

Modeling the Relation between Intellectual Capital and Efficiency of Companies

Saeed Yaqubianallaf

Master of Business Administration, Asia Superior Education Institute, Iranian
yaqubian@yahoo.com

Abstract: Increase in the gap between market value and book value of the companies has made scholars to carry out multiple researches regarding identification of the factors that have been removed from financial statements of the companies. Brand value, intellectual capital value, etc. are among factors that influence company value but are not provided in the financial statements. This paper is aimed at modeling the relation between intellectual capital and efficiency of the companies. The present paper is an applied research in terms of objective and an ex post facto research in terms of data collection. To achieve this objective, a sample comprised of 150 companies of Tehran Stock Exchange during 2007-2012 was used. To measure intellectual capital, Value Added Intellectual Coefficient formulated by Pulic was used. Value Added Intellectual Coefficient measures efficiency of three kinds of data: applied capital (financial and physical), human capital, and structural capital. This paper examines separate effects of capital efficiency including efficiency of human capital, structural capital, and applied (physical) capital on return on assets (ROA) for 150 companies during 2007-2012 by generalized least squares method. The results of testing the research hypotheses revealed that there is a positive significant relation between three dimensions of intellectual capital (relational capital, human capital, and structural capital) and company efficiency (return on assets). Also relational capital has more effect on ROA compared to other dimensions of intellectual capital.

[Saeed Yaqubianallaf. **Modeling the Relation between Intellectual Capital and Efficiency of Companies.** *J Am Sci* 2019;15(5):1-7]. ISSN 1545-1003 (print); ISSN 2375-7264 (online). <http://www.jofamericanscience.org>. 1. doi:[10.7537/marsjas150519.01](https://doi.org/10.7537/marsjas150519.01).

Key words: Intellectual capitals, efficiency, return on assets, Tehran Stock Exchange

Introduction

Emphasis on the intellectual capital shows a major difference between companies' operation in the old and modern economies. In the old economy, the value was resulted from physical assets; while in the modern economy, the value is created by applying knowledge and intellectual capital. One of the main problems of traditional accounting systems is their incompetency in measuring and reporting data pertaining to intangible assets (including knowledge) and hidden values of the company. (2) So this phenomenon has led to a great gap between book value and market value of the companies. The increasing difference observed between market value and book value in many companies has caused attention to missing values of financial statements.

Restrictions of financial statements in explaining company value are due to the fact that the source of economic value is production of material goods rather than intellectual capital (Madinios, 2011).

With respect to the works of different researchers, it seems that intellectual capitals are hidden values that tarnish financial statements and direct organizations to achieve competitive advantages. Furthermore, it is believed that restrictions of financial statements make accurate explanation of company value difficult and reveal this reality that these days economic value stems from

intellectual capital rather than material products (Chen, 2005).

In a knowledge-based organization in which knowledge constitutes a large part of a product value and also wealth of an organization, traditional accounting methods that are based on tangible assets and data pertaining to the prior operations of the organization are not adequate for evaluating the intellectual capital that is the greatest and most valuable assets for them (Sullivan, 2000). So, the intellectual capital approach is more comprehensive for the organizations that want to be well-aware of the value of their performance (Waterhouse, 1998).

The research questions are formulated as per below.

- Is there a significant relation between dimensions of intellectual capital and efficiency of companies in Tehran Stock Exchange?

- Which dimension of intellectual capital has more effect on efficiency of companies in Tehran Stock Exchange?

Theoretical Bases and Research Background Intellectual Capital

During recent years, a relative consensus has been created on division of intellectual capital components (Young, 2006). According to these studies and definitions, intellectual capital includes 1) relational capital (customer), 2) human capital, and 3) structural (organizational) capital.

Relational Capital (Customer)

The main subject of relational capital is the knowledge existing in the marketing channels and customer relationship which are the determining factor in converting the intellectual capital into the market value and so business performance of the organization (Chen, 2004).

Human Capital

Human capital of an organizations includes skills, expertise, problem solving ability, and leadership styles (Brooking, 1996). Human capital as a basis for intellectual capital results in improving the performance and creating profit for the company (Chen, 2004).

Structural (Organizational) Capital

It embraces databases, organizational charts, executive procedures of processes, strategies, and plans (Roos, 1997).

Intellectual Capital Models

In the intellectual capital literature, different models have been offered for measuring intellectual capital (Bontis, 2002). Some of them are specific models that have been designed and implemented in a specific company. Some others are merely theoretical models, most of them have not been accepted as a valid intellectual capital model (Rodov, 2002; Stewart, 1997; Sveiby, 1997). In general, intellectual capital models can be classified into two groups: (Hong Pew Tan, 2007)

Models that evaluate intellectual capital non-monetarily are namely.

1) invisible balance sheet, 2) intangible assets control, 3) balanced scoring card (BSC), 4) intellectual capital index, 5) technology server, 6) Scandia commercial navigation method (Edvinsson, 1997), 7) intellectual capital management model, and 8) Joia method.

Models that evaluate intellectual capital monetarily and financially are namely.

1) economic value added (EVA), 2) return on assets (ROA), 3) market capital formation method, 4) direct intellectual capital method, 5) methods of intellectual capital financial measurement, and 6) Tobin q method.

Value Added Intellectual Coefficient (VAIC) Model

Value added intellectual coefficient (VAIC) presented by Pulic (1998) will be used in this paper as the main model for measuring intellectual capital. Its measurement is based on three dependent variables, 1) relational capital efficiency (CEE), 2) human capital efficiency (HCE), and 3) structural capital efficiency (SCE).

Pulic (1998) stated that when VAIC is high, the efficiency of value added by the whole resources of

the company is better. Formulation of VAIC indices is as following:

$$VAIC_i = CEE_i + HCE_i + SCE_i$$

1. Value added (VA_i) of company i in year i is calculated as below:

$$VA_i = I_i + DP_i + D_i + T_i + M_i + R_i$$

Where,

I_i : total interest cost for the company in year i ;

DP_i : depreciation costs of the company for year

i ;

D_i : dividend of the company for year i ;

T_i : tax for year i ;

M_i : equity capital for year i ;

R_i : retained earnings of the company for year i

2. CEE_i is calculated by below relation:

$$CEE_i = \frac{VA_i}{CE_i}$$

Where,

CEE_i : coefficient of relational efficiency for company i

VA_i : total value added for company i

CE_i : net book value of assets for company i (Pulic, 1998; Sveiby, 1997)

3. Salary is one of the indices of human capital efficiency (HCEi). So, HCEi is calculated as below:

$$HCE_i = \frac{VA_i}{HC_i}$$

Where,

HCE_i : human capital efficiency for company i

VA_i : total value added for company i

HC_i : total outlay for salary for company i

4. Structural capital efficiency (SCEi) for company i is calculated as following.

The first step for determining SCEi is to calculate the company structural capital (SCi):

$$SC_i = VA_i - HC_i$$

Where,

SC_i : structural capital for company i

VA_i : total value added for company i

HC_i : total outlay for salary for company i

Pulic stated that there is an inverse relation between SC_i and HC_i , so SCEi is calculated as below:

$$SCE_i = \frac{SC_i}{VA_i}$$

Where,

SCE_i : structural capital efficiency for company i

SC_i : structural capital for company i

VA_i : total value added for company i

Research Background

The first empirical research for measuring the intellectual capital was carried out in the mid 1980s by a Swedish association and then many studies were carried out for determining the status of companies

intellectual capital inside the countries (Olsson, 2001; Abeysekera, 2005; Brennan, 2001) and among countries (Subbarao, 1997). Rudez (2007) studied the effect of intellectual capital components on the financial performance in hotel industry in Slovenia. The results of this research revealed that first there is a positive significant relation between intellectual capital components and financial performance in this industry and second, the effect of relational capital on the company financial performance is more than other intellectual capital components. Chang & Hsieh (2011) studied the relation between intellectual capital components and three operational, financial, and market performance in Taiwan Stock in the electronics industry. To measure intellectual capital, adjusted value added intellectual coefficient model has been used. The results show that the operational performance has a positive relation with the applied capital and has no relation with structural and human capitals. Also intellectual capital components have a negative relation with market and financial performance. Maditinos and colleagues (2011) studied the relation of intellectual capital components with financial and market performance in the Greece Stock. To calculate intellectual capital, value added intellectual coefficient method was used. The results indicated that there is no significant relation among intellectual capital and financial and market performance, and only the relation of human capital with return on equity has been confirmed. Zéghal, & Maaloul (2010) measured intellectual capital with value added index and studied its results on financial and economic performance and market value in 300 English companies. To measure intellectual capital, value added intellectual coefficient model has been used. The results show that efficiency of intellectual capital has a positive significant relation with economic performance and financial performance; but

as regards market value performance, the relation is only important in technology industry and also applied (physical and financial) capital has a negative relation with economic performance and a positive significant relation with market value performance and financial performance.

Importance of the Subject

During the second half of the twentieth century, the concept, role and importance of knowledge in economy and business have changed highly. Importance of this issue is to the extent that the European Union introduces conversion into the greatest knowledge-based economic pole in the world as its major goal in its meeting 2000 in Lisbon, Portugal. During recent decade, more than 7000 scientific papers have been published in the scientific journal and conferences on intellectual capital and any of them has studied a specific perspective. The role and importance of knowledge has always been increasing not only at a macro-economic level and business but also in the company management processes. One of the main problems of traditional accounting systems is their disability to measure intellectual capitals of the companies. That's why, inclination to measure and consider real value of intangible assets and knowledge in the financial statements of the companies has been increased more than ever (Hemmati, 2011).

Research Variables

Independent and dependent variables are as below.

Independent variables include value added coefficient of relational capital (CEE), value added coefficient of structural capital (SCE), and value added coefficient of human capital (HCE).

Dependent variable includes return on assets (ROA).

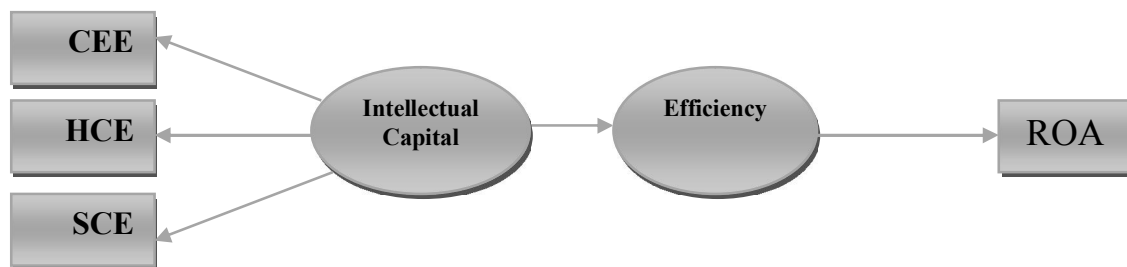


Figure 1- Research model

Research Hypotheses

- There is a significant relation between relational capital and return on assets.

- There is a significant relation between human capital and return on assets.

- There is a significant relation between structural capital and return on assets.

Statistical Universe and Statistical Sample

In this paper, companies accepted in Tehran Stock Exchange which have submitted their financial statements to Tehran Stock Exchange during 2007 – 2012 constitute the statistical universe. For the sample, companies accepted in Tehran Stock Exchange were selected by considering below features.

- Their financial period must end in 29 Esfand;
- They must have no changes in the financial year and trading halts over three months during the research period;
- They must not be among investment companies, financial mediation companies, leasing companies and banks;
- They must not incur losses during the research period and also the net book value of their assets must not be negative;
- Financial statements of the company must be available.

With regard to the above conditions, 150 companies were selected as the research sample.

Research Data and Method

This paper is regarded as a descriptive research and also an applied research in terms of objective. This paper is aimed at providing a proper method for measuring intellectual capitals of the companies and testing these methods in Tehran Stock Exchange. In so doing, first intellectual capital value of each company was calculated based on Pulic method for a six-year period from 2007 to 2012. Then the relation between intellectual capital dimensions and efficiency of the company was studied by using generalized least squares method. In this paper, Pulic comprehensive method, "value added intellectual coefficient model", is used for quantifying the intellectual capital. This

model is used due to its advantages and efficiency compared to other models. For example:

- It provides a standard basis for measurement (Sullivan, 2000)
- It is based on both aspects, evaluation of efficiency and creation of value from tangible and intangible assets in a company (Hong Pew Tan, 2007)
- All data used in VAIC calculation is based on accounting and financial standard information that has normally been stipulated in financial reports of the company. So, calculations based on the objective can be investigated and confirmed (Anne, 2003)
- This model has been used in many valid foreign studies (Nova, 2000)

Data required for testing the hypotheses has been gathered by Rahavard Novin software. The gathered data was classified by using except program and then variables were calculated for testing the research hypotheses based on the mentioned models.

Research Findings

As mentioned earlier, the regression method used in the present paper is generalized least squares method. To estimate the regression model, panel data has been used by assuming that B_1, B_2, \dots, B_0 is constant and error is variable. the regression model used in this paper is as following:

$$Y_{it} = B_0 + B_1 CEE_{it} + B_2 HCE_{it} + B_3 SCE_{it} + M_{it}$$

Where, Y_i is the dependent variable (efficiency) that is measured by ROA variable and independent variables of the model (intellectual capital) that include CEE_{it} , HCE_{it} , and SCE_{it} . also to study the correlation between residuals, Durbin – Watson statistic has been used; and if there was auto-correlation, auto-correlation problem has been removed by adding AR (1) sentence.

First hypothesis: there is a significant relation between relational capital and return on assets.

Table 1- the relation between relational capital and return on assets

	CEE	Durbin- Watson statistic	AR (1)	Adjusted R square	R- square	Prob. F-stat	F-stat
ROA	0.356	2.25	0.315	0.362	0.415	0.000	23.58

The results of data analysis show that there is a significant relation between relational capital and return on assets with the coefficient value (0.356). In general, relational capital explains 41 percent of changes in return on assets. Durbin – Watson value

shows that values of this index are appropriate after removal of the first order auto-correlation.

Second hypothesis: there is a significant relation between human capital and return on assets.

Table 2- the relation between human capital and return on assets

	HCE	Durbin- Watson statistic	AR (1)	Adjusted R square	R- square	Prob. F-stat	F-stat
ROA	0.261	1.39	0.318	0.268	0.325	0.000	32.21

The findings show that there is a significant relation between human capital and return on assets with the coefficient value (0.261). The value of R-square indicates that human capital explains 32 percent of changes in return on assets. Significance of

F statistic value depicts that this regression is significant statistically.

Third hypothesis: there is a significant relation between structural capital and return on assets.

Table 3- relation between structural capital and return on assets

	SCE	Durbin- Watson statistic	AR (1)	Adjusted R square	R- square	Prob. F-stat	F-stat
ROA	0.324	2.18	0.287	0.331	0.399	0.000	34.57

The research findings revealed that there is a significant relation between structural capital and return on assets with the coefficient value (0.324). The value of R-square shows that structural capital explains 39 percent of changes in return on assets.

Below table presents the relation between three dimensions of intellectual capital and efficiency in a regression model.

Table 4- the relation between intellectual capital dimensions and efficiency

	CEE	HCE	SCE	Durbin- Watson statistic	AR (1)	Adjusted R square	R- square	Prob. F-stat	F-stat
ROA	0.32	0.201	0.281	1.48	0.218	0.721	0.735	0.000	53.58

As shown by table (4), relational capital with the coefficient (0.32) has the greatest effect on the return on assets compared to human capital (0.201) and structural capital (0.281). in general, value of R-square shows that three dimensions of intellectual capital explain 73 percent changes in the efficiency. F statistic value indicates that the above mentioned regression is significant statistically.

Discussions and Conclusions

Nowadays, role and importance of return on the intellectual capitals in profitability and sustainability of the companies are more than financial capitals. In the other words, in the current knowledge- based societies, role and importance of financial capitals in determining sustainable profitability have been reduced remarkably compared to intellectual capitals. Due to the increasing importance of intellectual capitals in strategy superiority process, most companies seek to find methods of intellectual capital measurement and examine its relation with the company efficiency.

This paper has first introduced intellectual capital components and models and then a proper model for measuring intellectual capital of the companies to observe the real value of the organizations and incorporation of this capital into financial balance sheet. After calculating the value of intellectual capital of companies accepted in Tehran Stock Exchange by using Pulic model in a six-year

period, the significant relation between intellectual capital and efficiency of the companies was studied. Having analyzed the results, below findings was obtained.

1) There is a positive significant relation between intellectual capital dimensions and efficiency of the companies.

2) The relational capital has more effect on the return on asset compared to other dimensions of intellectual capital index.

The mentioned result is consistent with Zéghal, & Maaloul (2010), Bontis and colleagues (2010), Maheran Mohammad (2009), Sang Chan (2008), Kamat (2008), and Namazi & Ebrahimi (2010) research but is not consistent with Maditinos and colleagues research in 2011 on the Greece market.

The results of testing the first hypothesis underscore that intellectual capital is important in raising the performance and profitability of the institute. Although accepted accounting standards prevent from more identification of intellectual capital in the financial statements, investors have understood value of intellectual capital in their decisions and have regarded it necessary for better performance of the company. Today despite increase in the importance of intangible assets and particularly intellectual capital in the companies, accounting systems are not able to calculate the company performance clearly and properly.

With respect to these results, it is recommended to use this model for preparing, presenting, and analyzing complete and real financial statements in the accounting systems used by the companies.

Suggestions for Future Research

1) The researchers are recommended to measure intellectual capital by scorecard methods like dynamic evaluation and balanced evaluation of intellectual capital.

2) It is suggested to study the effect of intellectual capital on the financial performance by using market performance criteria like Tobin's Q, Stock returns and earnings growth.

3) It is suggested to study the relation between intellectual capital and non-financial performance like customer and employee satisfaction.

References

1. Abeysekera Indra, James Guthrie, (2005), An empirical investigation of annual reporting trends of intellectual capital in Sri Lanka, *Crit, Perspect, Accounting* 16, p151–163.
2. Anne Ho, Carol and Williams, S. Mitchell (2003) International comparative analysis of the association between board structure and the efficiency of value added by a firm from its physical capital and intellectual capital resources; *The International Journal of Accounting* 38, p465–491.
3. Bontis, N. N. C. Dragonetti, K. Jacobsen, G. Roos, (2002), the knowledge toolbox: a review of the tools available to measure and manage intangible resources, *Eur. Manag. J.* 17 (4) p.391–402.
4. Bose, R. (2004), "Knowledge management metrics, *Industrial Management and Data Systems*", Vol. 104, No. 6, pp. 457-468.
5. Brennan N. (2001), Reporting intellectual capital in annual reports: evidence from Ireland, *Account, Audit, Account J.* 14 (4). P, 423–436.
6. Brooking, A. (1996), "Intellectual Capital", Thomas Business Press, London.
7. Chang, W, Hsieh, J, (2011), "The dynamics of intellectual capital in organizational development" *African Journal of Business Management* Vol. 5(6), pp.2345-2355, 18 March 2011.
8. Chen, J, Zhu, Z. and Xie, H. Y. (2004), "Measuring intellectual capital: a new model and empirical Study". *Journal of Intellectual Capital*, Vol.5, No.1, p, 195-212.
9. Chen, M. C., Cheng, S. J. and Hwang, Y. (2005), "An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance", *Journal of Intellectual Capital*, Vol. 6 No. 2, pp. 159-76.
10. Edvinsson, L. (1997). Developing intellectual capital at Skandia, *Long Range Planning*, 30(3), p266–373.
11. García-Meca, Emma, and Isabel, Martínez (2007), the use of intellectual capital information in investment decisions an empirical study using analyst reports, *The International Journal of Accounting* 42, pp. 57–81.
12. Hemmati, Hasan, Amin Mehrabi, A study on the relation between intellectual capital and financial return in the companies accepted in Tehran Stock Exchange, *Accounting Research*, 3rd year, 2011, No. 10.
13. Hong Pew Tan, David Plowman and Phil Hancock, (2007) Intellectual capital and financial returns of companies, The Graduate School of Management, University of Western Australia, Crawley, Australia, The current issue and full text archive of this journal is, *Journal of Intellectual Capital*, Vol. 8 No. 1, 2007 pp. 76-95.
14. Maditinos, D, Chatzoudes, D, Tsairidis, Ch, Theriou, T, (2011)" The impact of intellectual capital on firms' market value and financial performance", *Journal of Intellectual Capital* Vol. 12 No. 1, 011pp. 132-151.
15. Namazi, Mohammad, Ebrahimi, Shahla, 2009, A study on the effect of intellectual capital on the current and future financial performance of the companies accepted in Tehran Stock Exchange, *Accounting and Auditing Research*, No. 4, pp. 1-22.
16. Nova, Kreditna Banka Maribor (2000). Annual Report, Author: Maribor, Slovakia.
17. Olsson, B (2001).Annual reporting practices: information about human resources in corporate annual reports in major Swedish companies, *J. HRCA* 6 (1) 39–52.
18. Pfeil Oliver P. (2003). The Valuation of Intellectual capital, Universität St. Gallen; Massachusetts Institute of Technology (MIT) - Sloan School of Management, March 10. Svieby, K, E (1997). The new organizational wealth. Managing and measuring knowledge based assets, berret Koehler, new York.
19. Pulic, A. (1998), Measuring the performance of intellectual potential in knowledge economy. Available online: [http:// www.measuring-ip.at/papers /Pulic/Vaictxt/vaictxt.html](http://www.measuring-ip.at/papers/Pulic/Vaictxt/vaictxt.html).
20. Rezaei, Farzin, 2010, Intellectual capital and performance based on intellectual capital and value, *Accounting and Auditing Research*, No. 7, pp. 52-71.

21. Rodov, I., and P. Leliaert. (2002). FIMIAM: Financial Method of Intangible Assets Measurement. *Journal of Intellectual Capital* 3 (3): 323–36.
22. Roos, J. G, Roos, G, Dragonetti, N. C., & Edvinsson, L (1997). *Intellectual capital: Navigating in the new business landscape*. Houndsmills, Basingtoke: Macmillan.
23. Rudez, Helena Nemeč and Mihalič, Tanja (2007) Intellectual capital in the hotel industry: A case study from Slovenia, *Hospitality Management* 26, pp.188–199.
24. Stewart, T. A. (1997), *Intellectual Capital: The Wealth of New Organisations*, Nicholas Brealey Publishing, London.
25. Subbarao A. V, D. Zeghal, (1997), Human resources information disclosure in annual reports: an international comparison, *J. HRCA* 2 (2) 53–73.
26. Sullivan, P. H. (2000), Value-driven intellectual capital: How to convert intangible corporate assets into market value. Toronto, Canada: Wiley.
27. Sveiby, K, (1997) *The New Organizational Wealth: Managing and Measuring Knowledge Based Assets*, Berrett Koehler, and San Francisco, CA.
28. Waterhouse, J. and Svendsen, A (1998), *Strategic Performance Monitoring and Management*, CICA, Toronto.
29. Young Chu, Ling Lin, Po Yu, Hsing Hwa Hsiung, Tzu Yar Liu, (2006) Intellectual capital: An empirical study of ITRI; Available online at: www.sciencedirect.com, *Technological Forecasting & Social Change* 73 (2006) 886–902.
30. Zéghal, Anis Maaloul, (2010) "Analysing value added as an indicator of intellectual capital and its consequences on company performance", *Journal of Intellectual Capital*, Vol. 11 Iss: 1, pp.39 – 60.

4/21/2019