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The Impact of Intellectual Capital On Profitability, Productivity And Market Valuation: Evidence From Iranian High Knowledge-Based Industries

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ABSTRACT

This study investigates the impact of intellectual capital (IC) on firms' performance indices, namely, profitability, productivity, and market valuation in the listed companies at Tehran Stock Exchange. Data were obtained from a sample of 69 firms in high knowledge-base industries from 2001 to 2008. In order to measure the intellectual capital index, we have used Value Added Intellectual Coefficient (VAICTM). Multiple linear regression was applied to analyze and test research hypotheses. The findings suggest that the performance of a firm's intellectual capital can explain its profitability and productivity, but not market valuation. The findings of the study reveal that there are positive relationships between firms' size, leverage and physical capital intensity, and their profitability and productivity. However, the results also show that, except for firms' size, there aren't significant associations of these factors with market valuation. The findings propose that managers can raise firm's performance by designing a plan to enhance intellectual capital, such as the plan of improving human capital performance by training and educating or employing new intellectual capital.

KEYWORDS: Intellectual capital, value added intellectual coefficient (VAICTM), profitability, productivity and market valuation.

1. INTRODUCTION

Knowledge-based economy appeared in the 1980s due to the investment, creation and use of high-technologies and highly-skilled labor on the one hand, and globalization on the other hand. Competitiveness as a result of knowledge-based economy began with spending resources (time and money) in scientific researches and creative works, attending to market place demands and protection of intellectual property (IP) (Lehman, 1996). With regard to the changes in business environment, a new challenge appeared for traditional accounting concepts. The challenge was the considerable difference between firm's book value and market value. Thus, the challenge caused researchers and theorists (e.g., Edvinsson, 1997; Bontis, 1998; Sveiby, 2000) to consider the IC as a main element of value creation.

Research about IC is necessary to understand the creative factors of firm value, and measure the hidden and component elements of firm value creation. Many researchers in the developed economies (e.g., Stewart, 1997; Riahi Belkaoui, 2003; Wang, 2008) or East Asian economies (e.g., Bonits et al. 2000; Chang-ji and Chuan-rui, 2009; Shin et al. 2010) examine the impact of measuring, managing, reporting and applying IC and intangible assets on firm performance and competitive advantages. However, few researchers have tested IC impact on emerging economies (Kamath, 2008). On the other hand, institutional and organizational characteristics, market aspects, political and economic environment in developing countries are, in many respects, different from the developed countries (Hofstede and Hofstede, 2004). Therefore, there is a need to study measuring, valuing, reporting and applying IC in developing countries, such as Iran. The study attempts to investigate the relationship between IC and firms' performance indicators over an 8 years period; moreover, it tries to present a model for estimating these indicators, based on value added intellectual coefficient (VAIC).

Several contributions are expected from the present study. First, the results of this research provide additional evidence to the literature about the relationship between IC and firms' performance in emerging markets. Second, this research is done in a country that has had the first rank among 61 developing countries in 2007 for "brain drain" according to the report of International Monetary Funds (IMF, 2007). Thus, the study can show to managers and politicians on an empirical-base, that IC indicator can have an effect on firm performance. Finally, the positive results of this study about the

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impact of IC on firm performance will, perhaps, encourage regulators and managers in Iran to pay attention to their IC, and to protect their IP.

2. LITERATURE REVIEW

Intellectual capital was first discussed by the economist John Kenneth Galbraith in 1969. Along the evolution path of the IC concept, theorists and researchers have attempted to present a general definition of IC from different views. But at present, there isn't consensus about the definition, and classification of IC components (Luthy, 1998). Stewart (1997, p. 67) defines IC as "packaged useful knowledge." He represents that IC includes an organization's processes, technologies, patents, employees' skills, and information about customers, suppliers, and stakeholders. One of the most accepted models for classifying IC which has been identified by a large number of scholars and researchers (e.g., Edvinsson, 1997; Bontis, 1998), divides IC into three basic components: human capital, structural capital and customer capital (relational capital). Human capital includes the knowledge, skills, experiences, abilities and talents of firms' employees and managers. Human capital is a basic and important element that contributes to firm value creation and financial growth. Structural capital includes organizational culture, intellectual procedure, process, philosophy, systems, databases and contracts. Customer capital (relational capital) is the ability of a company to protect its relationship with customers and other stakeholders. Based on this definition, customer satisfaction, relationship with network of suppliers, repeat business, relationship with strategic partners, financial growth and price sensitivity can all be considered as indicators of customer capital (relation capital).

The impact of knowledge assets on firm's performance has been investigated at both theoretical and empirical levels. Theoretical level attempts to help managers and decision makers to understand what are knowledge assets. What are their impacts on firm's performance? How can they indentify, measure and manage knowledge assets? How can they design a strategy based on knowledge assets to improve firm's performance? How can they design a plan for protecting and creating knowledge assets (Schiuma and Lerro, 2008)? From a theoretical standpoint, researchers discuss that IC can create value and competitive advantages for firms. Today, firms trying to achieve superior performance should focus on sustainable competitive advantages (Stewart, 1997). Also, Wiig (1997) points out that today's managers try to find better theories and approaches to improve their firm's performance. The CEOs of large US firms suggest that the performance of firms in the new economy depends on two elements. The first factor is the quality of knowledge-based assets from a competitive aspect within the firm, and the second factor is the ability of a firm to use its knowledge-based assets to create value and wealth.

In the two past decades, many researchers have investigated the impact of IC on firm's performance. Bontis et al. (2000) investigate the impact of three components of IC on business performance and their interrelationships in Malaysian industries. The results show not only that IC components have impact on business performance, but also they have interrelationship. Riahi-Belkaui (2003) considers the IC and firm's performance in US multinational firms based on the resource-based and stakeholder views. The results support both the resource-based and stakeholder views. Firer and Stainbank (2003) test the relationship between IC and firm's performance in South Africa. They find out that IC has positively correlated with profitability and productivity, but it doesn't have relation to market valuation. Kamath (2008) have tried to examine IC and firm's performance in the Indian pharmaceutical industry. The study results indicate that human capital has a prominent influence on profitability and productivity, but it does not have relation to market valuation. In recent years, a few researchers in Iran have considered IC and its impacts on firms' performance.

By considering the results of prior studies our research hypotheses are as follows:

1) There is a significant relationship between IC and a firm's profitability.
2) There is a significant relationship between IC and a firm's productivity.
3) There is a significant relationship between IC and a firm's market valuation.

3. RESEARCH METHODOLOGY

3.1 Study Sample

The research's sample comprises firms in the Tehran Stock Exchange (TSE) for the years 2001 through 2008. Due to the heterogeneity among the firms listed in TSE, we consider some special factors when choosing the firms. First, firms must be listed in TSE since 2001 and should not be financial firms. Second, 20th March must be the end of firms' financial year, and it must have

remained unchanged in the study's period. Third, firms must belong to high knowledge-based industries. Prior studies (e.g., Firer and Stainbank, 2003; Kamath, 2008) argue that the impact of IC and human capital can be substantial in certain service and manufacturing sectors, like banks and financial institutions, hotels, tourism sector, information and technology industry, education, pharmaceuticals, chemical and petrochemical. Thus, we investigate the impact of IC on firm's performance in high knowledge-based industries.

With regard to the aforementioned conditions, 69 firms and 508 observations during 2001 through 2008 are considered as the research's sample. Table 1 demonstrates the number of observations and investigated industries based on firm-year.

Table 1: Firm-year observation

Industry	Observations	Percentage
Chemical and petrochemical	204	40
pharmaceutical	188	37
Electrical	166	23
Total	508	100

3.2 Measuring of Intellectual Capital

In this study, Pulic (2000) Value Added Intellectual Coefficient model (VAICTM) is used to measure IC indicator. The main bases for choosing this model are as follows:

1- The base measurement in this model is standard and constant, which helps comparing large samples and different industries.

2- All of data in VAICTM are extracted from financial statements. Thus, they are objective.

3- The model has been used by numerous researchers to measure firm's IC (e.g., Firer and Stainbank, 2003; Kamath, 2008).

Pulic's (2000) model uses value added as a symptom of value creation by human capital, structural capital and physical and financial capital. Thus, the measurement of value added is the first step. Value added is measured by this equation: $VA=W+I+DP+DIV+ T+R$

Where:

VA: value added, W: salaries and wages, I: interest expenses, DP: depreciation expenses, DIV: dividends, T: corporate taxes and R: profits retained for the year.

The human capital efficiency, structural capital efficiency and capital employed efficiency are computed as below:

1- *Human Capital Efficiency (HCE)*: The ratio of total value added to total salaries and wages. This ratio shows the portion of human capital in creating firm's value added.

2- *Capital Employed Efficiency (CEE)*: The ratio of total value added to book value of assets. This ratio reveals that how much of firm's value added was created by physical and financial assets.

3- *Structural Capital Efficiency (SCE)*: For calculating structural capital, first, total of salaries and wages should be deducted from total amount of value added, then, the result should be divided by total value added. This ratio indicates how much of value added was generated by structural capital.

4- Finally, value added intellectual coefficient is calculated by equation as follows:

$VAICTM= HCE + SCE + CEE$

This coefficient represents the efficiency and ability of the firm's resources, tangible and intangible, in value creation for the firm. If this coefficient is high, it indicates that management has used the firms' resources efficiently.

3.3 Dependent Variables

There are three dependent variables in this study: profitability, productivity and market valuation. Each of them is defined as below:

1) *Profitability*: The ratio of net income divided by the book value of total assets. This ratio is a proxy to recognize management's sufficiency and efficiency to manage the firm.

2) *Productivity*: The ratio of total revenue to the total book value of assets. This ratio shows how the firm's assets were applied by managers to create revenue.

3) *Market valuation*: The ratio of total market capitalization, share price multiplied by the number of outstanding common shares, to the book value of net assets.

First and second dependent variables are accounting-based performance indicators, but the third variable is part of the market-based performance indicators.

3.4 Independent Variables

Intellectual capital: This variable is computed by Pulic's (2000) value added intellectual coefficient model (VAICTM). The model is explained above.

Firm Size: The natural logarithm of the total assets for a firm. This variable is used to control *the* impact of total assets on a firm's performance.

Leverage: The total debt divided by the book value of the total assets as reported in the firm's annual report. The ratio is applied to control the impact of debt servicing on a firm's performance.

Physical capital intensity: The natural logarithm of a firm's fixed assets to its total assets as reported in the firm's annual report. This variable is applied to control the impact of fixed assets on a firm's performance.

In addition, due to the intense auto-correlation between leverage and physical capital intensity ratios, as control variables, we use the natural logarithm of these variables to remove this auto-correlation (Momeni and Faal-e-ghayumi, 2008).

3. 5 Data Analysis

In this study, models are estimated and hypotheses are tested by regression and correlation analyses. Due to the power of multiple-linear-regression, we apply this method. Finally, regression's assumptions are tested and controlled. Inference about the test is based on a significant level which is obtained from the test. Thus, whenever the amount of the significant level is less than 5 percent null hypothesis on 95 percent level is not accepted. Statistical calculations have been done by Spss16.

4. EMPIRICAL RESULTS

4.1 Descriptive Statistic

The data of descriptive statistic are shown below:

Table 2: Descriptive statistic of variables

Variables	N	Average	SD	Variance	Skewness	Kurtosis
Intellectual Capital Index	508	12.1572	37.403	1399	9.109	127.903
Productivity	508	2.9715	49.989	2498.911	22.535	507.871
Profitability	508	0.9905	18.4499	340.401	22.536	507.909
Market valuation	508	3.5408	5.0041	25.042	0.427	26.410
Firm Size	508	26.4558	1.6294	2.655	0.747	1.752
Leverage	508	-0.4332	0.5872	0.345	1.196	28.593
Physical capital intensity	508	-1.32904	0.86207	0.743	-0.262	10.826

As mentioned above, due to high auto-correlation between leverage ratio and physical capital intensity ratio, we use their natural logarithm. Thus, in the descriptive statistical table the means of these variables are negative.

4.2 Multicollinearity between Independent Variables

There is often multicollinearity between independent variables. If this multicollinearity is high, the model will not be reliable. One of the methods to test multicollinearity is the correlation matrix. Thus, non-existent correlation between independent variables is whenever the correlation coefficient between two independent variables equals zero. In fact, reaching zero correlation coefficient is impossible, and as a rule we can adopt the correlation coefficient of less than 50 percent between each even independent variable, and multicollinearity can be ignored (Momeni and Faal-e-ghayumi, 2008). In this study, since estimated coefficients are significant and separable, multicollinearity between variables isn't intense. The rate of multicollinearity fluctuations between independent variables is presented in table 3. This table reveals that independent variables pairs don't have intense

multicollinearity. The highest multicollinearity exists between IC indicator and leverage ratio, which is 31 percent.

Table 3: Correlation coefficient between independent variables

Explain	Pearson correlated coefficient			
	intellectual capital index	Firm Size	leverage	Physical Capital Intensity
Intellectual Capital Index	1	0.309	-0.312	-0.087
significant level		0.000	0.000	0.049
number of observations	508	508	508	508
Firm Size		1	-0.165	-0.130
significant level			0.000	0.003
number of observations		508	508	508
Leverage			1	0.208
significant level				0.000
number of observations			508	508
Physical Capital Intensity				1
significant level				
number of observations				508

In addition, the results of statistical tests of Tolerance Index, the Variance Inflation Factor (VIF) and Condition Index are brought into table 4. The results reveal that there isn't multicollinearity between independent variables. If there is multicollinearity between independent variables, the amount of Condition Index statistic will be more than 10, the VIF statistic will be more than 5 and Tolerance Index statistic will move toward zero (Momeni and Faal-e-ghayumi, 2008).

Table 4: The multicollinearity statistics of independent variables

Independent variables	Tolerance	VIF	Condition Index
Intellectual capital index	0.813	1.230	1.001
Firm Size	0.273	3.662	1.785
Leverage	0.562	1.781	2.432
Physical capital intensity	0.280	3.569	4.054

4.3 Normality test of Dependent Variables

The normality of dependent variables is one of the most basic assumptions in the correlation's method. Therefore, in this study, Kolmogrov-Smirnov Test is applied to consider the normality of dependent variables. The results are shown in table 5. A significant level of dependent variables are more than 5 percent (containing 13.7 percent, 15.4 percent and 14.9 percent). Thus, dependent variables have normal distribution.

Table 5: Normality test of dependent variables

	Profitability	Productivity	Market valuation
Kolmogrov-Smirnov Z	1.135	1.209	1.733
Significant level	0.137	0.154	0.149
Number of observation	508	508	508

4.4 The Results of Hypotheses Test

Table 6: The results of hypotheses test are presented in table 6.

Hypotheses	Independent Variables	Dependent Variables	P-Value Level	Test's Result	T	R^2
There is a significant relation between intellectual capital and profitability	Intellectual capital index	Profitability	0.000	Hypothesis confirmation	3.808	0.298
There is a significant relation between intellectual capital and productivity	Intellectual capital index	Productivity	0.000	Hypothesis confirmation	3.760	0.300
There is a significant relation between intellectual capital and market value	Intellectual capital index	Market valuation	0.701	Hypothesis disconfirmation	0.384	0.331

4.5 Other Findings

According to table 7, firm size, leverage and physical capital intensity have significant and positive relations to profitability and productivity, since the significant levels of these variables are less than 5 percent. However, among the control variables, it is only the firm size that has a significant and positive relation to market valuation.

Table 7: The test's results of relation between independent and dependent variables

Dependent variables / Independent variables	Profitability			Productivity			Market valuation		
	Beta	T	P-Value	Beta	T	P-Value	Beta	T	P-Value
Intellectual capital	0.158	3.808	0.000	0.155	3.760	0.000	0.016	0.384	0.701
Firm Size	0.735	10.294	0.000	0.742	10.405	0.000	0.533	7.646	0.000
Leverage	0.571	11.468	0.000	0.574	11.546	0.000	0.470	0.977	0.329
Physical capital	0.474	6.725	0.000	0.473	6.714	0.000	-0.076	-1.099	0.272

4.6 Models

Based on the results of hypotheses' test and relation between variables, we develop three regression models for every dependent variable as below:

Equation1: $Profitability_{it} = \beta_1 VAIC_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 FIXASSET_{it} + \mu$

Equation2: $Productivity_{it} = \beta_1 VAIC_{it} + \beta_2 SIZE_{it} + \beta_3 LEV_{it} + \beta_4 FIXASSET_{it} + \mu$

Equation3: $Market\ Valuation_{it} = \beta_1 SIZE_{it} + \mu$

Where:

$Profitability_{it}$ = The ratio of net income to total assets for firm i in year t.

$Productivity_{it}$ = The ratio of sales to total assets for firm i in year t.

$Market\ Valuation_{it}$ = The ratio of market value to book value for firm i in year t.

$VAIC_{it}$ = The index of intellectual capital for firm i in year t.

$SIZE_{it}$ = Firm Size, natural logarithm of total assets for firm i in year t.

LEV_{it} = Leverage ratio, the ratio of liabilities to total assets for firm i in year t.

$FIXASSET_{it}$ = Physical capital intensity, natural logarithm of the ratio of fixed assets to total assets for firm i in year t.

$\beta_1, \beta_2, \beta_3, \beta_4$ = The independent variables' coefficients in models.

μ = models error.

The models' coefficients (i.e., beta) and their significant levels are brought into table 7. The results indicate that independent variables' coefficients are significant in 95 percent level.

4.7 Model's Reliability

In order to test the models' reliability, we must have regard to regression's assumptions, including lack of multicollinearity between independent variables, normal distribution of dependent variables, lack of autocorrelation between amounts of models' error, lack of heteroscedasticity in the amounts of models' error and also existence of linear regression relation between independent and dependent variables, the estimation ability of regression. In the previous sections, we showed that there isn't multicollinearity between independent variables; moreover, distributions of dependent variables are normal. To examine the lack of autocorrelation between amounts of models' errors, Durbin-Watson Test is used. In table 8, the results of this test for the dependent variables of the models 1, 2 and 3, are respectively 1.929, 1.92 and 1.588. In terms of statistics, if this index is between 1.5 through 2.5, the amounts of models' errors won't have intense autocorrelation (Momeni and Faal-e-ghayumi, 2008). Thus, these results reveal that there aren't intense autocorrelation among models' errors. Also, in table 8, coefficient of determination (R2) for each one of the models 1, 2 and 3 is respectively 0.298, 0.300 and 0.331, and F statistic is respectively 53.475, 54.036 and 62.360. In addition, the significant level of the models based on variance analysis test, p-value, equals zero which is less than 5 percent. Therefore, it can be concluded that models have the ability to estimate in 95 percent confidence interval. So, due to the normal distributions of dependent variables, it can be concluded that there isn't

heteroscedasticity among the amounts of models' errors and they also have normal distributions (Momeni and Faal-e-ghayumi, 2008).

Table 8: The models indexes

Explain	Profitability	Productivity	Market Valuation
N	508	508	508
Coefficient of determination (R^2)	0.298	0.300	0.331
F statistic	53.475	54.036	62.360
P-Value	0.000	0.000	0.000
Durbin-Watson test	1.929	1.92	1.588

5. CONCLUDING REMARKS

This study considers the association between IC and the traditional measures of a firm's performance (i.e., profitability, productivity and market valuation) in high knowledge-based industries in TSE, IC indicator is measured by using VAICTM methodology. The empirical results, based on linear multiple regression analysis, suggest that IC indicator has significant and positive relations with accounting-based performance indicators, namely, profitability and productivity, but it doesn't have significant relation with market-based performance indicator, namely, market valuation. Moreover, profitability and productivity have significant and positive relations with all other independent variables (i.e., firm size, leverage ratio and physical capital intensity). But, market valuation has only relation with firm's size variable. The results of this study are similar to results of other researchers in developing countries like Firer and Stainbank (2003) in South Africa and Kamath (2008) in India. This case represents that in the emerging markets probably non-accounting elements have impact on market-based performance indicators.

According to the results, there are positive association between IC and profitability and productivity. Thus, this study suggests that the firms' managers should improve the performance of human capital by training or employing of IC in order to increase their firms' performance. Also, to prevent brain drain, we suggest that Iran's government provides necessary facilities for employing, and providing job satisfaction among, skilled and educated persons. Finally, we propose that by using these models, financial analysts and other users will be able to analyze exactly the firm's performance.

This research reveals that there isn't relationship between market valuation and IC, thus, we propose that future studies consider the subject by other variables of market indicators such as Tobin's indicator or P/E ratio. Also, future researchers can investigate the impact of IC on the competitive ability of firms, and firms' leadership program or strategy.

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