Intellectual capital: the key value driver in knowledge economy

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Abstract

Value-based management concept regards corporate value growth for all stakeholders as the main company purpose which nowadays is primarily provided by intangible assets. However analysis of the process of converting intellectual capital (IC) and its components into the company financial performance is still a challenging research area. The main aim of the current study is to investigate the intellectual capital transformation into the company value on the basis of available information.

***Keywords:** intellectual capital, value creation, value added, return on intellectual capital.*

At the end of the 20th century developed US markets cause the shifts in world financial management and gave a priority to market value growth instead of balance financial performance indicators. This led to the value-based management (VBM) appear. It regards a company as a potential investment target. During the process of globalization and new economy development the significance of tangible assets decreases because they are not able to create company's competitive advantages. The growing awareness of intangible assets importance results in integration of value-based management and intellectual capital theory. IC-related investments increase every year and even exceed funding of financial and physical assets in some countries. (OECD, 2007; Zeghal, Maaloul, 2010) Some previous researches explain investment structure changes through transition to knowledge economy. (Stewart, 1997; Zeghal, 2000) Others researchers, for example Edvinsson (Edvinsson, 1997), Sveiby (Sveiby, 1997) and Lynn (Lynn, 1998), noted that the growth of intellectual capital importance influences value creation.

1. Value created by the intellectual capital

In the context of intellectual capital transformation into performance indicators it can be interpreted as the aggregate of key non-monetary and intangible resources that have strong long-run

influence on company functioning. (Bayburina, Golovko, 2008) Created value can be measured in dollars but depends on intangibles such as reputation, relationships with clients, employees competence and others. Similar definition was proposed by Edvinsson and Malone. According to them all knowledge that can be converted into the value can be regarded as intellectual capital. (Edvinsson, Malone, 1997) Zeghal and Maaloul extended their definition and determined intellectual capital as a sum of knowledge that can be used in process of value added creation. (Zeghal, Maaloul, 2010)

Academics increasingly regard value added as one of the main indicator of intellectual capital effectiveness. The survey carried out by the UK Department of Trade and Industry (DTI) shows that successful UK companies recognize that investing in IC is essential to their ability to create high value-added. (Zeghal, Maaloul, 2010) Some researchers consider capital employed as no longer significant for company strategy implementation unlike intellectual capital which allows firms to create value added. (Riahi-Belcaoui, 2003; Youndt, 2004) The relationship between intellectual capital and created value added is cosidered by Kimura at al. (Kimura at al, 2010) on the sample of Brazil public companies, Ozturk and Demirgunes (Ozturk, Demirgunes, 2007) analyzed the companies quoted on ISE (Istanbul Stock Exchange) data, etc. Though many researchers view value added as the key indicator of intellectual capital effectiveness the process of its transformation is still a point of contention. (Diez J.M. et al, 2010) For example Diez et al. revealed statistically significant relationship between intellectual capital and value added. But there is no tool that allows to differentiate value created by invested capital and value created by intellectual resources.

There was created a plenty of theories and concepts to measure intangible assets or intellectual capital and its components. Karl-Eric Sveiby's site contains the most comprehensive review of measurement methods. Some of them try to measure value created by intellectual capital or its quantity, while others are dedicated to identification the level of its influence on company performance. (Pulic, 2000; Stewart, 2002; Chen, Cheng, Hwang, 2005; Tan et al., 2007; Zeghal, Maaloul, 2010; Bayburina, Golovko, 2008) But until now there have been no generally accepted methods that allow to achieve those goals. Some of them are based on interviews and questionnaires, others use available financial information. The most frequently used ones are Q-Tobin coefficient (Tobin, 1969), EVA (Stern, 2001), VAIC (Pulic, 1997), FGV (Руус и др., 2008), MVA (Stern, 2001).

Some researchers regard EVA (economic value added) as an approximate measure of intellectual capital. They use the preposition that normal economic profit is generated by physical and financial assets while excess profit – by intangibles. (Lev, 1999) But nowadays EVA is criticized for its inability to measure creation or destruction of value (Fernandez, 2001; Velez-Pareja, Tham, 2001) and to estimate intangibles contribution to the value creation (Bontis, Dragonetti, Jacobsen, Roos, 1999). Many studies revealed only weak correlation between economic value added and company capitalization because EVA neglects development perspectives and future earnings. (Biddle, Bowen, Wallace, 1999; Tsuji, 2006;

Huang, Wang, 2008) Most part of researches dedicated to the analyses of EVA' ability to explain exceed market rate of return concluded the dominance of traditional measures of company performance. (Biddle, Bowen, Wallace, 1999; Visaltanachoti, Luo, Yi, 2008)

Future growth value (FGV) was designed by Stern Stewart & Co as the development of EVA concept. It uses Miller and Modigliani assumption about the possibility of company value separation on the present value of assets that company owns and present value of company ability to earn excess return. (Burgman, Roos, 2005) Future growth value is measured as the difference between company market value and current operations value (COV). COV equals present value of current EVA in perpetuity plus capital in place. FGV represents investors' assessment of new strategies and opportunities potential to create value. Some studies use FGV as an approximate indicator of intellectual capital that is able to reflect its market estimation. Presumably, it reaches the highest value in innovative industries. (Roos et al., 2008)

Value added intellectual coefficient (VAIC) was developed by Ante Pulic in order to measure value added by invested capital and intellectual capital components: human and structural. The coefficient is frequently used in researches because of simple methodology and necessity of only available financial information. The majority of papers dedicated to the relationship between intellectual capital components and value added creation, company capitalization and performance use VAIC concept. But simultaneously the coefficient is criticized for the questionable assumptions. (Zeghal, Maaloul, 2010; Andriessen, 2004) Also some studies demonstrated poor associated between VAIC and its components and company performance in some industries and emerging markets. (Firer, Williams, 2003; Chan, 2009; Puntilla, 2009)

Tobin's q coefficient was developed in 1969 by American economist James Tobin for investment expediency forecasting. If Tobin's q is greater than 1, then companies should spend more on capital. Later research of Tobin and Brainard based on the data from 1960 to 1974 proved the ability of the coefficient to explain company' investment policy. (Tobin, Brainard, 1976) But following studies didn't verify Tobin's results. (Blanchard, Rhee, Summers; Henwood, 1997) Nowadays coefficient isn't used for its intended purpose because of numerous criticism. But modern researches dedicated to intangible assets and knowledge economy view Tobin's q as an approximate measure of intellectual capital. The higher the coefficient the more intangibles company has and consequently the bigger part of created value can be explained by intellectual capital influence. Usually Tobin's q is calculated as the ratio of market value of invested capital to the replacement costs. (Tobin, 1969; Lindenberg, Ross, 1981) But some papers regard balance value of assets as approximately equal to the cost of replacement. (Youndt et al., 2004; Veltri, 2009) This assumption was used in current paper.

Spread between market and book company value (market value added, MVA) is growing fast in the new economy. There are several explanation theories but the most popular one considers the intellectual capital and its components influence on the market value. (Lev, Zarowin, 1999) Difference between market and book value can be used as an approximate indicator of intellectual capital, but cannot measure the quantity of intellectual capital. (Rodov, Leliaert, 2002) Book value can be interpreted as costs on material assets purchase whereas market value represents investors assessment of future earnings and growth potential. In order to calculate value created by intellectual capital more correctly financial statements should be adjusted on inflation, replacement cost of equipment, etc. (Rodov, Leliaert, 2002)

Figure 1 contains the relationship between market value added and future growth value concepts.

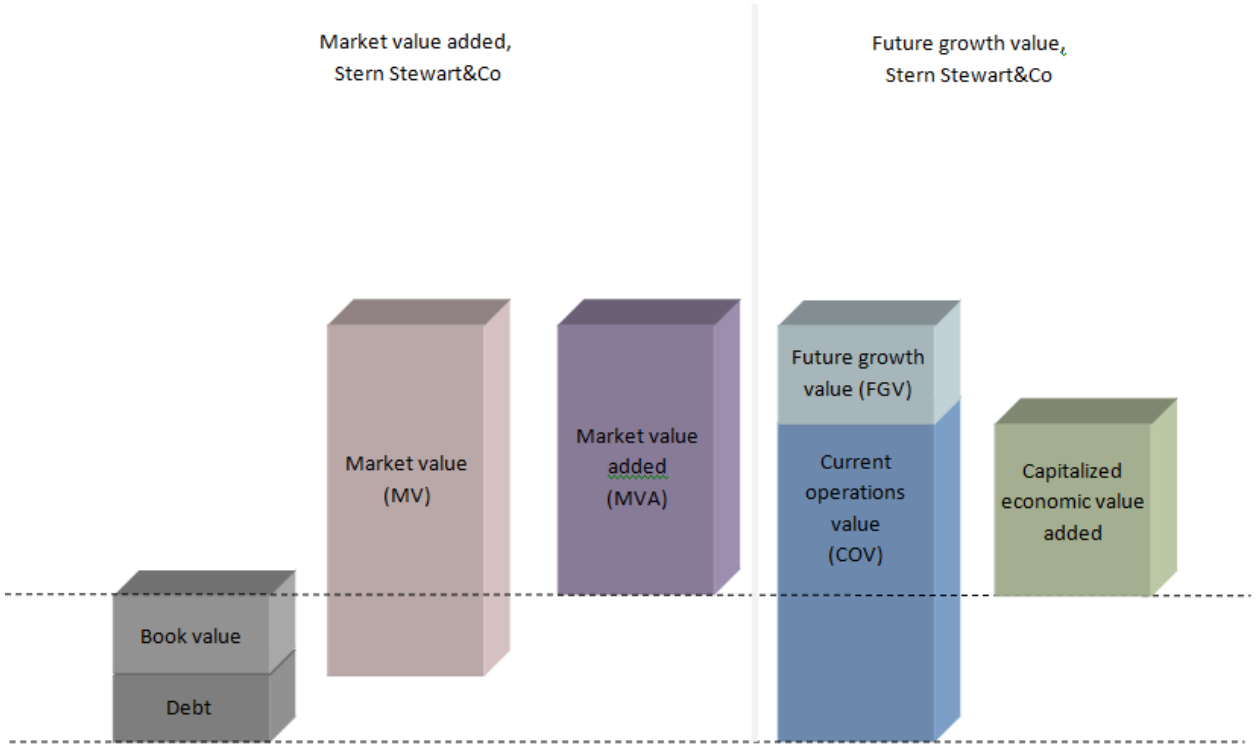

Figure 1. Relationship between market methods of intellectual capital evaluation

Current study intentionally uses both market and book indicators. This allows us to research the influence of both book and market information about company performance on intellectual capital.

Thus the review of previous researches evidences the lack of generally accepted measurement methods of value added that are created by company intellectual capital and its components. This fact complicates the analysis of intellectual capital effectiveness and limits the implementation of value-based management. There are a variety of indicators of value added creation oriented on short and long-run periods and based on different assumptions. So the comprehensive analysis of intellectual capital transformation into the value added requires a set of indicators.

2. Hypotheses development

The analysis of existent theoretical and empirical studies allows to determine the target area of current research. The main purpose of this paper is to determine the ability of intellectual capital to transform into the value added.

There was developed assisted hypotheses in order to achieve the purpose:

1. *Approximate indicators of intellectual capital and its components transform into company' value.* The hypothesis is used to verify whether intellectual capital lead to creation or destruction of firm value. Approximate indicators are chosen on the basis of existent theoretical and empirical studies. The hypothesis is going to test the explanation power of each indicator without taking into account the mutual influence of them.
2. *Non-financial indicators can better reflect intellectual capital than financial.* Since intellectual capital has intangible nature and cannot be measured quantitatively its financial measure could be incorrect. So non-financial indicators could better reflect the ability of intellectual capital to create value.

3. The selection of approximate indicators

Nowadays economic literature doesn't contain generally accepted structure of intellectual capital. Because of this reason its quantity can be measured only by approximate indicators. The paper divides intellectual capital into the structural, human and relational and uses indicators presented in Table 1. The choice of indicators was based on the review of empirical researches dedicated to intellectual capital and value creation. (Zickgraf, Merton et al., 2007; Starowiz, Marr, 2005; Mouritsen, Bukh, 2000)

Table 1

Approximate indicators of intellectual capital

	Structural capital (SC)	**Human capital (HC)**	**Relational capital (RC)**
Financial	- Intangible assets - R&D expenditures	- Costs of employees	
Non-financial	- Number of license, patents, trademarks - Integrated ERP system	- Number of employees - Board of directors qualification - The share of equity owners among directors	- Brand recognition - Site citation - Office location in the capital - Office location in millionaire city - Subsidiaries - Site quality

Chosen approximate indicators are briefly described below.

1. Intangible assets. The indicator was determined as balance value of intangibles according to financial statements.
2. R&D expenditures. The indicator was determined according to financial statements.
3. Costs of employees. The sum of all payments made to company employees during the year was used as indirect indicator of human capital quality.
4. Number of license, patents, trademarks that company owns. The indicator was determined using the company data and international patent database QPAT.
5. The implementation of ERP (Enterprise Resource Planning) systems. All integrated company systems based on information technologies and used for resource management was regarded as ERP («ERP», «Oracle», «NAVISION», «NAV», «SQL», «SAP», etc.). The indicator was determined as binary variable.
6. Number of employees. The indicator was determined as a total quantity of company employees at the end of year.
7. Board of directors' qualification. The Board was regarded as qualified when more than third of directors have PhD degree or large working experience. There were used the indicator values from 0 to 2.
8. The share of equity owners among directors. The indicator was calculated as the ratio of directors own company shares to the total number of the Board.
9. Brand recognition. Company brand was determined as well-known if the company is contained in international rating Global 1000. The rating is based on financial, ecological, social factors. The indicator was estimated as binary variable.
10. Site citations. The frequency of company site citations was determined with the help of Google Page rank. This tool registers the number of requests, direct and indirect links. The indicator took the value from 0 to 10.
11. Office location in the capital. The indicator is directly connected with the quantity of company relational capital because capital of country (region, districts, etc.) is characterized by high concentration of partner companies, suppliers and clients. The indicator was determined as binary variable.
12. Office location in millionaire city. It is expected that the larger number of potential stakeholders generate the higher degree of relational capital. The indicator was estimated as binary variable.
13. Subsidiaries. The indicator was determined as the number of subsidiaries.
14. Site quality. It is expected that more user-friendly and comprehensive site predetermines high level of relational capital. The indicator calculation used 4 criterions: investor relations page, possibility of language choice, usage of animated images, site pages

quantity. Each criterion was determined as binary variable. The total indicator "site quality" was determined as the sum of all criterions and took the value between 0 and 4.

4. The sample creation

The developed hypotheses were analyzed with the help of statistical methods using the panel data. The sample consists of companies data based on Amadeus database (Bureau Van Dijk), companies sites and Internet resources. The sample has been formed in two stages. On the first stage were selected companies that meet the following requirements:

- Company shares are traded on stock exchange. Such limitations are determined by the necessity of equity market value use in current paper.
- Financial, operational and others indicators are available from 2005 to 2009.
- Company operates in Great Britain. The country choice is determined by the fact that British financial market is developed and contains a lot of traded companies. Also Great Britain belongs to the first quantile of Knowledge index (9th position from 145 possible) that reflects company ability to generate, adopt and diffuse knowledge. High position allows to expect the presence of intellectual capital transformation into the company value. Also it simplifies the recognition of the transformation despite of using only available financial information.
- Company operates in the following industries: retail, wholesale trade, machinery, chemicals manufacture (including gas and oil), transport and telecommunication. The chosen industries contain big enough number of companies to collect sample suitable for intersectoral analyses.
- Company has more than 500 employees but less than 20 000. Such criterion assures the exception of too small and too large companies that have specific intellectual capital transformation. Also it contributes to the sample homogeneity.

The collected on the first stage sample consists of 172 British companies. On the second stage selected companies with found approximate and calculated value added indicators. Final sample that met all requirements consists of 64 companies. Note that the main reason of dismissals was the lack of information about employees' number and R&D expenditures.

Table 2

Descriptive statistics of value created by intellectual capital indicators

	EVA	FGV	MVA	VAIC	Tobin's q	Invested capital
Mean	3 913,8	732 638,0	-77 839,6	5,7	1,1	456 347,4
Median	4 636,2	424 426,2	-24 510,3	5,1	0,9	239 043,4
Maximum	149 691,9	13 544 045,0	8 156 096,0	34,2	11,0	2 711 000,0
Minimum	-219 991,4	-244 899,1	-3 449 627,0	1,8	0,0	3 803,4
Standard deviation	47 621,5	1 173 292,0	894 159,8	3,0	1,2	577 773,0
Coefficient of variation	12,2	1,6	11,5	0,5	1,1	1,3

Table 2 contains the sample descriptive statistics of value created by intellectual capital indicators. The sample heterogeneity could be explained by different quantity of intellectual capital. High level of EVA and MVA coefficients of variation could be explained by financial crisis. The sample contains crisis years data that are characterized by financial results reduction and stock market drop. But there is the assumption that companies with big quantity of intellectual capital are more persistent to the market fluctuation. So they were also included to the sample.

Table 3 includes structural capital approximate indicators descriptive statistics. The sample is heterogeneous and standard deviation of each approximate indicator higher than its mean value. Notice that median value deviates mean. The most common value of patents and ERP-systems is null.

Table 3

Descriptive statistics of structural capital approximate indicators

	Intangible assets	Number of license, patents, trademarks	Integrated ERP systems	R&D expenditures
Mean	219 844,9	39,2	0,3	25 139,2
Median	79 194,3	0,0	0,0	12 114,8
Maximum	2 684 210,0	562,0	1,0	101 000,0
Minimum	0,0	0,0	0,0	733,2
Standard deviation	405 411,6	109,5	0,5	27 520,8
Coefficient of variation	1,8	2,8	1,5	1,1

Descriptive statistics of human capital approximate indicators is represented in Table 4. The sample is quite homogeneous with respect to employees number because of collection methodology and shareholders among directors. Other approximate indicators are considerably inhomogeneous. The Board of directors qualification indicator demonstrates the highest fluctuations.

Table 4

Descriptive statistics of human capital approximate indicators

	Number of employees	Costs of employees	Board of directors qualification	The share of equity owners among directors
Mean	4 985,0	182 196,5	0,3	0,3
Median	3 379,0	109 554,4	0,0	0,3
Maximum	20 231,0	1 333 000,0	2,0	0,9
Minimum	166,0	2 465,3	0,0	0,0
Standard deviation	4 442,4	196 419,1	0,5	0,3
Coefficient of variation	0,9	1,1	1,6	0,8

Table 5 contains relational capital approximate indicators descriptive statistics. All indicators are non-financial. Three of them (brand recognition and indicators of office location) were determined as dummy variable. So their mean and standard deviation are not representative. Median shows that the most common values of indicators are zero. Other approximate indicators are quite homogeneous.

Table 5

Descriptive statistics of relational capital approximate indicators

	Brand recognition	Site citation	Office location in the capital	Office location in millionaire city	Subsidiaries	Site quality
Mean	0,2	4,1	0,5	0,2	26,6	2,7
Median	0,0	4,0	0,0	0,0	25,0	3,0
Maximum	1,0	7,0	1,0	1,0	176,0	4,0
Minimum	0,0	0,0	0,0	0,0	0,0	0,0
Standard deviation	0,4	1,5	0,5	0,4	27,0	1,0
Coefficient of variation	2,2	0,4	1,1	2,4	1,0	0,4

In order to analyze multicollinearity existence in regressions the correlation matrix was built (Table 6). Statistically significant correlation was found between employees number and their wages. Those indicators weren't used simultaneously in the same model.

Table 6

Correlation matrix of intellectual capital approximate indicators

	Brand recognition	Site citations	Office location in the capital	Office location in Millionaire City	Subsidiaries	Site quality
Brand recognition	1,00	0,10	0,07	-0,06	0,12	-0,19
Site citations	0,10	1,00	0,06	0,23	-0,02	0,36
Office location in the capital	0,07	0,06	1,00	0,37	0,10	0,01
Office location in Millionaire City	-0,06	0,23	0,37	1,00	0,15	0,24

Subsidiaries	0,12	-0,02	0,10	0,15	1,00	0,15
Site quality	-0,19	0,36	0,01	0,24	0,15	1,00

5. Empirical results

For the hypotheses testing the following model was used:

$$Y = c_0 + \sum_{i=1}^{n}(c_i \times x_i) + \varepsilon$$

where

Y– value created by intellectual capital;

x – approximate measure of intellectual capital;

n – number of approximate indicators.

To verify the hypotheses the panel data sample was tested with the help of ordinary least squares method (OLS).

On the first stage single-factor models were tested for each intellectual capital component. The following models are stable and contain significant coefficients.

EVA = 9 070,6 – 0,03 * emplc

VAIC = 6,5 -0,9 * dir_qual

VAIC = 6,1 – 1,3 * erp

VAIC = 6,3 – 0,02* subsdr

FGV = 32 673,1 + 2,7 * emplc + 508 138 * od_ratio + 128 742,9 * dir_qual

FGV = 433 671 + 1 220 699 * brand + 562 735,9 * population

FGV = 362 968,8 + 1,68 * int_as

P/BV = 1,5 – 0,0006 * empln

MVA = 343 682,7 – 83,4 * empln

MVA = 69 996,35 – 496 417,6 * erp

MVA = -139 324,2 + 350 242,6 * brand, where

- emplc – costs of employees (wage);
- dir_qual – Board of directors qualification;
- erp – integrated ERP systems;
- subsdr – number of subsidiaries;
- od_ratio – shareholders among directors;
- brand – brand recognition;
- population – office location in millionaire city;

- int_as – company intangible assets;
- empln – employee number.

The models allowed to identify the transformation of intellectual capital components into the value added and research the explanation ability of value added indicators.

On the second stage models included all financial and non-financial approximate indicators were tested. After that all non-significant variables were excluded from the models with the help of step by step procedure of successive elimination. (Aivazyan, 2003) Table 7 contains hypotheses testing results. Approximate indicators with results significant on 5% level are marked by plus or minus that are determined by their sign.

Table 7

Results of testing the hypotheses about intellectual capital transformation into the company value

		EVA	FGV	VAIC	MVA	Q-Tobin
SC (structural capital)	Intangible assets		+	+		
	Number of license, patents, trademarks					
	Integrated ERP system	-		-	-	-
HC (human capital)	Employees number		-	+	-	-
	Shareholders among directors	-		-		
	Board of directors qualification					
	Wage		-	+	-	-
RC (relational capital)	Brand recognition	+	+		+	+
	Site citation					
	Office location in the capital					
	Office location in millionaire city			+		
	Site quality	+		+		+
Log(invested capital)		-	+	-		
R^2 adjusted		5%	45%	23%	26%	11%

The tests result the absence of clear linear relationship between value created by intellectual capital and its approximate indicators. But there is the dependence between transformation existence and value added indicators. For instance, human and structural capital approximate indicators linearly transform only in future growth value (FGV) and value added intellectual coefficient (VAIC).

Also analyses revealed stable negative influence of ERP systems on value added indicators. The probable reason is improper integration of company activities that destroy value and make the payback of development and support costs impossible. Another one reason is the necessity of longer period to represent the influence of their implementation in company financial statements.

At the same time site quality and brand recognition have stable positive connection with intellectual capital indicators. Supposably it means that brand and site quality are significant relational capital components and their valuation based on available information can represent quantity and quality of company resources.

The analysis revealed that priority of using financial or non-financial indicators for the company activity analyses depends on the type of intellectual capital component. For instance structural capital contribution can be revealed with the help of its financial proxy represented in balance sheet. Note that such amount doesn't equal the value of structural capital. Human capital can be described by both financial and non-financial proxies. At the same time relational capital has weak financial proxies and can better be evaluated with the help of external non-financial estimates.

6. Conclusion

The conducted research revealed that chosen approximate indicators do transform into the company value. For instance, the best financial indicator of created value is future growth value (FGV). Note that despite of other financial indicators of created value FGV is the one that the most rarely used.

The second tested hypothesis aimed to recognize the priority of approximate indicator type. Empirical analyses of British companies sample show that the suitability of proxy type depends on intellectual capital component. For example, structural capital can be explained by financial proxies, while relational capital requires non-financial ones.

The verification of proposed hypotheses evidences the existence of intellectual capital transformation into the company value. Intellectual capital and its components can be regarded as the source of a company's organic growth to maintain sustainable development. Under the crisis conditions most of financial reserves are unavailable, the inner organizational efficiency by means of intellectual capital is a question of survival edge for most companies. It shows the necessity of future research concerning mutual interference of IC components, drivers of value destruction, relationship of company financial structure and IC and others.

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