The relationship between intellectual capital and earnings predictability in the companies listed in Tehran stock exchange

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Abstract

In this paper the researchers examined the relationship between intellectual capital and the earnings predictability of companies listed in Tehran Stock Exchange. The study was carried out in a period of time, between the years 2007 to 2011 which involved 101 companies listed in the Stock Exchange of Tehran. Research hypotheses, consisted of two main hypotheses, the first of which also included three sub- hypotheses. Research variables included components of intellectual capital as an independent variable and earnings predictability as the dependent variable. Firm size is also considered as a moderator variable. In order to test the research hypotheses, the researchers collected the necessary information from various sources, the Pulic model was used for estimating the value of intellectual capital and the Francis model was used to assess the earnings predictability. To summarize the data, the variables were fed into the Excel and then were processed by means of Eviews7 software for testing the hypotheses. The method used in this study was panel data with fixed effects. The results of testing the research hypotheses indicated that there is a significant relationship between intellectual capital and earnings predictability companies listed in the Stock Exchange of Tehran. It also shows that firm size as a moderator variable, affects the relationship between intellectual capital and earnings predictability in this corporation.

Keywords: intellectual capital, stability of earnings, human capital, structural capital, physical capital

Introduction

The rapid changes in today's world have caused organizations to face with different challenges in competition. Today, the industrial economy with the feature of optimum combination of factors of production and economic wealth, i.e. the tangible and physical assets, has given its place to a knowledge-based economy, where knowledge, as the key factor, plays an important role in creating value and wealth. (Chen *et al.*, 2004). In a knowledge-based economy, the success of an organization to gain competitive advantage and greater market share depends on the correct management of knowledge elements and intellectual capital along with other physical or tangible assets, and organizations are successful in the competition arena, that have an efficient manpower, appropriate structure and processes, and satisfied customers. For this purpose, the administrators of organizations focused on issues such as knowledge and creativity and knowledge-oriented organizations have gained more important than action-oriented organizations, because it is believed that human knowledge, by adding an element to the production process, fundamentally changes rules of the game. Lester Thurow (1996) in the book ‹The Future of Capitalism «writes: Era of intellectual power causes a fundamental shift in classical capitalism, because today the strategic asset is indeed «the thought of staff». So it can be generally said that, Organizations are successful that with the help of management tools and technologies, make use of opportunities to win. Intellectual capital is one of these tools. Thus, in the present circumstances, intellectual capital is considered as one of the most important factors for growth and excellence of organizations and, at a broader level, communities.

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Subject of knowledge management and intellectual capital, gradually open their place in organizations. The undeniable role that nowadays knowledge is playing in modern economics, business and management processes makes clear the growing importance of intellectual capital in the organizations more than before. The inability of traditional accounting and financial systems in the measurement of intellectual capital of firms and subsequently ignoring the importance of knowledge in the processes are the most important problems of traditional accounting systems. Most of these systems are unaware of the growing role and importance of knowledge in the organizations of the modern era, And are incapable of measuring the true value of intangible assets in their calculations. For this reason, the desire to measure and reflect the true value of intangible assets and knowledge in the financial statements of companies has increased more than past. Because in today›s knowledge-based economy, the return of the employed intellectual capital has become much more important than the return of the employed financial capital, the role and importance of physical capital in achieving sustained profitability has considerably decreased in comparison with the intellectual capital. On the one hand, because of the increased importance of accounting earnings forecast as a factor influencing the economic decisions of users and , on the other hand, because of the importance of intellectual capital, as an important part of the company›s total capital, in achieving sustainable and long-term profitability and the need to identify the impact of intellectual capital on the company›s future earnings forecast, the main issue of this study is to examine the role and importance of intellectual capital components in determining the predictive capability of corporate profits.

Theoretical framework

A review of existing literature shows that the organization has three types of capital: financial, physical and intellectual. Financial capital refers to net value of assets or equity. Physical capital also means productive capacity or service organization. But, intellectual capital, derived from the realm of science and knowledge. Although the economist named John Kenneth was the first person in 1969 who used the term intellectual capital (Bontis, 1998), in the 1990s this phrase was used by Stewart in Fortune magazine. Stewart, in a very broad definition, defines the intellectual capital as a set of knowledge,

information, intellectual property and experience of each individual in an organization, which are used to build wealth and competitive advantage (Stewart, 1997). In the operationalization of the concept of intellectual capital, Nahapiet and Goshal (1998) have identified human capital and structural capital of the organizations, which through knowledge, skills and capabilities provide the potential for the development of organizations. Overview of literature shows that intellectual capital exists, and it increases success and competitive advantage of the organizations and helps their financial success (Roslender&Fincham, 2001). Most of the primary literature in the field of intellectual capital, which can be named as the first group, is concerned to increase awareness and encourage managers to value intellectual capital for companies (Petty & Guthrie, 2000). Also in this literature, there has been much focus on issues related to measurement with emphasis on facilitation of foreign reporting (Bontis, 2001), which is considered as second group research. There is little agreement in the field of accounting and reporting intellectual capital (Petty & Guthrie, 2000). One reason is that it has not paid much attention to the development of a coherent theory (Berends *et al.*, 2001). In the present time, attempts have been made by researchers to develop coherent theories, particularly in the areas of accounting, (Andriessen, 2001). Emphasis on theory as a basis for developing operationalization is the third group of research in the field of intellectual capital.

Definition of intellectual capital

Despite the existence of a relative general consensus on the components of intellectual capital, no accepted and common definition of it is presented in the world (Pew tan *et al*, 2007). The existence of numerous definitions of intellectual capital and the lack of a comprehensive definition, and thus lack of reporting a definition, has led the researchers defines this term from their point of view and in accordance with empirical and experimental models (Abeysekera, 2008). However, some definitions are:

• Stewart defines intellectual capital in terms of organizational resources, related wealth creation through investments in knowledge, information, intellectual property and experience (Stewart, 1997).

• Bontis believes that intellectual capital is a volatile and elusive source, but when discovered and used, it allows the organization to use a new source in the competitive environment. In his studies, Bon-

tis concluded that intellectual capital is the search and following the effective use of knowledge, in comparison with data/ information (Bontis, 2004).

• Ross *et al*, argue that intellectual capital is the sum of knowledge of members of the organization, and application of their knowledge (Ross *et al*, 1997).

• Marr believes that intellectual capital is defined as a group of knowledge assets and is considered as the features of the organization and significantly, by increasing the level of value added for the key stakeholders of the organization, leads to improved competitiveness (Marr, 2005).

In recent years, what is observed regarding intellectual capital is an attempt to provide more comprehensive definitions of intellectual capital and more complete structures. In general, considering the arguments and concepts related to intellectual capital, we realize that in most classifications, intellectual capital is divided into three main categories including human capital, structural capital and relational capital. Studies show the inner relationship and symbiosis between these three capitals. For this reason, in most research conducted on intellectual capital, these three components are considered in the framework. Unfortunately, it must be acknowledged that an individual and exclusive look at these categorizations and the consideration of only these three components will result in an incomplete measure of intellectual capital in the organization (Brooking, 1997). For this reason, beside these components, the other components which can lead to achieving a more complete estimate of the organization's intellectual capital should be pointed out.

Measurement of Intellectual Capital

Success in a complex world with increasing competition is not possible only with having knowledge assets. Rather, the identification of these assets is necessary, though not sufficient. The great importance of intellectual capital has forced companies and their investors to obtain information about the quantity and quality of knowledge assets of the company. For awareness of current state of knowledge assets in companies, we should measure them. Although this task is difficult because of nature of these intangible assets, it helps us to measure their current amount, and compare this amount with the desired amount, and take the necessary steps to get closer to the ideal point. So it can be concluded that the identification of intangible assets of companies,

is necessary. Researchers, in recent years, have presented numerous models to measure intellectual capital, some of which in monitory form and some others in non-monetary form measure intellectual capital. In general, studies have suggested two main reasons for measurement:

• This allows managers to provide valuable information regarding management controls of intangible strategic resources for the survival and continuation of company activities. Through this, companies will be able to determine more rational policies, and make more strategic choices based on the obtained information.

• It provides valuable information about the current status of intellectual capital, and the possibility of its development in the company, so that the market can obtain a more realistic assessment of the company resources, which was not previously available through the financial - Economic statements. There are various methods for measuring intellectual capital. Some of these methods are methods that have been designed exclusively for use in the given companies and are not general and common ones, but they still exist, and are the basis for creating new methods. Williams (2002) argues, the different methods can be placed into four main groups:

1. Direct Intellectual Capital Methods (DIC): Include the estimates of monetary value of intangible assets or intellectual capital through identifying their constituent elements. According to this method, value of the elements is calculated once individually and the total value of their classes shows the value of the respective assets.

2. Market Capitalization Methods (MCM): Calculating the difference between the market value of a company (based on market prices) and shareholders' equity adjusted for inflation or cost of replacement, Which is considered as the value of intellectual capital or intangible assets.

3. Return-on-assets Methods (ROA): Calculation of average of earnings before tax for several years and dividing it by average tangible assets of the company in those years. The result of this calculation is called the rate of return on assets, which is then compared with the industry average. The difference between these two figures is multiplied by average tangible assets so that the average of annual earnings from intangible assets can be obtained. Then, this average earned income, is divided by the weighted average cost of capital or interest rate so that an estimate of the value of intangible assets or intellectual capital can be obtain.

4. Scorecard Methods(SC): These methods are based on the identification of intangible assets or intellectual capital elements, and indicators and scales achieved based on the scorecard and their report in the form of graph. These methods are similar to direct intellectual capital methods, and their only difference is that in the scorecard methods there is no estimate of the monetary value of intangible assets or intellectual capital.

Methodology

This study was an experimental study to examine the correlation relationship, and only the relationship between the independent and dependent variables have been examined. The combined data (combined data time series and cross section data) have been used. Because in the present study, actual and historical data were extracted from all relevant sites, such as the Stock Exchange, the New Deal and other software, electronic archives, papers, books, and related documentation has been used, it can be of research type of classification based on previous data.

The ultimate goal of the current study is to find the correlation between the two elements of intellectual capital and its components which are stability of earnings. Also, the effect of firm size as a modulator factor on the relationship between these two variables has been examined.

Besides, the effect of firm size as a modulator factor on the relationship between these two variables has been examined. Also, the effect of firm size as a modulator factor on the relationship between these two variables was examined.

The study was carried out between the years 2007 and 2011.Samples of this research were from all firms listed in Tehran Stock Exchange for the time period mentioned above which had the following eligible:

1. Given the time period, the company is listed on the Stock Exchange prior to 2007, and until the end of 2011, it has been removed from the list of companies.

2. The company shares have been traded during the financial year, and will not substantially interrupt the transaction.

3. In the study period, the company should not be operating loss in its fiscal year-end audited income statement.

4. In order to increase comparability, the financial year of the Company is based on the calendar year.

5. Due to the lack of clear boundaries between operating and financing activities, financial companies (investment companies, financial intermediation, holding companies, and leasing), and also because they have different reporting structures, these companies are excluded from the sample.

Thus, considering the above-mentioned limitations, 101 companies were identified as eligible, all of which have been studied and therefore no sampling was done.

To summarize the data, initial variables using the collected data were calculated in Excel, and the hypotheses were tested using Eviews7 software. The method used in this study was that of panel data with fixed effects.

The Hypotheses of the Study

According to the theoretical foundations of study, and also in order to achieve the research objectives, the following research hypotheses have been formed:

1) Between intellectual capital and earnings predictability, as an indicator of the quality of earnings, there is a significant relationship.

1-1) between human capital and earnings predictability, there is a significant relationship.

1-2) between structural capital and earnings predictability, there is significant relationship.

1-3) between physical capital and earnings predictability, there is significant relationship

2) Firm size affects the average intellectual capital, and earnings predictability Corporation.

Variables of the study

The three variables used in this study included independent variables, dependent variables and moderator variables.

In this study, variable of intellectual capital along with its components, including structural capital, human capital and physical capital were considered as independent variables, and were also calculated based on Pulic model (2000), with the following steps:

First step: Determining the value added

$$VA = P_i + I_i + C_i + D_i + DIV_i + T_i$$

VA: Value-added Enterprises
P_i: Operating Profits
C_i: employee costs
DIV_i: dividends
I_i: interest expense

D_i: depreciation

T_i: tax

Second step: Determining the physical capital efficiency

Value added to (VA) physical capital used ratio, is called the coefficient of physical capital efficiency, the index is calculated by the following equation.

$$CEE = \frac{VA}{CE}$$

CEE: Physical Capital Efficiency

CE: Capital used is equal to the book value of the company's total assets minus intangible assets.

Third step: Determining the human capital efficiency

Human capital efficiency indicates that for every \$ spent on employee costs, how much value add is created.

$$HCE = \frac{VA}{HC}$$

HCE: Human Capital efficiency

HC: Human capital, is the total employee costs

Fourth step: Determining the structural capital efficiency

This step shows the share of structural capital in the value creation. Structural Capital includes all reservoirs nonhuman knowledge in an organization, including databases, organizational charts, procedures and guidelines. It also gives more value to the organization compared with the physical assets.

$$SCE = \frac{SC}{VA}$$

SCE: Structural Capital Efficiency

SC: Structural Capital

Fifth step: Determining the value added intellectual coefficient

This index represents the efficiency of creating value, or intellectual abilities of the company. When this coefficient is greater, the management has used more potential of the company.

$$VAIC = HCE + SCE + CEE$$

VAIC: value added intellectual coefficient

HCE: Human Capital efficiency

SCE: Structural Capital Efficiency

CEE: Physical Capital Efficiency

Pulic Model: Because of its advantages in comparison with other models, this model as the model used in this study intended to measure intellectual capital. Some of the most important of its advantages are as follows:

Provides a basis for measuring, with fixed standard.

All the calculated data in the value added intellectual coefficient have been extracted from the audited financial statement of the company, so the calculations can be verified.

This model is based on two aspects of performance evaluation and value creation resulting from tangible and intangible assets of in the company.

Also, in this study, earnings predictability, which is one indicator of the quality of earnings, is considered as the dependent variable. To evaluate the earnings predictability, we must first calculate stability of earnings using the Sloan model (2005) as follows:

$$E_{i,t} = \beta_{o,i} + \beta_{1,i} E_{i,t-1} + e_t$$

$E_{i,t}$: net profit of company i in year t

$E_{i,t-1}$: Net profit of company i in year t-1

β_1: stability of earnings

In above model, the coefficient of explanatory variable $E_{i,t-1}$, namely B_1, which is a regression model, indicates the stability of earnings. Then, Francis *et al* model is used to assess earnings predictability, as follows:

$$\mathrm{Predictability} = \sqrt{\sigma^2}(V_j)$$

In this model, after the estimation of Sloan model, square root of the error is calculated, and higher (lower) values obtained imply lower (higher) predictability of earnings.

Furthermore, one of the Company's internal factors, which affect the financial structure and profitability of companies, is the firm size. In this study, using the logarithm of the book value of assets, the effect of firm size was examined as one moderator variable on the relationship between variables.

$$Log(ASSETS)$$

ASSETS: book value of assets

Finally, the multiple regression model is used to determine the relationship between intellectual capital efficiency ratio, and each of its components, with earnings predictability.

$$Y = \beta_{\circ} + \beta_1 HCE + \beta_2 SCE + \beta_3 CEE + \beta_4 FSIZE + e_{it}$$

Hypothesis Testing

Before testing the research hypotheses, descriptive statistics of the variables were calculated and presented in Table 1. This table contains descriptive statistics for the independent variables, moderator variables and the dependent variable.

Table 1. Descriptive statistics for variables of the study

Type of variable	variable	Number of observations	Mean	Median	Standard deviation(SD)	Coefficient of skewness	Coefficient of kurtosis
Dependent	earnings predictability	500	0.307	0.258	0.23	1.786	3.919
Independent	intellectual capital	500	42.794	25.93	67.931	5.539	37.247
	Human Capital	500	32.736	24.702	67.806	5.544	37.296
	Physical Capital	500	0.301	0.268	0.166	1.424	4.092
	Structural Capital	500	0.938	0.96	0.08	-2.171	26.74
Moderator	Firm Size	500	5.766	5.694	0.614	1.094	1.814

The First Main Hypothesis

The first main hypothesis: There is a significant relationship between intellectual capital and earnings predictability as an indicator of the quality of earnings.

To test the main hypothesis, the following model is estimated

$$Y = \beta_0 + \beta_1 VAIC + \beta_2 SIZE + e_{it}$$

The following results were obtained from test of the first main hypothesis:

Table 2. Results of regression analysis of the first main hypothesis

variable	Coefficient of correlation	SD	T-test	p-value
C	4.091247	0.731767	5.590912	0.0000
VAIC	0.001117	0.000210	5.332796	0.0000
SIZE	-0.368283	0.127130	-2.89689	0.0040
AR(1)	-0.192106	0.046911	-4.09514	0.0001
Durbin − Watson test	2.205		Adj-R-squared	0.848392
Prob(F-statistic)			0.000	

The prob (F-statistic) in Table (2) indicates significance of fitted regression model to the 95% of confidence level. It has been confirmed that there is a linear relationship between the independent and dependent variables.

Adjusted R2 is equal to 0.84, which indicates that approximately 84% changes in the dependent variable are because of the independent and moderator variables. To test the independence of the error components in fitted model Durbin− Watson statistics was used. If the result is between 1.5 and 2.5, it can be confirmed that there is no significant correlation between the error components in the model and their behavior is independent from each other. According to Durbin − Watson statistics, in estimation of the basic model, it was found that the above model has autocorrelation, and to overcome this, "AR" was used. As it can be seen in the Table 2, the obtained statistics is equal to 2.205; therefore in this model the independence of error components in fitted regression model may be resulted.

Finally, as shown in Table 2, the intellectual capital variable coefficient, at the level of 5% of error, is significant, so there is a significant relationship between these variables and the dependent variable and thus according to the projections, the coefficient is considered to be positive. The result shows that, there is a significant relationship between intellectual capital and earnings predictability as an indicator of earnings quality and, therefore, the first main hypothesis will be accepted.

According to the results listed in Table 3, the assumptions of the first sub-hypothesis were also tested.

According to the results of testing the regression model, as described above, it can be stated that the P-Value of F- statistic, which indicates the significance of the regression, is equal to 0.000, and indicates that the model is significance at the 95% confidential level. Adjusted R^2 is also equal to 0.85 which indicates that approximately 85% of changes of the dependent variable can be explained by the independent variables in the model, which represents a good explanatory power of the regression. According to the table, the results obtained of the sub-hypotheses are as follows:

Table 3. Results of theory analysis of sub- hypothesis

variable	Coefficient of correlation	SD	T-test	p-value
C	4.458511	0.751604	5.931997	0.0000
HCE	0.001251	0.000428	2.924125	0.0037
CEE	0.044590	0.075311	0.592070	0.5541
SCE	-0.403504	0.143050	-2.820716	0.0050
SIZE	-0.39268	0.128857	-2.865716	0.0044
AR(1)	-0.199650	0.041849	-4.770725	0.0000
Durbin − Watson test	2.226	Adj-R-squared		0.852685
Prob(F-statistic)		0.000		

The first sub-hypothesis: As it is obvious, the correlation coefficient of independent variable of human capital is equal to 0.00125, and significant at 0.0037. Thus, according to the t-statistic and p-value of this variable, the results indicate the significance of this coefficient, at the error level of 5 percent. This result indicates that there is a positive and significant relationship between human capital efficiency and earnings predictability in the listed companies on the Stock Exchange, and consequently, the first sub-hypothesis is verified.

The second sub-hypothesis: Since the correlation coefficient of independent variable of structural capital is -0.4035, and a significant number is 0.005, therefore, the t-statistic and p-value of this variable the results indicate the significance of this coefficient, at the error level of 5 percent. This result indicates that there is a positive and significant relationship between structural capital efficiency and earnings predictability in the listed companies on the Stock Exchange, and consequently, the second sub-hypothesis is verified.

The third sub-hypothesis: Since the correlation coefficient of independent variable of physical capital is 0.04459, and a significant number is equal to 0.5541, therefore, considering t-statistic and p-value of this variable, the results indicate that coefficient is not significant at 5% level of error. This result indicates that there is no significant relationship between physical capital efficiency coefficient and earnings predictability in the listed companies on the Stock Exchange, and consequently, the third sub-hypothesis may be rejected.

The second main hypotheses

The second main hypotheses: Firm size affects the average intellectual capital, and earnings predictability of a corporation. To test the second hypothesis, the following model will be used:

$$Y = \beta_0 + \beta_1 VAIC + \beta_2 SIZE + \beta_3 VAIC \times SIZE + e_{it}$$

In this study, firm size variable was considered as a moderator variable, and the impact of firm size on the components of intellectual capital and the earnings predictability was assessed.

Table 4. Results of analysis of The second main hypotheses

variable	Coefficient of correlation	SD	T-test	p-value
C	3.379367	1.036007	3.261915	0.0012
VAIC	0.008644	0.002394	3.609843	0.0003
SIZE	-0.247738	0.179622	-1.379214	0.1686
VAIC× SIZE	-0.001170	0.000394	-2.972481	0.0031
AR(1)	-0.181998	0.058029	-3.136331	0.0018
Durbin − Watson test	2.222	Adj-R-squared		0.621323
Prob(F-statistic)		0.000		

According to the results of testing the regression model, as shown in the Table 4, it can be seen that the P-value of F- statistic, which indicates the significance of the regression, is equal to 0.000, and this indicates that the model is significance at 95% of confidence level. Adjusted R^2 is also 0.62, and this indicates that approximately 62% of changes in the dependent variable can be explained by the independent variables in the model , which represents a relatively good explanatory power of the regression.

As it is obvious, the correlation coefficient of independent variable of VAIC× SIZE is -0.00117, and the significant number is 0.0031. Thus, according to the t-statistic and p-Value of this variable, the results indicate the significance of this coefficient, at the error level of 5 percent. These results indicate that firm size affects the relationship between intellectual capital and earnings predictability in the listed companies in Tehran Stock Exchange. The results confirmed the two main hypotheses of the study.

Conclusions and Recommendations

Because of today's competitive arena, the ability to achieve a more accurate prediction of profit is considered as an important advantage in business organizations. On the other hand, since the importance and recognition of intellectual capital in organizations is increasingly growing, the present study was conducted to examine the relationship between intellectual capital and earnings predictability as an indicator of the quality of earnings in the listed companies in the Tehran Stock Exchange. Therefore, the value of added intellectual capital coefficient model was used as an indicator of intellectual capital in a five - year period. Then, stability of earnings was also assessed through the Sloan model. Finally through the model of Francis et al, earnings predictability was evaluated. The research includes two main hypotheses and three sub-hypotheses. The results of testing these hypotheses indicate that there is a significant relationship between intellectual capital and earnings predictability in the studied enterprises and the firm size also has a moderator effect on the relationship between the two. Thus the importance of intellectual capital in predicting profit of corporations becomes clearer.

Finally, it may be suggested that with the numerous indicators of earnings quality, future researchers can examine the relationship between intellectual capital and these indicators. Also, since in the present research the focus was mainly on the relationship between intellectual capital and corporate performance, and little was investigated about the methods of measuring intellectual capital, it is recommended to the future researchers to take this important issue into their close considerations.

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