to individuals, firms and Nations"[2].

A second group of researchers adheres to balance approach, in which intellectual capital is understood as an indicator of firm market value excess over the book value. According to P. Strassmann, the company's cost of knowledge can be represented as the difference between the reporting of its financial assets and real market value [14]. D. Tobin, in turn, suggests using a figure (Tobin coefficient), representing the ratio of market value to the replacement cost of its assets [17].

The first intellectual capital monitoring problem became particularly acute, when the companies with a few physical assets but with a high development potential due to the high level of intellectual capital appeared. In some organizations, the intellectual capital (unrecorded assets) equal to the material (discounted) assets or exceed them [6]. The main reasons for the need of intellectual capital monitoring are as follows:

- Evaluation of intangible assets provides to measure of so-called "driving forces" that affect the productivity of the company;
- Monitoring of intellectual capital can more accurately assess the value of the company, as well as widely introduce a reporting system, offering investors a more complete information

about the company to analyze the effectiveness of investment programs;
- Monitoring improves the efficiency of intellectual capital management, which leads to an increase in the company's rating.

At present time scientists have developed both quantitative and qualitative evaluation models of intellectual capital [8,11]. The use of qualitative models does not involve rigid units, these models are more flexible and are usually based on expert assessments [15]. In the application of quantitative methods we should adhere to a rigid model, use a clear plan of study. Indicators of intangible assets to be measured are separate (major) sides of the enterprise (e.g., certain results or processes), and the estimation method is a selected tools promoting performance measurement on qualitative and quantitative criteria.

Particular attention should be given to methods that allow an assessment of intellectual capital on the basis of the entity's financial reporting [18]. The advantage of these methods is the availability of the information base. One of these methods is the method to adjust in some way the value of the net assets depending on the use of intellectual capital.
The paper presents the modified model of Calculated Intangible Value; an indicator of the intangible assets fundamental value is calculated based on three major Russian companies. For factor analysis of this indicator quantitative (net asset value) and qualitative (a comparative measure of return on assets) factors were marked. On the basis of factor analysis we determined the factors' effect on the received index value and proved the assumption that the quality factor is the most influential. The calculation results allowed to substantiate the possibility of Calculated Intangible Value modified model use, based on intangible assets fundamental value calculation, to evaluate the use of companies' intellectual capital.

2 Problem Formulation

2.1 Intellectual Capital Valuation Models
As noted earlier, there are currently quite a number of approaches to assess the intellectual capital. In general, depending on the method of intellectual capital, evaluation models can be grouped into 4 groups, namely, models based on the method:

- ROA;

- MCM;
- DIC;
- SC.

Method ROA (Return on Assets method) - an Anglo-American method based on the evaluation of return on assets, when the average value of the company's income before taxes divided by the average value of tangible assets. This result should be compared with the industry average, comparative analysis can provide information about the value of intangible assets.

MCM method (Market Capitalization Method) based on the market value of the company; the value of intangible assets is determined as the difference between the market value and the book value of the company (its own shareholders' equity).

DIC method (Direct Intellectual Capital methods) associated with the valuation of the components of intellectual capital; in other words, the separation of intangible assets into their constituent components to evaluate each component separately and then together intellectual capital as a whole.

Method SC (Scorecard Method) is largely similar to the method of DIC, however SC method (in contrast to the DIC method) allows to present the results in the form of scorecards; component indicators of intellectual capital are represented as scoring or graphs.

Some intellectual capital evaluation models are presented in Table 1.

All of the models have their advantages and disadvantages. So, S.Stahle, P.Stahle, analyzing models of Knowledge Capital Earnings and Value Chain Scoreboard[TM], proposed by B.Lev, noted that these models upgrade intellectual capital measures from mere IC indicators into active variables in a production function [12]. Aho S., Stahle S., Stahle P. think that Calculated Intangible Value method should be considered only as an estimate of financial effectiveness, resulting from the companies' return on assets (ROA) [1]. This model measures the financial advantage compared to its competitors in the industry. The advantages of ROA methods and MCM are the use of accounting information, relying on well-established accounting practices.

Table 1. Description of some intellectual capital assessment models

Model designation, the author of the model	Model Specifications
Models based on the method of ROA	
Calculated Intangible Value Author – Stewart [13].	The model assumes the calculation of excess return of tangible assets, which is the basis for determining the share of income attributable to intangible assets.
Knowledge Capital Earnings Author – Lev [10].	Income from intangible assets is defined as the share of income on which there is excess of the expected return on physical and financial assets.
Models based on the method of MCM	
Tobin's coefficient (Tobin's q) Author – Tobin [17].	Tobin's q is defined as the ratio of company's market value to its replacement cost.
Investor assigned market value, IAMV^{TM} Author - Stanfield [1].	This method is based on the fact that the company's market value is determined by the investor and it's a true value.
Models based on the method of DIC	
Technology Broker Author - Brooking [3].	This method involves the evaluation of intellectual capital on the basis of responses analysis to the questions relating to the four components of intellectual capital: human resources, intangible assets, marketable assets, infrastructure assets.
Intellectual Asset Valuation Author - Sullivan [16].	The model is based on the evaluation of intellectual property.
Models based on the method of SC	
Balanced Scorecard, BSC The authors - Kaplan and Norton [7].	The model is a mechanism that ensures consistent bring to the staff of company's goals, development strategy, as well as control of the objectives on the basis of key performance indicators (KPI). Balanced Scorecard covers four main areas - customers, finances, internal processes, learning.
Value Chain Scoreboard^{TM} Author - Lev [9].	The model is a matrix of non-financial parameters (sensors), represented in three categories, depending on the developmental cycle: - Opening / training; - introduction (application); - commercialization.

2.2 Determination of the Corrected

Net Assets value based on Calculated Intangible Value (CIV) model

To assess the effectiveness of companies' intellectual capital use it is advisable to use the model of Calculated Intangible Value, as it, on the one hand, refers to a method of ROA, allowing to make calculations using the financial reporting data, on the other hand - makes it possible to adjust the value of the net assets depending on a number of factors, where efficiency of intellectual capital use is a part.

Economists Volkov D.L., Garanina T.A. [19] on the basis of this model propose to determine the fundamental value of intangible assets, using the following formula:

$$V_i^{REOI} = \frac{REOI_1}{k_w} = NA_T^{BV} * \frac{RONA - RONA_{LAVG}}{k_w} \quad (1)$$

Where V_i^{REOI} - fundamental value of intangible assets;

$REOI_1$ - economic value added;

k_w - weighted average cost of capital;

NA_T^{BV} - the net asset value;

$RONA$ - return on assets;

$RONA_{LAVG}$ - return on assets in the industry average.

As a weighted average cost of capital (k_w) proposed to use the average value of the profitability of the industry ($RONA_{LAVG}$).

Fundamental value or intrinsic value – is a value, considering by investor (based on certain factors or an evaluation) as "true"; fundamental value becomes the market value when the

remaining investors are coming to the same conclusion.

Apart from the fact that in the modified CIV model fundamental value calculation of the intangible assets allows you to adjust the net assets value and thus to evaluate some impact of intellectual capital, factor analysis can be carried out on the basis of this model, i.e. to determine the effect of factors on the resulting indicator. The factors model allows us to consider two factors:

1. The net asset value;

2. Comparative indicator of the return on assets, estimating deviation margin assets from the average value.

Net asset value is a quantitative factor, comparative indicator of the return on assets - quality. Taking into account the characteristics of the intellectual capital, it must be assumed that the value of the fundamental value of intangible assets is influenced primarily by quality indicator - a comparative measure of return on assets.

3 Problem Solution

3.1 Calculation of the Fundamental Value of Intangible Assets

Three large Russian companies from different industries with high rates of revenue and market capitalization are selected for the calculation of the fundamental value of intangible assets (as of 2018):
1. PJSC "LUKOIL" (revenue – 53,901 mio rubles, the market capitalization - 3,739,125 mio rubles, the industry - Oil and gas production, oil refining).
2. PJSC "MegaFon" (revenue – 305,426 mio rubles, the market capitalization – 396,552 mio rubles, the industry - Telecommunication).
3. PJSC "Magnit" (revenues – 414,6 million rubles, the market capitalization – 358,626 mio rubles, the industry - Trade).

Initial data for the calculation are presented on a quarterly basis for the last 3 years (Table 2).

Table 2. Initial data for the calculation of the fundamental value of intangible assets

	I q. 2016	II sq. 2016	III q. 2016	IV q. 2016	I q. 2017	II sq. 2017	III q. 2017	IV q. 2017	I q. 2018	II sq. 2018	III q. 2018	IV q. 2018
PJSC "LUKOIL"												
Assets, bn. rub.	357	413	410	438	438	432	446	468	477	486	498	506
Net equity, bn. rub.	335	369	370	430	430	419	420	430	432	425	430	436
Net income bln. rub.	1.0	36.3	37.4	97.5	6.0	4.1	5.4	15.7	1.3	7.9	12.8	18.9
PJSC "MegaFon"												
Assets, bn. rub.	465	472	472	465	497	479	467	483	491	490	584	582
Net equity, bn. rub..	175	151	161	150	155	112	120	128	140	143	149	147
Net income bln. rub.	12.0	22.8	32.6	36.6	5.2	-13.1	-4.9	5.3	10.2	12.9	18.4	16.4
PJSC "Magnit"												
Assets, bn. rub.	110	128	122	126	116	123	114	150	141	138	130	146
Net equity, bn. rub..	59	76	70	63	64	92	82	83	130	138	130	132
Net income bln. rub.	1.3	22.6	24.3	29.8	1.2	34.9	36.5	37.6	1.5	9.2	14.4	31.0

Source: Data of the companies accounting. Average return on assets value in industries are presented in Table 3

Table 3. Average Indicators of return on assets in the industry,%

Industry	2016	2017	2018
Oil and gas production and oil refining	10.0	11.1	20.4
Telecommunications	7.6	9.1	7.4
Trade	5.7	7.5	3.6

The Source: data of statistical reports.

Calculated based on the formula (1) analyzed fundamental value of intangible assets of companies presented in Table 4.

Table 4. The fundamental value of intangible assets, bln. Rub.

	I q. 2016	II sq. 2016	III q. 2016	IV q. 2016	I q. 2017	II sq. 2017	III q. 2017	IV q. 2017	I q. 2018	II sq. 2018	III q. 2018	IV q. 2018
PJSC "LUKOIL"	-326.3	-44.8	-32.8	527.1	-377.2	-382.9	-374.0	-300.6	-425.9	-390.7	-375.3	-355.8
PJSC "MegaFon"	-115.6	-55.1	-14.7	5.5	-137.2	-144.9	-133.5	-112.9	-101.0	-92.3	-85.5	-90.9
PJSC "Magnit"	-47.0	160.2	173.8	198.5	-55.3	256.6	269.4	195.5	-91.2	117.1	270.1	645.7

Source: Secondary data processing, 2019

The fundamental value of intangible assets of PJSC "LUKOIL" and PJSC "Magnit" in all periods, except for the IV quarter of 2016, has a negative value, due to the low profitability of assets, compared with industry averages and indicates inefficient use of intellectual capital. So, in I quarter 2016 in the PJSC "LUKOIL" net asset value is equal to 335,323 bn. Rub., but adjusted net assets value as a result of the inefficient use of the intellectual capital is negative, it amounted to -326,3 bn. Rub. On the contrary, in the IV quarter of 2016 the return on assets higher than the average value, which is largely due to the effective use of intellectual capital; in this regard, the adjusted net asset value (527,1 bn. rub.) is higher than the book value (430 bn. rub.).

Not always the excess of company's return on assets over the average value leads to the excess of fundamental value of intangible assets over book value of net assets. For example, in PJSC "MegaFone" in the IV quarter of 2016 the figure of the fundamental value of intangible assets is positive, indicating the exceed of company's return on assets value over average. However, the book net asset value is equal to 150 bn. Rub, and the corrected value of net assets - 5.5 bn. Rub only. This is because of a small deviation of company's profitability from the average industry value (small deviation is less than 1%). In this period the return on assets was 7.9%, return on assets in the industry average - 7.6%.

3.2 Factor Analysis of the Fundamental Value of Intangible Assets

As noted earlier model of the fundamental value of intangible assets can be represented in the form of two factors (net asset value and a comparative measure of return on assets). In this regard, for the factor analysis it is advisable to use the method of absolute differences.

Since the quantitative factor is the net asset value it should be first assessed the impact of this factor:

$$\Delta V_i^{REOI}(NA_T^{BV}) = \Delta NA_T^{BV} * RONA_C b \qquad (2)$$

where $\Delta V_i^{REOI}(RONA_C)$ – change of fundamental value of intangible assets due to net assets value impact;

ΔNA_T^{BV}- change of net assets value in reporting period compared with base one;

$RONA_C b$ - comparative measure of return on assets in base period.

The impact of quality factor - the comparative index of ROA - should be evaluated as follows:

$$\Delta V_i^{REOI}(RONA_C) = NA_T^{BV} r * \Delta RONA_C \qquad (3)$$

where - $\Delta V_i^{REOI}(RONA_C)$ - change of fundamental value of intangible assets as a result of comparative index return on assets influence;

$NA_T^{BV} r$ - the cost of net assets in the reporting period;

$\Delta RONA_C$ - change a comparative measure of return on assets in the reporting period compared to the base.

The overall change in the fundamental value of intangible assets is due to the influence of two factors:

$$\Delta V_i^{REOI} = \Delta V_i^{REOI}(NA_T^{BV}) + \Delta V_i^{REOI}(RONA_C) \quad (4)$$

where ΔV_i^{REOI}- change of the fundamental value of intangible assets in the reporting period compared to the base.

As periods quarters were taken; base period is a quarter before reporting.

Factor analysis results are shown in Table 5.

In spite of the negative figures of intangible assets fundamental value in the PJSC "LUKOIL" and PJSC "Magnit", the change of this indicator is positive in most periods.

Results of the factorial analysis confirmed the assumption that the greatest influence on the intangible assets fundamental value has a quality factor - the comparative index ROA.

Table 5. The results of factor analysis of the fundamental value of intangible assets, bln. Rub.

	II sq. 2016	III q. 2016	IV q. 2016	I q. 2017	II sq. 2017	III q. 2017	IV q. 2017	I q. 2018	II sq. 2018	III q. 2018	IV q. 2018
PJSC "LUKOIL"											
ΔV_i^{REOI}	281.6	12.0	559.9	-904.3	-5.7	8.9	73.4	-125.3	35.2	15.4	19.5
$\Delta V_i^{REOI}(NA_T^{BV})$	32.6	-0.1	-5.3	0.0	9.9	-1.2	-9.1	-0.9	6.9	-4.5	-5.3
$\Delta V_i^{REOI}(RONA_C)$	314.1	12.1	565.2	-904.3	-15.6	10.2	82.5	-124.4	28.4	19.9	24.8
PJSC "MegaFon"											
ΔV_i^{REOI}	60.5	40.4	20.2	-142.7	-7.8	11.4	20.6	11.9	8.8	6.8	-5.4
$\Delta V_i^{REOI}(NA_T^{BV})$	16.0	-3.6	1.0	0.2	38.4	-10.6	-9.7	-10.7	-2.0	-3.5	1.0
$\Delta V_i^{REOI}(RONA_C)$	44.5	44.0	19.2	-142.8	-46.2	22.0	30.3	22.5	10.7	10.3	-6.4
PJSC "Magnit"											
ΔV_i^{REOI}	207.1	13.7	24.7	-253.8	311.9	12.8	-73.8	-286.7	208.3	152.9	375.6
$\Delta V_i^{REOI}(NA_T^{BV})$	-13.9	-13.3	-16.1	3.9	-23.4	-26.3	3.6	110.1	-5.3	-7.3	5.4
$\Delta V_i^{REOI}(RONA_C)$	221.0	26.9	40.8	-257.7	335.3	39.1	-77.4	-396.8	213.6	160.2	370.2

Source: Secondary data processing, 2019

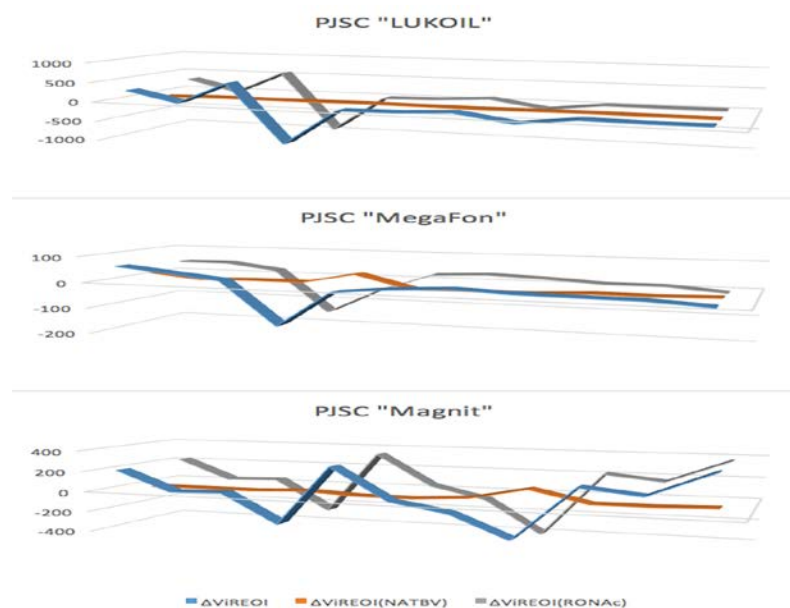Results of the factorial analysis are presented graphically in Figure 1.

Fig.1: The influence of factors on the change in the fundamental value of intangible assets

It can be argued that the quantitative factor - the net asset value - does not affect the performance indicator, since a change of this factor is completely offset by the change in a comparative measure of return on assets. In the CIV model net assets figure "is adjusted" (reduced or increased) by comparing the profitability of the company with the average value. In case of a negative value of the comparative indicator of return on assets, the fundamental value of intangible assets shows how low (negative) is the value of company's net assets due to the low return on intellectual capital.

4 Conclusion

Currently, the relevant questions are evaluating the intellectual capital of companies. There are quite a number of approaches to both qualitatively and quantitatively evaluate the intellectual capital. Special attention in the evaluation of the use of intellectual capital deserves Calculated Intangible Value (CIV) model, because it allows you to make calculations based on the financial reporting, i.e., it provides availability of the information. For the calculations it is advisable to modify the specified model and determine the fundamental value of intangible assets. The indicator provides with a certain degree to estimate the impact of intellectual capital efficiency use on company's net assets value. In addition, on the basis of this model, it is possible to determine the impact of factors such as the value of net assets and the relative return on assets on the resulting indicator.

The results of calculations for the three major Russian companies allow to quantify how net assets deviate from their book value, depending on the efficiency of intellectual capital use. Based on these results it was concluded that not always the excess of the return on assets over the average value leads to the excess of intangible assets fundamental value over book value of net assets. The situation is similar with a slight (less than 1%) excess of the company's assets profitability over the industry average profitability and demonstrates the lack of effective use of the intellectual capital. The results of the factor analysis confirmed the assumption that the greatest influence on the figure of intangible assets fundamental value has a qualitative factor – a comparative indicator of return on assets.

The main disadvantage of the modified CIV model is the use of return on assets, which only indirectly reflects the impact of intellectual capital. However, taking into account the difficulty of quantifying the intellectual capital, the lack of techniques, allowing to reliably determine this

parameter, a modified model of Calculated Intangible Value, based on the calculation of the fundamental value of intangible assets, can be used as a way of assessing of companies' intellectual capital efficiency use.

References:

[1] Aho,S., Stahle, S., Stahle,P., Critical analyses of the Calculated Intangible Value (CIV) method., *Measuring Business Excellence.* Vol. 15, No. 4, 2011, pp. 27-35.

[2] Albert S., Bradley K., The Impact of Intellectual Capital, *Open University Business School Working Paper*, No. 15, 1996.

[3] Brooking, A., *Intellectual Capital: Core Assets for the Third Millennium Enterprise.* Thomson Business Press, London, United Kingdom, 1996, 224 p.

[4] De Zubielqui, G., & Seet, P Intellectual capital system perspective: A case study of government intervention in digital media industries. Presented by O'Connor A. & Roos G. (Eds.), *Integrating Innovation: South Australian Entrepreneurship Systems and Strategies* South Australia: University of Adelaide Press. 2015. pp. 277-302.

[5] Edvinsson L.,Malone M., *Intellectual Capital: realizing your company's true value by finding its hidden brainpower.* New York: Harper Business, 1997, 240 p.

[6] FeleagĂ, L., Feleagă, N., Dragomir, V., & Râbu, L. European evidence on intellectual capital: linking methodologies with firm disclosures, *Acta Oeconomica.* – Vol. 63, No. 2., 2013. pp.139-156.

[7] Kaplan, R., Norton, D., *The Balanced Scorecard: Translating Strategy into Action.* Harvard Business School Press. 1996, 336 p.

[8] Kövesi, J., Tóth, Z., & Jónás, T. How much is intellectual capital worth for the organization? Separating the measurement and evaluation of intellectual capital elements with evaluator functions at EMS companies, *Acta Oeconomica.* – Vol. 62, No. 1., 2012. pp.65-91.

[9] Lev, B., *Intangibles: Management, Measurement and Reporting, Brookings Institution.* Washington, 2002., 231 p.

[10] Lev, B., Mintz, S.L. Seeing Is Believing: A Better Approach to Estimating Knowledge Capital., *CFO Magazine*, No. 15, 1999, pp.29-37.

[11] Schoenherr, T. Leveraging Suppliers for Product Innovation Performance: The

Moderating Role of Intellectual Capital, *Transportation Journal*, – Vol. 57, No. 4., 2018. pp.365-398.

[12] Stahle, P., Ståhle, S. Measurement of Intangible Capital: Assessment of the Methods Presented by Baruch Lev, *Intellectual Capital in Organizations, Non-Financial Reports and Accounts.* 2014, Available at https://www.researchgate.net/publication/2733 83402_Stahle_P_Stahle_S_2014_Measuremen t_of_Intangible_Capital_Assessment_of_the_ Methods_Presented_by_Baruch_Lev_In_Patri cia_Ordonez_de_Pablos_and_Leif_Edvinsson _Eds_Intellectual_Capital_in_Organizations_ No

[13] Stewart, T.A., *Intellectual Capital: The New Wealth of Organizations*. NY: Bantam Doubleday Dell Publishing Group, 1997, 320 p.

[14] Strassmann P. A., *Information payoff: The transformation of work in the electronic age,* New York: Free Press, 1985, 298 p.

[15] Su, H. Business Ethics and the Development of Intellectual Capital, *Journal of Business Ethics*. – Vol. 119, No. 1., 2014. pp.87-98.

[16] Sullivan, P., *Value-driven Intellectual Capital: How to convert intangible corporate assets into market value.* Wiley., 2000, 240 p.

[17] Tobin J., Brainard W.C., Asset Markets and the Cost of Capital*, Economic Progress, Private Values and Public Policy, Essays In Honor of William Fellner, North-Holland*, 1977, pp. 235-262

[18] Ugalde-Binda, N., Balbastre-Benavent, F., Canet-Giner, M., & Escribá-Carda, N. The Role of Intellectual Capital and Entrepreneurial Characteristics as Innovation Drivers, *Innovar: Revista De Ciencias Administrativas Y Sociales.* – Vol. 24, No. 53., 2014. pp.41-60.

[19] Volkov D.L., Garanina T.A., Intangible assets: problems of content and evaluation, *Bulletin of St. Petersburg State University*. - Vol. 8, No. 1., 2007. pp.82-105.