

THE INTELLECTUAL CAPITAL EFFECTIVENESS AND ENTERPRISES` PERFORMANCE - EMPIRICAL STUDY OF POLISH LISTED COMPANIES USING VAIC METHOD

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Abstract:

The question of the existence and measurement of intellectual capital (IC) in enterprises is significantly growing in importance in recent years. Researchers` attention is not only drawn to the measurement of IC absolute value, but also to the analysis of IC effectiveness. Scientists try to answer the question on the importance of intangible assets in creating company value. One of the possible methods to determine it, is the Value Added Intellectual Coefficient (VAIC) which was created in 1997 by A. Pulic from the Austrian Intellectual Capital Research Center. Theoretical intellectual capital efficiency considerations focus on issues of creating value for the company and its importance for the enterprise performance. Theoretical assumptions imply that the high efficiency of IC is positively correlated with the value of the company (measured by MV/BV ratio) and the company's performance, such as return on assets, equity and investments. However, empirical studies do not always confirm this relationship. The aim of the article was to examine the intellectual capital efficiency using the VAIC method and its impact on the market value and the performance of Polish companies listed on the Warsaw Stock Exchange from the IT industry. Research timeline covered years: 2010 - 2013. Empirical studies took into account the time delay, what answered the question of whether and with how long delay effectiveness of the individual components of VAIC (SCE, CEE and HCE) has a statistically significant effect on the value and the company's performance measured by: ROA, ROE, ATO and MV / BV.

Keywords: intellectual capital effectiveness, human capital, VAIC method, enterprises` performance, polish stock exchange

1. INTRODUCTION

In the contemporary knowledge-based economy the importance of intellectual capital (IC) defined as the combined assets that allow organizations to function is growing (Brooking, 1998, pp. 12). IC is also seen as the ability to use the knowledge possessed by a person or a company to make better use of human and natural resources (Stowe, Kwiatkowski, 2001, pp. 86). In the discussion on the IC significance for the company there is emphasized that it may have a major impact on achieving and maintaining competitive advantage. T.A. Stewart [1997, p. 32] considers the IC as a sum of all the knowledge employees have, in turn, according to L. Edvinsson`a and M. Malone`a [2001, p. 39] IC is perceived apart from knowledge, also as experience, organizational structure, relationships with clients and professional skills that are sustainable competitive advantage. In other words, IC plays strategic role in the modern enterprise, so it is advisable to measure it and also how and with what force IC affects the company's position in the market and its performance.

2. MEASUREMENT METHODS OF INTELLECTUAL CAPITAL

The most well-known and at the same time basic classification of measurement methods of intellectual capital is the division proposed by the E.C. Sveiby (2001), consisting of four groups: a) *Direct Intellectual Capital Methods*, focusing on the study of certain intangible assets. This group includes such methods as: *The Value Explorer*, *Intangible Assets Valuation*, *Accounting for the Future*, *Inclusive Valuation Methodology*, *Total Value Creation* and *Technology Broker*.

b) *Market Capitalization Methods*, which show the difference between the market value and the book value, representing the value of intellectual capital. These methods include ratio of market value to book (MV / BV), *Tobin's Q ratio*, *Investor Assigned Market Value*

c) *Return on Assets Methods*, which examine the profitability of individual assets involved in the company during the period. These methods include: *Value Added Intellectual Coefficient*, *Calculated Intangible Value*, *Human Resources Costing*, *Knowledge Capital Earnings*, *Economic Value Added (EVA)*.

d) *Scorecard Methods*, that, like the direct measurement methods focus on the determination of individual components of intellectual capital with such difference that they rarely allow an investigation of their monetary value. Among these methods there are distinguished: *Balanced Scorecard*, *Intangible Assets Monitor*, *IC-Rating*, *Skandia Navigator*, *Holistic Approach Value*.

Since the paper concentrates around the problem of the effect of the company's intellectual capital efficiency in this article one of the Return on Assets Methods will be used - Value Added Intellectual Coefficient (VAIC).

3. DESCRIPTION OF VAIC METHOD

VAIC method was developed by A. Pulic of the Austrian Research Centre of Intellectual Capital. VAIC can assess what is the return on the capital invested in the company. Its high value means that the company uses resources effectively, both tangible and intangible. This tells how intellectual capital is able to create value-added. Calculation of VAIC takes place in a five step process (Pulic, 2000, pp. 702-714).

Stage I: At the beginning the value added (VA) is calculated, which is the difference between revenues and expenditures of the company excluding depreciation and expenses incurred for employees. In the VAIC method value added is calculated as the sum of: operating profit, remuneration and other benefits attributed to employees and depreciation.

Stage II: Calculating the efficiency of physical (employed) capital (CEE), which is the ratio of value added and the value of physical capital, which is defined as the book value of equity (net assets). CEE indicator informs about the tangible resource efficiency in the enterprise. In other words it provides information about value added generated by the involvement of one unit of physical capital.

Stage III: Determining the effectiveness of human capital, which is the ratio of value added and human capital. This indicator provides information how much value added is created as a result of investing one monetary unit in employee.

Stage IV: Calculation of structural capital (SC) and the efficiency of its use. According to A. Puric structural capital is the difference between value added and human capital. Its efficiency is calculated as the ratio of structural capital and value added. This ratio indicates what is the structural capital share in value added. A. Puric model assumes that, in the creation of value added for the enterprise, human capital is inversely proportional to the structural capital.

Stage V: Determining the value added intellectual coefficient (VAIC), which is the sum of performance indicators of physical capital (CEE), human (HCE) and structural (SCE).

The main advantages of the VAIC method are: relatively simple calculation, no major problems with the acquisition of data and the ability to assess which of the assets (tangible or intangible) bring the most benefits to the company. Moreover, by calculating VAIC for a long time horizon, there is the opportunity to observe changes in the efficiency of assets involved in the company, which can help in the diagnosis of barriers to the strategic development of the company.

4. BACKGROUND OF THE VAIC STUDIES

In the studies on the effectiveness of intellectual capital in Polish enterprises dominates the positive analysis. In the paper of K. Beyer (2013) the author examines the value of VAIC and its components for the 20 Polish listed companies included in the WIG-20 index. The research conducted for the years 2009-2012 shows that Polish companies deriving from different sectors adopt different values of VAIC (from 2.26 to 17.22). Moreover similar variation has been found for the components making up the VAIC, although the most effective was human capital (4.08), and the least physical (0.47). In this study, there was no clear trend of changes in both the VAIC and its individual components. M.W. Staniewski and P. Szczepankowski (2012) analyzed the efficiency of intellectual capital in 2008-2010 for the six companies listed on the stock exchange from the energy industry. The authors found that the difference in values for the surveyed companies VAIC is quite small. Moreover, it turned out that, similarly as in the case of K. Beyer (2013) research, most efficient was human capital (mean 2.81), and the least - physical capital (0.38) as well. To the similar conclusions came Authors: A. Ujwary-Gil and R.K. Sliwa (2006), who analyzed in 1999-2004 two Polish companies from the telecommunications industry (TPSA and Netia) and found that most of the VAIC is generated by the human capital (an average of 3.08 for TPSA and 0.12 for Netia). The results were also compared to the values reported by European companies in the same industry. In other analyzes, E. Bombiak (2012) and K. Herring (2013) found also that human capital is the most important factor for the VAIC. Polish studies have not tried to investigate how the effectiveness of the company capital (human, physical and structural) affects the its performance. This problem however has been taken by foreign authors. Komnenic and Pokrajcic (2012) state that VAIC is positively correlated with ROA, ROE, and the average value of revenues. Shiu et al. (2006) in their study on a sample of Taiwanese companies from the technology sector found a strong positive relationship between VAIC and ROA, the book value, revenue growth and the efficiency of employees. Chan (2009), analyzing companies from Hong Kong, noticed a strong correlation between ROA and VAIC and ROE. He examined also the impact of individual components of VAIC on corporate performance. He found a significant relationship between human capital and income and the company book value and between structural capital and ROE and ROA as well. Positive relationship between human capital and ROA observed Maditinos et al. (2011) on a sample of Greek companies. Comprehensive analysis of the impact of three VAIC components on the enterprises performance made Yu et al (2011). They noticed a strong positive relationship between SCE and the CEE and the value of the company. They found also that efficiency of structural and physical capital have the greatest positive influence on ROA and ROE. However, not all studies show a statistically significant positive relationship between VAIC and the results of the company. These include analysis conducted by Lonnqvist and Kujansivu (2005) on a sample of 60 304 Finnish companies from 11 industries and by Kamath (2008) on Indian companies. Interesting analysis took Clarke et al (2010), who examined how the current high effectiveness of all capital, as well as individual components VAIC affect the future results of the company. The authors concluded that the strongest relationship exists between HCE from the previous year and the current performance of the company.

Analysis of the current state of knowledge indicates that it is important to test how strong is the relationship between VAIC (and its components) and the enterprise performance. Similar opinion has Fijałkowska J. (2013, pp. 71), who believes that it is necessary to deepen empirical studies on large

sample and to conduct long term research to examine the impact of capital efficiency on the enterprise results.

5. METHODOLOGY

The study was carried out in three stages. The first step evaluated the effectiveness of tangible and intangible assets forming VAIC indicator. In the second stage, companies performance has been defined and calculated. The third stage included an analysis of the impact of the efficiency of capital: physical, human and structural on enterprises performance. Time delay (*time lag*) has been taken into account. The study consisted of a total sample of 21 companies listed on the Warsaw Stock Exchange included in the WIG-Info (IT companies).

Stage 1: Estimating the value of CEE, HCE, SCE and VAIC The first component of the analyzed VAIC was CEE (values for the test subjects are presented in Table 1).

Table 1: Effectiveness of the capital employed (CEE) during 2010-2013

	Company name	2010	2011	2012	2013	Mean
1	Arcus	0,24	0,22	0,33	0,42	0,30
2	Asseco Business Solutions	0,37	0,37	0,34	0,35	0,36
3	Asseco Poland	0,16	0,16	0,14	0,14	0,15
4	Asseco South Eastern	0,24	0,25	0,29	0,31	0,27
5	Betacom	0,56	0,77	0,76	0,74	0,71
6	CD Projekt	0,15	0,38	0,34	0,24	0,28
7	CI Games	1,01	0,76	-0,38	0,45	0,46
8	ComArch	0,76	0,80	0,82	0,91	0,82
9	Comp	0,25	0,32	0,24	0,36	0,29
10	Elzab	0,55	0,56	0,58	0,71	0,60
11	Infovide-Matrix	0,43	0,44	0,37	0,35	0,40
12	LSI Software	0,58	0,59	0,55	0,52	0,56
13	Macrologic	1,26	1,29	1,25	1,16	1,24
14	NTT System	0,17	0,14	0,12	0,14	0,14
15	Opteam	0,59	0,63	0,65	0,60	0,62
16	PC Guard	0,36	0,19	0,32	0,36	0,31
17	Power Media	1,28	1,28	1,32	1,06	1,23
18	Qumak	0,64	0,71	0,59	0,76	0,68
19	Simple	1,35	1,31	1,33	1,33	1,33
20	Talex	0,46	0,46	0,49	0,67	0,52
21	Wasko	0,43	0,49	0,44	0,58	0,48
	Mean	0,56	0,58	0,52	0,58	

Source: Own work based on the financial statements of the companies

In the analyzed period 2010-2013 the average value of the efficiency of capital employed (CEE) in the surveyed companies remained at the same level, the lowest value was 0.52 (2012), the highest 0.58 in the years: 2011 and 2013. This means that on average each year 1 euro invested in physical assets generate 56 cents of value added. The highest average yield in the period was characterized by the company *Simple*, in which each euro invested in physical capital generated 1.33 euro of value added. Significantly higher efficiency within the companies surveyed had human capital (HCE), which on average generated 1.77 euro value added of each euro invested. (Table 2).

Table 2: Effectiveness of the human capital (HCE) during 2010-2013

	Company name	2010	2011	2012	2013	Mean
1	Arcus	1,05	0,70	1,02	1,22	1,00
2	Asseco Business Solutions	1,88	1,86	1,85	1,91	1,88
3	Asseco Poland	2,25	2,12	2,02	1,89	2,07
4	Asseco South Eastern	1,65	1,57	1,48	1,39	1,52
5	Betacom	0,96	1,47	1,44	1,52	1,35
6	CD Projekt	1,24	2,73	2,53	1,78	2,07
7	CI Games	13,53	7,07	-3,73	9,36	6,56
8	ComArch	1,18	1,20	1,20	1,21	1,19
9	Comp	1,61	1,58	1,18	1,78	1,54
10	Elzab	1,31	1,25	1,40	1,79	1,44
11	Infovide-Matrix	1,19	1,24	1,12	1,00	1,14
12	LSI Software	1,71	1,48	1,45	1,66	1,57
13	Macrologic	1,48	1,51	1,56	1,54	1,52
14	NTT System	1,51	1,66	1,51	1,69	1,59
15	Opteam	1,64	1,71	1,73	1,78	1,72
16	PC Guard	1,52	2,00	2,68	2,60	2,20
17	Power Media	0,96	1,17	1,12	1,21	1,11
18	Qumak	1,50	1,48	1,34	1,19	1,38
19	Simple	1,36	1,49	1,44	1,60	1,47
20	Talex	1,39	1,25	1,08	1,49	1,30
21	Wasko	1,47	1,67	1,39	1,43	1,49
	Mean	2,02	1,82	1,28	1,95	

Source: Own work based on the financial statements of the companies

The highest average return in the analyzed period recorded the company *CI Games* (6.56 euro of each euro invested in human capital). While the lowest occurred in the case of a company *Arcus* where HCE rate was 1. It should be noted that, apart from the mentioned *Arcus* company, all researched subjects recorded HCE ratio greater than 1, which means that the money involved in human capital is less than the value added.

Out of the three components forming VAIC the lowest average rate of return over the analyzed time period appeared in the case of structural capital (SCE). This value was 0.34 what implies that each invested unit of structural capital generates almost two times less added value than physical capital and five times less than human capital (Table 3).

Table 3: Effectiveness of the structural capital (SCE) during 2010-2013

	Company name	2010	2011	2012	2013	Mean
1	Arcus	0,05	-0,42	0,02	0,18	-0,04
2	Asseco Business Solutions	0,47	0,46	0,46	0,48	0,47
3	Asseco Poland	0,56	0,53	0,51	0,47	0,52
4	Asseco South Eastern	0,40	0,36	0,33	0,28	0,34
5	Betacom	-0,04	0,32	0,31	0,34	0,23
6	CD Projekt	0,19	0,63	0,60	0,44	0,47
7	CI Games	0,93	0,86	1,27	0,89	0,99
8	ComArch	0,15	0,17	0,16	0,17	0,16
9	Comp	0,38	0,37	0,15	0,44	0,33
10	Elzab	0,23	0,20	0,28	0,44	0,29
11	Infovide-Matrix	0,16	0,19	0,11	0,00	0,12
12	LSI Software	0,41	0,32	0,31	0,40	0,36
13	Macrologic	0,32	0,34	0,36	0,35	0,34
14	NTT System	0,34	0,40	0,34	0,41	0,37
15	Opteam	0,39	0,42	0,42	0,44	0,42
16	PC Guard	0,34	0,50	0,63	0,62	0,52
17	Power Media	-0,04	0,15	0,10	0,17	0,09
18	Qumak	0,33	0,33	0,25	0,16	0,27
19	Simple	0,27	0,33	0,31	0,38	0,32
20	Talex	0,28	0,20	0,08	0,33	0,22
21	Wasko	0,32	0,40	0,28	0,30	0,33
	Mean	0,31	0,34	0,35	0,37	

Source: Own work based on the financial statements of the companies

The lowest, positive structural capital efficiency has been recorded in the case of *Power Media* company (0.9), while the highest by *CI Games* (0.99). In none of the surveyed companies there was observed more than proportional increase in the value added (> 1) as a result of the involvement of structural capital. Calculated components HCE, SCE and CEE form VAIC indicator (Table 4).

Table 4: Value added intellectual coefficient (VAIC) during 2010-2013

	Company name	2010	2011	2012	2013	Mean
1	Arcus	1,34	0,50	1,37	1,82	1,26
2	Asseco Business Solutions	2,73	2,69	2,66	2,73	2,70
3	Asseco Poland	2,97	2,81	2,67	2,50	2,74
4	Asseco South Eastern	2,29	2,18	2,10	1,98	2,14
5	Betacom	1,48	2,56	2,51	2,60	2,29
6	CD Projekt	1,58	3,74	3,47	2,47	2,82
7	CI Games	15,46	8,68	-2,83	10,70	8,01
8	ComArch	2,08	2,17	2,18	2,28	2,18
9	Comp	2,24	2,27	1,57	2,57	2,16
10	Elzab	2,09	2,01	2,26	2,94	2,32
11	Infovide-Matrix	1,79	1,87	1,60	1,35	1,65
12	LSI Software	2,70	2,39	2,31	2,57	2,49
13	Macrologic	3,06	3,14	3,17	3,05	3,11
14	NTT System	2,02	2,19	1,97	2,24	2,10
15	Opteam	2,62	2,76	2,80	2,82	2,75
16	PC Guard	2,22	2,69	3,63	3,57	3,03
17	Power Media	2,19	2,59	2,54	2,44	2,44
18	Qumak	2,47	2,52	2,19	2,11	2,32
19	Simple	2,98	3,12	3,07	3,31	3,12
20	Talex	2,12	1,90	1,65	2,49	2,04
21	Wasko	2,21	2,56	2,11	2,31	2,30
	Mean	2,89	2,73	2,14	2,90	

Source: Own work based on the financial statements of the companies

Data in Table 4 show that the coefficient VAIC for all test subjects received in the reporting period recorded the average value greater than 1, which means that the investment both in intangible and tangible assets generated above-average value added. Most of value added, generated *CI Games* (8.01 euro for each euro invested in the company). The worst company was again *Arcus* (average VAIC for four years was 1.26). VAIC index value changes did not show clear upward or declining trend, both in terms of the average for all study subjects and for individually analyzed companies.

Stage II: Defining and determining the enterprise performance

In order to analyze the impact of intellectual capital on company performance the notion of corporate business performance has been defined. Referring to the three areas: value, profitability and productivity four variables have been taken to further studies: the ratio of the market value and book value (MV / BV), return on assets (ROA), return on equity (ROE) and asset turnover ratio (ATO). In the studied group in the four year period of analysis the average values were: 5.7% for ROA, 8.6% for ROE, 137.8% for ATO and 1,62 for the rate of MV / BV.

Stage III: Analysis of the intellectual capital impact on corporate performance

Four financial indicators: ROA, ROE, ATO and MV / BV have been used as dependent variables. As independent variables VAIC components: HCE, SCE and CEE were used.

6. RESULTS

Analysis was divided into two groups. The first group (Tables: 5-7) shows the results for the same year, whereas in the second group (Tables: 8-10) the test results included a time delay (one year). The significance of correlation (p value) indicating the level of statistical significance of the relationships, has been described as follows:

- *** very high significant level of $p < .001$
- ** high significant level of $p < .01$
- * significant level of $p < .05$

The relationship between the current values of the VAIC components and the current companies results

Table 5: CEE, HCE, SCE and market value during 2010-2013

	Standardized coefficients (β)	t-value	p	VIF
2013				
CEE	0.670628	0.32	0.751	1.08
HCE	-0.67088	-1.09	0.290	2.61
SCE	8.37795	1.43	0.171	2.73
R-square=0.107				
2012				
CEE	1.157436	2.38	0.029**	1.38
HCE	-0.36183	-2.18	0.043*	1.42
SCE	3.947372	4.83	0.001***	1.64
R-square=0.734				
2011				
CEE	1.17524	3.07	0.007***	1.00
HCE	0.94067	5.99	0.001***	2.09
SCE	-0.04573	-0.05	0.957	2.09
R-square=0.832				
2010				
CEE	1.052261	1.47	0.160	1.20
HCE	0.477942	3.14	0.006***	2.76
SCE	-0.45854	-0.24	0.810	2.62
R-square=0.644				

Source: Own work

Data in Table 5 show that the strongest relationship between VAIC components and enterprise value as measured by the MV / BV is recorded for human capital efficiency (HCE), for which the observed positive relationship has been noticed for years: 2010-2011. However there was no relationship in 2012 and 2013. The effect of CEE, HCE and SCE on ROA is shown in Table 6.

Table 6: CEE, HCE, SCE and ROA during 2010-2013

	Standardized coefficients (β)	t-value	p	VIF
2013				
CEE	0.104745	4.93	0.001***	1.08
HCE	0.024158	3.85	0.001***	2.61
SCE	0.123646	2.06	0.055*	2.73
R-square=0.843				
2012				
CEE	0.072306	3.85	0.001***	1.38
HCE	0.056579	8.83	0.001***	1.42
SCE	0.047698	1.51	0.149	1.64
R-square=0.892				
2011				
CEE	0.085553	5.79	0.001***	1.00
HCE	0.021046	3.47	0.003***	2.09
SCE	0.102363	3.18	0.005***	2.09
R-square=0.869				
2010				
CEE	0.041326	2.52	0.022***	1.20
HCE	0.018674	5.35	0.001***	2.76
SCE	0.253949	5.91	0.001***	2.62
R-square=0.949				

Source: Own work

In all studied years, there was a strong positive correlation between ROA and efficiency of physical capital (CEE) and human capital (HCE). In addition, in 2010-2011 it was noted that a significant impact on the return on equity had structural capital efficiency (SCE). There was no relationship between productivity, measured as the asset turnover (ATO) and any of the components of VAIC for any

reference year, with the exception of 2010, which reported a negative correlation between the efficiency of structural capital (SCE) and asset turnover ratio (ATO).

Table 7: CEE, HCE, SCE and ROE during 2010-2013

	Standardized coefficients (β)	t-value	p	VIF
2013				
CEE	0.19407	6.53	0.001***	1.08
HCE	0.02165	2.47	0.024**	2.61
SCE	0.232261	2.77	0.013**	2.73
R-square=0.838				
2012				
CEE	0.131485	5.25	0.001***	1.38
HCE	0.090137	10.54	0.001***	1.42
SCE	0.030505	0.72	0.479	1.64
R-square=0.933				
2011				
CEE	0.155608	10.11	0.001***	1.00
HCE	0.0345	5.45	0.001***	2.09
SCE	0.188276	5.62	0.001***	2.09
R-square=0.950				
2010				
CEE	0.09473	2.98	0.008***	1.2
HCE	0.020081	2.96	0.009***	2.76
SCE	0.421171	5.05	0.001***	2.62
R-square=0.908				

Source: Own work

The relationship between the current values of the components of VAIC and future performance of a company

Tables: 8-10 present the impact of physical capital efficiency (CEE), human (HCE) and structural (SCE) from the time t_0 on the indicator: MV / BV, ROA, ROE ATO for the period t_1 . It was assumed that t_0 takes discrete values: 2010, 2011 and 2012, while t_1 : 2011, 2012 and 2013 respectively.

Table 8: CEE, HCE, SCE and market value during 2010-2013

	Standardized coefficients (β)	t-value	p	VIF
MV/BV 2013				
CEE ₂₀₁₂	1.724461	1.05	0.308	1.38
HCE ₂₀₁₂	1.130871	2.02	0.026**	1.42
SCE ₂₀₁₂	7.002915	2.53	0.007***	1.64
R-square=0.314				
MV/BV 2012				
CEE ₂₀₁₁	1.233974	3.08	0.007***	1.00
HCE ₂₀₁₁	0.874081	5.3	0.001***	2.09
SCE ₂₀₁₁	0.122986	0.14	0.890	2.09
R-square=0.807				
MV/BV 2011				
CEE ₂₀₁₀	0.664016	1.13	0.275	1.20
HCE ₂₀₁₀	0.425776	3.4	0.003***	2.76
SCE ₂₀₁₀	-0.66999	-0.43	0.669	2.62
R-square=0.648				

Source: Own work

Table 9: CEE, HCE, SCE and ROA during 2010-2013

	Standardized coefficients (β)	t-value	p	VIF
ROA 2013				
CEE ₂₀₁₂	0.085187	3.75	0.002***	1.38
HCE ₂₀₁₂	-0.02905	-3.74	0.002***	1.42
SCE ₂₀₁₂	0.173778	4.54	0.001***	1.64
R-square=0.778				
ROA 2012				
CEE ₂₀₁₁	0.035898	1.21	0.244	1.00
HCE ₂₀₁₁	-0.07646	-6.26	0.001***	2.09
SCE ₂₀₁₁	0.221957	3.43	0.003***	2.09
R-square=0.714				
ROA 2011				
CEE ₂₀₁₀	0.079792	3.03	0.008***	1.20
HCE ₂₀₁₀	0.008222	1.47	0.161	2.76
SCE ₂₀₁₀	0.070366	1.02	0.322	2.62
R-square=0,630				

Source: Own work

Table 10. CEE, HCE, SCE and ROE during 2010-2013

	Standardized coefficients (β)	t-value	p	VIF
ROE 2013				
CEE ₂₀₁₂	0.148266	0.036638	0.001***	1.38
HCE ₂₀₁₂	-0.0371	0.012513	0.009***	1.42
SCE ₂₀₁₂	0.222367	0.061637	0.002***	1.64
R-square=0.695				
ROE 2012				
CEE ₂₀₁₁	0.075101	0.041421	0.088***	1.00
HCE ₂₀₁₁	-0.13474	0.01703	0.001***	2.09
SCE ₂₀₁₁	0.358872	0.090182	0.001***	2.09
R-square=0.807				
ROE 2011				
CEE ₂₀₁₀	0.143202	0.040793	0.003***	1.20
HCE ₂₀₁₀	0.013808	0.008688	0.130	2.76
SCE ₂₀₁₀	0.127871	0.106897	0.248	2.62
R-square=0,687				

Source: Own work

Analyzing the time lag with which the components of VAIC affect the performance of companies the most frequently observed relationship was a positive relationship between the effectiveness of human capital and the value of the company and between the effectiveness of physical capital and ROE. This relationship was observed for all studied years. There were not observed any of the dependence in any years between any of the components of VAIC and productivity measured by asset turnover ratio.

7. CONCLUSIONS

The conducted study shows that human capital is the most important in the creation of value added for the companies, what corresponds with previous studies on Polish companies. Furthermore it was found that in the process of market value formation human capital plays a key role, though this was not the rule for all years. This means that the stock exchange investors highly valued human capital in the surveyed enterprises. However, there was not observed relationship between the company value and structural or physical capital that was pointed by Yu et al (2010). Analysis of VAIC compounds for the same period of the study showed that the most frequently observed relationship was the impact the effectiveness of physical and human capital on ROA and ROE, what partly corresponds with the results of the research that Maditinos et al (2011) have conducted and confirms that in assessing the company's financial situation a key role perform physical assets. However, the study of Chan (2009) shows that the greatest impact on ROE and ROA had structural capital, in turn, according to Yu et al (2010) on the ROE and ROA, apart from structural capital impact, also the positive influence of physical capital has been stated. However, from the analysis of the delay with which the capital of the company may affect the enterprise results, derives the conclusion that human capital has the greatest

importance for the creation of market value, while physical capital has strongest influence on ROE. These results partially coincide with the conclusions of the Clarke et al. (2010) studies.

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