

Knowledge Capital Earnings of a Company Listed on Warsaw Stock Exchange¹

Anna Ujwary-Gil, Ph.D.

Department of Management, Wyższa Szkoła Biznesu – National-Louis University, Nowy Sacz, Poland

ujwary@wsb-nlu.edu.pl

Abstract: The article makes an attempt at empirical verification of the Knowledge Capital Earnings (KCE™) method. KCE™ is one of calculating methods, whose main purpose is to value intellectual capital of a company listed on a stock market, and to evaluate to what extent a company is overvalued or undervalued on the capital market. Analogously, it is possible to indicate how much a unit price of shares is overvalued or undervalued on the market. The article omits all issues related to the speculative nature of the stock market, emphasizing only the practical and possible use of the tool (KCE™) as well as the intellectual capital valuation, overvaluation and undervaluation of a company and its unit stock price. A public company operating in a fuel industry and listed on Warsaw Stock Exchange has been selected for the analysis. The approach presented here is quite interesting among other methods using financial measures for intellectual capital valuation, although, obviously, it demonstrates several weaknesses mentioned in the article.

Keywords: knowledge capital earnings, KCE™, intellectual capital, valuation, overvaluation, undervaluation, stock exchange, stock price, comprehensive value.

1. The problem of intellectual capital valuation with the KCE™ method

One of the main goals of the *Knowledge Capital Earnings* – KCE™ method (Lev, 2003, Lev, Gu, 2004) is to analyze the returns on physical and financial capital and to determine the economic value of an enterprise's intellectual capital which allows to analyze its market position and its attractiveness on the capital market. The author of the method to start with establishing normalized earnings for the past three years, including the current year, and for three next years, based on the forecasts adopted by an enterprise. In order to tie the existing intellectual capital in an enterprise with the future one, characterized by a longer return period, normalized earnings are calculated as weighted average, where the coefficient for future years is twice as high as that for the past years. It is worth noting that this approach is strongly subjective, especially as far as determining the size of the forecasted earnings of an enterprise are concerned. Moreover, if our calculations are based on normalized earnings of an enterprise understood as weighted average, then enterprises, even if they did not generate any earnings in a given year, generated intellectual capital which can be assessed. For the purpose of our analysis the whole calculation was based on company earnings in year *t*. Table 1 presents basic formulas used in KCE™ method as well as the author's own proposal². Subject literature shows deficit of such complex presentations of the KCE™ method that would specifically take into account how much an enterprise is undervalued or overvalued in the capital market. There are few articles containing references only to intellectual capital valuation (e.g. Thaker, 2001; Andressen, 2004; Sudarsanam, Marr, 2005; Stankosky, Mac Garrigle, 2006; Wang, 2013; Pucar, 2013).

Table 1: Stages of intellectual capital valuation using the KCE™ method

Formula	Description
$IC_v = CE_{IC} / D_{IC}$	IC _v – intellectual capital value CE _{IC} – part of company earnings generated by intellectual capital (intangible driven earnings) D _{IC} – discount rate of intellectual capital
$CE_{IC} = CE - (CE_{ph} + CE_f)$	CE _{IC} – part of company earnings generated by intellectual capital (intangible driven earnings) CE – company earnings CE _{phc} – part of company earnings generated by physical capital (phc) CE _{fc} – part of company earnings generated by financial capital (fc)
$CE_{phc} = ROA_{phc} \times Ph_c$	CE _{phc} – part of company earnings generated by physical capital ROA _{phc} – return on physical capital (assets)

¹ The project was financed by National Science Center on the basis of decision number DEC-2012/05/D/HS4/01338 and partly by the Reinvent project is funded by the Marie Curie Industry-Academia Partnerships and Pathways Programme (IAPP). Project number 324448.

² See also: (Ujwary-Gil, 2009, 2008, 2006).

Anna Ujwary-Gil

	Ph _C – size of physical capital (as part of company book value)
$Ph_C = TFA + I - LTD$	Ph _C – physical capital of an enterprise TFA – tangible fixed assets I – inventories LTD – long-term debt
$CE_{fc} = ROA_{fc} \times F_C$	CE _{fc} – part of company earnings generated by financial capital ROA _{fc} – return on financial capital (assets) F _C – size of financial capital (as part of company book value)
$F_C = CA - I + LTI - CL$	F _C – financial capital of an enterprise CA – current assets I – inventories LTI – long-term investments CL – current liabilities
$CV = BV + IC_V$	CV – comprehensive value BV – book value of net assets IC _V – intellectual capital value
MV / CV	MV – market value is a product of the number of shares available on the market and a unit price of a share CV – comprehensive value is a book value of a company increased by intellectual capital value
$OV = (MV - CV); (MV > CV)$	If market value is higher than comprehensive value (MV>CV), an enterprise is overvalued (MV-CV) and a unit share value exceeds its real value
$UV = (CV - MV); (MV < CV)$	If market value is lower than comprehensive value (MV<CV), an enterprise is undervalued (CV-MV) and a unit share value is lower than its real value
$O_{SV} = O_V / S_N$	O _{SV} – overvaluation of share value O _V – overvaluation of company value S _N – number of shares
$U_{SV} = U_V / S_N$	U _{SV} – undervaluation of share value U _V – undervaluation of company value S _N – number of shares

It is obvious that intellectual capital as such does not generate value; it can only do so by increasing the productivity of other resources possessed by a company, except for tangible intellectual properties, such as patents or licenses. Here we can adopt a return rate calculated for the whole industry. B. Lev (Lev, Gu 2004; Nadiri, Kim, 1996; Poterba, 1997) adopted the value of 7%, which is a result of many years of research and which reflects average annual rate of return on physical capital (assets) for the whole economy. The average rate of return on physical capital oscillates between 10% and 11% annually. Taking into account corporate income tax at 35% B. Lev, basing on works of other researchers, estimates average rate of return on physical capital at the level of 7%.

In order to calculate the share of physical capital, one must first calculate its value. For example A. Pulić (Pulić, 2000) treats physical and financial capital as book value of net assets, which practically boils down to the value of equity capital. Physical capital as defined by B. Lev refers to all material and tangible resources and related investments.

A company balance sheet provides information on the size of financial capital existing in a company. There are various ways of measuring productivity of such capital, ranging from the most secure government securities to the expected return rate when engaging such capital in a portfolio of company projects. B. Lev adopted here the rate of 4.5%, reflecting the return rate on 10-year government bonds in 1980-1990.

2. Intellectual capital valuation of a fuel company listed on Warsaw Stock Exchange

The study uses the case study analysis and secondary data. The choice of a company was intentional, with particular attention paid to companies listed on Warsaw Stock Exchange for at least the past 5-6 years. The paper makes an attempt at empirical verification of the Knowledge Capital Earnings (KCETM) method. KCETM is one of calculating methods, whose main purpose is to value intellectual capital of a company listed on a stock market, and to evaluate to what extent a company is overvalued or undervalued on the capital market. Analogously, it is possible to indicate how much a unit price of shares is overvalued or undervalued on the market. In order to visualize the importance and interpretation of obtained calculations, we selected a company quoted on Warsaw Stock

Anna Ujwary-Gil

Exchange and operating in fuel industry. Table 2 presents historical and financial data of the surveyed company in years 2008-2012:

Table 2: Intellectual capital valuation of a fuel company quoted on Warsaw Stock Exchange

Financial data/year	2008	2009	2010	2011	2012
Market value (MV)	17 814 082 390,65	19 037 330 305,11	21 629 247 214,77	24 533 391 738,96	26 479 467 966,51
Number of shares	427 709 061,00	427 709 061,00	427 709 061,00	427 709 061,00	427 709 061,00
Share prize	41,65	44,51	50,57	57,36	61,91
Book value (BV)	20 531 647,00	21 707 211,00	24 239 953,00	26 798 683,00	28 306 833,00
Tangible fixed assets	26 268 757,00	27 070 437,00	27 403 013,00	26 578 651,00	24 743 734,00
Inventories	9 089 047,00	10 619 859,00	11 294 851,00	16 296 517,00	15 011 047,00
Long-term debt	4 634 178,00	13 242 204,00	10 684 821,00	12 120 002,00	9 196 658,00
Current assets	8 605 847,00	8 813 187,00	9 424 067,00	13 835 820,00	10 809 096,00
Long-term investment	716 551,00	2 163 449,00	2 675 701,00	1 453 814,00	15 765 002,00
Current liabilities	21 809 925,00	14 157 516,00	16 225 018,00	19 812 793,00	15 127 289,00
Earnings	79 535 205,00	67 927 990,00	83 547 432,00	106 973 074,00	120 101 550,00
Physical capital	30 723 626,00	24 448 092,00	28 013 043,00	30 755 166,00	30 558 123,00
Financial capital	-21 576 574,00	-13 800 739,00	-15 420 101,00	-20 819 676,00	-3 564 238,00
CE _{phc}	2 150 653,82	1 711 366,44	1 960 913,01	2 152 861,62	2 139 068,61
CE _f	-970 945,83	-621 033,26	-693 904,55	-936 885,42	-160 390,71
CE _{ic}	78 355 497,01	66 837 656,82	82 280 423,54	105 757 097,80	118 122 872,10
IC _v	746 242 828,67	636 549 112,52	783 623 081,33	1 007 210 455,24	1 124 979 734,29
CV	766 774 475,67	658 256 323,52	807 863 034,33	1 034 009 138,24	1 153 286 567,29
MV/CV	23,23	28,92	26,77	23,73	22,96
OV	17 047 307	18 379 073	20 821 384	23 499 382	25 326 181

Anna Ujwary-Gil

	914,98	981,59	180,44	600,72	399,22
UV	n/a	n/a	n/a	n/a	n/a
O _{SV} (PLN)	39,86	42,97	48,68	54,94	59,21
U _{SV} (PLN)	n/a	n/a	n/a	n/a	n/a

For example, if the company earnings (CE) in 2008 equals 79 535 205 PLN while its financial capital amounts to -21 576 574 PLN, then, following this assumption, we can expect that -970 945.83 PLN is generated by financial capital (-21 576 574.00 x 4,5%). The term “financial capital”, just like the physical capital presented above, is not used in the Polish accounting system. This accounts for the difficulties in defining it and determining what should constitute its value. This difficulty is particularly visible in the balance sheets of companies operating in the banking sector, constructed differently than the balance sheets of manufacturing or insurance companies. According to B. Lev’s assumptions, financial capital is composed of cash, bonds, company shares and financial instruments. Thus, in the presented case, assuming that the physical capital of an enterprise amounts to 30 723 626 PLN, the share of physical capital in CE would be expressed by the amount of 2 150 653.82 PLN (30 723 626 x 7%). If we add the share of CE generated by financial capital, we will obtain 78 355 497.01 PLN (2 150 653,82 + (-970 945.83)).

If the company earnings (EC) equals 79 535 205 PLN, we will not be able to explain the difference amounting to 78 355 497.01 (79 535 205 – 1 179 707.99) relying on the company balance sheet or profit and loss account. It is the value that is not based on tangible resources of a company and which results from applying knowledge in company operations.

The amount 78 355 497.01 PLN defines the productivity of intellectual capital existing in an enterprise. If this capital generates such value, it is essential to know what value the capital itself has. This constitutes the core and probably the most controversial part of the KCE™ method. In case of physical and financial capital, their values were known, as well as their return rates. This enabled to calculate the generated value in an enterprise. Here we have to proceed in an opposite way. We know the value created in an enterprise by intellectual capital (IC); what we lack is its productivity (return rate of IC). Knowing it, we may use it as a discount rate for intellectual capital alone, which will finally give us a picture of an economic value of intellectual capital.

In the presented example the value of IC equals 70 909 952.05 (78 355 497.01/(1+10,5%)) and is growing (Figure 1):

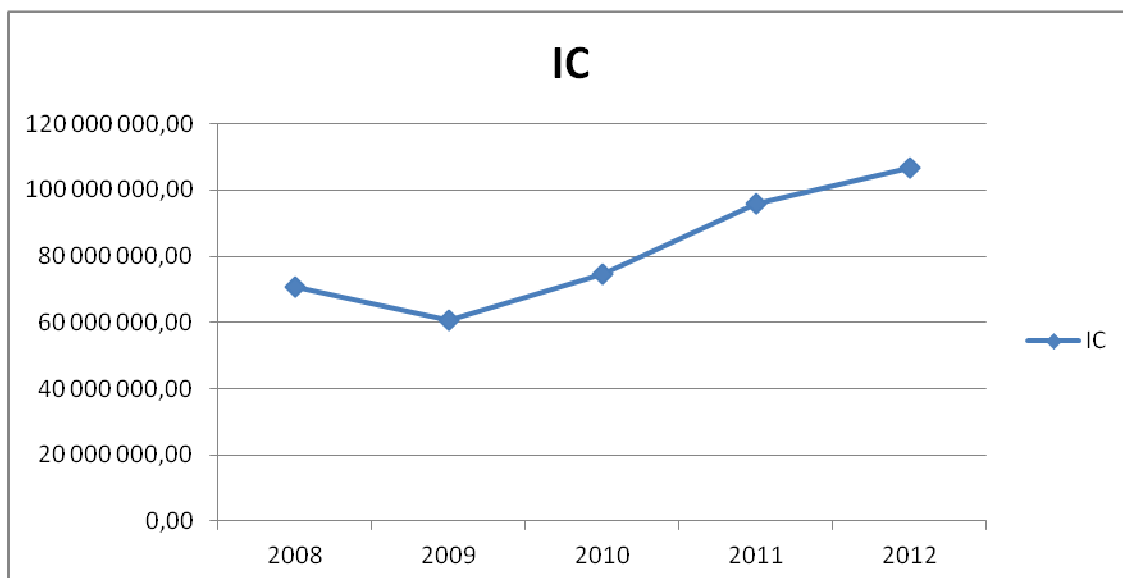


Figure 1: Intellectual capital value of a fuel company in 2008-2012

Anna Ujwary-Gil

B. Lev assumes that discount rate for intellectual capital is 10.5%. This is a result of average rate of return on shares in 1980-1990 in two analyzed industries: programming and biotechnologies. B. Lev's team also conducted an in-depth study of productivity of company assets, searching correlations between profit from shares and a cash flow, earnings and intangible driven earnings (IDE). It appeared that the correlation between return on assets and cash flow was 0.11, whereas that between return on assets and earnings – 0.29, while the correlation between return on assets and IDE was 0.53.

Another example of company valuation through its intellectual capital is the sum of intellectual capital value (IC_v) and book value of company net assets (BV). The result of such operation was defined by B. Lev as the so-called comprehensive value (CV). If we juxtapose market value and obtained comprehensive value of a company, we will receive a modified version of the presented coefficient, determining the relation of market value (MV) to book value (BV). The MV/CV coefficient – contrary to the MV/BV coefficient – reflects both physical and intellectual capital. It allows us to determine how the market overvalued or undervalued the economic value of an enterprise, thus enabling us to predict higher than expected profit from shares as well as future changes to market value.

B. Lev, in cooperation with M. Bothwell z CSAM (Credit Swiss Asset Management), in the period from August to December 2000 measured the correlation between the rate of return on shares (profit) and the coefficient of market value to comprehensive value (MV/CV) on a sample of 105 enterprises. The results they obtained indicated that 53 companies which were undervalued in the market (MV/CV coefficient was below 1) enjoyed a 7% return rate on average, measured by increased share prices in that period. On the other hand, 52 enterprises overvalued in the market (MV/CV coefficient was above 1) saw their share prices plunge by 15.5% on average in the same period.

An objection frequently raised against official financial reporting is that there is lack of information on real attractiveness of companies for capital decisions. Company balance sheets do not present a real picture of their market attractiveness, making the process of investment decisions highly uncertain. It should therefore be expected that an overwhelming majority of enterprises are either undervalued or overvalued by stock exchange, therefore decisions must be highly speculative. By proposing the so-called comprehensive value (CV), the KCE™ method aims at determining to what extent an enterprise is undervalued or overvalued. It is achieved by comparing comprehensive value and market value. In our case, the fuel company is overvalued on the capital market.

3. Conclusions from the conducted research

B. Lev and F. Gu calculated real return on the use of physical, financial and intellectual capital, which is not the same as the contribution of the above capital to earnings. Its real contribution may be lower or higher, as average measures (here average return rates) may either inflate or lower the calculated value. Moreover, earnings are a result of accumulating both physical (tangible) capital as well as intellectual (non-tangible) capital. It is this synergy that creates value. This, in turn, makes it difficult to determine which part of earnings refers to a particular type of capital. The KCE™ method is based on an assumption that tangible and non-tangible capital of a company generates earnings thanks to which a company achieves an economic result and which perform a productive function of an enterprise. We can define it as subjective as arbitrarily adopted coefficients dominate the whole calculation, namely of expected rate of return on physical and financial capital and discount rate for intellectual capital. The KCE™ method measures (values) intellectual capital as a whole, without dividing calculated value according to the classification of intellectual capital elements. This may pose a certain problem in managing intellectual capital, as it does not aid managers in making their decisions concerning actions to take in order to maximize the values of those types of capital and, as a result, their value to shareholders. On the other hand, synergy and certain inseparability of intellectual capital elements hinders the process of its valuation. We do not fully understand how intellectual capital influences company value. What we can expect after obtaining the results from applying a calculation procedure is an answer of how much (in value) of intellectual capital affects the company value. The value of intellectual capital is obtained from a static composition of physical and financial capital of an enterprise. It does not take into account the dynamic nature of investment in intellectual capital. For example, the value of patents in a company portfolio may only be determined when, if at all, the company decides to implement the patent or to sell it.

The KCE™ method offers managers a possibility of valuing an enterprise and its presence on capital market even more so as it focuses directly on intellectual capital valuation. The method may, inter alia, be used to assess in which companies we should invest in the long run. As the speculative nature of the Polish capital market is still its biggest weakness, it makes it difficult to achieve correct or at least approximate assessment of company shares value, as they are usually too low. Admittedly,

many investors consider buying (selling) shares in the bull (bear) market, which allows them to generate income, but on a minimum level, often exceeding operational costs. Such short-term strategies of investing in shares are not conducive to obtaining reliable valuations of company shares and account for too rash reactions of investors who sell shares when they experience an even slight increase in price. Therefore, complex use of coefficients presented above would allow managers to assess the effectiveness of an enterprise in the context of generated intellectual capital. It should be obvious that the lower asymmetry of information between company owners and stakeholders, the greater the chance for reliable valuation of its shares and the lower the cost of capital.

The greatest weakness of this method, though, is certain latitude in interpreting key terms, such as physical capital, financial capital, normalized earnings, which are not used in Polish accounting system (it is difficult to precisely determine which items in the balance sheet refer to them). This may explain why scientists show certain freedom in choosing elements needed for calculations. In a joint publication on measuring intellectual capital, its authors (Kasiewicz, Rogowski, Kicińska, 2006) for calculating normalized earnings adopted the value of gross profit at the end of each year, they defined financial capital as long-term financial assets, while physical capital – tangible fixed assets. According to B. Lev, normalized company earnings is based on earnings from three past years and a three year earnings forecast (starting from the base year, for which an analysis is performed), adopting the weight “2” for forecasted earnings. The legitimacy of Lev’s method of calculating normalized company earnings is not fully understandable, especially if we want to calculate how much the value of intellectual capital was in past years. Moreover, it may happen that a company will not generate any earnings in a given year. In spite of this, the method of calculating normalized company earnings accounts for the fact that such earnings will be noted.

4. Research perspectives

It is probably too early to fully evaluate the KCE™ method, especially as this would require a few years of observations of what happens to shares representative of selected industries in the capital market. As it seems, the KCE™ method is better than commonly used methods at reflecting changes in the way contemporary markets function, especially in highly-developed countries. It particularly allows the following activities:

- including the company’s current operations and future prospects into its assessment,
- including relationships between resources, especially tangible and non-tangible ones, into company assessment,
- using more complete financial information in taking decisions, especially of investment type,
- analyzing companies whose market value is lower than their book value,
- seeking correlations between intellectual capital value and stock exchange value of a company.

As we can see from the evaluation of the KCE™ method presented here, in order to fully use this tool for intellectual capital valuation, we should pay special attention to:

- using this method in calculations, we should consider whether the calculation base is constituted by net earnings from sale of products, goods and materials or by gross profit included in the profit and loss account (part of an annual report). Adopting such different basis accounts for the fact that obtained results and, consequently, the value of assessed intellectual capital cannot be compared as results may be contradictory,
- if normalized company earnings, understood as weighted average, is used in this method as a basis for calculations, then companies, even if they did not generate any earnings, created intellectual capital which may be valued,
- we should also consider what makes physical capital and what makes financial capital, understood as part of the production part of a company, as they constitute the calculation part of the method. If we adopt only tangible fixed assets presented in the balance sheet as the basis of our calculation of physical capital, neglecting the value of inventories and long-term liabilities, this will also distort the results. This does not mean, though, that when accepting tangible fixed assets as physical capital, we wrongly interpreted this part of the method. What we need here is a consistent application of one or the other interpretation so as to achieve results that could be compared. If we interpret financial capital as long-term financial assets (not taking into account inventories and short-term liabilities), we can observe that the obtained figures are comparable. In spite of this, the use of the method presented here calls for uniform and consistent application of an adopted interpretation by measuring various companies, otherwise the results will not be comparable,

Anna Ujwary-Gil

- the size of adopted rates of return on physical and financial capital and their adjustment to companies operating in different industries require a deeper analysis. On the other hand, calculation of what discount rate for intellectual capital, understood as its cost, reflecting high risk of non-tangible assets, should be, still remains a difficult issue, requiring more research on a larger group of enterprises from various industries or economy sectors,
- the discount rate of 10.5% adopted here, as well as division of calculated earnings on intellectual capital by its value accounts for the fact that we obtain information on total value of intellectual capital generated by a company in its whole history. It seems justified, though, to discount the value of calculated earnings on intellectual capital in a given year of analysis. Then we obtain the current value of intellectual capital, which may serve as the basis of current considerations and comparisons, more than the analysis of indefinite and uncertain future,
- the KCE™ method enables us to calculate the market value of an enterprise, which may be significant for determining its transaction price. It becomes helpful in determining investment attractiveness of a company, allowing us to ascertain whether its current price of shares is too high or too low compared to their real value,
- high undervaluation of companies is a result of, among other things, high dynamics of the values used in calculation. When market value and financial capital (investment) grow, the share of intellectual capital declines.

References

- Andriessen, D. (2004) *Making Sense of Intellectual Capital. Designing a Method for Valuation of Intangibles*, Elsevier.
- Kasiewicz, S., Rogowski, W., Kicińska, M. (2006), *Kapitał intelektualny. Spojrzenie z perspektywy interesariuszy*, OE, Warszawa.
- Ortiz, M.A.A (2006) Intellectual capital (intangible assets) valuation considering the context, *Journal of Business & Economics Research*, Vol. 4, No. 9, pp.
- Lev B. (2001), *Intangible. Management, Measurement, and Reporting*, Brooking Institution Press, Washington, D.C.
- Lev B., Gu F. (2003) *Intangible assets. Measurement, Drivers, Usefulness*, Boston University School of Management Accounting, Working Paper.
- Lev B., Gu F. (2004), *The Valuation of Intangibles for Impairment Tests*, Retrieved from SSRN: <http://ssrn.com>.
- Nadiri, I., Kim, S. (1996) *R&D, Production Structure and Productivity Growth: A Comparison of the U.S., Japanese and Korean Manufacturing Sectors*, National Bureau of Economic Research, Working Paper 5506, Cambridge.
- Poterba, J. (1997) *The Rate of Return to Corporate Capital and Factor Shares: New Estimates Using Revised National Income Accounts and Capital Stock Data*, National Bureau of Economic Research, Working paper 6263, Cambridge.
- Pucar, S. (2013) Intellectual Capital Growth Model: Using IC Measurement Logic on AK Endogenous Model. Proceedings of the International Conference on Intellectual Capital, Knowledge Management & Organizational Learning, pp. 333-343.
- Pulic, A. (2000) VAIC (TM) - an accounting tool for IC management, *International Journal of Technology Management* Vol. 20, Iss. 5-8, pp. 702-714.
- Stankosky, M., Mac Garrigle, E.F (2006) Validating enterprise management engineering through the use of knowledge capital assessments, *Journal of Information and Knowledge Management*, Vol. 5, Iss. 2, pp. 129-142.
- Sudarsanam, S., & Marr, B. (2005) Intellectual Capital. *Perspectives on Intellectual Capital*, 56.
- Thaker, K. (2001), Financial Management Analysis of Knowledge and Earning with Reference to Selected Companies in India, *Journal of Financial Management and Analysis*, Vol.2, Iss.14.
- Ujwary-Gil, A. (2008) Ocena metody KCE™ – wnioski z przeprowadzonych badań, *Przegląd Organizacji*, nr 11.
- Ujwary-Gil, A., Śliwa, R.K. (2006) Dylemat wartości przedsiębiorstwa – metoda KCE™, *Organizacja i Kierowanie*, nr 1(123).
- Ujwary-Gil, A. (2009) *Kapitał intelektualny a wartość rynkowa przedsiębiorstwa*, Warszawa: Ch&Beck.
- Wang, M.Ch. (2013) Value relevance on intellectual capital valuation methods: the role of corporate governance, *Quality & Quantity*, Vol. 47, Iss. 2, pp. 1213-1223.
- Warsaw Stock Exchange: www.gpw.pl.