The relationship between intellectual capital and financial performance of companies in the capital market with the emphasize on the components of ROE, EVA, and ASR

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Abstract: In a knowledge-based organization, where, knowledge forms a large part of the amount and quality of organization's profitability, traditional accounting methods, which are based on tangible assets and information of previous operations of the organization, are incapable of valuing intellectual capital as their most valuable assets. Therefore, the intellectual capital approach is the most comprehensive for organizations who want to know their profitability capacities better. The fundamental importance of this study is the lack of intellectual capital items in the financial statements of the companies as well as a huge gap between book value and market value. In the past, tangible assets had higher importance but today, large part of organizations' assets are intangible assets thus, in today's economy, organizations success depend on the way of managing these assets. Results confirmed that It is worth mentioning that, in developing countries, unlike developed countries, local markets are valued by physical capital rather intellectual capital and they are less depend on IC as an strategy. One reasons for this is that, they are still depend on trading and processing of natural resources as a fundamental growth strategy.

1. Introduction

Restrictions of access to physical resources in the organizations have emerged new approaches in the development of non-physical facilities and value producing procedures in order to improve and enhance product/service.

Hence, the need to use all the available capacity of the organization including: financial capital, physical assets, intellectual capital, professional procedures and work patterns, human capital, information systems, communication networks, costumer supply chain management, knowledge-based properties and so on, is obvious more than ever before. Beside these issues, establishment of optimized frameworks and considering all capabilities to develop efficiency and effectiveness of the assets in order to achieve organizational are being focused in this approach. One of the important aspects of this new approach is paying attention to capacities and values that come forth through a series of organizational resources. These resources cannot be dealt with through applying tradition measures used for financial and physical assets such as physical measures and determining final prices. In fact, with the development of new approaches in the field of economics, the pure concentration on tangible resources as raw materials for value creation in organizations is replaced by simultaneous focus on all of properties such as physical, financial, and nonphysical resources. Through this, modern view in investigating and assessment of organization's assets, in addition to traditional concepts of industrial economy is based on redefining and implementation of these new economic concepts.

In traditional economics, assets are the collection of properties deemed to be involved in the production of goods. In other words, in traditional economy, the concept of fixed assets involves buildings, equipment, materials, machinery, and transport systems that is being used in the production process and will not change unless by depreciation.

The first efforts in the field of concepts of intellectual capital are beholden to works of Fritz Machlup in 1962. However, in a historical view, the invented the concept of intellectual capital is attributed to economist John Galbrays in the year 1969. Although, in this regard, we must mention the efforts of James Tobin in the second half of past century who had first introduced Tobin q ratio in order to examine the performance of organization's intellectual capital. As a result of these efforts, the literature on intellectual capital and organizational development was on track quickly. Nevertheless, through a more accurate investigation one can say that, the concept of intellectual capital attracted the theorists and researchers since eighties and was widely attracted by organizations from nineties.

The components of intellectual capital in the view of Edvinsson and Mallon are as following:
- Human capital
- Costumer capital
- Structural capital
- Organizational capital
- Processing capital
- Innovation capital

In this view, the organizational capital is the system and philosophy of the organization aimed to use organizational capabilities. The processing capital includes techniques, procedures, and programs that serve to implement and improve service and product distribution systems. Innovation capital consists of assets related to intellectual property and intangible infrastructures. Intellectual property, itself, consists of rights and privileges such as copyright and trade mark and intangible infrastructures.

The simple definition of intellectual capital is the difference between market value and book value of assets of a company.

Intellectual capital consists of that part of companies' capital or assets which is based on knowledge and is owned by the company. Therefore, it is a raw material and economic factor of organization's life. Intellectual capital as knowledge, experience, technical comment and software assets is defined beyond financial and physical assets. According to the definition, intellectual capital can also include knowledge itself (which has been transformed to intellectual property of a company) or the final result of its transfer process. Items such as patents, copyright, and trade mark can be used to evaluate intellectual capital for accounting purposes. Intellectual capital is the storage of the existing knowledge in a particular area of organization and is a tool for understanding the knowledge transformation process over the time.

One of the definitions of intellectual capital is provided by OECD which explains intellectual capital as economic value of two non-tangible groups of assets of a company:
1. Organizational capital (structural)
2. Human capital

M Vall man (1996) a member of SEC defines intellectual capital as assets that, nowadays, are valued zero in the balance sheets. These assets include:
- The intellectual power of individuals,
- Brand,
- Trademarks, and

Assets registered in the accounting records by historical cost of assets, but their value has increased over the time (Mojtahedzadeh, 2009, p2).

2. Material and Methods

In terms of purpose, this research is an applied research. In terms of methodology our method is based on correlation.

In this research, we have used library studies including books, articles and foreign and domestic journals to collect research literature and the data required to test the hypotheses.

The statistical population consists of all companies listed in Tehran Stock Exchange. The reason to choose these companies as statistical population was the ease of access to their audited financial statements as well as their stock returns in different periods.

Concerning the 7-year period of study (from 2005 to 2011), we have been selected companies which listed in Tehran Stock Exchange at least in the beginning of 2005 with the end of fiscal year in Esfand, 29. The sampling method was step by step with systematic elimination.

In this study, the companies that have selected that have all of the following conditions:
1. Listed in Tehran Stock Exchange before 2005.
2. Their fiscal year ends at Esfand 29.
3. Their shares must be traded at the beginning and end of their fiscal year.
4. Have presented their financial statements to bourse in order to study at the end of fiscal year.
5. In the studied period, the companies should not have operating losses in the audited profit and loss accounts as well as after considering taxes.

Therefore, among all companies listed in Tehran Stock Exchange, 73 companies have been selected according to aforementioned conditions.

2.1. Research variables

Independent variable:

In this study, the intellectual capital along with its components including structural, human and physical capital is regarded as independent variables.

Dependent variables:

In this study, the dependent variable was the financial performance which indices are based on EVA, MB, Tobin q, ROA, ASR, P/E, ATO, ROE.

Control variable:

In order to control firm size on variables, firm size is introduced as control variable.

2.2. Research Hypotheses.
1. There is a significant relationship between components of intellectual capital and return on capital as an index of company's financial performance.

a. There is a significant relationship between components of intellectual capital and return on equity (ROE) index of company's return on capital.

b. there is relationship between components of intellectual capital ASR index of Return on capital

2. There is a significant relationship between components of intellectual capital economic value added (EVA) as a modern criterion of company's financial performance.

3. There is significant relationship between firm size, intellectual capital, and financial performance.

The multiple regression models for the hypotheses are as follows

4. a. ROE $_i$= β $_i$+ β $_1$HCE+ β $_2$SCE+ β $_3$CEE + β $_4$FSIZE +ei

4. b. ASR = β $_i$+ β $_1$HCE+ β $_2$SCE+ β $_3$CEE + β $_4$FSIZE +ei

5. EVA = β $_i$+ β $_1$HCE+ β $_2$SCE+ β $_3$CEE + β $_4$FSIZE +ei

3. Results
Testing first hypothesis

First main hypothesis: there is a significant relationship between components of intellectual capital and return on capital as an index of company's financial performance.

This hypothesis is divided into two sub-hypotheses.

First sub-hypothesis: there is a significant relationship between components of intellectual capital and return on equity (ROE) index of company's return on capital.

Table 1: Pearson correlation coefficient, significance level of components of intellectual capital and book value of ROE

	Physical capital	Structural capital	Human capital
Pearson correlation coefficient	0.696	0.432	0.074
Significance level	0.000	0.000	0.095
Number	511	511	511

The Pearson correlation matrix in the above table shows that, ROE is significant with structural capital (SCE) and physical capital (CEE) in 7 years and is significant with human capital in 1 year.

The model for regression analysis is as follows

$$ROE_{it} = \beta_0 + \beta_1 HCE_{it} + \beta_2 SCE_{it} + \beta_3 CEE_{it} + \varepsilon_{it}$$

Table 2: Analysis of variance of regression between components of intellectual capital and book value of ROE

Model		Sum of squares	Degree of freedom	Mean of squares	Statistic of F	Significance level
1	Regression	5.337	4	1.334	473.010	0.000
	Sum of square of errors	1.412	506	0.003		
	Total	6.749	510			

According to following table, the probability of F is equal to 0.000 which is lower than 0.05, therefore, the null hypothesis is rejected.

Table 3: Correlation coefficient and Durbin-Watson test between components of intellectual capital and book value of ROE

Model	Correlation coefficient	Determination coefficient	Adjusted determination coefficient	Error of estimation index	Durbin-Watson
1	0.889	0.791	0.789	0. 052832	1.997

Using following model

$$ROE_{it} = -0/236 - 0/001 HCE_{it} + 0/35 SCE_{it} + 0/53 CEE_{it} + \varepsilon i$$

We have

Table 4: Coefficients of regression equation between components of intellectual capita and book value of ROE

Model		Non-standardized coefficients		Standardized coefficients	Statistic of t	Significance level	Linearity test	
		B	Standard error	Beta			Tolerance	Variance inflation factor
1	Intercept	-0.236	0.020		-11.723	0.000		
	HCE	-0.001	0.000	-0.095	-3.927	0.000	0.701	1.426
	SCE	0.353	0.016	0.590	22.368	0.000	0.594	1.683
	CEE	0.534	0.014	0.772	37.111	0.000	0.957	1.045

Second sub-hypothesis: there is relationship between components of intellectual capital ASR index of Return on capital.

Table 5: Pearson correlation coefficient, significance level of components of intellectual capital and ASR

	Physical capital	Structural capital	Human capital
Pearson correlation coefficient	0.197	0.113	0.042
Significance level	0.000	0.011	0.343
Number	511	511	511

The Pearson correlation matrix in the above table shows that, ROE is significant with structural capital (SCE) in 1 year and is significant with physical capital (CEE) in 7 years and is significant with human capital (HCE) in 4 year. The direction of relationship is positive except for 1 year in CEE which is negative. Therefore, H_0 hypothesis is accepted and H_1 is rejected.
The model for regression analysis is as follows

$$ASR_{it} = \beta_0 + \beta_1 HCE_{it} + \beta_2 SCE_{it} + \beta_3 CEE_{it} + \varepsilon_{it}$$

Table 6: Analysis of variance of regression between components of intellectual capital and ASR

Model		Sum of squares	Degree of freedom	Mean of squares	Statistic of F	Significance level
1	Regression	210847.1	4	52711.77	10.781	0.000
	Sum of square of errors	2473971	506	4889.271		
	Total	2684818	510			

According to the above table, the probability of F is equal to 0.000 which is lower than 0.05, therefore, the null hypothesis is rejected.

Table 7: Correlation coefficient and Durbin-Watson test between components of intellectual capital and ASR

Model	Correlation coefficient	Determination coefficient	Adjusted determination coefficient	Error of estimation index	Durbin-Watson
1	0.280	0.79	0.71	69.9233237	1.523

Using following model

$$ASR_{it} = -102/49 + 98/33 CEE_{it} + \varepsilon i$$

We have

Table 8: Coefficients of regression equation between components of intellectual capita and ASR

Model		Non-standardized coefficients		Standardized coefficients	Statistic of t	Significance level	Linearity test	
		B	Standard error	Beta			Tolerance	Variance inflation factor
1	Intercept	-102.492	26.656		-3.846	0.000		
	HCE	0.048	0.240	0.010	0.201	0.841	0.701	1.426
	SCE	26.024	20.912	0.069	1.244	0.214	0.594	1.683
	CEE	98.333	19.055	0.225	5.160	0.000	0.957	1.045

According to the results presented in the above tables, on can see that, component of intellectual capital (especially physical and structural capital) have significant relationship with indicators of return on capital so that, the determination coefficient for ROE is 0.79 indicating the proper explanatory power of components of intellectual capital for return of capital. Therefore, the first main hypothesis is accepted.

Testing second main hypothesis
      Second main hypothesis: there is a significant relationship between components of intellectual capital economic value added (EVA) as a modern criterion of company's financial performance

Table 9: Pearson correlation coefficient, significance level of components of intellectual capital and EVA

	Physical capital	Structural capital	Human capital	Coefficient of intellectual capital
Pearson correlation coefficient	-0.124	0.220	0.206	0.168 0.000 498
Significance level	0.006	0.000	0.000	
Number	498	498	498	

The Pearson correlation matrix in the above table shows that, ROE is significant with structural capital (SCE), human capital (HCE), and coefficient of intellectual capital but is not significant with physical capital (CEE). There are two models for regression analysis is as follows

$$EVA_{it} = \beta_0 + \beta_1 HCE_{it} + \beta_2 SCE_{it} + \beta_3 CEE_{it} + \varepsilon_{it}$$

And

$$EVA_{it} = \beta_0 + \beta_1 VAIC_{it} + \beta_2 FSIZE_{it} + \varepsilon_{it}$$

Table 10: Analysis of variance of regression between components of intellectual capital and EVA

Model		Sum of squares	Degree of freedom	Mean of squares	Statistic of F	Significance level
1	Regression	4E+013	4	9.496E+012	55.374	0.000
	Sum of square of errors	8E+013	494	1.715E+011		
	Total	1E+014	498			
2	Regression	4E+013	2	1.804E+013	103.304	0.000
	Sum of square of errors	E+0139	496	1.746E+011		
	Total	1E+014	498	9.496E+012	55.374	

According to the above table, the probability of F in two models is equal to 0.000 which is lower than 0.05, therefore, the null hypothesis is rejected.

Table 11: Correlation coefficient and Durbin-Watson test between components of intellectual capital and EVA

Model	Correlation coefficient	Determination coefficient	Adjusted determination coefficient	Error of estimation index	Durbin-Watson
1	0.557	0.310	0.304	414116.660	1.734
2	0.543	0.294	0.292	417902.687	1.732

Using following models

$$EVA_{it} = -1837338 + 3738/2\,HCE_{it} - 299155 SCE_{it} - 221337 CEE_{it} + \varepsilon i$$

And

$$EVA_{it} = -1956968 + 400947 Fsize + \varepsilon i$$

We have

Table 12: Coefficients of regression equation between components of intellectual capita and EVA

Model		Non-standardized coefficients		Standardized coefficients	Statistic of t	Significance level	Linearity test	
		B	Standard error	Beta			Tolerance	Variance inflation factor
1	Intercept	-1837338	165812.9	-	-11.081	0.000	-	-
	HCE	3738.181	1494.387	0.112	2.501	0.000	0.704	1.420
	SCE	-299155	125899.8	0.115	-2.376	0.018	0.565	1.681
	CEE	-221337	113347.5	0.075	-1.953	0.051	0.957	1.045
2	Intercept	-19656968	160093.5	-	-12.224	0.000	-	-
	VAIC	821.687	628.067	0.051	1.308	0.191	.951	1.051
	F size	4700974.4	29330.175	0.529	13.670	0.000	.951	1.051

Testing third main hypothesis

Third main hypothesis: there is significant relationship between firm size, intellectual capital, and financial performance.

Table 13: Pearson correlation coefficient and significance level of firm size, components of intellectual capital and financial performance

	ROE	ASR	EVA
Correlation coefficient	0.202	0.168	0.540
Significance level	0.000	0.000	0.000
number	511	511	498

Based on the statistical output of the above table the variable of firm size has a significant relationship with indicators of financial performance excluding the asset turnover ratio and it can be concluded that, there is positive and significant relationship between firm size, indicators of financial performance, and other components of the intellectual capital in the multiple regression model.
Using the following model

$$FP_{it} = \beta_0 + \beta_1 HCE_{it} + \beta_2 SCE_{it} + \beta_3 CEE_{it} + \beta_4 Fsize + \varepsilon_{it}$$

We have

Table 14: Coefficients of regression equation between components of intellectual capita, firm size and financial performance

Indicator of financial performance	Estimated regression model	Correlation coefficient	Determination coefficient	Firm size coefficient β	Statistic of T	Direction of relationships		
					Fsize	Sig.	Intellectual capital	Financial performance
ROE	$ROE_{it} = -0/236 - 0/001 HCE_{it} + 0/35 SCE_{it} + 0/$	0.889	0.791	-	1.159	0.247	Not significant	
ASR	$ASR_{it} = -102/49 + 16/27 Fsize_{it} + 98/33 CI$	0.280	0.079	+16.27	3.212	0.001	+	+
EVA	$EVA_{it} = -1837338 + 3738/2 HCE_{it} - 299155 SCE_{it} - 221337 CEE_{it} + 424981 Fsize$	0.557	0.310	42981+	13.218	0.000	-	-

According to the analyses presented above the summary is as follows.

First main hypotheses: There is a significant relationship between components of intellectual capital and return on capital as an index of company's financial performance.

The first main hypothesis was divided into two sub-hypotheses:

First sub-hypothesis: There is a significant relationship between components of intellectual capital and return on equity (ROE) index of company's return on capital.

According to the above results, the correlation coefficient between the components of intellectual capital and ROE in the model is 0.889. Concerning the coefficients of F and T and their significance level there is a positive and significant relationship between them and intellectual capital explains 79% of the changes of ROE.

In addition, considering the efficiency coefficient of physical and structural capital had the highest coefficient (0.353 and 0.534, respectively) in the regression equation, therefore they have more explanatory power than human capital component.

Second sub-hypothesis: there is relationship between components of intellectual capital ASR index of Return on capital.

According to the results the significance level of correlation coefficient between components of intellectual capital and return on equity ASR is lower than 0.509 indicating that, H_0 is accepted and H_1 is rejected. Therefore, there is no significant relationship between intellectual capital and ASR.

First main hypothesis: There is a significant relationship between components of intellectual capital and return on capital as an index of company's financial performance.

According to the results of sub-hypotheses, accepting the first and rejecting the second, we can say that, the null hypothesis is rejected and H_1 is accepted. Therefore, there is significant relationship between intellectual capital and ASR.

The second main hypothesis: There is a significant relationship between components of intellectual capital economic value added (EVA) as a modern criterion of company's financial performance.

According to the above results, the correlation coefficients between the components of intellectual capital and ROE in the models are 0.557 and 0.543, respectively. Concerning the coefficients of F and T and their significance level there is a negative and significant relationship between them and intellectual capital explains 31% of the changes of ROE.

In addition, only human capital has a significant effect on EVA.

The third main hypothesis: There is significant relationship between firm size, intellectual capital, and financial performance.

According to the results, excluding the regression model of ROE, other models can explain the relationship between components of intellectual capital, financial performance, and firm size. In addition, the significance of correlation between firm size and financial performance indicators and intellectual capital is less than 5%. Therefore, one can say that, firm size can explain the relationship between intellectual capital and financial performance.

4. Discussions

The author, in this work, concluded that, there is significant and positive relationship between variables of intellectual capital and financial performance indicators in the considered level of significance. In this regard, components of intellectual capital have the highest correlation with the indicators of profitability, market value and value added. It is worth mentioning that, in developing countries, unlike developed countries, local markets are valued by physical capital rather intellectual capital and they are less depend on IC as an strategy. One reasons for this is that, they are still depend on

trading and processing of natural resources as a fundamental growth strategy. Iranian stock market, also, is not exempted from this issue and therefore, physical capital (CEE) has the highest coefficient.

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