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The impact of intellectual capital on firm performance: Evidence from Tehran Stock Exchange

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A B S T R A C T

The aim of the present research is to study the relationship between intellect capital components and performance evaluation indicators. For measuring intellectual capital, the study uses Pulic's method [Pulic, A. (2000). VAIC™–an accounting tool for IC management. *International Journal of Technology Management, 20*(5-8), 702-714.], which consists of three components of physical capital efficiency, human capital efficiency and structural capital efficiency. In the present study first, the value of the intellectual capital of the companies listed on Tehran Stock Exchange over the period 2006-2012 is calculated. Next, the relationship between the components of intellectual capital and financial return of the companies are evaluated. For calculating the financial performance 8 performance indicators in 5 groups presenting market value, profitability, activity, capital return, orientation on value creation are used. In the present research the statistical method used for data analysis is multiple regression and correlation coefficients. The selected sample of research includes 73 companies in continuous way for a time period of 7 years and the size of the company has been considered as a control variable. The findings indicate a positive and significant relationship between intellectual capital and financial performance of companies and a positive effect of the size of company on availability rate of intellectual capital and financial performance of a company.

1. Introduction

During the past few years, there have been tremendous studies on learning more about the relationship between intellectual capital (IC) and firms' performance (Kalkan et al., 2014). Örnek and Ayas (2015), for instance, studied the relationship between intellectual capital, innovative work behavior and business performance reflection. Al-Musali et al. (2014) performed a survey on intellectual capital and its effect on financial performance of banks by looking into some evidences from Saudi Arabia. They reported that IC performance of Saudi banks was low and it was positively related to bank financial performance indicators. However, when Value Added Intellectual Capital (VAIC) was split into its components, the relationships between these components and bank financial performance indicators were varied. Sydler et al. (2014) indicated that IC-creating costs could generate IC assets in a subsequent year and that an increase in IC was associated with a higher return on assets over time. They

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also showed that all three IC factors independently could lead to the creation of IC. They presented implications for knowledge management theory and practice.

2. Analytical model and the method of measurement of research variables

For explaining the relationship between corporate financial performance and the employed intellectual capital, the following multiple regression model has been used:

$$Y=\beta_0+\beta_1 HCE+\beta_2 SCE+\beta_3 CEE+\beta_4 FSIZE+\varepsilon \quad (1)$$

A) Independent variable: intellectual capital

Pulic (1998, 2000) presented Value Added Intellectual Capital (VAIC) for measurement of intellectual capital of firms. In this method, intellectual capital is divided into three components of human, cultural (organizational) and physical capitals. In the present research, Pulic's model has been used for calculation and measurement of intellectual capital and that reason for using this method is the ease of its application in calculation of intellectual capital and its independence and its realness which uses financial statements and their complementary notes. In addition, financial statements show what exist in reality and they are not imaginary and they look at what exist in a firm through a monetary (Rial) view.

$$\mathrm{VAIC} = \mathrm{HCE} + \mathrm{SCE} + \mathrm{CEE}, \quad (2)$$

where VAIC, HCE, SCE and CEE represent intellectual capital value added, Human capital efficiency, Structural capital efficiency and Physical capital efficiency, respectively. In addition, this model starts with the ability of the firm with creating value added. Value added is the difference between *IN* and *OUT*. Therefore, value added can be calculate through the following equation:

$$VA = OP + EC + D + A, \quad (3)$$

where value added (*VA*) is a function of operating profit (*OP*), depreciation and amortization of tangible and intangible assets (*D* + *A*) and *EC* represents total employee expenses. In the present research the total employee expenses (EC) has been extracted from statements and Cost Notes (Direct wage and manufacturing overhead), Administrative expenses and cost of sales. Also, Depreciation and Amortization of tangible and intangible assets have been extracted from the table of Adjusted operating cash flow.

Physical capital efficiency (CEE): This item refers to the ratio of value added (VA) to the employed physical capital, the index of which can be obtained through the following relationship:

$$CEE = VA/CE = \text{Value Added} / \text{Tangible asset}, \quad (4)$$

where CE = Total assets – intangible assets = tangible assets.

Human capital efficiency (HCE): human capital efficiency factor indicates how much value added (*VA*) for each spent Rial for employee expenses (wage and salary) in firm has been created. Ratio of *VA* to *HC*, will indicate the capability of human capital (*HC*) over value creation in a firm.

HCE = VA / HC = (value added) / (total employee expenses of salary and benefits of a firm)

HC = total paid salary and wage to human resources = total expenses of the employees of a firm

Structural capital efficiency (SCE): the third relationship is "structural capital efficiency (SCE)", which indicates the contribution of the structural capital in creation of value added. Structural capital includes all the non-human Knowledge repositories in an organization, which includes databases, organizational charts, processes and solutions and grants a value beyond physical assets to an organization. In the

Pulic model, structural capital (*SC*) is equal to *VA* minus *HC*. In this way, the third relationship between *VA* and *SC* will be calculated in the following way:

SCE = SC / VA = (Structural capital) / (value added)

SC = VA – HU = (Value added) – (total employee salary expenses of a firm)

B) Dependent variable: financial performance indices

For calculating corporate financial performance in the present research 8 financial indicators in five groups as the representing measures for corporate financial performance have been selected summarized in Table 1 as follows,

Table 1
Indicators and groups of financial performance

Item	Group of financial performance	Performance index	Measurement method	
1	Market value of firm	MB	Ratio of capital market value to book value of equity	MB=MV/BV
		Tobin q	Book value of total assets / (book value of debts + market value of normal share	Q=(M.V.S+B.V.D)/B.V.A
		P/E	Earnings per share/ price per share	Price/ EPS
2	Profitability	ROA	Ratio of operational profit to book value of total assets	ROA= OP / TAS
3	Activity	ATO	Ratio of total earnings to total assets	ATO= TR / TAS
4	Capital return	ASR	Annual stock returns	ASR $=(p_1-p_0 + D)/ p_0$
		ROE	Ratio of net income to equity	ROE= OP / TE
5	Value creation – oriented	EVA	Economic Value Added	EVA=(R-C)Capital

C) Control variable: firm size

Firm size: firm size is influential on the relationship between intellectual capital and corporate financial return and performance. In the present research the effect of the size of the firm on the relationship between these variables with its effect on the regression equation has been controlled. For calculating the size of firm, natural log of market value (MV) of a firm has been used.

3. Research methodology

The present research is an applied research from aim point of view and from method viewpoint is a correlation research. The aim of a correlation study might be to establish the relationship or to prove the lack of its existence and to apply relationship in conducting predictions. In this study, bibliographical method has been used for data collection for literature part of the research and the data collection tools are data banks and the required data include operational profit, employees salary and wage expenses, depreciation and amortization, tangible assets, total assets, equity, income, stock price of the sample firms stated in their audited financial statements and these data have been extracted from the available records in RahAvardNovin Software as well as in some case from electronic archive and internet and due to using audited financial statements it can be said that the used data in this study are real data and have high validity and reliability. Research statistical population includes all the listed companies on Tehran Stock Exchange. The reason of choosing these firms as our research population is ease of access to their audited financial statements as well as accesses the stock returns of these firms during different dates. Considering the 7 year time period of the present study (from the beginning of 2006 to the end of 2012), those firms have been selected that at least have been listed on Tehran Stock Exchange at the beginning of 2006 and also their fiscal year would end at 20th March of every year. A systematic elimination and stage wise sampling method has been used.

In the present study, the firms selected as sample should have all the following conditions:

1. They must have been listed on Tehran Stock Exchange at least before 2001.

2. Their fiscal year should end at 20th March of every year.

3. The stock of these firms should be traded in the beginning and at the end of their fiscal year.

4. Should have submitted their Year-end financial statements for review to Exchange.

5. During the period under review, the firm should not have operational loss in its Fiscal year end audited profit and loss account and also its financial balance after tax of Profit and loss account will be negative amount.

Considering the above mentioned criteria, from all the listed firms in Tehran Stock Exchange, from 282 qualified firms, some firms had trading interruptions which were deleted from research population and 73 firms were selected as our sample for this study.

4. Research hypotheses

The hypotheses of the present study include 6 main hypotheses and 5 secondary hypotheses which are presented as below:

1st main hypothesis: There is a significant relationship between intellectual capital variables and market valuation indicators as the corporate financial performance index.

1st secondary hypothesis: There is a relationship between variables of intellectual capital and the ratio of market capitalization to book value of common stocks (MB) of a firm from market valuation indicators.

2nd secondary hypothesis: There is a relationship between intellectual capital variables and ratio of Tobin q of a firm from market valuation indicators.

3rd secondary hypothesis: There is a relationship between intellectual capital and ratio of P/E variables from market valuation indicators.

2nd main hypothesis: There is a significant relationship between intellectual capital and profitability ratio (ROA) variables as an indicator of corporate financial performance.

3rd main hypothesis: There is a significant relationship between intellectual capital and activity ratios (ATO) variables as an indicator of corporate financial performance.

4th main hypothesis: There is a significant relationship between intellectual capital and capital return variables as an indicator of corporate financial performance.

4th secondary hypothesis: There is a relationship between intellectual capital variable and ROE index which is one of the criterion of capital return.

5th secondary hypothesis: There is a relationship between intellectual capital variable and ASR index which is one of the criteria of capital return.

5th main hypothesis: There is a significant relationship between variable of intellectual capital and index of creation value emphasis as a new criterion of corporate financial performance.

6th main performance: There is a significant relationship between firm size with total average of intellectual capital and corporate performance.

5. Data analysis method

After completing data collection step, the research has a huge collection of data at hand which must be used for performing the next step to extract and classify the available data and prepare them for the

fundamental step of the data analysis. In line with this aim, first intellectual capital index as independent variable has been calculated through the extracted data from the financial statements and available data in data banks for the sample firms for the 7 year period. Then for calculation of the indices of the corporate financial performance through the available data in data banks and for calculating EVA from the extracted data the text of the financial statements have been used. Following that, after performing normality test, the dependent variable has been studied. For models analysis on a year to year basis Pearson's correlation coefficient has been used and for integrated data and regression analysis has been used. The basis of inference has been from significance level of P-value, in such a way that when the value of probability or significance level of the test becomes smaller than 0.05, null hypothesis will be rejected at the confidence level of 95%. Using SPSS software for testing hypotheses and performing other analyses with the application of statistical methods of normality test (Kolmogorov–Smirnov test), Autocorrelation test (Durbin–Watson), Multi colinearity, Variance inflation factor, correlation (correlation coefficient, determining factor), regression analysis and test of its coefficients, correlation analysis and its coefficients and test of significance equality of a few correlation have been used. Validity of the estimated models over the validity of the required assumption for the model estimation in the present research has been studied in the following ways:

1) Kolmogorov - Smirnov test

2) The remaining diagram against the estimated values (not having the pattern / model in this diagram indicate to the Homogeneity of variance. this diagrams have been presented in the analysis of every hypothesis)

3) Durbin–Watson test (values near to 2 indicate lack of autocorrelation)

4) Value of Variance inflation factor (factor of increasing variance) in the end of the estimated tables values smaller than 5 indicate to lack of severe colinearity among independent variables.

Four variables out of 8 dependent variables have shown normal distribution in different year which are: *EVA, ASR, ATO, ROE* and the other four with Log transformation will find a normal distribution. These variables have been used in these forms in the models: *Ln(ROA), Ln(P/E), Ln(Q-TOBIN)* and *Ln(MB)*.

Descriptive indicators of variables

We first look at some basic statistics of the survey. Table 2 and Table 3 present some indicators for describing the research variables. These indicators include central indices such as average, mean, standard deviation, skewness, Kurtosis. Calculation of these indices in general and also in separation by year has been calculated and presented as follows,

Table 2
The summary of some basic statistics

	Variable					
Statistics	Human capital	Physical capital	Structural capital	Intellectual capital coefficient	Firm size	Ratio of market value to book value
Quantity	511	511	511	511	511	508
Average	7.11073	0.36061	0.63970	11.55364	5.5049	3.799
mean	2.73787	0.32633	0.63475	3.75240	5.4741	2.457
Standard deviation	15.406602	0.189601	0.192056	36.518387	0.69294	4.5573
skewness	4.225	1.376	-157	6.376	0.214	4.601
Kurtosis	17.317	2.947	-515	44.103	-296	28.669

Table 3
The summary of some basic statistics

	Q –Tubin ratio	Book return on equity	Ratio of asset turnover	Return of investment	Return on assets	Economic value added	Price to Earnings per share ratio
Quantity	511	511	511	511	511	511	505
Average	1.83024	0.19578	0.84010	38.3857	0.54758	504983.48	7.577
Mean	1.43851	0.17172	0.81483	19.1400	0.44677	74414.51	6.031
Standard deviation	1.245865	0.115039	0.346642	72.5558	0.432585	1899532.69	5.9427
Skewness	3.632	1.198	0.739	1.748	2.742	7.157	3.321
Kurtosis	17.828	1.622	1.434	4.448	11.829	56937	17237

The average value of the data indicates that 50% of the data are less than the middle number of the series and 50% of the data of more than the middle number of the series. The closeness of the average and mean indicate the symmetry of the data. Standard deviation shows dispersion and finally skewness is the symmetry index of the data. In addition, Table 4 and Table 5 show data analysis for each year and for different variables, separately.

Table 4
Some basic statistics over the period 2006-2012

Indices	Variables	2006	2007	2008	2009	2010	2011	2012
Average	MB	3.731	4.532	5.989	4.926	3.469	2.156	1.796
	Tobin Q	1.94341	2.1.668	2.28211	2.10238	1.58875	1.46829	1.32305
	ROE	223540	20671.	19818.	19417.	17799.	18251.	.18739
	ATO	83181.	86738.	81726.	81263.	81581.	86547.	.87035
	ASR	65.085205	55.119589	68.211507	37.046986		34.984247	15.282329
	ROA	58151.	60316.	63524.	60416.	56208.	38513.	.46178
	P/E	7.316	8.946	8829	8.425	6.980	5831	6.660
	EVA	141990.51	212414.73	747367.44	348732.44	475024.38	846536.65	762818.17
Mean	MB	2.754	2.901	3865	3.436	2.260	1.682	1.410
	Tobin Q	1.71029	1.55037	1.72880	1.66471	1.30350	1.24497	1.09336
	ROE	20372.	19481.	18884.	17268.	14280.	14755.	.15388
	ATO	87160.	85615.	83879.	79614.	77571.	87310.	.78135
	ASR	46.280000	38.300000	43.300000	17.260000		21.340000	5.070000
	ROA	48001.	53677.	52220.	52010.	50215.	37342.	.36479
	P/E	6.053	6.556	7.376	7.315	5.232	5.394	4.112
	EVA	63526.39	61282.65	64756.87	75295.13	44224.02	129730.21	141177.611

Table 5
Some basic statistics over the period 2006-2012

Indices	Variables	2006	2007	2008	2009	2010	2011	2012
average	Fsize	5.2958	5.3757	5.5555	5.6488	5.5425	5.5704	5.5458
	HCE	6.96876	5.76227	6.21991	6.57826	7.87598	8.50588	7.86403
	SCE	0.64027	0.62415	0.62810	0.63418	0.64207	0.65551	0.65364
	CEE	0.43005	0.39361	0.36175	0.35124	0.31224	0.32611	0.34926
	VAIC	9.19897	8.50605	9.12757	10.15271	12.66590	15.57106	15.35324
Mean	Fsize	5.3915	5.4275	5.4954	5.5491	5.4421	5.5535	5.5223
	HCE	2.71810	2.69799	2.70753	2.57455	2.68424	2.92927	3.18347
	SCE	0.63210	0.62935	0.63066	0.61158	0.62746	0.65862	0.68588
	CEE	0.43155	0.34001	0.35142	0.31847	0.28815	0.31189	0.30741
	VAIC	3.82685	3.73269	3.66144	3.67139	3.56895	3.95768	4.21555

Based on the information given in Table 4 and Table 5, the characteristics of the research variables have been specified somehow and all the variables can be analyzed considering the relevant indicators in statistical view. According to the results, the number of data for all the variables is 511 for total 7

years under study. For example, the average of intellectual capital and economic value added are equal to 11.55364 and 50.4983.48, respectively. The 4th row shows dispersion and deviation parameters from average criterion and the 5th and 6th show skewness and kurtosis over normal curve (bell-shaped) that the variable of economic value added with 7.157 has the highest skewness among variables.

6. Research hypotheses test

1st main hypothesis: There is a significant relationship between intellectual capital variable and market valuation indicators as an index of corporate financial performance.

Secondary hypotheses will be tested with the following statistical symbols:

$$\begin{cases} H_0: & \beta_1 = \beta_2 = \beta_3 = 0 \\ H_1: & \beta_i \neq 0 \text{ at least for i=1,2,3} \end{cases}$$

Table 6 shows the results of examining the 1st hypothesis test.

Table 6
The summary of testing the first hypothesis

Hypothesis test	Dependent variable	Pearson's correlation coefficient	Physical capital	Structural capital	Human capital	Correlation coefficient	Determining factor	f-value	Durbin-Watson	T-value	Model's sig. level	Confirmed hypothesis
1st secondary	MBV	r	0.364	0.222	-0.026	0.565	0.319	58.813	1.620	-9.466	0.000	H_1
		Sig. level	0.000	0.000	0.879							
		quantity	511	511	511							
		Regression	$Ln(MB)_{it} = -2.45 - 0.008HCE_{it} + 0.87SCE_{it} + 2.01CEE_{it} + \varepsilon_i$									
2nd secondary	TOBIN Q	r	0.364	0.222	-0.026	0.686	0.470	112.171	1.616	-13.011	0.00	H1
		Sig. level	0.000	0.000	0.879							
		quantity	511	511	511							
		Regression	$Ln(Q-tobin)_{it} = -1.69 - 0.003HCE_{it} + 0.60SCE_{it} + 1.56CEE_{it} + \varepsilon_i$									
3rd secondary	P/E	r	0.015	0.135	-0.087	0.195	0.38	4.896	1.412	6.209	0.000	H_0
		Sig. level	0.741	0.002	0.051							
		quantity	503	503	503							
		Regression	$Ln(P/E)_{it} = 1.48 - 0.65SCE_{it} + \varepsilon_i$									

Considering the fact that the significance levels of correlation coefficient for 1st and 2nd secondary hypotheses are smaller than 0.5 and the regression model is also significant, it can be concluded that intellectual capital can explain the changes on MB and TOBIN Q in an acceptable level (respectively 32% and 47%). Also, considering the results of the 1st to 3rd secondary hypotheses which led to the confirmation of 1st and 2nd secondary hypotheses and rejection of 3rd secondary hypothesis and also the based on the obtained information we can conclude that H_0 is rejected and H_1 is accepted and this indicates that the 1st main hypothesis of the research is confirmed, that is we can conclude that there is a positive relationship between intellectual capital and market valuation indicators especially the components of physical and structural capitals. From the result of the 1st main hypothesis it can be concluded that the finding of this research is consistent with the findings of Chen et al. (2005), Wang (2011), Bani et al. (2014) and has some similarities and some differences with other studies in the same field.

1st main hypothesis: There is a significant relationship between intellectual capital and profitability ratio (ROA) variables as a corporate financial performance.

$$\begin{cases} H_0: & r_{ROA,VAIC} = 0 \\ H_1: & r_{ROA,VAIC} \neq 0 \end{cases}$$

Here $r_{ROA,VIAC}$ represents correlation coefficient between intellectual capital with profitability ratio (ROA) variables.

Table 7
The results obtained from 2nd hypothesis test

Hyp.			Physical capital	Structural capital	Human capital	Correlation coefficient	Determining factor	f-value	Durbin-Watson	T-value	Model's ig. Value	Confirmed hypothesis
2nd main	ROA	Pearson's correlation coefficient	0.433	0.392	0.42	0.318	0.101	103.978	1.889	-18.278	0.000	H_1
		Sig. level	0.000	0.000	0.360							
		quantity	507	507	507							
		Regression equation	$Ln(ROA)_{it} = -3.87 - 0.008\,HCE_{it} + 1.82SCE_{it} + 2.19CEE_{it} + \varepsilon i$									

Considering the conducted studied over the period 2006-2012 the findings of Table 7 indicate that correlation coefficient in the explained model between the variables of intellectual capital and ratio of ROA is equal to 0.318. According to the confidences of *F* and *T* and significance value of them, there is a significant and positive but weak relationship between them and intellectual capital can explain 10% of the changes of Return on assets ratio (ROA) including market valuation indicators of a firm. Also considering the fact that the coefficients of physical capital efficiency and structural capital efficiency have the highest value (2.19 and 1.82) in the regression equation; hence, they have a higher power of explaining compared with the variable of human capital and human capital does not have a significant effect on ROA index. Namazi and Ebrahimi (2009) in their study have confirmed the existence of a positive relationship between intellectual capital with Return on Assets Ratio with a determining factor of 0.697 and have reported similar results.

3rd main hypothesis: There is a significant relationship between variables of intellectual capital and ratios of activities as indices of corporate financial performance.

$$\begin{cases} H_0: & r_{ATO,VAIC} = 0 \\ H_1: & r_{ATO,VAIC} \neq 0 \end{cases}$$

where $r_{ATO.VIAC}$ represents the correlation coefficient between variables of intellectual capital and ratio of activities. Table 8 presents the summary of our findings.

Table 8
The results obtained from 3nd hypothesis test

Hypothesis test	Dependent variable	Pearson's correlation coefficient	Physical capital	Structural capital	Human capital	Correlation coefficient	Determining factor	f-value	Durbin-Watson	T-value	Model's ig. Value	Confirmed hypothesis
3rd main	ATO	r	0.342	-0.071	-0.151	0.368	0.135	19.794	1.857	7.517	0.000	H_0
		Sig. level	0.000	0.111	0.018							
		quantity	511	511	511							
		Regression	$ATO_{it} = -0.236_{it} + 0.689CEE_{it} + \varepsilon i$									

As Table 8 shows, the significance level of the correlation confidence between variables of intellectual capital and asset turnover (ATO) – activity ratio is larger than 0.5 which is acceptable. This together with the fact that regression model is not significant for variables of human and structural capitals indicating that H_0 is accepted and H_1 is rejected. Therefore, it can be concluded that there is no significant relationship between intellectual capital and activity ratio (ATO). Determining factor or R^2 is equal to 0.135 which indicates the lack of balance in explanation of changes of assets turnover ratio ATO by intellectual capital variables.

4th main hypothesis: There is a significant relationship between variables of intellectual capital and ratios of capital return as an index of corporate financial performance.

Secondary hypotheses with the following statistical symbols will be testes:

$$\begin{cases} H_0: & \beta_1 = \beta_2 = \beta_3 = 0 \\ H_1: & \beta_i \neq 0 \text{ at least for i=1,2,3} \end{cases}$$

Table 9
The results of 4th hypothesis test

Hypothesis test	Dependent variable	Pearson's correlation coefficient	Physical capital	Structural capital	Human capital	Correlation coefficient	Determining factor	f-value	Durbin-Watson	T-value	Model's sig. Value	Confirmed hypothesis
5th secondary	ASR	r	0.197	0.113	0.042	0.280	0.079	10.781	1.523	-3.846	0.000	H_0
		Sig. level	0.000	0.011	0.343							
		quantity	511	511	511							
		Regression	$ASR_{it} = -102.49 + 98.33CEE_{it} + \varepsilon_i$									
4th secondary	ROE	r	0.696	0.432	0.074	0.889	0.791	473.010	1.997	-11.723	0.000	H_1
		Sig. level	0.000	0.000	0.095							
		quantity	511	511	511							
		Regression	$ROE_{it} = -0.236 - 0.001HCE_{it} + 0.35SCE_{it} + 0.53CEE_{it} + \varepsilon_i$									

Based on the findings from Table 9 we can see that correlation coefficient in the explained model between the variables of intellectual capital and return on equity is equal to 0.889. According to the results of Table 9, *F* and *T* coefficients maintain significant values and we conclude there is a positive and significant relationship between physical and structural capital and ROE and intellectual capital can explain 79% of the changes of return on equity (ROE) including return on capital indices. Also, considering the fact that the coefficients of physical capital and structural capital efficiency have the highest value (0.534 and 0.353) in this regression equation; hence, they have a higher explaining power compared with human capital which has a reverse relationship. Hence, considering the results of the 4th and 5th secondary hypotheses which confirms the 4th secondary hypothesis and rejects of 5th secondary hypothesis and also the information obtained from the table it can be concluded that H_0 hypothesis is rejected and H_1 is accepted and this indicates that 1st main hypothesis is confirmed. That is it can be concluded that there was a positive relationship between intellectual capital and return on capital indices.

From the comparison of the result of 4th main hypothesis with other studies it can be stated that the findings of this study are consistent with the findings of Namazi and Ebrahimi (2009), Madhoushi and

Asghari Nejad Amiri (2009), Goldi Sedghi (2008), Chen et al. (2005), Appuhami (2007) and have some similarities and some difference with other studies in the same field of study.

5th main hypothesis: There is a significant relationship between the variable of intellectual capital and value creation-based index EVA as the new index of corporate financial performance.

$$\begin{cases} H_0: & r_{ASR,VAIC} = 0 \\ H_1: & r_{ASR,VAIC} \neq 0 \end{cases}$$

where $r_{ASR,VAIC}$ represents correlation coefficient between the variables of intellectual capital and return on equity EVA.

Table 10
The results of testing the 5th hypothesis test

Hypothesis test	Dependent variable	Pearson's correlation coefficient	Physical capital	Structural capital	Human capital	Correlation coefficient	Determining factor	f-value	Durbin-Watson	T-value	Model's sig. Value	Confirmed hypothesis
3rd main	EVA	r	-0.124	0.220	0.206	0.557	0.310	55.374	1.734	-11.081	0.000	H_1
		Sig. level	0.006	0.000	0.000							
		quantity	498	498	498							
		Regression	$EVA_{it} = -1837338 + 3738.2\,HCE_{it} - 299155SCE_{it} - 221337CEE_{it} + \varepsilon i$									

As we can observe from the results of Table 10, significance value of the variables of intellectual capital and economic value added are smaller than 5%. This information indicates the rejection of H_0 and acceptance of H_1. Correlation coefficient in the explained models between variables of intellectual capital and economic value added are equal to 0.557 and 0.543, respectively. Considering *F* and *T* factors and their significant values there is a significant and negative relationship between them and intellectual capital explains 31% of the changes in economic added value. Also human capital efficiency alone has a significant and positive effect on economic value added.

Rahmanaye Roodposhti and Hemati (2009) in their study with the use of 6 models for measuring intellectual capital evaluated the relationship between intellectual capital and economic value added and did not reach to a consistent finding. However, Nikomaram, H., & Eshaghi, F. (2010) in their study stated that there was a significant relationship between intellectual capital and return on investments and value added and the effect of intellectual capital on these indices. In general, although, different findings have been found from these studies what is notable is the effect of intellectual capital on economic value added index.

6th main hypothesis: There is a significant relationship between firm size with total average of intellectual capital and corporate financial performance.

Secondary hypotheses are test with the following statistical symbols:

$$\begin{cases} H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0 \\ H_1: \beta_i \neq 0 \;\; i = 1,2,3,4 \end{cases}$$

Table 11
Correlation coefficient of 6th hypothesis test

	MB	Tobin Q	P/E	ROA	ATO	ROE	ASR	EVA
Pearson's correlation coefficient	0.365	0.373	0.059	0.315	-0.157	0.202	0.168	0.540
Significance level	0.000	0.000	0.183	0.000	0.000	0.000	0.000	0.000
Quantity	508	511	503	507	511	511	511	498

Based on the statistical output of the Table 11 and (sig≤5) firm size variable has a significant relationship with corporate financial performance, except for the Asset turnover ratio index for which the relationship is negative, for the rest of the years this relationship is positive and it can be interpreted that there was a positive and significant relationship between firm size and corporate financial performance indices and intellectual capital variables in multiple regression model.

Table 12
Regression equation coefficients analysis of the 6th hypothesis

Financial performance index	Explained regression model	Correlation coefficient	Determining factor (R^2)	Firm size factor - β	t-value		Relation direction	
					FSIZE	Sig. level	Intellectual capital	Financial performance
MB	$Ln(MB)_{it} = -2.45 - 0.008HCE_{it} + 0.87SCE_{it} + 2.01CEE_{it} + 0.40Fsize$	0.565	0.470	+0.40	8.904	0.000	+	+
Tobinq	$Ln(Q-tobin)_{it} -1.69 - 0.003HCE_{it} + 0.60SCE_{it} + 1.56CEE_{it} + 0.23Fsize$	0.686	0.319	+0.23	9.247	0.000	+	+
P/E	$Ln(P/E)_{it} = 1.48 + 0.14Fsize_{it} - 0.65SCE_{it}$	0.195	0.38	+0.14	3.153	0.0002	-	+
ROA	$Ln(ROA)_{it} = -3.87 - 0.008HCE_{it} + 1.82SCE_{it} + 2.19CEE_{it} + 0.21Fsize$	0.318	0.101	+0.21	5.243	0.000	+	+
ATO	$ATO_{it} = -0.236 - 0.073Fsize_{it} + 0.689CEE_{it}$	0.368	0.135	-0.073	-3.125	0.002	-	-
ROE	$ROE_{it} = -0.236 - 0.001HCE_{it} + 0.35SCE_{it} + 0.53CEE_{it}$	0.889	0.791	-	1.159	0.247	Not significant	
ASR	$ASR_{it} = -102.49 + 16.27Fsize_{it} + 98.33CEE_{it}$	0.280	0.079	+16.27	3.212	0.001	+	+
EVA	$EVA_{it} = -1837338 + 3738.2HCE_{it} - 299155SCE_{it} - 221337CEE_{it} + 424981Fsize$	0.557	0.310	+42981	13.218	0.000	-	+

Now we want to study the effect of firm size on the relationship between intellectual capital variable and financial performance indices through studying the coefficients of the variable of firm size (FSIZE). As it has been mentioned in Table 12, except for regression model of return on equity, the rest of the considered models are significant with the variable of firm size. The significant value of t-test also confirms this. Therefore, the variable of firm size is effective in explaining the relationship between the variables of intellectual capital and financial performance. In addition, the intellectual capital coefficients in the above equations indicate to influence positively on the access rate of companies to intellectual capital and their financial performance level.

9. Discussion and conclusion

After testing each of the hypotheses and concluding each of them separately it is time for making an overall conclusion of this study. In summary, there was a positive and significant relationship between the components of the variable of intellectual capital and indices of financial performance. In this relationship, intellectual capital variable has maintained the highest correlation with indices including investment return, market value and value added including financial performance indices. In this regard, the effect of firm size on intellectual capital variable and financial performance was direct and in the same direction. It should be noted that in developing countries contrary to developed countries, valuation of local markets with the increase of physical capital developed more than intellectual capital and they were less dependent on intellectual capital as a functional strategy. One of the reasons for this

is that this group is still dependent on trading and processing natural resources as a basic strategy for growth and development. Iran's Exchange Market also is not an exception from this and due to this physical capital has allocated the highest coefficient in intellectual capital components to itself.

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