

International Economic Conference of Sibiu 2013 Post Crisis Economy: Challenges and Opportunities, IECS 2013

Intellectual Capital and Firm Performance: A Dynamic Relationship in Crisis Time

Silvia Sumedrea^{a*}

^a*Faculty of Economic Sciences and Business Administration, "Transilvania" University, Braşov, Romania*

Abstract

The link between organisational performance and intellectual capital is becoming more and more an interesting issue, especially in times of severe economic turbulence, when companies are seeking for new solutions in order to survive and develop their business. This paper analyses the structure of the intellectual capital and its influence on the economic performances based on the VAIC model. The results were obtained by applying certain regression models and suggest that, in crisis time, the development of companies is influenced by the human and the structural capital, while profitability is additionally linked to the financial capital through the value added intellectual capital coefficient.

© 2013 The Authors. Published by Elsevier B.V. Open access under [CC BY-NC-ND license](https://creativecommons.org/licenses/by-nc-nd/4.0/).

Selection and peer-review under responsibility of Faculty of Economic Sciences, Lucian Blaga University of Sibiu.

Keywords: intellectual capital; VAICTM; company performances; value added; crisis.

1. An introduction

Intellectual capital is a relatively recent concept that quickly gained ground because organisations increasingly tend to develop models based on knowledge where the human factor plays a central role. According to Ederer (2006) “[...] Nothing will matter more to Europe’s future than the ability of countries, governments, workers and companies to innovate – a process which will depend in no small degree on the efficiency of our decision-making and the quality of our human capital”.

* Corresponding author.

E-mail address: silvia.sumedrea@unitbv.ro

An increasingly turbulent and changing business environment constrains firms to seek alternative solutions to the problems they face and to use all their available resources more efficiently. The economic and financial crisis of 2008-2011 and its repercussions in the following period have more strikingly brought into focus the idea of analysing the relationship between the organizational performance and its resources. This paper focuses on studying the relationship between companies’ financial performance and their intellectual capital, especially during the crisis of 2010-2011. The economic performance of the most visible entities of the Romanian economy, namely companies listed on BSE in Categories I, II and III, were analysed. The analysis was conducted from a total of 105 listed companies, excluding financial companies, companies with negative equity and losses and companies for which complete data for the analysed period were not published. As a result, a total of 62 viable companies remained for analysis: 14 listed in BSE Category I and 48 in BSE Category II.

Like the rest of the economy and the society, these companies were affected by the economic and financial crisis even if they are among the most powerful in the economy, as evidenced by the evolution of the main stock index BET-C whose component is determined by them.

Table 1: Dynamic of BET-C ratio

| Indicators | Symbol | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|--------------------|--------|-------|-------|-------|--------|-------|-------|--------|-------|
| BET_C | Points | 3912 | 5025 | 6665 | 1977 | 2718 | 3 111 | 2 621 | 2 786 |
| BET-C | % | 38.22 | 28.49 | 32.64 | -70.34 | 37.31 | 14.60 | -15.74 | 6.28 |
| Previous year =100 | | | | | | | | | |

Source: www.bvb.ro

A company’s financial performance could be analysed using several indicators, but the most relevant indicators for the present study were considered to be the return on assets (ROA), the return on equity (ROE) and the growth rate of the business (GROW), because of their mode of calculation that is directly related to the efforts made by a company to gain performance.

2. Literature review

The organisational development and the success it can achieve depend crucially on the human resources at its disposal and, more precisely, on how this human capital is developed. Since businesses are becoming more complex, dynamic and globally competitive, knowledge (that an organization has) and intelligent workers (who know how to use and develop this knowledge) become valuable intangible assets (part of the intellectual capital of the organisation), which increases the capacity of creating value for its members (Sumedrea, 2012).

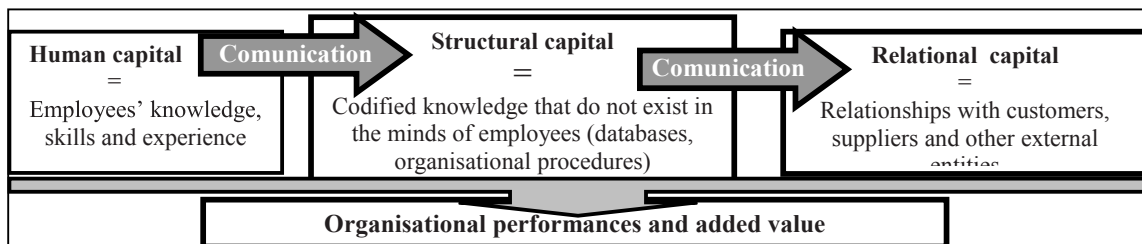


Fig. 1: Link between intellectual capital and organisational performances
Source: Sumedrea, 2012, pp.273

In the last 25 years a whole literature developed aiming to clarify the concept of intellectual capital (IC) and to decipher the role it plays in increasing the performance of firms. Among the pioneers in this field is Thomas A. Stewart - one of the editors of Fortune magazine - who defined intellectual capital as follows: „Intellectual capital,

then, is knowledge that transforms raw materials and makes them more valuable [...]. Though financial accounting does not measure intellectual capital, markets clearly do" (Stewart, 1997).

Although an intangible asset, the intellectual capital is not recorded separately in accounting terms, such as fixed assets, in order to allow the quantification on its contribution to creating value for the organisation. Hence, the challenge to identify the dimension and the influence degree on the firm's performance appears. Since 1992, Hall classified IC as being either "assets" (brands, trademarks, contracts, etc.) or "skills" (know-how of employees, organisational culture, etc.) and then, almost 10 years later, the concept has evolved, so Lev (2001) shows it as a source of future benefits (value).

Roos, G., Pike, S., Fernstrom, L. (2005) have studied this problem from a practical standpoint, looking at U.S. companies listed on the New York Stock Exchange (NYSE) and on the National Association of Securities Dealers Automated Quotations (NASDAQ) in order to understand what leads to an increased value and competitiveness of for those companies listed, since in Europe, as early as 2001, the company Skandia (see figure 3) understood among the firsts that the market value of the firm is given not only by its fixed assets or by the holders' equity but also by the intellectual capital that it owns and develops (Bontis, 2001, Zerenler, 2008).

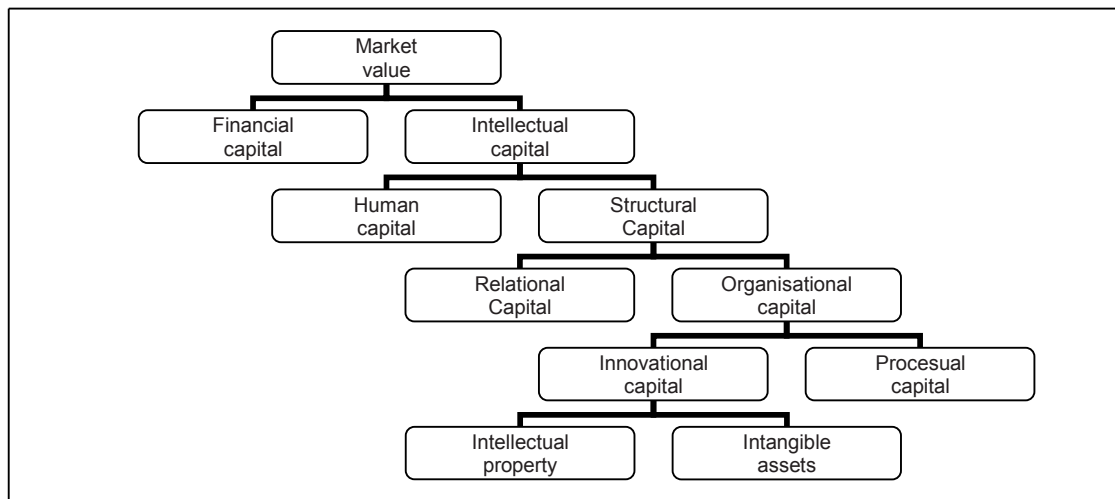


Fig. 2: Leif Edvinsson model - structure of intellectual capital at Skandia
Source: Bontis (2001)

Although there is no widely accepted single definition, all researchers who have dealt with this issue agree that by identifying and using intellectual capital, firms benefit if they use it as a basis for strategic innovation. This gain is seen either as profit or as a benefit or value added.

Understanding the influence of intellectual capital on company performance measurement requires understanding and measuring its components (Bontis, 2001; Baruch, 2001; Marr, Schiuma and Neely, 2004). Numerous contributions in the field can be grouped depending on the approach used, as follows:

- market-based approach (Tobin's Q ratio)
- approaches based on financial methods (Economic Value Added - EVATM, Market Value Added - MVATM)
- approaches based scoring methods (Skandia Navigator, Balanced Scorecard)
- approaches based on value added (VAICTM, and so on).

Although initially the Skandia Navigator model considers that IC has two components (human and structural capital), now most researchers agree that IC has three components, namely: human capital, structural capital and relational (social) capital.

Human capital includes all the knowledge, skills, abilities, talents, experience and know-how available to the organisation's members, as well as the motivation and commitment to the organisation and its values, which are necessary for performing the required daily tasks, by applying the firm's strategies.

Structural capital (organisational) includes information systems, knowledge encoded in the form of databases, processes and organisational procedures (which are not in the minds of the employees, but on external media), trademarks, patents, and infrastructure required to support the application of the organisational strategies.

Relational capital (social) means external links with suppliers and customers of the organisation, which allows it to buy and sell goods and services in an efficient and effective manner (through knowledge of customer preferences and of the factors that lead to a satisfactory relationship with them, and so on).

3. Research methodology

In terms of value added based approaches, one of the most important contributions in this area is developed by Ante Pulic (2000) who proposed a measure of the efficiency of value added by using corporate intellectual ability (Value Added Intellectual Coefficient -VAICTM). This represents a modern approach for measuring business efficiency and expressing the value creation of a company. In other words, VAIC shows the value creation efficiency of the resources used by the company. The main advantage of this approach is that the figures are easy to obtain from the companies' financial data and they can be used for comparisons between companies or for comparing the company's performances in different years. Instead of dealing with the relational capital, that is not easy to measure, the VAIC method deals with the following three types of capital: financial, human and structural in order to measure the efficiency of the intellectual capital. The model indicates that the higher the VAIC value, the greater the company's potential to utilise its intellectual capital in order to increase its performances.

The main indicator of VAIC is Value Added (VA), whose simplified mathematical expression is given in formula (1).

$$VA_t = OUT_t - IN_t = OP_t + HC_t + D_t + A_t \quad (1)$$

Where:

VA_t = value added in year "t", OUT_t = net sales of year "t", IN_t = cost of raw materials, energy, water, gas, services and other similar resources for year "t", OP_t = operational profit for year "t", HC_t = cost of labor in year "t", D_t = depreciation in year "t", A_t = amortisation in year "t".

According to Pulic (2000) and Sthale (2011), the human capital (HC) in the companies is quantified by the staff costs, both salary and related contributions (pension fund, health insurance and unemployment fund equivalent).

Ordenez de Pablos (2004) developed the concept that the structural capital (SC) is the expression of knowledge at organisational level and its value represents the amount necessary to obtain value added over the use of human capital (viewed as knowledge at individual level). The VAIC approach in calculating the structural capital is:

$$SC_t = VA_t - HC_t \quad (2)$$

VAIC model involves the use of more refined indicators, i.e. human capital efficiency (HCE), structural capital efficiency (SCE) and capital employed efficiency, calculated as:

$$HCE_t = VA_t / HC_t \quad (3)$$

$$SCE_t = SC_t / VA_t \quad (4)$$

$$CEE_t = VA_t / CE_t \quad (5)$$

The Value Added Intellectual Capital coefficient is then computed as the sum of the above three components, and represents the expression of the overall value creation efficiency:

$$VAIC_t = HCE_t + SCE_t + CEE_t \tag{6}$$

In order to capture the relationship between business efficiency and value creation, we investigated the relationship between VAIC, its components and the companies’ performances. Because growth can easily be linked to organisational performance improvement (Delgado et al, 2012), this was selected as a proper measurement for our purpose. Furthermore, the development of the company becomes obvious when managers are able to use more efficiently the assets and the financial capital in order to obtain more profit. We therefore analysed the performances in terms of growth and profitability (because they are the main common goals in any organizations) under the expression of ROA (return on assets), ROE (return on equity) and GROW (dynamic of net sales):

$$ROA_t = NetProfit_t / TotalAssets_t \tag{7}$$

$$ROE_t = NetProfit_t / ShareholdersEquity_t \tag{8}$$

$$GROW_t = (NetSales_t / NetSales_{t-1}) - 1 \tag{9}$$

The main hypothesis that we tested refer to the following:

- the more a company is able to use human capital, the more profitable a company becomes
- the more a company is able to use structural capital, the more profitable a company becomes
- the more a company is able to use financial capital, the more profitable a company becomes

For testing these hypotheses, financial data related to assets and liabilities for analysed companies were collected, as well as information on turnover, operating profit, depreciation, staff costs and net profit. The next step was to develop and test multiple regression models in order to identify the influence that VAIC and its three components have on the financial performance of companies. The regression functions tested are shown in table 2.

Table 2: Regression models

| <i>Dependent variable</i> | <i>Regression models</i> |
|---------------------------|---|
| <i>ROA_t</i> | $ROA_t = a_{0t} + a_{1t}HCE_t + a_{2t}SCE_t + a_{3t}CEE_t$ |
| | $ROA_t = a_{1t}HCE_t + a_{2t}SCE_t + a_{3t}CEE_t$ |
| | $ROA_t = a_0 + a_{1t}VAIC_t$ |
| <i>ROE_t</i> | $ROE_t = b_{0t} + b_{1t}HCE_t + b_{2t}SCE_t + b_{3t}CEE_t$ |
| | $ROE_t = b_{1t}HCE_t + b_{2t}SCE_t + b_{3t}CEE_t$ |
| | $ROE_t = b_0 + b_{1t}VAIC_t$ |
| <i>GROW_t</i> | $GROW_t = c_{0t} + c_{1t}HCE_t + c_{2t}SCE_t + c_{3t}CEE_t$ |
| | $GROW_t = c_{1t}HCE_t + c_{2t}SCE_t + c_{3t}CEE_t$ |
| | $GROW_t = c_0 + c_{1t}VAIC_t$ |

The regression functions were applied on a total of 62 non-financial companies listed on Bucharest Stock Exchange. First, a selection was made on the total number of 104 listed companies in order to eliminate the unlisted and then the financial ones, as their activity is regulated and, as a consequence, their innovative potential is limited. New financial products/services can be offered only after obtaining special approvals, and employees have to limit their innovative behaviour. Second, after analysing the financial data, a second selection was made, in order eliminate those companies that registered losses and negative equity during the analysed period (2010-2011) and also to eliminate the companies that cannot offer complete information for the analysed period. Third, the regression analysis was conducted by using Excel Data Analysis Tools, for a confidence level of 95%.

4. Results

When testing the link between ROA and VAIC and its components, the results indicate that for the analysed period (2010-2011), VAIC is a better explicative variable than HCE for ROA. As a consequence, the return on assets can be explained by a regression function as in formula (10). The main figures for coefficients “a_{it}” are presented in table 3.

$$ROA_t = a_{0t} + a_{1t} \cdot VAIC_t, \text{ where } t = 2010, 2011 \tag{10}$$

Table 3: Summary output for ROE regression

| | Year 2010 | | | Year 2011 | | |
|-------------------------|-----------------------|----------------|-----------------------|-----------------------|----------------|-----------------------|
| Multiple R | 0.649075 | | | 0.626491 | | |
| R ² | 0.421298 | | | 0.392491 | | |
| Adjusted R ² | 0.411653 | | | 0.382366 | | |
| Significance F | 1.16*10 ⁻⁸ | | | 5.13*10 ⁻⁸ | | |
| | Coefficients | Standard Error | P-value | Coefficients | Standard Error | P-value |
| Intercept | -0.10811 | 0.019570 | 7.54*10 ⁻⁷ | -0.10851 | 0.022402 | 9.33*10 ⁻⁶ |
| VAIC | 0.034718 | 0.005253 | 1.16*10 ⁻⁸ | 0.034269 | 0.005504 | 5.13*10 ⁻⁸ |

In a similar approach, ROE is explained better by VAIC, instead of using the sum of VAIC components. The regression function is depicted in formula (11), while the summary output of the regression analysis is presented in table 4. One may observe that, while the influence of VAIC on assets profitability is similar in the two-year period, the influence of intellectual capital on equity’s profitability is different from one year to another (while in 2010 the influence is positive, in 2011 this changed).

$$ROE_t = b_{0t} + b_{1t} \cdot VAIC_t, \text{ where } t = 2010, 2011 \tag{11}$$

Table 4: Summary output for ROE regression

| SUMMARY OUTPUT (Observations : 62) | | | | | | |
|------------------------------------|--------------|----------------|----------|-----------------------|----------------|-----------------------|
| | Year 2010 | | | Year 2011 | | |
| Multiple R | 0.369798 | | | 0.501416 | | |
| R ² | 0.136751 | | | 0.251418 | | |
| Adjusted R ² | 0.122363 | | | 0.238942 | | |
| Significance F | 0.003095 | | | 3.31*10 ⁻⁵ | | |
| | Coefficients | Standard Error | P-value | Coefficients | Standard Error | P-value |
| Intercept | -0.47913 | 0.153567 | 0.002779 | 1.30911 | 0.327839 | 0.00018 |
| VAIC | 0.127084 | 0.041221 | 0.003095 | -0.36158 | 0.080547 | 3.31*10 ⁻⁵ |

Analysing the link between the intellectual capital and the company growth reveals that the dynamic of the business is influenced primarily by the human and structural capital (see formula (12)), and not essentially by the financial capital, as the figures in table 5 show.

$$GROW_t = c_{1t} \cdot HCE_t + c_{2t} \cdot SCE_t, \text{ where } t = 2010, 2011 \tag{12}$$

Table 5: Summary output for GROW regression

| | Year 2010 | | | Year 2011 | | |
|-------------------------|--------------|----------------|----------|--------------|----------------|----------|
| Multiple R | 0.423715 | | | 0.728131 | | |
| R ² | 0.179534 | | | 0.530174 | | |
| Adjusted R ² | 0.149193 | | | 0.505677 | | |
| Significance F | 0.002666 | | | 1.61E-10 | | |
| | Coefficients | Standard Error | P-value | Coefficients | Standard Error | P-value |
| Intercept | 0 | #N/A | #N/A | 0 | #N/A | #N/A |
| HCE | 0.104485 | 0.029045 | 0.000652 | 0.078556 | 0.009564 | 2.12E-11 |
| SCE | -0.07421 | 0.035341 | 0.03996 | -0.04136 | 0.012287 | 0.001335 |

5. Conclusions

The pattern of economic growth has fundamentally been altered by the financial crisis that begun in 2008 and whose reverberations are felt even four years later. New concepts and new ways of doing business emerged and developed. The Romanian economy was hit hard during the crisis, and the companies looked for new methods of surviving. We conducted a study for the most known and transparent companies in the market, analysing the existence of a possible link between the intellectual capital and the organisational performances in order to identify if these companies used their innovative potential to surpass the crisis.

Our findings show that human capabilities, knowledge, skills and experience represent an explicative factor of business development in crisis time. Also, use of new procedures, “out of the box” thinking and reduced use of organisational procedures seem to make the difference in the turbulent business environment, as the negative coefficient of structural capital shows.

The link between the profitability and intellectual capital is confirmed once more, because even in time of crisis the performance must rely on human ability to adapt to changes and learn.

References

- Abdulsalam I, F., Al-Qaheri I, H., Al-Khayyat, R. (2011) -The Intellectual Capital Performance of Kuwaiti Banks: an Application of VAIC™1 Model, *iBusiness*, 3, pp.88-96
- Arenas, F. (2012) - Organizational Knowledge and Organizational Performance: A Dynamic Relationship, Proceedings of the 9th International Conference on Intellectual Capital, Knowledge Management & Organisational Learning, Bogotá, Colombia, Academic Publishing International Limited, pp.6-16
- Bontis, N. (2001) – Assessing knowledge assets: a review of the models used to measure intellectual capital, *International Journal of Management Reviews*, 3(1), pp.41-60
- Chen, M., C., Cheng, S., J (2005) -An empirical investigation of the relationship between intellectual capital and firms’ market value and financial performance, *Journal of Intellectual Capital*, 6(2), pp. 159-176
- Clarke, M., Seng, D., Whiting, R., H. (2011) - Intellectual capital and firm performance in Australia, *Journal of Intellectual Capital*, 12(4), pp. 505-530
- Delgado, M., Ardila, H., Ibarra E. (2012)- Organizational Growth: Dynamic Capabilities as a Source of Sustainable Competitive Advantages – Literature Review , Proceedings of the 9th International Conference on Intellectual Capital, Knowledge Management & Organisational Learning, Bogotá, Colombia, Academic Publishing International Limited, pp.77-84
- Ederer, P. (2006) - Innovation at Work: The European Human Capital Index, pp.2, available at: <http://www.lisboncouncil.net/publication/publication/45-the-european-human-capital-index.html>,
- Hall, R. (1992) – The strategic analysis of intangible resources, *Strategic Management Journal*, 13(2), pp.135-144
- Ienciu, M., N (2012)- The Current Status Of Researches On Intellectual Capital: A Qualitative Approach, *Studia UBB, Oeconomica*, 57(3), pp.60-69

- Jianu I., Brătianu C. (2007) Dinamica semantică a conceptului de capital intelectual, available at:
<http://www.managementmarketing.ro/pdf/articole/45.pdf>
- Lev, B. (2001) - *Intangibles. Management, Measurement and Reporting*, Brookings Institution Press, New York, NY.
- Marr, B., Schiuma, G., Neely, A. (2004) - Intellectual capital - defining key performance indicators for organizational knowledge assets, *Business Process Management Journal*; 10(5), pg. 551-569
- Mondal, A., Ghosh, S., K. (2012) -Intellectual capital and financial performance of Indian banks, *Journal of Intellectual Capital*, 13(4), pp. 515-530
- Nazari, J.,A., Herremans, I., M. (2007) - Extended VAIC model: measuring intellectual capital components, *Journal of Intellectual Capital*, 8(4), pp. 595-609
- Ordóñez de Pablos, P. (2004) - Measuring and reporting structural capital: Lessons from European learning firms, *Journal of Intellectual Capital*, 5(4), pp.629 - 647
- Pulic, A. (2000), MVA and VAICTM - Analysis of Randomly Selected Companies from FTSE 250, Austrian Intellectual Capital Research Center, Graz, available at: www.measuring-ip.at/Papers/ham99txt.htm
- Razafindrambinina, D., Anggreni, T. (2011)- Intellectual capital and corporate financial performance of selected listed companies in Indonesia, *Malaysian Journal of Economic Studies*, 48(1), pp.61-77
- Roos, G., Pike, S., Fernstrom, L. (2005) – *Managing intellectual capital in practice*, Elsevier Ltd, Oxford, available at :
http://www.amazon.com/Managing-Intellectual-Capital-Practice-G%C3%B6ran/dp/0750679409#reader_0750679409
- Sabolovic, M. (2009) - Business Performance Analysis via VAICTM, *European Research Studies*, XII (3),pp.77-82
- Stahle, P., Stahle, S., Aho, S. (2011) -Value added intellectual coefficient (VAIC): a critical analysis, *Journal of Intellectual Capital*, 12 (4), pp. 531-551
- Stewart, T., A. (1997) – *Intellectual Capital*, QFinance, pp.1-4, available at:
<http://www.qfinance.com/contentFiles/QF01/g956u8c7/11/1/intellectual-capital.pdf>
- Sumedrea, S. (2012) – *Managementul organizatiei*, Editura ASE, Bucuresti, pp.273-277
- Tan, H., P., Plowman, D., Hancock, P. (2007) - Intellectual capital and financial returns of companies, *Journal of Intellectual Capital*, 8(1), pp. 76-95
- Zerenler, M., Hasiloglu, S., B., Sezgin, M. (2008) – “Intellectual Capital and Innovation Performance: Empirical Evidence in the Turkish Automotive Supplier”, *Journal of Technology Management & Innovation*, 3(4), pp. 31-40