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The study of the relation between intellectual capital and financial performance

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ABSTRACT

Categories of intellectual capital is important that over last few decades that has attracted attention of academic circles. actually change the pattern of corporate and with the emergence of new challenges and compete in the global arena, companies to maintain their competitive advantage should be worth more to think as intellectual capital as a key factor companies to create value and sustain competitive advantage has become known then identification and reporting of intellectual capital issue importance for corporate managers and users of financial statements. In this study, the relationship between intellectual capital components and financial performance of listed companies in the cement industry Studied at the Tehran Stock Exchange. The study period is 2007 to 2011 years. For test the hypotheses and data analysis from method of least squares regression and neural networks are used. The results indicated a significant relationship between intellectual capital and corporate financial performance indicators. On the other research findings can be concluded between intellectual capital and financial performance of companies in the same (similar) craft approach to regression analysis and neural networks value added intellectual coefficient model Polic (VAIC) gives similar results however, the performance impact on capital employed human capital is a significant difference in performance.

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Introduction

Intellectual capital includes knowledge, skills, communication and other elements. Intellectual capital as a key factor at excellence and maintain a competitive advantage for companies is recognized many researchers believe that the role of intellectual capital as a source of competitive advantage for companies is increasing day to day (Adoynson and Malone, 1997).

In the opinion of many scholars, twentieth century industrial economy was and twenty-first century is century of knowledge-based economy in industrial economics main factors for growth physical assets and corporate profitability, access to resources and raw materials and the geographical location but in today's knowledge-based economy although the aforementioned factors, physical assets, access to resources and raw materials and an important location for business growth but the main factor for the development and maintain competitive advantage of companies and the intellectual capital of the company (Mar, 2005).

In other words, company to maintain its competitive market base not only physical assets and rely on their own resources rather, the creation and maintenance of these assets and intellectual capital management step. Looking at the big companies in the last decade, we easily that mere presence of machinery and other physical assets and labor high on the success and profitability of the company is not and factors such as creativity and innovation in the delivery of new products and customer-friendly key factor in maintaining and position the company has become. A look at the top ten of Fortune magazine view and the last issue of the magazine in 2011 that includes Apple, Google, Microsoft and understandable that having skilled manpower, expertise and creative and other company has become a key factor and large multinational companies relying on their own resources and high investment in machinery can not maintain its position in the competitive market to ensure and for this purpose the investment more thought and knowledge management in enterprises step.

With attention to importance of knowledge in the past decade and the changes in the world economy. And move of identify the knowledge-based economy, rate and Intellectual Capital management issue has become critical for companies, managers must effectively manage the intellectual capital of the company. Users of financial statements must be aware of the company's intellectual capital able to predict the future and make informed decisions to take. After proper identification and valuation and proper management of intellectual capital for companies and is essential for users of financial statements that importance is increasing day by day (Compel, 2010).

With attention to importance of intellectual Capital in a knowledge-driven companies in this study, we relationship between intellectual capital and financial performance of firms examined the Cement industry two approaches, regression analysis and neural networks to evaluate the influence of independent variables on the dependent variables of the study compared and conclusions.

Problem Statement

Today, the ability to produce wealth, knowledge-based organizations. Recent studies show that unlike traditional sources of yield loss, knowledge really is specifically to enhance business performance. The transformation of intellectual capital has an organization that creates value thus, knowledge-based economy, organizations are looking to create, manage, develop and optimize utilization of intellectual capital in order to create organizational value and business process improvement. Also

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managers of the importance of intellectual capital category realized in the Knowledge-Based Economy and as it is a vital ingredient in the creation of competitive advantage, business owners focus on sustainable profitability and increase their wealth.

Since the concept of intellectual capital since a lot of research in developing countries on different aspects of intellectual capital including its relationship with corporate actions taken. In recent years, the cement industry directly and indirect impact on the economy is huge. The industry value added economic activity in a way that accounts who confirms employment is high.

Today, investors, creditors and managers looking for timely and reliable indicators to evaluate the performance and efficiency of economic units. using indicators such investors hold about or increase dividends, creditors about security of investment managers about the company will judge their performance in various sectors then variables of intellectual capital indicators of the financial performance of these companies is to be cost all resources are considered and the impact of intellectual capital variables and also the best basis for analyzing the impact on the financial performance of the companies discussed and measurements.

The importance and necessity of research:

Nowadays despite increasing importance of intangible assets and intellectual capital of the company most accounting systems, industrial able to measure intellectual capital companies and are not reflected in the financial statements and while the importance of intellectual capital employed sustainable profitability in line with company financial capital has been taken over. Due to the deep intellectual capital of companies increasing share of the world market, Sustainable profitability and ultimately increased shareholder wealth and also with regard to the complexities of today's global business environment for investors, creditors and other groups can use intellectual capital of the company as an indicator to assess the current status and performance of the business unit and also anticipated that future consideration. For this reason and many other reasons do extensive research and deep intellectual capital on various aspects of the concept of intellectual capital valuation methods And reporting of intellectual capital and with other management accounting and economic concepts seem necessary. For analysis and statistical calculations were performed in order to evaluate intellectual capital research various approaches have been used important to study the best approach for research and evaluation of intellectual capital gives some interesting results.

Research purposes:

This paper is using valuation models polic at direction measuring Intellectual Capital Cement any significant relationship between the independent variables of intellectual capital Including human capital efficiency (HCE), structural capital efficiency (SCE) and capital employed efficiency (CEE) dependent variables including total return on assets (ROA), Return on equity (ROE) basic index profitability (BEP) examined also any significantly associated with regression and neural network approaches are compared and evaluated best approach to the analysis of data in order to test this conclusion.

Research hypotheses:

The main hypotheses:

1) Investigate the relationship between intellectual capital and financial performance of firms is significant.

Sub-hypotheses:

A) Between the intellectual capital and the return on assets (ROA) is significantly associated companies.

B) Between intellectual capital and return on equity (ROE) is significantly associated companies.

C) Between intellectual capital and basic index profitability (BEP) are significantly associated companies.

2) Compare and evaluate the relationship between the components of intellectual capital and financial performance of the company's approach is significantly different regression neural network approach.

History research

The first experimental study to measure intellectual capital in the mid-1980s was conducted by the Swedish Association and after a lot of research was done to measure intellectual capital firms in different countries. Bunts Association of Canada (1998) and research in Malaysia Bunts and colleagues (2000) showed that between the elements of intellectual capital (human, structural and customer) with positive correlation with the performance of the industry. Regardless of the type of human capital on firm performance of the industry and structural capital is positively associated with financial performance. Balky study (2003) was an American multinational corporation that financial performance of U.S. multinationals and significant positive relationship between intellectual capital and firms.

In Boxboro research (2004) that was done in Turkey that both human capital and customer capital have an impact on the market value of companies. Chen et al (2005) The relationship between intellectual capital and market value and financial performance of listed companies in Taiwan's stock looked They thought Polic value-added models to measure the intellectual capital and the regression showed what's more is that the intellectual capital of the company's financial performance will be better and more market value.

Photon and colleagues (2007) relationship between intellectual capital and financial performance of the Singapore Exchange based on three financial indicators (earnings per share, return on equity and return annually) were examined. The results showed a positive relationship between intellectual capital and financial performance indicators and there are Significant differences between the coefficients of intellectual capital in various industries.

Apothem (2007) Impact factor value of intellectual capital into Thailand's stock exchange. Results coefficient value of intellectual capital to the price of Thai stocks. Results showed that the relationship between intellectual capital companies with a significant increase in their stock price. In Iran Angara Rustavi and Sera (2002) examined the relationship between intellectual capital stock market value of listed companies Stock Exchange began in Tehran. Findings indicate that intellectual capital is correlated with the stock market. Hematite and Kohlrabi (2010) examined the relationship between intellectual capital and financial performance of listed companies in Tehran Stock Exchange began during the years 2003 to 2008. The results demonstrate the intellectual capital is a significant positive relationship between efficiency and corporate finance. Numazu and Abraham (2009) examined the impact of intellectual capital on the financial performance of future of listed companies began in Tehran Stock Exchange for the years 2002 to 2005. The results showed that, regardless of company size, debt structure and financial performance in the past, between the intellectual capital and financial performance between intellectual capital and financial performance of the company's current and future level in all disciplines and industries, there is a significant

positive relationship. Abbasid and Sedgwick (2010) also study the performance impact of each element of intellectual capital on firm financial indicators presented in the Tehran Stock Exchange. The results show that firms with higher intellectual capital they have better financial performance. Yahiya Hausas Yeaned and others (2011) examined the impact of intellectual capital on firm performance of the pharmaceutical industry have accepted in Tehran Stock Exchange. The results indicated a significant relationship between intellectual capital and the measures of corporate financial performance.

Method research:

This research was a descriptive as the present study is applied. The purpose of this study and provide a suitable method for measuring intellectual capital companies and the relationship between intellectual capital and financial performance of companies cementations accepted in Tehran Stock Exchange and best method is a statistical approach to the analysis of research.

Data collection method:

Information required by the study of corporate financial data CD, provided by the Stock Exchange of Tehran, PDF format, which includes the annual financial statements and explanatory notes along financial Statements and policy processing software and a new approach is taken.

Statistical samples:

The research is method sampling cup. In this method, the financial statements of all listed companies in Tehran Stock Exchange (Cement Company) for the years from 2007 to 2011 (a total of 26 130 participants / year) consider the following characteristics of the 20 companies have been qualified.

1. They can be financial period ending March 29.
2. during the study period to be profitable.
3. During the financial year have not changed.
4. During the study period, they are not negative equity.
5. The balance sheets of these companies are included in intangible assets during the period of investigation.

The research model:

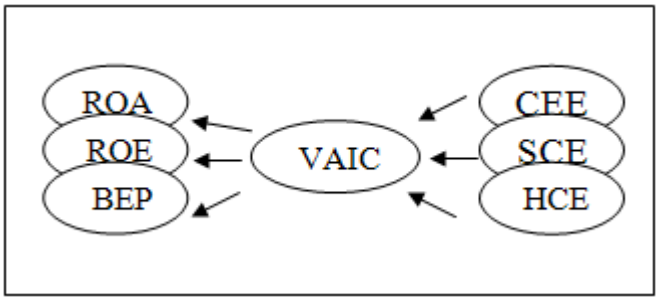
In this study to measure intellectual capital use Polic value added intellectual coefficient model. Polic value added intellectual coefficient model (VAIC) was introduced in 1997. In this year's first scientific results based on the value added intellectual capital coefficient were tested in Australian banks. This model was developed Polic in 1998 and the value added intellectual coefficient and its application in business management at the First World Congress and measuring intellectual capital was raised at McMaster University. In 1999, the first application of the value added intellectual capital coefficient in top 400 companies in Croatia and the results were published in the Journal of the economy. Polic your model completed in 2000 and to this day many of the world's scientific literature on intellectual capital value added ratio and the various applications that have been published in the literature by other teachers Polic other written and professionals from different countries. Value added intellectual coefficient has been introduced in a number of scientific conferences and many people in business have used this factor.

Polic model (2000) was the difference between the value of the company Proceeds from the sale of goods or services and the cost of materials and services purchased:

Cost of materials and purchased services - total revenue from sales of goods and services = VA (value added) The value of the information annual financial statements of the companies can also be calculated as follows:

Operating profit + depreciation expense + cost of staff salary = VA (value added)

In fact, the model Polic pay salaries and wages of employees as an expense is not considered as an investment value Added Intellectual Coefficient Polic model has three subsidiaries Human Capital Efficiency (HCE)[1], Structural capital efficiency (SCE)[2] and Capital Employed Efficiency (CEE)[3].



Variables:

Independent variables and dependent variables are divided into two categories. The dependent variable is the variable that changes is the independent variable.

Independent variables:

According to the model used Theoretical models and the intellectual capital components Polic Used as independent variables are as follows: Capital Employed Efficiency (CEE), structural capital efficiency (SCE) and Human Capital Efficiency (HCE).

1) Human Capital Efficiency (HCE)

This ratio represents the value created by workers Divided by the value added to the cost of the employee's salary and that means that for every riyal salary costs although RLS is a value-added and wages.

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

HC: human capital, which is equal to the cost of employee payroll.

2) Structural capital efficiency (SCE)

This ratio represents the value added created by the processes and company will be added existing structures.

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

SC: capital structure is obtained from the equation: SC = VA-HC

3) Capital Employed Efficiency (CEE)

This ratio represents the value created by the use of physical assets is evident a few Rails value for the asset has been created. This ratio is obtained by dividing the value of the capital employed:

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

CE: capital employed equals the book value of corporate assets except for intangible assets.

Given the above definitions, the following equation is obtained Polic factor worth thinking about:

$$VAIC = HCE + SCE + CEE$$

As can be seen in the capital Polic models of communication (the client) is not considered.

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[1] . Human Capital Efficiency
[2]. Structural Capital Efficiency
[3] . Capital Employed Efficiency

Dependent variables:

Dependent variables in the study of the financial performance of companies in the three cases are considered that profitability ratios are presented in the form ratios above are criteria that purest and most transparent companies measure their performance. Ratios and how to calculate is as follows:

1) Return on assets: This ratio indicates the efficiency of the asset:

$$ROA = \frac{NI}{TA(A)}$$

ROA: return on total assets

NI: net income

TA (A): Average total assets

2) Return on equity: This ratio shows the performance of equity in other words, for every Rails how much profit is the company's equity.

$$ROE = \frac{NI}{E(A)}$$

ROE: Return on equity NI: net incomeE (A): Average equity

3) Main profitability indicators:

The ratio non virtually eliminating the profit and loss net operating profit affected by the activities of the firm measures the company's assets and is actually one of the best indicators of Operation.

$$BEP = \frac{OI}{TA(A)}$$

BEP: main profitability indicators

OI: Operating Increment

TA (A): Average total assets

Statistical tools and methods:

The data extracted from the financial statements and the accompanying notes to the annual audited with using excel software to sort and classify and regression and neural networks, and data were processed using MATLAB software.

Analysis of survey data with use regression for the analysis of research data of method of least squares regression is used that method for finding the coefficients of the model equation $R^2 = \frac{\sum_{i=1}^{n}(Y_i - \hat{Y})^2}{\sum_{i=1}^{n}(Y_i - \bar{Y})^2}$ and coefficient of correlation were used to determine the modified $R^{\approx 2} = 1 - [\frac{n-1}{k-1}.(1-r)^2]$ also determine the effects of independent variables model with dependent variables that are required by the significance level (significance) and represents the amount of error in rejecting the null hypothesis (H0) that (P-value) is also known and no matter how much less sig is easier to reject the null hypothesis and (α) error level is 0/05 considered and used to test all hypotheses and research. In general we can say

$$\begin{cases} sig < \alpha \rightarrow H_0 & \text{Refuse to accept} \\ sig \geq \alpha \rightarrow H_0 & \text{Not refuse to accept} \end{cases}$$

:

The first step is to assess the relationship between components of intellectual capital and return on assets using a regression equation:

$$ROA_{it} = a_0 + a_1 HCE_{it} + a_2 SCE_{it} + a_3 CEE_{it} + \mu_{it}$$

To test the research model and each of the independent variables in 95% and with using observed table above significance level of the F-statistic less than 5% is can be concluded between intellectual capital and rate of return on assets is a significant relationship about relationship between each subset of intellectual capital rate of return on assets with attention T-test for the significance level should be less than 5% to represent the relationship between variables must be said that the efficiency of capital employed and human capital performance most relevant financial performance indicators return on assets and the efficiency of structural capital and financial performance indicators return on assets is no significant relationship.

The second step is to assess the relationship between components of intellectual capital and return on equity using a regression equation:

$$ROE_{it} = a_0 + a_1 HCE_{it} + a_2 SCE_{it} + a_3 CEE_{it} + \mu_{it}$$

To test the research model and each of the independent variables in 95% and with using observed table above significance level of the F-statistic less than 5% is can be concluded between intellectual capital and rate of return on equity is a significant relationship about relationship between each subset of intellectual capital rate of return on equity with attention T-test for the significance level should be less than 5% to represent the relationship between variables must be said that the efficiency of capital employed and human capital performance most relevant financial performance indicators return on equity and the efficiency of structural capital and financial performance indicators return on equity is no significant relationship.

The third step is to assess the relationship between components of intellectual capital and main profitability indicators using a regression equation:

$$BEP_{it} = a_0 + a_1 HCE_{it} + a_2 SCE_{it} + a_3 CEE_{it} + \mu_{it}$$

To test the research model and each of the independent variables in 95% and with using observed table above significance level of the F-statisticless than 5% is can be concluded between intellectual capital and rate of main profitability indicators is a significant relationship about relationship between each subset of intellectual capital rate of main profitability indicators with attention T-test for the significance level should be less than 5% to represent the relationship between variables must be said that the efficiency of capital employed and human capital performance most relevant financial performance indicators main profitability indicators and the efficiency of structural capital and financial performance indicators main profitability indicators is no significant relationship.

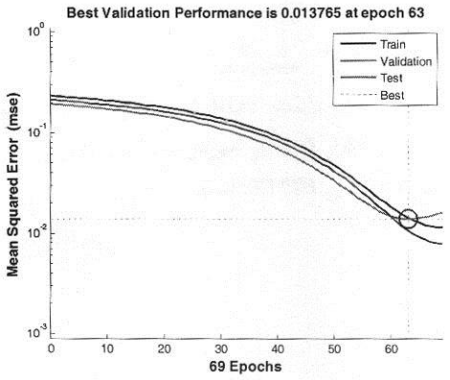
Analysis of survey data with using Neural Networks

after construction of neural networks that three input neurons W1, W2 and W3 (Oman Aspens) Variable and a constant (bias) that is similar to linear regression and input to the network (Coefficient of determination of the coefficients of the independent variables of the model) and the neural network (BEP, ROE, ROA) set function to start training after training, the network can be evaluated so good to see Network.

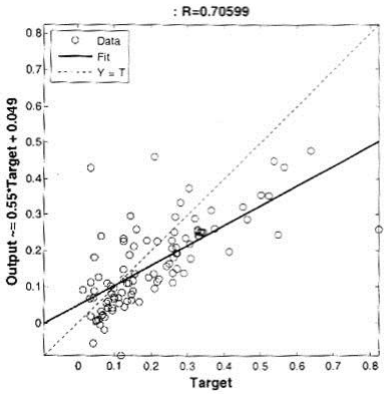
After this step, re-entry and the networks want it. at this stage, the neural network performance for output (y-test) with we show that the system error and in the next section correlation coefficients of the neural network model we want by a decree that brought the system to the power of 2 and regression coefficient is equivalent to the modified our offers that compares with a revised set of regression coefficients are comparable.

Since neural networks can be chosen randomly from all the coefficients generalize ability of properties that can be regression coefficients need to be modified or (Adjusted R Square) do not sample size for the model to examine the impact and the coefficients for the independent variables or input neurons and bias model (variables) of the network has used the dips table is prepared and submitted for analysis.

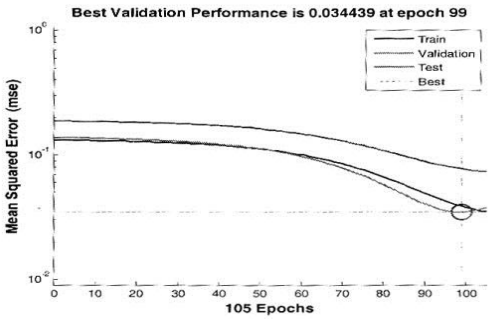
In table 1 result neural network computation coefficient of determination represents the ROA (return on assets) 0.4911 and significance of regression coefficients and the significance level used and all levels of significance were calculated by regression and neural networks in order to provide and the objective of extracting table above same objective function regression test neural network so output of the neural network is a linear regression which is linearly compare and analyze the result. all of the above tables 2 and 3 are derived for the number of neural network do for dependent variables ROE and BEP.



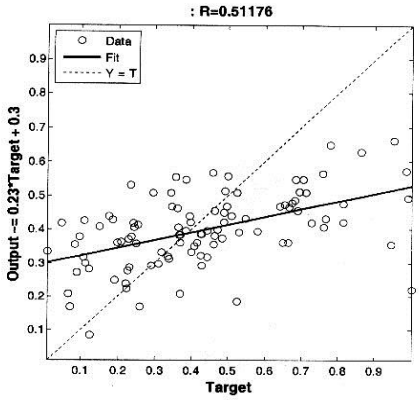
Best result of network performance variables ROA that charts above neural networks have been extracted from repeat 69 times on the network to stop training and the best part of it in repeat 63 times on the training error (mean square) training is 0.013765.



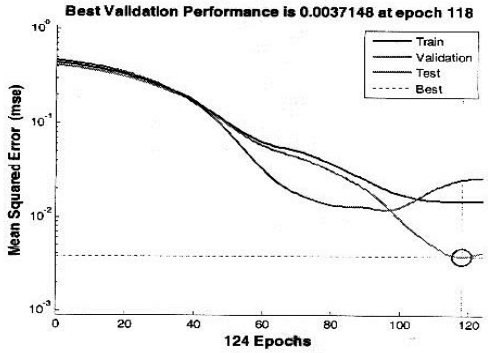
This diagram dispersion between the actual output of the neural network with purpose of the predicted dependent variable ROA shows a correlation coefficient R = 0.70599.



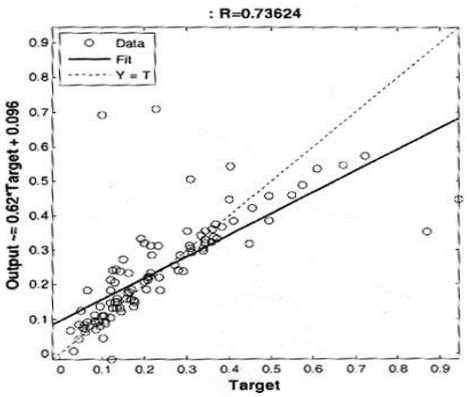
Best result of network performance variables ROA that charts above neural networks have been extracted from repeat 105 times on the network to stop training and the best part of it in repeat 99 times on the training error (mean square) training is 0.034439.



This diagram dispersion between the actual output of the neural network with purpose of the predicted dependent variable ROE shows a correlation coefficient R = 0.51176.



Best result of network performance variables BEP that charts above neural networks have been extracted from repeat 124 times on the network to stop training and the best part of it in repeat 118 times on the training error (mean square) training is 0.0037148.



This diagram dispersion between the actual output of the neural network with purpose of the predicted dependent variable BEP shows a correlation coefficient R = 0.73624.

For the dependent variable ROA:

1) Intellectual capital is a significant correlation with returns of the assets of the company. (Regression coefficient R2 = 0.501)

2) Capital employed efficiency (CEE) and the Human Capital Efficiency (HCE) with a coefficient of 0.45628 and 0.010312 are associated with return of the assets of the company (direct and meaningful relationship).

3) The structural capital efficiency (SCE) and asset return correlation exists.

For the dependent variable ROE:

1) Intellectual capital and return on equity of associated companies is significant. (Regression coefficient R2 = 0.317)

2) Capital employed efficiency (CEE) and the Human Capital Efficiency (HCE) with a coefficient of 0.52826 and 0.015186 equity returns are associated companies (direct and meaningful relationship).

3) The structural capital efficiency (SCE) There is no significant relationship between equity and efficiency.

For the dependent variable BEP:

1) The profitability of the intellectual capital of the company has a direct and significant. (Regression coefficient R2 = 0.548)

2) Capital employed efficiency (CEE) and the Human Capital Efficiency (HCE) with a coefficient of 0.59784 and 0.0073648 are associated with the main profitability indicators (direct and meaningful relationship).

3) The structural capital efficiency (SCE) and the asset return correlation exists.

Final conclusion The regression approach:

1) confirm existence of a relationship between the components of intellectual capital and financial performance can be found in the research findings Boniest, Rah, Chen and colleagues, and Helena Rodgers and Tania Michael, Ten and et al consistent with the findings and Williams was inconsistent.

2) The dependence of the coefficients of the variables can be concluded that the cement industry main profitability indicators of the dependent variable (BEP) are most associated with independent variables tested.

3) In practice, the efficiency of capital employed in the cement industry (CEE) most are related to corporate financial performance in other words, the cement industry has depended heavily on their physical assets and indeed much of the value of its assets is a must.

4) The cement industry structural capital efficiency (SCE) no relationship does not affect the financial performance of this industry

1) impact factors and impact of independent model variables (intellectual capital) cement industry most associated respectively to main profitability indicators (BEP) with 0.5229 and the rate of return on assets (ROA) and 0.4911 and less dependence on the returns from equity (ROE) is now 0.2875.

2) Human Capital Efficiency (HCE) in neural network model has highest association with corporate financial performance and cement industries in terms of productive and unproductive labor more dependent nonlinear approach itself.

3) Structural capital efficiency (SCE) in a neural network model has lowest correlation with the financial performance of companies.

1) To compare the dependence of the coefficients of the independent variables (intellectual capital) between approach to regression and neural network approach regression coefficient of determination corrected or Adjusted R-Square neural networks can be used to determine the coefficients. Using the Adjusted R-Square for regression, the independent variables are random changes in the mode or amount of sample to provide a more optimal and neural networks since the coefficients are random and nonlinear is more suitable for comparison and analysis.

2) The square of the mean square errors of both approaches (RMSE) , which are very close to one of both approaches can be used to analyze the research model . This is the estimated error rate (regression) margins very slightly more efficient than neural networks.

3) Significant independent effect of each approach on Capital Employed (CEE) and the Human Capital Efficiency (HCE) model is investigated in the regression approach (CEE) neural network approach is most effective and has the greatest impact on HCE financial performance of their companies.

4) Both linear approach (regression) and nonlinear (Neural networks) structural capital efficiency (SCE) little or no impact on the financial performance of companies has no affect in this case both approaches overlap.

Research limitations:

There are limitations in research component and interpretation of research findings and the generalization that should be considered include:

1. Due to the limited sample of listed companies in Tehran Stock Exchange and the country's cement industry and with due to many companies in the financial year to the end of March, the results extend to other companies and industries should be done with caution.

2. Since the calculation of financial statements prepared by the research variables based on the historical cost basis used in the and adjusted financial information based on the current value results may be different from the current results.

Suggestions

Based on the findings the following recommendations are offered:

1) According to many studies have been done on the intellectual capital of the country, local or national model may be developed and more information for were brought.

2) Due to the effect of intellectual capital on the financial performance of company is to offer investors when deciding to have a special interest.

3) Due to the limitations and requirements of accounting standards is proposed Iranian companies, information concerning the identification, measurement and reporting of intellectual capital in their annual report to board of assembly offer.

Conclusion of regression approach

regression results	Prob.	Adjusted R-square	R-square	Independent variables			Dependent variable
				HCE	SCE	CEE	
Confirm hypothesis	Acceptable	0.486	0.501	0.010312	0.10277	0.45628	ROA
Confirm hypothesis	Acceptable	0.296	0.317	0.015186	0.18606	0.52862	ROE
Confirm hypothesis	Acceptable	0.533	0.548	0.0073648	0.090702	0.59784	BEP

Conclusions neural network approach:

R-Square	Independent variables			Dependent variable
	HCE	SCE	CEE	
0.4911	0.5863	0.0279	0.1737	ROA
0.2875	0.3596	0.2297	0.2090	ROE
0.5229	0.9295	0.0885	0.2215	BEP

4) According to the neural network approach to analyze and evaluate intellectual capital firms in the same industry and similar is recommended. This approach leads to regression approaches are used and compared.

5) Is proposed for heterogeneous firms Dissimilar or intellectual capital of the profession for any R -linear (neural network) is used.

6) Is proposed to estimate and forecast the volatility skew variables investigated in the study of neural network approach are used.

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