VALUE ADDED INTELLECTUAL CAPITAL IN IT COMPANIES IN POLAND – CASE STUDY

Jan POLCYN[1] ORCID: 0000-0001-7847-2743
Viktoriia VOVK[2] ORCID: 0000-0002-8187-4257

Abstract: *The purpose of this article is to measure VAIC for IT companies and to determine the relationship between VAIC and the stock market value of companies. The presented study adopted the following hypothesis: VAIC is related to a company's stock market value. The conducted analyses have confirmed the relationship between VAIC and the stock market value of IT companies. This association shows a correlation coefficient of approximately 0.63. Among the analysed variables that make up VAIC, a higher correlation was found between the stock market value of the company and HCE – the value of the correlation coefficient was around 0.67. This article is a first attempt to take a broader look at the issue of VAIC measurement in Polish companies. In future publications, the authors intend to increase the dataset to enable a more precise analysis of model 1 and to carry out the analysis according to the formulas for model 2-3 of VAIC measurement presented in this work.*

Key words: intellectual capital, human capital, VAIC, IT companies

JEL codes: A13**,** A19, E24, J24, O34

Introduction

Intellectual capital (IC) is gaining increasing popularity in the research community due to the continuous growth and development of the knowledge-based economy.

The key to the discussion of intellectual capital (IC), is its definition in relation to VAIC. This study assumes that intellectual capital is "the sum of a firm's 'hidden' assets, not fully captured in the balance sheet, thus including both what is in the heads of the organization's members and what remains in the company when they leave" (Roos and Roos, 1997).

Contemporary academic literature identifies the following components of intellectual capital: human capital, structural capital and relational capital. At the micro level, intellectual capital includes non-physical (value-added) sources of goodwill such as human capital (including skills, work experience, training), relational capital (including customer and stakeholder relationships, brands, contracts) and structural capital (including company culture, work environment, intangible law). Macroeconomic research on human capital has been focused mainly on determining indicators and defining the value of a company (Stahle et al., 2011) (Stępień et al., 2021).

Nowadays, we observe correlations allowing us to state that knowledge-based organisations have shifted the factors of productivity and value creation from material inputs to skilled and technically proficient employees (the human mind being the dominant source of value generation) (Vishnu and Gupta, 2014), (Pereira-Rodrigues and Santos-Rodrigues, 2017) (Kuzior et al., 2021) (Bogachov et al., 2020).

The intellectual capital of companies is cited as the reason why the market value of a company may be higher than the financial cost of actually replacing its fixed assets. This also indicates that intellectual capital is not accounted for in companies' accounting systems (Nadeem et al., 2019).

[1] Stanislaw Staszic State University of Applied Sciences in Pila, Poland
[2] Viktoriia VOVK State University of Applied Sciences in Pila, Poland
DOI: 10.29302/oeconomica.2023.25.2.24

Analyses conducted in India using the sample of 22 large pharmaceutical companies show a positive relationship between intellectual capital and company performance as measured by return on assets and return on sales (Vishnu and Gupta, 2014).

In the literature, the measurement of intellectual capital is divided into four categories: 1) direct intellectual capital (DIC) method; 2) market capitalisation method (MCM); 3) return on assets (ROA) method; 4) scorecard (SC) method (Sveiby, 2010).

VAIC model assesses human capital efficiency (HCE), structural capital efficiency (SCE) and employed capital efficiency (Vishnu and Gupta, 2014).

In previous surveys, VAIC has been most frequently assigned to the banking and finance, (Young et al., 2009), information technology (Zeghal and Maaloul, 2010) (Pal and Soriya, 2011) and pharmaceutical industries (Kamath, 2008).

Controversy over VAIC measurement

Today, we are functioning to a great extent in a knowledge-based economy. Accordingly, we are seeing significant growth in intangible assets such as human capital, customer relations, brand, corporate reputation, organisational processes, innovation and patents. Consequently, it is necessary to manage and measure human capital, as these activities allow for a sustainable competitive advantage (Pereira-Rodrigues and Santos-Rodrigues, 2017).

The model developed by Pulic is one of the first and most well-known models of VAIC measurement, yet it has been widely criticized (Pulic, 2000).

Detailed analyses of the VAIC measurement model show that it is reasonable to analyse value added and human capital in this model. What raises doubt, however, is the measurement of structural capital (Ariff et al., 2017).

Pulic indicates that there is no correlation between VAIC and traditional methods, which suggests that it is a different method (Pulic et al., 2009). EVA (economic value added) is related to the capital employed and financial flow, but does not enable determining the efficiency of intellectual capital (Pulic, 2000).

Reports on the role of intellectual capital in shaping firm performance are ambiguous. Observations of the pharmaceutical industry show a positive association only with return on assets (ROA), furthermore they suggest that physical capital, rather than intellectual capital, is the main driver of corporate performance (Mehralian et al., 2012). Other studies find a slight association between VAIC and company performance (Kamath, 2008).

The model described by Pulic (Pulic, 2000) is represented by the following equation:

$$VAIC = HCE + SCE + CEE \quad (1)$$

where:
HCE (human capital efficiency) = value added (VA)/human capital (HC)
SCE (structural capital efficiency) = structural capital (SC=VA-HC)/value added (VA),
CEE (capital employed efficiency) = value added (VA)/capital employed (CE)

In Pulic's model (1), human capital (HC) is interpreted as employee expenditure (salaries and investment in human resources), structural capital (SC) is interpreted as the difference between the added value generated by the company (VA) and human capital (HC), capital employed (CE) is interpreted as the financial capital available to the company (book value) (Stahle et al., 2011), (Marzo, 2021). The Pulic model (1) assumes that company generated value added is based on the use of physical and intellectual capital. Further, it is assumed that the value added generated for a company is related to its overall efficiency (Pulic, 2000). Critics of Pulic's model point out that he actually refers in his model to the productivity of physical, human and structural capital and these quantities are not closely related to intellectual capital (Bakhsha et al., 2017). Some researchers argue that Pulic

confuses stocks with flows and expenses with assets (Andriessen, 2004). Iazzolino and Laise believe that Pulic uses some terms at his own discretion, in a way that deviates from the definitions formulated in the literature (Iazzolino and Laise, 2013). They also criticise the method of calculating added value and the concept of human capital (Stahle et al., 2011). In the Pulic model (Pulic, 2000) the notion of relational capital was omitted, consequently the e-VAIC model which includes this capital has been proposed (Vishnu and Gupta, 2014):

$$e\text{-}VAIC=HCE+SCE+RCE+CEE \quad (2)$$

where:
HCE (human capital efficiency) = VA/(employee costs + director's salary),
SCE (structural capital efficiency) = VA/research and development expenditure),
RCE (rational capital efficiency) = VA/(marketing, sales, advertising expenditure),
CEE (capital employed efficiency) = VA/capital employed

Another model proposed by Stahle uses net values, while pointing out that they are more reliable for measuring the effectiveness of intellectual capital (Stahle et al., 2011):

$$e\text{-}VAIC=HCE+SCE+RCE+CEE \quad (3)$$

where:
HCE (human capital efficiency) = net sales/(employee costs + director's salary),
SCE (structural capital efficiency) = net sales/research and development expenditure,
RCE (rational capital efficiency) = net sales/(marketing, sales, advertising expenditure),
CEE (capital employed efficiency) = net sales/capital employed

Critical analyses by Stahle et al. indicate that the parameters used to determine VAIC in the Pulic model are not consistent with commonly accepted definitions of intellectual capital. The VAIC model proposed by Pulic only shows the efficiency of a company's labour and capital inputs. Furthermore, the use of overlapping variables in this method is subject to major criticism. The results obtained by the Stahle team do not support the hypothesis adopted by Pulic concerning the correlation of VAIC with the stock market value of the company (Stahle et al., 2011).

The measurement of intellectual capital (IC) needs to answer two main concerns: one is to measure the level of intellectual capital and the other is to look for methods to optimise intellectual capital.

Methodology

Data for the analysis have been collected from 5 IT companies listed on the Warsaw Stock Exchange. The IT industry has been chosen for the analysis due to previous literature reports of a particularly strong correlation between VAIC and company stock market value in this sector (Zeghal and Maaloul, 2010), (Pal and Soriya, 2011). Although companies listed on the Warsaw Stock Exchange are obliged to publish their financial reports in the National Court Register, the published reports have proven incoherent, incomplete and often even devoid of data, which has made it impossible to obtain reliable data. These weaknesses have led to difficulties in collecting data for the analyses and have been the direct cause of limiting the analyses to only 5 companies in 5 years and to using only model 1 in the VAIC calculations. Data for the analyses have been obtained from the web portals of the companies qualified for the analyses on 23 April 2022. (Figure 1).

VAIC has been determined using the Pulic model (equation 1). Literature reports indicate that VAIC measurement results should be combined with other metrics of company performance (Iazzolino and Laise, 2012). Our analyses have examined the correlation between VAIC and company

stock market value and, in addition, as a highly significant component of VAIC, the correlation between human capital efficiency (HCE) and company stock market value (SMV).

Results of the analyses

The summary presented in Table 1 raises suspicion that a company's stock market value may be related to both VAIC and HCE. However, the presented analyses have failed to verify this clearly due to the insufficient volume of collected data.

Table 1. Variables used in the analyses

Company name and web portal address	Year	HCE	SCE	CEE	VAIC	Number of employees	VAIC per employee	Company stock market value
ASSECO Poland S.A. https://inwestor.asseco.com	2016	0,87	-0,15	0,06	0,79	2 586	0,0003	4 478 696
	2017	0,71	-0,41	0,05	0,36	2 465	0,0001	3 650 353
	2018	0,86	-0,17	0,06	0,76	2 261	0,0003	3 827 974
	2019	0,68	-0,47	0,05	0,26	2 197	0,0001	5 312 019
	2020	0,73	-0,37	0,06	0,42	2 357	0,0002	5 652 321
CD PROJEKT S.A. https://www.cdprojekt.com	2016	6,15	0,84	0,56	7,55	184	0,0411	4 979 358
	2017	5,74	0,83	0,37	6,94	192	0,0361	9 323 640
	2018	5,10	0,80	0,22	6,12	219	0,0280	13 995 072
	2019	3,95	0,75	0,29	4,99	244	0,0204	26 692 524
	2020	7,40	0,86	0,72	8,99	326	0,0276	26 497 924
Comarch S.A. https://www.comarch.pl	2016	0,51	-0,97	0,28	-0,18	4 311	0,0000	1 415 203
	2017	0,39	-1,54	0,23	-0,92	4 343	-0,0002	1 545 336
	2018	0,50	-1,01	0,30	-0,22	4 694	0,0000	1 236 269

Company name and web portal address	Year	HCE	SCE	CEE	VAIC	Number of employees	VAIC per employee	Company stock market value
	2019	0,33	-1,99	0,22	-1,43	4 994	-0,0003	1 504 670
	2020	0,39	-1,58	0,25	-0,95	5 049	-0,0002	1 581 936
NTT System S.A. https://ntt.pl	2016	2,51	0,60	0,19	3,30	133	0,0248	38 855
	2017	2,46	0,59	0,17	3,22	121	0,0266	30 641
	2018	2,60	0,61	0,18	3,39	121	0,0280	32 523
	2019	2,57	0,61	0,22	3,41	128	0,0266	29 866
	2020	3,08	0,68	0,29	4,05	141	0,0287	69 923
WASKO Sp. z o.o. https://www.wasko.pl	2016	0,43	-1,33	0,12	-0,78	477	-0,0016	99 394
	2017	0,57	-0,74	0,14	-0,02	458	-0,0001	216 114
	2018	0,51	-0,97	0,13	-0,33	416	-0,0008	125 839
	2019	0,71	-0,42	0,17	0,46	402	0,0011	115 808
	2020	0,69	-0,45	0,16	0,40	384	0,0010	108 513

Source: own calculations based on data available from the websites of the companies analysed on 23.04.2022

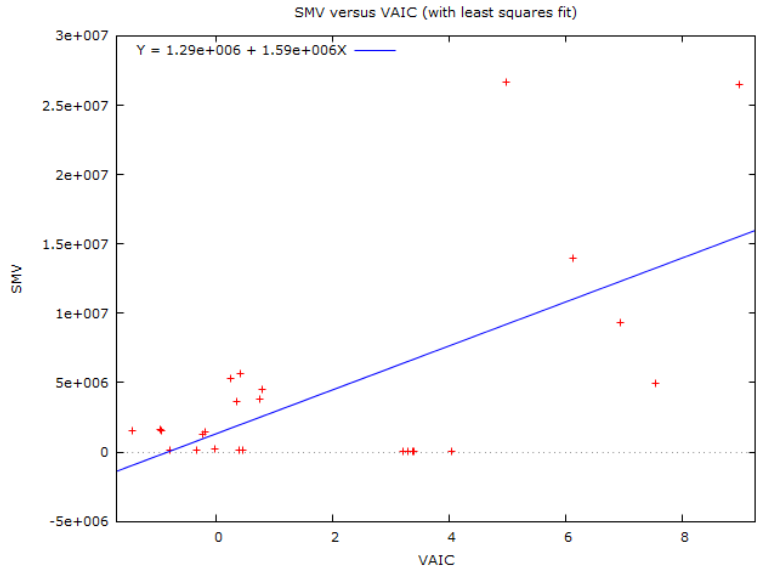

Figure 1. Correlation between a company's stock market value (SMV) and value-added intellectual capital (VAIC)
Source: own study based on analysed data

The conducted analyses have allowed to identify the relationship between the company's stock market value and VAIC (Figure 1). This result is consistent with the results obtained by Pulic (Pulic, 2000), (Pulic et al., 2009) and at the same time contrary to the results obtained by Stahle et al. (Stahle et al., 2011). The above formulation is supported only by the correlation coefficient, but it should also be noted that the presented data are only a case study and, moreover, the presented analyses are just a prelude to broader analyses.

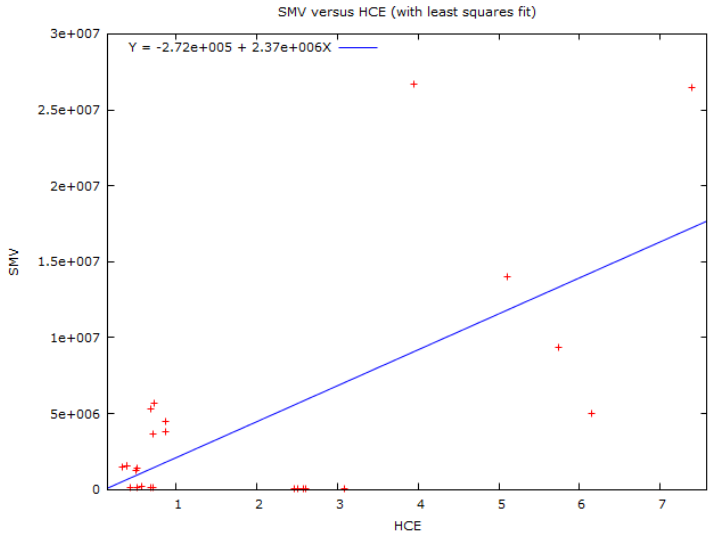

Figure 2. Correlation between a company's stock market value (SMV) and human capital effectiveness (HCE) index
Source: own study based on analysed data

Similar correlations to those quoted earlier were also observed in the analyses of the correlation coefficient between the stock market value of a company and the human capital effectiveness (HCE) index (Figure 2). There are numerous studies demonstrating the impact of human capital on economic growth - in particular, the importance of the knowledge-based economy is

highlighted (Romer, 1970). The above formulation is supported only by the correlation coefficient (fig.2), but it should also be noted that the presented data are only a case study and, moreover, the presented analyses are just a prelude to broader analyses.

Conclusions

The analyses presented in this study allow for setting further research directions on VAIC measurement methods. It is necessary to collect more reliable data and to select companies with different business profiles for the analytical process.

A relatively high correlation has been found between VAIC and HCE and the company stock market value. This observation corresponds to the research trend indicating the role of human capital in economic growth.

Accessibility of credible sources of information, even for listed companies, which should and are obliged by law to publish financial data according to strictly defined standards, was a serious limitation in the conducted analyses.

References

ANDRIESSEN, D. 2004. *Making Sense of Intellectual Capital: designing a method for the valuation of intangibles*, Elsevier Butterworth-Heinemann.

ARIFF, A. H. M., VAN ZIJL, T. & ISLAM, A. 2017. Value Added Intellectual Coefficient (VAIC): Revisiting the Basic of the Model. *Proceedings of the International Conference on Accounting Studies (Icas) 2017***,** 127-131.

BAKHSHA, A., AFRAZEH, A. & ESFAHANIPOUR, A. 2017. A Criticism on Value Added Intellectual Coefficient (VAIC) Model. *International Journal of Computer Science and Network Security,* 17**,** 59-71.

BOGACHOV, S., KWILINSKI, A., MIETHLICH, B., BARTOSOVA, V. & GURNAK, A. 2020. ARTIFICIAL INTELLIGENCE COMPONENTS AND FUZZY REGULATORS IN ENTREPRENEURSHIP DEVELOPMENT. *Entrepreneurship and Sustainability Issues,* 8**,** 487-499.

IAZZOLINO, G. & LAISE, D. 2012. Some Methodological Remarks on the Concept of Value Added Intellectual Coefficient (VAIC (TM)). *Ifkad - Kcws 2012: 7th International Forum on Knowledge Asset Dynamics, 5th Knowledge Cities World Summit: Knowledge, Innovation and Sustainability: Integrating Micro & Macro Perspectives***,** 1686-1704.

IAZZOLINO, G. & LAISE, D. 2013. Value added intellectual coefficient (VAIC) A methodological and critical review. *Journal of Intellectual Capital,* 14**,** 547-+.

KAMATH, G. B. 2008. Intellectual capital and corporate performance in Indian pharmaceutical industry. *Journal of Intellectual Capital,* 9**,** 684-+.

KUZIOR, A., LYULYOV, O., PIMONENKO, T., KWILINSKI, A. & KRAWCZYK, D. 2021. Post-Industrial Tourism as a Driver of Sustainable Development. *Sustainability,* 13**,** 14.

MARZO, G. 2021. A theoretical analysis of the value added intellectual coefficient (VAIC). *Journal of Management & Governance***,** 27.

MEHRALIAN, G., RAJABZADEH, A., SADEH, M. R. & RASEKH, H. R. 2012. Intellectual capital and corporate performance in Iranian pharmaceutical industry. *Journal of Intellectual Capital,* 13**,** 138-+.

NADEEM, M., DUMAY, J. & MASSARO, M. 2019. If You Can Measure It, You Can Manage It: A Case of Intellectual Capital. *Australian Accounting Review,* 29**,** 395-407.

PAL, K. & SORIYA, S. 2011. Financial Reporting of Intellectual Capital and Company's Performance in Indian Information Technology Industry. *International Journal of Asian Business and Information Management,* 2**,** 34-49.

PEREIRA-RODRIGUES, G. & SANTOS-RODRIGUES, H. 2017. Intellectual Capital Measurements- Its Application in Practice: Literature Review. 9th European Conference on Intellectual Capital (ECIC), Apr 06-07 2017 Inst Univ Lisboa, Lisbon, PORTUGAL. NR READING: Acad Conferences Ltd, 351-357.

PULIC, A. 2000. VAIC (TM) - an accounting tool for IC management. *International Journal of Technology Management,* 20**,** 702-714.

PULIC, A., KOLAKOVIC, M. & JELCIC, K. 2009. EFFICIENCY OF INTELLECTUAL CAPITAL IN HOTEL BUSINESS. *Tourism and Hospitality Management-Croatia,* 15**,** 129-138.

ROMER, P. M. 1970. Endogenous Technological Change. *Journal of Political Economy,* 98**,** 71-102.

ROOS, G. & ROOS, J. 1997. Measuring your company's intellectual performance. *Long Range Planning,* 30**,** 413-426.

STAHLE, P., STAHLE, S. & AHO, S. 2011. Value added intellectual coefficient (VAIC): a critical analysis. *Journal of Intellectual Capital,* 12**,** 531-+.

STĘPIEŃ, S., CZYŻEWSKI, B., SAPA, A., BORYCHOWSKI, M., POCZTA, W. & POCZTA-WAJDA, A. 2021. Eco-efficiency of small-scale farming in Poland and its institutional drivers. *Journal of Cleaner Production,* Volume 279, 10 January 2021, 123721.

SVEIBY, K. E. 2010. *Methods for measuring intangible assets* [Online]. Available: www.sveiby.com/article/Methods-for-Measuring-Intangible-Assets [Accessed].

VISHNU, S. & GUPTA, V. K. 2014. Intellectual capital and performance of pharmaceutical firms in India. *Journal of Intellectual Capital,* 15**,** 83-+.

YOUNG, C. S., SU, H. Y., FANG, S. C. & FANG, S. R. 2009. Cross-country comparison of intellectual capital performance of commercial banks in Asian economies. *Service Industries Journal,* 29**,** 1565-1579.

ZEGHAL, D. & MAALOUL, A. 2010. Analysing value added as an indicator of intellectual capital and its consequences on company performance. *Journal of Intellectual Capital,* 11**,** 39-+.