The Impact of Intellectual capital on Financial Reporting Quality: An Evidence from Tehran Stock Exchange

Roya Darabi

Assistant Professor Department of Accounting,

South Tehran Branch, Islamic Azad University

Royadarabi110@yahoo.com

Tell : 00989123194494

Fax : 00982188772328

Sedigheh Kamran Rad & H. Heidaribali

Accounting Department, Payam Noor University,

Po Box, 19395-4697, Tehran, I. R. of Iran.

se_kamranrad@yahoo.com

aliheadari@yahoo.com

Acknowledgment: This research has been conducted as a research plan, "The Impact of Intellectual Capital on Financial Reporting Quality of the accepted Companies in Tehran Stock Exchange (TSE)", with the support of South Tehran Branch., Islamic Azad University.

Abstract

This study investigates the effect of different intellectual capital components on the financial reporting quality. In order to conduct this study, a sample including 184 accepted companies in Tehran Stock Exchange that work in deference industries between 2004 and 2009 have been selected. The methodology of the present study is co relational research and has an applied purpose. Co relational analysis and multiple linear regressions are the statistical methods are used in this study. The results from hypothesis testing demonstrated among the different components of intellectual capital, two components of capital employed efficiency and human capital efficiency have significant positive effect on the dependent variable of financial reporting quality and structural capital efficiency has a significant negative effect on the financial reporting quality. Among these three components of intellectual capital, the effect of human capital efficiency on the financial reporting quality is stronger with than the other two factors.

Key Words: *Intellectual capital, Intellectual capital components, Financial Reporting, Financial Reporting Quality, Quality of Accruals.*

1. Introduction

Twenty first century is the knowledge-centered economies century. In knowledge-centered economies, knowledge or intellectual capital, gains priority as one of the factors of wealth production, in comparison to other physical and tangible assets (Bontis, 1998). So, as the most important capital knowledge has replaced financial and physical capitals of today's global economy. With the growth of knowledge-centered economies, we are considerably witnessing the fact that in comparison with other tangible assets, intangible assets companies are significant factors in maintaining and accomplishing their stable competitive advantage (Tayles et al. 2002). Therefore, investors and creditors are interested in the intellectual capital and its components (human capital, capital employed and structural capital), thus, their revealing plays an important role in decision-makings of these two groups. By intellectual capital, we mean the development and application of sources of knowledge in the companies. Hence, in the third millennium A.D., in which intellectual capital rather than physical capital is the main foundation of the future activities and success of the company in the knowledge-centered economies (Williams, 2000), the increase of understanding and application of intellectual capital help firms to be more efficient, effective, profit-making and innovative (Chen, 2005).

On the other hand, one of the most significant resources, which the users use them to make decisions, is the group of reports called financial reports. Those accounting reports that are prepared and presented aiming to meet the informational needs of those users who are out of commercial units, are within the scope of financial reports.

Provision of financial reports with intellectual capital approach improves the quality of financial reports. The quality of financial reporting, the accuracy and validity of financial reports in expressing the data relevant to operations of companies as well as declaring all the assets of companies, including intangible assets and intellectual capital, inform the users. According to the first conceptual statement of the Financial Accounting Standard Board (FASB), financial reporting needs to "provide useful data to help potential investors make logical decisions". Therefore, disclosure of intellectual capital in financial statements leads to usefulness of users' decision-making and thus it will be really necessary for organizations to consider intellectual capital.

2. Theoretical Literature of the Research

Intellectual capital includes knowledge, information, intellectual asset and experience that can be used for creating wealth. Intellectual asset refers to collective intellectual capability or the key knowledge as a whole (Bontis et al. 2000).

Some researchers such as Bontis (1998), Roos et al. (1997), Brooking (1996), Stewart (1998) and others had written about intellectual capital and all had reiterated the importance of this intangible asset.

In recent decade, firms have devoted particular attention to measurement and disclosure of intellectual capital to present reports to the users. On the other hand, firms like to enhance the quality of the data that they present. The recent studies suggest that the increase in the financial reporting quality which can have important economic consequences (Healy and Palepo, 2001; Bushman and Smith, 2001; Lambert et al. 2006).

The financial reporting quality, accuracy and validity of financial reports in expressing the data regarding firms' operations, particularly expected cash flows aim are used to notify the investors. According to the

first conceptual statement of Financial Accounting Standard Board (FASB), financial reporting needs to "provide useful data to help potential investors make logical decisions".

According to the view suggesting that accruals improve the information value of profit by decreasing the effect of unstable infatuations during cash flows, this study uses the quality index of accruals as an index for measuring the quality of financial reporting. In addition, accruals are assessments of cash flows and future earnings. Based on the studies conducted such as the one by Dechow & Dichev (2002), one of the factors affecting the financial reporting quality is the quality of accruals and thus the better quality of accruals are the better the financial reporting quality will be.

2.1. Background of the Study

Since no study was found to investigate the effect of intellectual capital on financial reporting quality, a number of studies which have covered one aspect of the present study are presented below.

Verdi (2006) in an article titled "The Relationship between Financial Reporting Quality and Efficiency of Investment" tested the relationship between financial reporting quality and efficiency of investment between 1980 and 2003. He argued that increase in the financial reporting quality can bring about significant economic consequences such as investment efficiency. The results of his study demonstrate that the quality index of financial reporting, which is called the quality of accruals, is correlated with investment.

Chen et al. (2010) have compared the quality of accounting for the firms that are members of EU before and after accepting international standards of financial reporting in 2005. Factors of smoothing, income management, quality of accruals, and timely identification of loss were considered in order to assess accounting quality.

The researchers demonstrated that the highest degree of accounting quality has been related to the period after accepting international standards of financial reporting (Barth, 2007 and 2008).

Rudez & Mihalic (2007) in the study titled "Investigation of the Effect of the Components of Intellectual Capital on the Financial Performance of Hotel Industry" discovered that there is a significant relationship between the components of intellectual capital and financial performance in this industry and also indicating the great effect of capital employed efficiency on the performance in comparison to other components of intellectual capital.

Tai & Chen (2009) in the study titled "The New Model of Assessment of Linguistic-Oriented Intellectual Capital" presented a new model to assess the performance of intellectual capital by using a combination of Fuzzy and then Tupe approaches with a multi-variant decision making technique which was tested for high-tech firms in Taiwan. The study results demonstrated the significant relationship between components of intellectual capital and performance. Bramhandkar et al. (2007) investigated the effect of intellectual capital on the performance of 139 pharmaceutical firms and concluded that there is a significant relationship between components of intellectual capital and performance of firms.

Appuhami (2007) in the study titled "The Effect of Intellectual Capital on Performance (Investors' Profit)", investigated the relationship between components of intellectual capital, including human capital, structural capital, and capital employed on the performance of firms in the banking and insurance industry of the country and concluded that there was a positive significant relationship between each single component of intellectual capital and performance.

Shiu (2006) also investigated that there was a significant relationship between intellectual capital and performance of 80 high-tech firms. Juma & McGee (2006) in their study indicated that there was a positive significant relationship between intellectual capital and performance of high-tech firms in the US. Richieri et al. (2008) in their study investigated that there was a significant positive relationship between the components of firms' intellectual capital and their financial performance for the 1,000 biggest companies in Brazil for the period between 2000 and 2005.

3. Methodology

3.1. Statistical community and Sample

Statistical community of the present study included all the accepted companies in Tehran Stock Exchange between 2004 and 2009 in 6 industries as stated in table 1. Among the aforementioned industries, 184 firms that were working in the under study years were investigated, but no sampling was performed. The number of firms for each industry is stated in table 1. (Table 1)

3.2. Research Hypotheses

Based on the theoretical literature and the conducted studies, research hypotheses were developed as follows. The present study has one primary hypothesis and three secondary hypotheses.

Main hypothesis: "There is a significant relationship between the components of intellectual capital and the financial reporting quality".

Secondary hypotheses:

H_1: There is a significant relationship between human capital efficiency and the financial reporting quality.

H_2: There is a significant relationship between capital employed efficiency and the financial reporting quality.

H_3: There is a significant relationship between structural capital efficiency and the financial reporting quality.

3.3. Research Methodology

The research methodology is comparative-deductive in which theoretical foundations related to the study have been obtained through library studies and comparative methods. The related data was collected through observation of financial statements and the accompanying notes as found on www.rdis.com.

This study is an experimental investigation that is shown the effect of intellectual capital components on the financial reporting quality in the accepted companies in Tehran Stock Exchange in particular industries. Thus, this study has an applied purpose, based on the analysis of the data collected from Tehran Stock Exchange. On the other hand, it is a co relational study which is conducted using multiple linear regressions.

3.4. Models Used in the Study

In this study, models of Dechow and Dichev (2002) and Francis et al. (2005) were used in order to calculate the quality index of financial statement and Pulic's (2000) Value Added Intellectual Coefficient (VAIC) model was used in order to measure intellectual capital, and all these models will be further described.

3.4.1. Model of measuring the quality index of Financial Statements

Quality index of accruals consistent with Dechow and Dichev's (2002) model and Francis et al. (2005) model is used to measure the quality index of financial statements. The mentioned model has been presented in the form of the equation (1):

$$cAc_{i,t} = B_0 + B_1 cF_{i,t-1} + B_2 cF_{i,t} + B_3 cF_{i,t+1} + B_4 \Delta S_{i,t} + B_5 PPE_{i,t} + \varepsilon_{i,t} \quad (1)$$

Where cAc is current accruals, ΔS is Changes in the sales, CF is cash resulting from the operational activities of the firm in the years – it , t , + it , PPE is book value of property, tnalp atnempiuqe dn (Cost price of property, plant and equipment minus accumulated depreciation) and ε - CAC is error of assessment of accruals.

In this model, the operating cash flow in this year, last year and next year is used in order to assess the quality of accruals.

Since accruals are not associated with cash flows, the smaller size of corneal deviation of accruals of working capital is operating cash flows, the higher quality accruals will be regarded. PPE and ΔS have been defined as the control variables for this model.

3.4.2. The model of measuring intellectual capital index

Several methods are presented to measure intellectual capitals (Hunter, Webster and Wyatt, 2005). In this study, according to the following reasons, Value Added Intellectual Coefficient model (VAIC) (Pulic, 1998; Pulic, 2000) was used to measure intellectual capitals:

This model is based on two aspects of performance and value creation from tangible and intangible assets of a company (Tan et al., 2007). This model provides a standard and consistent measurement basis (Pulic, 1998; Sveiby, 2001).

In fact, there are limited approaches which can exactly measure intellectual capital. All data used in calculating value added intellectual coefficient are based on standard accounting and financial information which are usually listed in financial reports of companies. Therefore, purpose-based calculations can be considered and approved (Pulic, 1998; Tan et al. 2007).

Most intellectual capital methods are criticized because they measure subjectively and cause many problems during measurement (Sveiby, 2000; Williams, 2001).

Formulation of value added intellectual coefficient (VAIC) is as equation (2):

$$VAIC_i = HCE_i + CEE_i + SCE_i \quad (2)$$

Where VAIC is value added intellectual coefficient, HCE is human capital efficiency, CEE is capital employed efficiency, and SCE is structural capital efficiency.

The first step for calculating the components of IC includes HCE, CEE and SCE is calculation of value added for firm which is described as follows:

The calculation of value added (VA_i) for firm I is as equation (3):

$$VA_i = I_i + DP_i + W_i + D_i + T_i + R_i \quad (3)$$

Where I is total interest expenses, DP is depreciation expenses, W is payroll, D is dividends, T is corporate tax and R is profits retain for the year.

Based on Pulic's (1998) theories, one of the indices of human capital efficiency of a firm is the sum of expenses of payroll.

Thus, human capital efficiency (HCE) is obtained in equation (4):

$$HCE_i = \frac{VA_i}{HC_i} \quad (4)$$

Where HCE is human capital efficiency, VA_i is value added for firm and HC_i is investment in Human Capital during the 't' period or total salary and wage include all incentives.

CEE_i is obtained in equation (5):

$$CEE_i = \frac{VA_i}{CE_i} \quad (5)$$

Where CEE is capital employed efficiency and CE_i is book value of net assets.

SCE_i is obtained in equation (6):

$$SCE_i = \frac{SC_i}{VA_i} \quad (6)$$

Where SCE is structural capital efficiency and SC_i is structural capital.

In order to calculate SC_i in the above-mentioned formula, equation (7) is used:

$$SC_i = VA_i - HC_i \quad (7)$$

3.5. Research Variables

This study uses intellectual capital as an independent variable. The components of intellectual capital include human capital efficiency (HCE), Capital employed efficiency (CEE) and structural capital efficiency (SCE) and it is calculated on the basis of the VAIC model. The dependent variable of this study is the financial reporting quality and the quality index of accruals is used to measure the quality index of financial reporting.

4. Data Analysis

The data related to 184 firms, that have formed our statistical community, in the period between 2004 and 2009 has been analyzed in order to investigate the relationship between variables to test the hypotheses of the study. The collected data was calculated using the Excel software and was analyzed using SPSS 17 and E views 6.

The analysis of data in the descriptive statistics parts started with the calculation of main indexed such as mean, median, distribution indexes of standard deviation, skewness and Kurtosis. Then, test of normality of the independent variable, which was conducted using Kolmogorov-Smirnov Test, was investigated. In order to analyze the models, Pearson correlation co-efficient and in order to analyze the merged data, combined data analysis or Panel without fixed effects, with fixed effects and with random effects was used. In order to determine the appropriateness of the model with fixed effect model and random effect model, *Hasman* Test was used.

4.1. Descriptive Statistics

In the descriptive statistics part, analysis of the data has been done use the main indices of average, median, distribution factors, standard deviation, skewness and kurtosis. The skewness and kurtosis of FRQ, HCE, and SCE is to the right, skewness of CEE is to the left and skewness of LnFRQ is about 0 and is almost symmetrical. The kurtosis of all variables except LnFRQ is higher than normal distribution (table 2).

5. Research Tests

5.1. Normality Test

In order to investigate the normality of the dependent variable, the null hypothesis and the alternative hypotheses in the study are written as follows:

$$\begin{cases} H_0: & \text{For the dependent variable, the data show normal distribution.} \\ H_1: & \text{For the dependent variable, the data show un normal distribution.} \end{cases}$$

Table 3 depicts the normality state of the distribution of the values of the dependent variable.(Table 3)

The meaningful level for FRQ is lower than 5% in all years, thus FRQ does not have normal distribution. However, the level of meaningfulness for the logarithm variable of FRQ is higher than 0.05% in all years, thus logarithm of FRQ has normal distribution.

5.2. Process of Selecting the Best Model

In Panel analysis, one of the most fundamental issues is determining the intercept and determining if the fitting should be for the model without intercept (previous model) or for the model with intercept.

When the model has intercept, the next question is whether a model with fixed effects is more proper or a model with random effects. Therefore, the process for selecting the model is as follows:

1. The model without fixed effects (merged data) has been fitted.

2. The model with fixed effects has been fitted and this model has been analyzed in comparison to the model without effects, using *Chaw* Test.

3. The model with random effects has been fitted and it has been compared to the model without fixed effects using *Hasman* Test.

At the end, among the three models, the most proper will be selected and the significance of each of the dependent variables will be discussed (*See the Appendix*).

5.3. Testing the Primary Hypothesis

With regard to the abovementioned issues and the investigation, the model with random effects was selected as the most proper model for fitting and the results gained from use of this model as follows:

Main Hypotheses: “There is a significant relationship between the components of intellectual capital and the financial reporting quality”.

The regression model used for the primary hypothesis of the research can be stated as equation (8):

$$Ln\,(FRQ_{it}) = \beta_0 + \beta_1 CEE_{it} + \beta_2 HCE_{it} + \beta_3 SCE_{it} + \varepsilon_{it} \quad (8)$$

Where FRQ is dependent variable of financial reporting quality, CEE is latipac employed efficiency, HCE is latipac namuh efficiency and SCE is latipac larutcurts efficiency.

Null hypothesis and the alternative hypothesis for the meaningfulness of the model are as follows:

$$\begin{cases} H_0 : \beta_1 = \beta_2 = \beta_3 = 0 \\ H_1 : \beta_i \neq 0 \qquad i = 1,2,3 \end{cases}$$

$$\begin{cases} H_0 : & \text{There is no significant model.} \\ H_1 : & \text{There is a significant model.} \end{cases}$$

Table 4

Probability value of F is 0.000 and is lower than 0.05, thus the null hypothesis is rejected with 95% certainty and there is a significant model. Value of coefficient of determination is 0.079 which indicates that dependent variables have strong and significant effect on the dependent variable. Durbin-Watson test of this model shows that the observations are independent of one another since test statistic is 1.73 and is located between 1.5 – 2.5.

T value for CEE is 1.67 and it is significant at the level of 90%. T value for HCE is 3.54 and it is -4.19 for SCE, thus HCE and CSE are significant at the level of 95%. The results gained from the study indicate that the two independent variables of capital employed efficiency and human capital efficiency have positive effect on the dependent variable of financial reporting quality, while the effect of the independent variable of structural capital efficiency on the dependent variable is negative.

Therefore the final model of this study can be defined as equation (9):

$$Ln\,(FRQ_{it}) = 13/195 + 0/016\ CEE_{it} + 0/01\ HCE_{it} - 0/028\ SCE_{it} \quad (9)$$

5.4. Testing the Secondary hypotheses

First secondary hypothesis: H_1 "There is a significant relationship between capital employed efficiency and the financial reporting quality".

The regression model used for the first hypothesis is presented in the form of equation (10):

$$Ln\,(FRQ_{it}) = \beta_0 + \beta_1\ CEE_{it} \quad (10)$$

Second secondary hypothesis: H_2 "There is a significant relationship between human capital efficiency and the financial reporting quality".

The regression model used for the second hypothesis is presented in the form of equation (11):

$$Ln\,(FRQ_{it}) = \beta_0 + \beta_1\ HCE_{it} \quad (11)$$

Third secondary hypothesis: H_3 "There is a significant relationship between structural capital efficiency and the financial reporting quality".

The regression model used for the third hypothesis is presented in the form of equation (12):

$$Ln\,(FRQ_{it}) = \beta_0 + \beta_1\ SCE_{it} \quad (12)$$

Table 5 depicts the test of the secondary hypotheses of the study. (Table 5)

As it can be seen in table 5, the probability values of *Hasman* test for the models of first and second secondary hypothesis are 1 and for the third model is 0.638 since this value is not lower that 0.05 , as for the primary hypothesis, use of a model with random effects has priority over other models. Therefore, the models presented with random effects are as follows:

5.4.1. First Model (first secondary hypothesis)

The probability value of F for capital employed efficiency is 0.057 and since this value is not lower than 0.05, therefore the variable is not significant at the level of 95%, but it is significant with 90% certainty. Coefficient of determination of the model is 0.01 and it indicates that the independent variable of CEE, on its own, does not have a strong and significant effect on the dependent variable. Durbin-Watson of this model indicates that the observations are independent of one another as its value is 1.73 and is located between 1.5 -2.5.

The model of effectiveness of the independent variable of capital employed efficiency on the dependent variable is as stated in equation (13):

$$Ln\ (FRQ_{\ i}) = 13\ /\ 22\ +\ 0\ /\ 018\ \ CEE_{\ i} \qquad (13)$$

5.4.2. Second Model (second supplementary variable)

The probability value of F for human capital efficiency is 0.000 and since this value is lower than 0.05, therefore the variable is significant at the level of 95%. Coefficient of determination of the model is 0.08 and it indicates that the independent variable of HCE, on its own, does not have a strong and significant effect on the dependent variable of the study. Durbin-Watson test of this model is 1.72 and this indicates that the observations are independent of one another.

The model of effectiveness of the independent variable of human capital efficiency on the dependent variable is as stated in equation (14):

$$Ln\ (FRQ_{\ i}) = 13\ /19\ +\ 0\ /\ 01\ \ HCE_{\ i} \qquad (14)$$

5.4.3**.** Third Model (third Secondary hypothesis)

The probability value of F for structural capital is 0.002 and since this value is lower than 0.05, therefore the variable is significant at the level of 95%. Coefficient of determination of the model is 0.01 and it indicates that as for the other two independent variables, the independent variable of SCE, on its own, does not have a strong and significant effect on the dependent variable of the study. Durbin-Watson test of this model is 1.72 and this indicates that the observations are independent of one another.

The model of effectiveness of the independent variable of structural capital efficiency on the dependent variable is as stated in equation (15):

$$Ln\ (FRQ_{\ i}) = 13\ /\ 26\ -\ 0\ /\ 027\ \ \ SCE_{\ i} \qquad (15)$$

5.5. Investigating the co relational coefficient between variables:

In order to prove the linear relationship between two variables, Pearson co relation coefficient is used. The correlation of the variables, in the form of null hypothesis and the alternative hypothesis, is as follows:

$$\begin{cases} H_0 : \rho_{XY} = 0 \\ H_1 : \rho_{XY} \neq 0 \end{cases}$$

Pearson Correlation matrix for investigating the relationship between variables is calculated in table 6 and the main results are: (Table 6)

As it can be seen in table 6, the correlation between the dependent variable of financial reporting quality (LnFRQ) and the capital employed efficiency (CEE) is 0.085 and the correlation between LnFRQ and human capital efficiency (HCE) is 0.363, that both are significant. However, the correlation between dependent variable and structural capital efficiency (SCE) is 0.044 which is not significant.

6. Discussion and Conclusion

First this study collect data required to calculated of the different components of intellectual capital (IC), that is Capital employed efficiency (CEE), human capital efficiency (HCE) and structural capital efficiency (SCE) as the independent variable, as well as the financial reporting quality (FRQ) as the dependent variable for 184 accepted companies in Tehran Stock Exchange and work in chemical and pharmaceutical industries, other non-metal minerals, cement, lime, plaster, tiles and ceramics, rubber and plastic, food and drink productions, sugar and sugar cubes, oil, products of oil refinery and nuclear fuels for a 6-year-period between 2004 and 2009 from audited financial statements of the companies and their accompanying notes.

Second the variables used in the study were calculated using Excel software. Eventually the significant relationship between intellectual capital and financial reporting quality for the companies under study was analyzed using SPSS and E views software.

Results of the study are shown as follows:

- Among the different components of intellectual capital as the independent variable, the effect of capital employed efficiency (CEE) on the dependent variable of financial reporting quality (FRQ) is positive and significant.
- Among the different components of intellectual capital as the independent variable, the effect of human capital efficiency (HCE) on the dependent variable of financial reporting quality (FRQ) is positive and significant.
- Among the different components of intellectual capital as the independent variable, the effect of structural capital efficiency (SCE) on the dependent variable of financial reporting quality (FRQ) is negative and significant.
- Among the three components of intellectual capital, the effect of human capital efficiency (HCE) on the financial reporting quality (FRQ) is by far stronger than the other two factors.

Based on the results of the present study and according to the significant effect of the components of intellectual capital as one intangible asset on the financial reporting quality and since based on the first statement of concept of the financial accounting standard board (FASB), financial reporting needs to "provide useful data so to help potential investors in their logical decision-makings", disclosure of intellectual capital in financial statements will lead to the usefulness of decision-makings of the users and thus the significance of proper disclosure of intellectual capital in financial reports of firms is more evident in order to contribute to their accomplishing of goals.

References

Appuhami, B., and Ranjith, A. (2007). The Impact of Intellectual Capital on Investors' Capital Gains on Shares: An Empirical Investigation of Thai Banking, Finance & Insurance Sector. *International Management Review,* 3(2), 14-25.

Barth, M., and Landsam, W., and Lang, M. (2008). International Accounting Standards and Accounting Quality. *Journal of Accounting Research,* 46(3), 467-498.

Barth, M., & Landsman, W., Lang, M. and Williams, C. (2007). Accounting quality: International Accounting Standards and US GAAP. Working paper (Stanford University and University of North Carolina), (November).

Bontis, N. 1998. Intellectual Capital: An Exploratory Study That Develops Measures and Models. *Management Decision*, 36(2), 63-76.

Bontis, N., Chua, W. and Richardson, S. (2000). Intellectual Capital and the Nature of Business in Malaysia. *Journal of Intellectual Capital,* 1 (1), 85-100.

Brooking, A. (1996). Intellectual Capital: Core Asset for the Third Millennium Enterprise, International Thomson Business Press, New York.

Bramhandkar, A., and Erickson, S. and Applebee, I. (2007). Intellectual Capital and Organizational Performance: an Empirical Study of the Pharmaceutical Industry. *the Electronic Journal of Knowledge Management,* 5(4), 357-362.

Bushman, R., and Smith, A. J. (2001). Financial Accounting Information and Corporate Governance. *Journal of Accounting and Economics,* 32 (April), 237-333.

Chen, H., and Tang, Q.,& Jiang, Y.,& Lin, Z. (2010). the Role of International Financial Reporting Standards And Accounting Quality: Evidence from the European Union. *Journal of International Financial Management & Accounting,* 21(3), 220-278.

Chen, M-C. and 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,* 6(2), 159-176.

Chen, P. (2005). Intellectual Capital Performance of Commercial Banks in Malaysia. *Journal of Intellectual Capital,* 6(3), 385-396.

Dechow, P.M., and Dichev, I.D. (2002). the Quality of Accruals and Earning: The Role of Accrual Estimation Errors. *the Accounting Review,* 77(1), 35-59.

Francis , J., and LaFond, R.,& Olsson, P., and Schipper, K. (2005). 'the Market Pricing of Accruals Quality. *Journal of Accounting and Economics,* 39(2), 295-327.

Hunter, L., and Webster, E., and Wyatt, A. (2005). Measuring Intangible Capital: A review of current Practice. *Australian Accounting Review,* 15(36), 4-21.

Healy, P., and Palepu, K. (2001). Information Asymmetry, Corporate Disclosure, and the Capital Markets: A Review of the Empirical Disclosure Literature. *Journal of Accounting & Economics,* 31(1-3), 405–440.

Juma, N., and McGee, J. (2006). the Relationship between Intellectual Capital and New Venture Performance: An Empirical Investigation of the Moderating Role of the Environment. *International Journal of Innovation and Technology Management*, 3(4), 379-405.

Lambert, R., and Lenz, CH., and Verrecchia, R. E. (2006). Accounting Information Disclosure & the Cost of Capital. *Journal of Accounting Research,* 45(2), 385-420.

Pulic, A. (1998). Measuring the Performance of Intellectual Potential in the Knowledge Economy. Available online: http://www.measuring-ip.at/OPapers/Pulic/ Vaictxt /vaictxt.html.

Pulic, A. (2000). VAICTM- An Accounting Tool for IC Management. *International Journal of Technology Management*, 20(58), 702-714.

Richieri, F.L., and Cruz Basso, L. F., and Leiva Martin, D. De. (2008). Intellectual Capital and the Creation of Value in Brazilian Companies. Electronic copy available at: http:// ssrn.com. (January): 1-22.

Roos, J., and Roos , G.,& Dragonetti, N. C., and Edvinsson, L. (1997). intellectual Capital: Navigating the New Business Landscape. Macmillan, New York, NY.

Rudez, H. N., and Mihalic, T. (2007). Intellectual Capital in the Hotel Industry: A Case Study from Slovenia. *International Journal of Hospitality Management*, 26(1),188-199.

Shiu, H. (2006). Application of the VAIC Method to Measures of Corporate Performance: A Quintile Regression Approach. *The Journal of American Academy of Business,* 8(2), 156-160.

Stewart, T.A. (1998). Intellectual Capital: The New Wealth of Organizations. Performance Improvement, 37(7), 56–59.

Sveiby, K.E. (2000). Intellectual Capital and Knowledge Management'. Available online: http:// www. Sveiby.com.au/book contents.html, accessed: (May).

Sveiby, K.E. (2001). A Knowledge-Based Theory of the Firm to Guide in Strategy Formulation. *Journal of Intellectual Capital, 2*(4), 344-358.

Tai, W-S., and Chen, C-T. (2009). A New Evaluation Model for Intellectual Capital Based on Computing with Linguistic Variable. Expert Systems with Applications, 36(2): 3483-3488.

Tan, H.P., Plowman, D., and Hancock, P. (2007). Intellectual Capital and Financial Returns of Companies. *Journal of Intellectual Capital*, 8(1), 76-95.

Tayles, M., and Bramley, A.,& Adshead, N., and Farr, J. (2002). Dealing with the Management of Intellectual Capital : The Potential Role of Strategic Management Accounting. *Accounting, Auditing & Accountability Journal*, 15(2), 251-267.

Verdi, R.(2006). Financial Reporting Quality and Investment Efficiency. Working Paper (Massachusetts Institute of Technology (MIT), (September).

Williams, S. Mitchel. (2000). Is Company's Intellectual Capital Performance and Intellectual Capital Disclosure Practices Related? Evidence from Publicly Listed Companies from the FTSE 1000. Working Paper (Presented at McMasters Intellectual Capital Conference, Hamilton Ontario).

Williams, M. (2001). Is Intellectual Capital Performance and Disclosure Practice Related?. *Journal of Intellectual Capital,* 2(3), 192-203.

Table 1 List of under study industries

metI	yrtsudnI	Sub-industries	rebmuN
1	Non-metal minerals	Other non-metallic mineral products, glass, cement, lime, plaster, tiles and ceramic	61
2	chemical and pharmaceuticall	chemical and pharmaceutical products	56
3	Oil	Coke products, products from oil refinery and nuclear fuel	5
4	food products except sugar and sugar cubes	food products	32
5	sugar and sugar cubes	sugar and sugar cubes products	17
6	rubber and plastic	rubber and plastic products	13
latoT			184

Table 2 Descriptive statistics of the research variables

elbairaV	egarevA	naideM	dradnats noitaived	ssenwekS	sisotruk
CEE	1/174	1/140	1/491	-2/278	28/468
HCE	5/027	3/144	10/657	4/593	29/129
SCE	0/700	0/726	0/824	3/272	41/179
FRQ	645071	204011	1501400	5/891	42/116
Ln FRQ	13/247	13/010	0/792	1/028	1/273

Table 3 Kolmogorov -Smirnov Test

elbairaV	raeY	rebmuN	Z value of Kolmogorov- Smirnov Test	ytilibaborp seulav
FRQ	83	184	3/946	0/000
	84	184	4/130	0/000
	85	183	4/105	0/000
	86	184	4/468	0/000
	87	184	4/219	0/000
	88	184	3/726	0/000
LnFRQ	83	184	1/219	0/103
	84	183	1/049	0/221
	85	182	1/349	0/053
	86	183	1/331	0/058
	87	183	1/154	0/139
	88	184	1/136	0/151

Table 4 Analysis of the panel data with random effect

Variables	Estimated value	T value	Coefficient of determination	F value	Durbin-Watson Test	Probability of Hasman Test
Fixed value	13/195	57/535	0/079	0/000	1/730	1/000
CEE	0/016	1/671				
HCE	0/010	3/542				
SCE	-0/028	-4/187				

Table 5 Assessment of the co-efficient for the simple linear models

variables	assessed value	T value	coefficient of determination	F value	Durbin-Watson value	probability of Hasman Test
Fixed value	13/222	51/764	0/010	0/057	1/73	1/000
CEE	0/018	1/908				
Fixed value	13/194	56/567	0/080	0/000	1/72	1/000
HCE	0/010	3/565				
Fixed	13/263	50/190	0/010	0/002	1/72	0/638
SCE	-0/027	-3/190				

Table 6 Pearson correlation coefficient

	LnFRQ		
	CEE	HCE	SCE
Correlation coefficient	0/085**	0/363**	0/044
Level of significance	0/005	0/000	0/143
number	1096	1099	1099

Appendix

Indention in the paper selection process was the best model to achieve the best fit model for study models, different models were studied. According to the results, the model with random effects was chosen as a suitable model and its results were presented in the main text. Here other models are used in this research and their results are presented as follows:

1. The models used in this research

1.1 Model without fixed effects and random effects

In this section, panel analysis is used for the analysis and estimation of general model. Due to the nature of the data, this kind of method is used because in panel analysis, cross-sectional – time data are collected. In the way that data are collected, independence of observations cannot be maintained because there are several views of each company in different years that these observations are interdependent. In other words, in this analysis, the numbers of data include the number of firms multiplied by the number of years.

The estimated model is as equation (1):

$$Ln\,(FRQ_{it}) = \beta_0 + \beta_1 CEE_{it} + \beta_2 HCE_{it} + \beta_3 SCE_{it} + \varepsilon_{it} \quad (1)$$

The null hypothesis and the alternative hypotheses for significance of model are written as follows:

$$\begin{cases} H_0 : \beta_1 = \beta_2 = \beta_3 = 0 \\ H_1 : \beta_i \neq 0 \qquad i = 1,2,3 \end{cases} \qquad \begin{cases} H_0 : \text{There is no significant model} \\ H_1 : \text{There is significant model} \end{cases}$$

Panel analysis is given in table 1:

Table 1 Data integration analysis

Variables	Estimated value	T value	Coefficient of determination	F value	Durbin-Watson Test
Fixed value	13/052	419/412	0/138	0/000	1/720
CEE	0/037	2/977			
HCE	0/027	13/350			
SCE	0/023	1/391			

Probability value of F is 0.000 and is lower than 0.05, so the null hypothesis is rejected with 95% certainty and there is a significant model. Value of coefficient of determination is 0/138. T value for CEE is 2.98, for HCE is 13/35 and it is 1/39 for SCE. Thus, only two independent variables of human capital efficiency and capital employed efficiency are significant at the level of 95% and the effects of both variables are positive. Durbin-Watson test of this model shows that the observations are independent of one another since test statistic is 1/72 and is located between 1/5 – 2/5 .

1.2 Model with fixed effects

In this section, model with fixed effects is estimated that offered as equation (2):

$$Ln\,(FRQ_{it}) = \beta_0 + \beta_1 CEE_{it} + \beta_2 HCE_{it} + \beta_3 SCE_{it} + \varepsilon_{it} \quad (2)$$

Table 2 Analysis of data integration - fixed effects

Variables	Estimated value	T value	Coefficient of determination	F value	Durbin-Watson Test	Probability of Chaw Test
Fixed value	13/219	267/148	0/870	0/000	1/730	0/001
CEE	0/016	1/904				
HCE	0/006	2/880				
SCE	-0/030	-3/272				

Probability value of F is 0.000 and is lower than 0.05, so the null hypothesis is rejected with 95% certainty and there is a significant model. Value of coefficient of determination is 0/87. T value for CEE is 1/904 (significant at the level of 90%), for HCE is 2/88 and it is -3/272 for SCE and thus the two independent variables of human capital efficiency and latipac larutcurts efficiency are significant at the level of 95%. The effects of two independent variables of capital employed efficiency and human capital efficiency is positive and the effect of independent variable of latipac larutcurts efficiency is negative. Durbin-Watson test of this model shows that the observations are independent of one another since test statistic is 1/73 and is located between 1/5 – 2/5 .

The estimated model is as equation (3):

$$Ln\,(FRQ_{it}) = 13/21 + 0/016\;CEE_{it} + 0/006\;HCE_{it} - 0/03\;SCE_{it} \quad (3)$$

In next step to determine whether the model with fixed effects is more appropriate or the integrated model, Chaw test is used. In other words, Chaw test will test the following hypothesis:

H_0: The integrated model is appropriate

H_1: The Model with fixed effects is appropriate

Probability value to determine the appropriateness of model with fixed effects is 0/001. So, the null hypothesis is rejected. The rejection of the null hypothesis shows that model with fixed effects is more appropriate than integrated model and finally model with random effects compared with model with fixed effects that is presented in detail in the main paper.

2. Study of correlation between variables

Correlation between variables has been investigated in the main paper in general. In this section, Pearson correlation coefficient is stated in table 3 to examine the relationship between variables for each industry:

Table 3 - Pearson correlation coefficient to examine the relationship between variables for each industry

Table 3 - Pearson correlation for each industry

Industry		LnFRQ		
		CEE	HCE	SCE
Pearson correlation	Rubber and Plastic	-.008	.027	-.057
	Chemical	.065	.683**	.086
	Pharmaceuticall	-.009	.211**	.334**
	Cement	-.169*	.239**	.494**
	Food products	.110	.206**	-.096
	Sugar and Sugar cubes	.306**	.318**	-.062
	Tile	.224	.554**	.062
	Non-metal minerals	-.022	.199*	.053
	Oil	.435*	.598**	-.031
Sig. (2-tailed)	Rubber and Plastic	.945	.816	.622
	Chemical	.393	.000	.261
	Pharmaceuticall	.913	.007	.000
	Cement	.026	.002	.000
	Food products	.129	.004	.185
	Sugar and Sugar cubes	.002	.001	.544
	Tile	.088	.000	.637
	Non-metal minerals	.805	.022	.545
	Oil	.016	.000	.871
N	Rubber and Plastic	76	77	77
	Chemical	174	174	174
	Pharmaceuticall	162	162	162
	Cement	174	174	174
	Food products	191	191	191
	Sugar and Sugar cubes	98	99	99
	Tile	59	60	60
	Non-metal minerals	132	132	132
	Oil	30	30	30

As observed in table 3, capital employed efficiency in Cement industry has significant negative relationship with LnFRQ (-0/17) in Sugar industry has significant positive relationship (0/31) and also in Oil industry has significant positive relationship (0/435) with LnFRQ. In other industries the relationship between these two variables is meaningless.

Human capital efficiency variable in all industries has significant positive relationship with LnFRQ. Just in Rubber & Plastic industry, this relationship is meaningless. The highest correlation in Chemical industry is 0/68, in Oil industry is 0/60 and in Tile industry is 0/55.

Structural capital efficiency in Cement and Pharmaceuticall industry has significant positive relationship with LnFRQ respectively 0/33 and 0/49. In other industries the relationship between these two variables is meaningless.

3. The remaining distribution diagrams in contrast with the estimated values to identify the consistency of the variance

The remaining distribution diagrams in contrast with the estimated values is contained important information including no regular pattern in distribution of these points can indicate the consistency of variance which is one of the assumptions of regression modeling. In the following diagrams, this point is considered and approximately distribution is random in all diagrams.