A Criticism on Value Added Intellectual Coefficient (VAIC) Model

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Abstract
Value Added Intellectual Coefficient (VAIC) is one of the methods that have so far been used to calculate the degree of intellectual capital coefficients. Value Added Intellectual Coefficient (VAIC) that was presented in 2000 by Pulic measures the efficiency of three types of data: used capital (financial and physical), human capital and structural capital. Pulic has named the three efficiencies in his method as independent variables and has used Return on Assets (ROA), Return on Equity (ROE), Earnings per Share (EPS) and Enhanced Productivity (EP) variables as dependent variables. Many criticisms were made about Pulic's method among which the type of considered independent variables, i.e., the three efficiencies could be named as in fact the efficiency of physical, human and structural capitals have been calculated and they have nothing to do with the intellectual capital. Also as far as evaluation of VAIC method is concerned, the relationship among independent variables will not create any serious problem by itself. To explain the issue in details, the problems and criticisms made about VAIC method will be noted and in order to confirm the claim, a quantitative sample in a case study will be taken into account

Key Words:
Added Value, Intellectual Capital, Value Added Intellectual Coefficient (VAIC)

1. Introduction

Value Added Intellectual Coefficient (VAIC) method is one of the common methods to measure the degree of intellectual capital efficiency and in the defined special type from Pulic's point of view, is based on the financial performance of the companies. There are many criticisms made about this method. This method is not in fact able to assess the degree of effectiveness of intellectual capitals in an organization and it only studies the degree of their efficiency. Also the relation between the adopted independent variables in the mentioned method will make us face serious problems to assess the validity of the model [1].

In intellectual capital approach, finding the relation and degree of effectiveness of each of the coefficients of intellectual capital on the company's added value is desirable and attractive for us. Thus, it is highly important to achieve a method through which the degree of effectiveness of intangible assets or in other words, the same value-added intellectual capital coefficients are assessed [2].

Value Added Intellectual Coefficient (VAIC) method studies generally the coefficients of the intellectual capital including the three categories of coefficients under the titles of physical capital, structural capital and human capital; while the conducted studies show that the intellectual capital coefficients under the three general titles of human capital, structural capital and customer capital consist of detailed and minor components. Thus the design of a principal model that could measure the degree of effectiveness of the components of the three main categories of intellectual capital separately is very valuable. Also it should be added that VAIC method studies variables such as Return on Assets (ROA), Return on Equity (ROE), Earnings per Share (EPS) and Enhanced Productivity (EP) and that none of them directly study the added value of the organization [3].

The above mentioned points clarify well the necessity to achieve a method that could measure separately the degree of effectiveness of the intellectual capital coefficients directly on the added value of the organization and not indirectly on the financial performance variables, not under the title of the three general categories of these coefficients.

Criticism of Value Added Intellectual Coefficient (VAIC) model:

Although VAIC method is generally named as one of the common methods to measure intellectual capital, it is also used in the studies about the efficiency of intellectual capital. In fact a large number of the papers that point to the efficiency of intellectual capital used Pulic's famous model to calculate the efficiency of the intellectual capital. Thus in this section, a brief explanation together with the main criticisms made to this method are presented and we will see that this method not only has some problems and shortcomings, but also is not able either to measure the efficiency of the intellectual capital.

Pulic has introduced this method to calculate the efficiency of the key sources of the organization and the main output of the calculations of this method is a coefficient of the

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degree of effectiveness of the financial capital to create the company's added value. He speculates two key sources of the activities of the organization as the used capital resources (financial or physical) and intangible ones (including human and structural capital). He studies measurement of intellectual capital from the viewpoint of calculating efficiency of the resources to create value. The most important assumption of this capital model is to take the costs related to the human resources into account. In fact the total set of these costs is assumed as the human capital and when deducting this amount from the total added value of the company, the structural capital is also calculated [4]. Then by dividing the added value by the physical and financial capitals, the added value per one investment unit in the tangible assets is calculated and by dividing the added value by the human capital, the added value per an investment unit in the human capital is calculated. Of course this model divides the added value by the reversed structural capital to calculate the similar coefficient in the structural capital. Hence the efficiency of the intellectual capital could be calculated as the total of human and structural capital efficiencies and the efficiency of the total resources of the company is also calculated as the total efficiency of the intellectual capital and efficiency of the tangible resources [5].

Although it seems that Pulic has presented a simple structure to calculate the efficiency of intellectual capital, in fact this structure relies on some highly challenging assumptions. Andriessen has found four main criticisms with this method that is mentioned briefly as follows [2]:

1. This method cannot separate the capitals from costs correctly, thus all the costs that are spent on human resources are not considered as the capital. Only the costs related to education, learning and development of skills are considered as capital.
2. This model shows the meaning of reserve (balance) and flow for each other because added value means the flow which comes from resources (reserves) such as human capital. If the costs of human resources are accepted as capitals, these capitals will be considered as a flow that adds to the balance of human capital (and thus is not a synonym for human capital).
3. Dividing the added value by human capital cannot calculate the efficiency of human capital which means how much every human capital unit can increase the added value. Because the added value results from the three sources of human, structural and financial capitals and determining the share of each of these three in the added value requires study of the superior relations among these factors.
4. Supposition of the fact that the effect of structural capital is opposite to the human capital will have strange results and will distort the model.

Stahle et al, 2011 recently presented an article under the title of criticism of VAIC method and studied this method in details. They, rewriting the expressed relations in method and removal of some of its ambiguities showed that in fact VAIC efficiency (or a type of intensity) demonstrates the workforce and the company's financial capital and does not have a special link with the company's intellectual capital. In addition, the other shortcomings such as using the variables will provide an overlap in this method. Stahle has classified the articles that used this method and has also reviewed some of the results of these studies which do not sometimes correspond with each other.

There are also some other criticisms of VAIC method. The major part of these criticisms was made by Andriessen in 2004. Andriessen said that the principal suppositions are the problematic methods and lead to inefficient results [2]. However, a large number of researchers such as Chen et al in 2005, Shui in 2006, Kujansiu and Langoist in 2007, Ten et al in 2007, Yamala and Kosken in 2007, Komas in 2007 and 2008 as well as Chen in 2009 referred to VAIC method as the most attractive method among the suggested methods to measure the intellectual capital. For example, Chen in 2009 referred to some very suitable arguments by VAIC and concluded that VAIC is the best and most suitable method to measure the intellectual capital [6]. Also Camas in 2007 and 2008 proved that VAIC method is the most suitable one to measure the intellectual capital [7].

The added value of a company is the result of total operational profit (P), costs of human resources (C), reduced value of current and long-term assets (D) and depreciation of other assets of the company (A). The added value formula, i.e., A + D + P is mainly equal to the company's operational profit [8].

The part related to the fundamental capital of the VAIC is calculated by finding the difference between the company's added value and its human capital. However, there is no reason that the fundamental capital variable could be classified as the fundamental capital. The calculated fundamental capital is merely a traditional financial and accounting variable which is similar to the operational profit.

The efficiency of the human capital is calculated through dividing the added value of a company by its human capital [9]. This coefficient shows the actual productivity of the company's staff, i.e., the value that the company obtains through investment of one monetary unit over the human workforce. This parameter is defined officially as follows: "Added value for each unit of the human resources costs shows the efficiency of an economic unit and also demonstrates the number of the required workers and the economic situation of that unit." If a parameter is given number '1', it will mean that the produced added value is completely dependent on the costs of human resources.

The second element of efficiency means the fundamental capital efficiency in the Value Added Intellectual Coefficient model which is the result of dividing the fundamental capital of the company by its added value [9].

The fundamental capital efficiency measures the amount of capital that a company gains by investing of a currency on the added value and indicates the productivity or efficiency of the added value. The third factor of efficiency, i.e., capital efficiency used by a company is calculated through dividing the added value by the used capital of the company and as its name shows, it measures the amount of the used capital efficiency. In the last stage, the formula of calculating the Value Added Intellectual Coefficient defines the intellectual capital efficiency of the company and using it, the Value Added Intellectual Coefficient of the company is calculated [9]. The intellectual capital efficiency is gained by adding human capital efficiency to fundamental capital efficiency. No mention has been made of intellectual capital in any part of the calculations because the variables are merely the financial parameters and the variables related to human workforce. This variable has a clear relationship with the actual productivity measurement coefficient of the human workforce and is merely a more complicated copy of it which shows the general productivity of the human workforce of a company in practice.

Eventually the Value Added Intellectual Coefficient is calculated by adding the general productivity of the human workforce to the used capital efficiency. No emphasis has been made on intellectual capital in any part of the calculations. In return, this parameter is mainly an efficiency parameter that is calculated by adding the productivity of the human workforce to productivity o/r the capital efficiency to come up with a general productivity measurement parameter.

Value Added Intellectual Coefficient method is based on the main elements of intellectual capital, i.e., physical (fundamental) capital, human capital and efficiency of the intellectual capital. The intellectual capital is calculated directly through the figures that are extracted from the offices of the company and these figures do not include something which is actually related to intellectual capital. Therefore, Value Added Intellectual Coefficient measures the operational efficiency of a company in practice so that it has no relation with the intellectual capital.

When the elements of the intellectual capital change to financial figures and amounts change in a non-linear and non-analytical way, they lose their connection with the meaning of intellectual capital. For example, human capital in practice has four factors such as skills of the staff, work experience, education and incentive 3, but the human capital in Value Added Intellectual Coefficient model is only shown with the costs of the human resources. In this case, it goes without saying that the concept of this meaning has certainly changed and no mention of the previous cases will be made.

This model has a similar problem with fundamental capital and it does not have any relation with the capital at all so that the Value Added Intellectual Coefficient as the indicator (determiner) of the intellectual capital is misleading. Considering this model in practice (when the intellectual capital is deprived of its conceptual factors), it works in a linear form with the used parameters of today and this gives rise to the question whether this model can gain the actual added value in addition to the financial parameters that are currently used?

In addition to the conceptual ambiguities of Value Added Intellectual Coefficient, calculating its formula has the following serious problems in connection with the internal credit and interpretation of the parameter:

The equations of physical capital efficiency and human capital efficiency have overlaps and complete dependence on each other that emanate from their roots. It means that the two are derived from each other:

$$\text{Efficiency of human capital} = \frac{1}{\text{Efficiency of physical capital} - 1}$$

or

$$\text{Efficiency of physical capital} = \frac{1}{\text{Efficiency of human capital} - 1}$$

This status in practice creates a situation in which the human capital efficiency cannot be analyzed and interpreted significantly in the equation of 'human capital efficiency + physical capital efficiency = intellectual capital efficiency' without making any reference to the added value or human capital.

This is the actual problem because human capital is found to be equal to the salary costs and it is often interpreted as the human capital coefficient. Thus, the more the costs of the salary are, the more the human capital will be (for example, Corado et al studies, 2004 could be referred to). When in the Value Added Intellectual Coefficient model, the human capital efficiency is calculated by dividing the added value by the salary costs, there will be a situation where the less the salary costs are in the denominator of the fraction, the higher the human capital efficiency will be.

This problem could be solved by taking the following into consideration:

Human capital efficiency merely measures the use of human capital and not the human capital at the measurement spot.

When comparing the amounts of the intellectual capital efficiency and the intellectual added value coefficient in the two measurement spots, it should be noted that the measurement spots apply to a general level of salary. Hence, the companies or countries that have high salaries cannot

be compared with the companies or countries that have low salaries.
Use of added value is problematic. The independent variables of added value, i.e., operational profit (P), salary costs (C), capital reduction (D), asset depreciation (A) at different economic sections have remarkably different structures from each other. For example, the companies that are active in the investment sections such as heavy metal industries, wood industries and banks have advantage because the amount of their intellectual added value usually goes up without taking the human capital and its foundations into consideration.

Meanwhile the physical capital which is obtained using the following equation: A + D + P = SC connect the physical capital parameter and the intellectual added value coefficient together. This relation is particularly higher in the case of the two variables A and D. This relation makes comparing the two following cases impossible:
Comparison between capital industries and non-capital industries
Comparison between wealthy countries and poor countries
Other problems with Value Added Intellectual Coefficient (VAIC):
The first problem related to Value Added Intellectual Coefficient (VAIC) is the way to calculate the added value of the organization. As it was mentioned above, several methods (formula) were mentioned in this model to calculate the added value and now it should be considered which of the mentioned methods could be a better model for calculating the actual figure of the added value.
When calculating the added value in some of the considered relations, the human workforce costs were also added. This issue required many debates. In the formula of the added value, the human workforce costs is positively effective, thus the big companies that have many human workforces and their workforce costs are high should have higher added value, while this is not always the case and this clarifies the problem to define added value and the method to calculate it well. The other problem with the above model is the type of the intellectual capital coefficients that were considered. The above model classifies the intellectual capital coefficients into to human capital and structural capital categories and in the next step, the structural capital is divided into two categories of organizational capital and customer and eventually the two factors of innovative capital and process capital were taken into account for the organizational capital coefficient. Also the Value Added Intellectual Coefficient (VAIC) model helps to calculate the process capital from the financial statements which are in fact the reference of the model calculations. No definition has been imagined and they were calculated by only using the mathematical relations between the coefficients.

SC=CC+LNC+PC
SC: Structural capital
LNC: Innovation capital
Process capital PC :
Customer capital CC :

The considered coefficients for the intellectual capital in this model are very restricted. Among all the defined coefficients for the above intellectual capital model, only two coefficients of human capital and structural capital were considered. Further more, these two coefficients under study do not consider all the minor coefficients. For example, for the human capital coefficient, it is not just limited to the salary and wages of the staff and no effect of the important coefficients such as creativity of the staff, knowledge of the staff, job skills and other coefficients of the human capital were noticed. This issue applies to the structural capital coefficient, while this is even worse when it comes to structural capital because VAIC model has used the following relation to calculate the structural capital:

SC=VA-HU
How is the model for this type of calculation of structural capital justified?
As far as mathematics is concerned, this type of subtraction is completely wrong because VA variable is of added value type and is a type of profit, while HU variable is of costs type so how could we deduct the two variables when they are of two different types?

It was at least better that the Value Added Intellectual Coefficient (VAIC) model was considered equal to the staff costs as it had presented a definition for the human capital. However, this definition is not a complete and suitable definition and presents a definition for the structural capital to make it equal to the costs in the financial statements.

The considered parameters for VAIC model (the intellectual capital coefficients considered in the model) cause the intellectual capital and its efficiency not to be assessed and evaluated in fact as only the company's workforce and its used physical capital will be assessed.

The other forms that apply to VAIC model is the type of calculation of its input variables. When the given figure is divided by the costs of the human capital efficiency of its staff costs, the added value that by itself has some shaky position in the method to calculate it is reached. Considering the meaning of efficiency, human capital efficiency is the amount of the gained added value of each unit of costs for the human workforce. There is no problem so far in the type of relation for the human capital efficiency. The main problem is the figure of the added value because the calculated figure for the added value consists of all different types of intangible assets as well as tangible assets

of the organization, so how the efficiency of human capital is gained by dividing it by the costs of the staff? This problem is also noticeable when calculating the capital efficiency.

The other important problem in this model is the existing relation between input variables, i.e., human capital efficiency and structural capital efficiency that are used and the independent variables that have relations with each other. Although this relation is not linear, it does not cause any error in the model either.

Selection of proper option to calculate added value:
The method by which the added value is calculated should be able to encompass all the effective factors in adding value to the organization, i.e., it should be able to include both tangible and intangible assets so that the best methods to calculate will be as follows as far as the components of calculation of the two methods are concerned:

Added value = Profit before tax deduction + salary and wages of the staff + interest + tax
Added value = Company's depreciation costs + Company's total interest costs + Company's share dividend + Company's tax + Capital of shareholders' equity.

Study of a quantitative sample

In this study, VAIC was studied in more than 50 organizations. For example the result of one of the studies was the case study of Pars Oil Company that showed the absence of a significant relation among the coefficients and the results of this study have been completely mentioned as follows.

Research method

Library studies were used to collect data from the financial statements of the organization under study.
In order to find the relation between intellectual capital coefficients in the organization under study and the added value from the, a regression analysis could be used. EVIEWS software was used for this purpose employing secret temporal data.

Timescale of the study

The timescale of the study and the company's financial statements are from 1982 to 2011.
Variables of the study
The variables under study in this research are classified into three categories of independent variables, dependent variables and controlling variables.
Dependent variables:
ROA
ROE
EPS
EP

Independent variables:
1. VACA
2. VAHU
3. STVA
4. VAIC

Controlling variables:
1. FSIZE
2. DEBT
3. Logarithm of the natural prices of shares

As far as controlling variables are concerned, it is worth mentioning that we have had the equality of variables in both sides including equality of dependent variables and independent variable/s through a regression analysis. Independent variables are selected in a way to make sure about their relation with the dependent variables. I am pretty sure that there might be variables whose effect on dependent variables is not certain. These variables are considered as the controlling variables in the model in question. The controlling variables like the independent variables are added to the right side of the regression equation to distribute the correlation coefficients among the variables.

Model and procedure

The added value intellectual coefficient method could be seen in the following stages:
First stage: To determine the added value (VA)
According to the beneficiaries' view, the added value is calculated as follows:
VA=OUTPUT-INPUT
OUTPUT = Total income from sale of goods and services
INPUT = Total costs of materials, purchased components and services
According to this approach, every individual or group that is affected by the events of the commercial unit should have an interest in the commercial unit. This group of beneficiaries consists of shareholders, employees, financial suppliers, government and society. Hence to measure the performance, a criterion such as the beneficiaries' added value is better than the accounting profit which only indicates the shareholders' yield. Thus the added value could be calculated according to the following equation:
VA = S - B - DP = W + I +T + NI
Where NI is the profit following deduction of tax.
R = Changes in the accumulated profit
S = Income from sale
B = Cost price of sold goods and presented services
DP = Depreciation
W = Salary and wages of the staff
I = Interest
DD = Divided dividend
T = Tax
Second stage: To determine the efficiency of used capital (physical and financial)

In order to present a complete image of the efficiency of the resources creating value in this model, it is necessary to consider the physical capital efficiency as well as financial capital and this efficiency is calculated as follows:
VACA = VA ÷ CE
Used capital efficiency : VACA
CE: Used capital which is equal to the book value of the total assets of the company minus intangible assets of it
Third stage: To determine the efficiency of human capital
According to this model, all the costs of the staff are considered as human capital:
VAHU = VA ÷ HU
VAHU: Human capital efficiency
HU: Human capital which is equal to the total costs of the company's salary and wages.
Fourth stage: To determine the efficiency of structural capital
STVA = SC ÷ VA
SC=VA-HU
STVA: Structural capital efficiency
SC: Structural capital of the company
Fifth stage: To determine the added value intellectual coefficient
VAIC = VACA + VAHU + STVA

Controlling variables:
FSIZE: Natural logarithm of total investments = The size of organization
DEBT: Ratio of total debts to total assets = Pyramid credit
The third controlling variable is also equal to the natural logarithm of the share price.
Suggested models
Linear Regression Model
Some models are considered in this section and the regression relation is estimated using them and then using the significant level of the estimated coefficients, the models are approved and or rejected.

ROE=C(1) +C(2) *VACA+C(3) *VAHU+C(4) *STVA	The first hypothesis
ROA= C(1) +C(2) *VACA+C(3) *VAHU+C(4) *STVA	The second hypothesis
EPS= C(1) +C(2) *VACA+C(3) *VAHU+C(4) *STVA	The third hypothesis
EP= C(1) +C(2) *VACA+C(3) *VAHU+C(4) *STVA	The fourth hypothesis
ROE=C(1) +C(2) *VACA+C(3) *VAHU+C(4) *STVA+C(5) *DEBT+C(6) *LNJS	The fifth hypothesis
ROA=C(1) +C(2) *VACA+C(3) *VAHU+C(4) *STVA+C(5) *DEBT+C(6) *LNJS	The sixth hypothesis
EPS=C(1) +C(2) *VACA+C(3) *VAHU+C(4) *STVA+C(5) *DEBT+C(6) *LNJS	The seventh hypothesis
EP=C(1) +C(2) *VACA+C(3) *VAHU+C(4) *STVA+C(5) *DEBT+C(6)*LNJS	The eighth hypothesis

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

Net interest NI :
Total shareholders' equity over no. of shares. = Total shareholder's equity) Average(SHE(A) :

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

NI : Net interest
Total assets (Average (TA(A)) :

$$EPS = \frac{CSNI}{WANCS}$$

Ordinary shareholders' net interest CSNI :
Symmetrical average of the issued ordinary number of shares WANCS :

1. The number of ordinary shares issued at the end of this period was used instead of the symmetrical average number of issued ordinary number of shares.

$$\mathrm{EP} = \frac{\mathrm{OUTPUT}}{\mathrm{INPUT}}$$

System output that could be the amount of production OUTPUT:
System input that could be the number of working hours or the amount of raw materials INPUT:

Results from software analysis
The First hypothesis:
First hypothesis: ROE=C(1) +C(2) *VACA+C(3) *VAHU+C(4) *STVA
As the estimated results of the above formula show, PVALUE amount is more than 0.05 for all the coefficients and this means that these coefficients are insignificant. It is noticed that the amount of R-squared is also 0.89 and since we only accept 5% error, this also shows that the first hypothesis has not been made clear.

ROE=C(1)+C(2)*VACA+C(3)*VAHU+C(4)*STVA

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-3.371462	7.148720	-0.471618	0.6515
C(2)	8.531247	3.665398	2.327509	0.0528
C(3)	0.754903	0.707961	1.066306	0.3217
C(4)	2.981375	13.97257	0.213373	0.8371

R-squared	0.898904	Mean dependent var	5.050907
Adjusted R-squared	0.855578	S.D. dependent var	2.493332
S.E. of regression	0.947539	Akaike info criterion	3.005391
Sum squared resid	6.284814	Schwarz criterion	3.150080
Log likelihood	-12.52965	Hannan-Quinn criter.	2.914185
F-statistic	20.74713	Durbin-Watson stat	1.783625
Prob(F-statistic)	0.000734		

The Second hypothesis:

ROA=C(1)+C(2)*VACA+C(3)*VAHU+C(4)*STVA

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.187921	0.142242	-1.321133	0.2280
C(2)	0.825968	0.072933	11.32511	0.0000
C(3)	-0.002528	0.014087	-0.179464	0.8627
C(4)	0.175763	0.278020	0.632194	0.5473

R-squared	0.980271	Mean dependent var	0.167429
Adjusted R-squared	0.971815	S.D. dependent var	0.112302
S.E. of regression	0.018854	Akaike info criterion	-4.828925
Sum squared resid	0.002488	Schwarz criterion	-4.684235
Log likelihood	30.55908	Hannan-Quinn criter.	-4.920131
F-statistic	115.9335	Durbin-Watson stat	0.941950
Prob(F-statistic)	0.000002		

ROA= C(1) +C(2) *VACA+C(3) *VAHU+C(4) *STVA

We notice that the coefficients of C(3), C(1) and C(4) are not significant, but the amount of R-SQUARED statistic of F shows a significant regression.

The third hypothesis: EPS= C(1) +C(2) *VACA+C(3) *VAHU+C(4) *STVA

EPS=C(1)+C(2)*VACA+C(3)*VAHU+C(4)*STVA

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-282.2004	1313.544	-0.214839	0.8360
C(2)	-1330.687	673.4995	-1.975781	0.0887
C(3)	126.1287	130.0845	0.969590	0.3646
C(4)	537.8364	2567.395	0.209487	0.8400

R-squared	0.608714	Mean dependent var	380.4232
Adjusted R-squared	0.441020	S.D. dependent var	232.8710
S.E. of regression	174.1059	Akaike info criterion	13.43249
Sum squared resid	212190.0	Schwarz criterion	13.57718
Log likelihood	-69.87870	Hannan-Quinn criter.	13.34129
F-statistic	3.629911	Durbin-Watson stat	1.741767
Prob(F-statistic)	0.072683		

As the estimated results of the above formula show, PVALUE amount is more than 0.05 for all the coefficients and this means that these coefficients are insignificant. It is noticed that the amount of R-squared is also 0.60 and since we only accept 5% error, this also shows that the third hypothesis has not been made clear.

The fourth hypothesis: EP= C(1) +C(2) *VACA+C(3) *VAHU+C(4) *STVA

EP=C(1)+C(2)*VACA+C(3)*VAHU+C(4)*STVA

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-1.211086	1.294666	-0.935443	0.3807
C(2)	-0.470278	0.663820	-0.708442	0.5016
C(3)	-0.192796	0.126215	-1.503693	0.1764
C(4)	3.329139	2.530497	1.315606	0.2298

R-squared	0.320839	Mean dependent var	0.272072
Adjusted R-squared	0.029769	S.D. dependent var	0.174216
S.E. of regression	0.171604	Akaike info criterion	-0.411970
Sum squared resid	0.206135	Schwarz criterion	-0.267281
Log likelihood	6.265836	Hannan-Quinn criter.	-0.503176
F-statistic	1.102276	Durbin-Watson stat	2.148154
Prob(F-statistic)	0.409725		

As the estimated results of the above formula show, PVALUE amount is more than 0.05 for all the coefficients and this means that these coefficients are insignificant. It is noticed that the amount of R-squared is also 0.32 and since we only accept 5% error, this also shows that the third hypothesis has not been made clear.

ROE=C(1)+C(2)*VACA+C(3)*VAHU+C(4)*STVA+C(5)*DEBT+C(6)*LNJS

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	74.97539	27.12072	2.764506	0.0396
C(2)	-12.01901	9.974352	-1.204992	0.2821
C(3)	2.521048	0.841243	2.996815	0.0302
C(4)	-16.25358	13.23025	-1.228517	0.2739
C(5)	-9.967751	8.211655	-1.213854	0.2790
C(6)	-2.520488	0.795729	-3.167522	0.0249

R-squared	0.966395	Mean dependent var	5.050907
Adjusted R-squared	0.932791	S.D. dependent var	2.493332
S.E. of regression	0.646390	Akaike info criterion	2.267626
Sum squared resid	2.089103	Schwarz criterion	2.484660
Log likelihood	-6.471942	Hannan-Quinn criter.	2.130816
F-statistic	28.75776	Durbin-Watson stat	2.483163
Prob(F-statistic)	0.001084		

The fifth hypothesis: ROE=C(1) +C(2) *VACA+C(3) *VAHU+C(4) *STVA+C(5) *DEBT+C(6) *LNJS

As the estimated results of the above formula show, PVALUE amount is not less than 0.05 for all the coefficients and this means that all the coefficients are not significant. It is noticed that the amount of R-squared is also 0.96 which shows a strong relation.

ROA=C(1)+C(2)*VACA+C(3)*VAHU+C(4)*STVA+C(5)*DEBT+C(6)*LNJS

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	1.666262	0.268373	6.208761	0.0016
C(2)	0.115768	0.098701	1.172913	0.2937
C(3)	0.048114	0.008325	5.779849	0.0022
C(4)	-0.498100	0.130920	-3.804622	0.0126
C(5)	-0.548077	0.081258	-6.744876	0.0011
C(6)	-0.042537	0.007874	-5.402154	0.0029

R-squared	0.998378	Mean dependent var	0.167429
Adjusted R-squared	0.996756	S.D. dependent var	0.112302
S.E. of regression	0.006396	Akaike info criterion	-6.963727
Sum squared resid	0.000205	Schwarz criterion	-6.746693
Log likelihood	44.30050	Hannan-Quinn criter.	-7.100537
F-statistic	615.5159	Durbin-Watson stat	2.192787
Prob(F-statistic)	0.000001		

The sixth hypothesis: ROA=C (1) +C (2) *VACA+C (3) *VAHU+C (4) *STVA+C (5) *DEBT+C (6) *LNJS

It is noticed that the C (2) coefficient is not significant, but the amount of R-squared indicates a strong relation (co-linear error).

The seventh hypothesis: EPS=C (1) +C (2) *VACA+C (3) *VAHU+C (4) *STVA+C (5) *DEBT+C (6) *LNJS

EPS=C(1)+C(2)*VACA+C(3)*VAHU+C(4)*STVA+C(5)*DEBT+C(6)*LNJS

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	9313.856	6742.891	1.381285	0.2257
C(2)	-5563.861	2479.874	-2.243606	0.0749
C(3)	410.2531	209.1540	1.961488	0.1071
C(4)	-3494.301	3289.373	-1.062300	0.3367
C(5)	-3614.153	2041.623	-1.770235	0.1369
C(6)	-177.5142	197.8381	-0.897270	0.4107

R-squared	0.761867	Mean dependent var	380.4232
Adjusted R-squared	0.523734	S.D. dependent var	232.8710
S.E. of regression	160.7089	Akaike info criterion	13.29952
Sum squared resid	129136.7	Schwarz criterion	13.51655
Log likelihood	-67.14735	Hannan-Quinn criter.	13.16271
F-statistic	3.199338	Durbin-Watson stat	2.833535
Prob(F-statistic)	0.113813		

It is noticed that all the coefficients are significant, but the amount of R-squared is 0.76 which indicates that the 7th hypothesis has not been made clear.

The eighth hypothesis: EP=C (1) +C (2) *VACA+C (3) *VAHU+C (4) *STVA+C (5) *DEBT+C (6) *LNJS

EP=C(1)+C(2)*VACA+C(3)*VAHU+C(4)*STVA+C(5)*DEBT+C(6)*LNJS

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-17.82785	3.473824	-5.132054	0.0037
C(2)	4.305979	1.277589	3.370394	0.0199
C(3)	-0.583885	0.107753	-5.418757	0.0029
C(4)	7.816711	1.694630	4.612637	0.0058
C(5)	2.696604	1.051810	2.563775	0.0504
C(6)	0.502643	0.101923	4.931598	0.0044

R-squared	0.887074	Mean dependent var	0.272072
Adjusted R-squared	0.774148	S.D. dependent var	0.174216
S.E. of regression	0.082795	Akaike info criterion	-1.842458
Sum squared resid	0.034275	Schwarz criterion	-1.625424
Log likelihood	16.13352	Hannan-Quinn criter.	-1.979267
F-statistic	7.855340	Durbin-Watson stat	2.643004
Prob(F-statistic)	0.020526		

The results show that all the coefficients are not significant, but the amount of R-squared is 0.88 which indicates that the 8th hypothesis has not been made clear.

Conclusion

Considering the estimated functions that were presented above, we could conclude that there is a major problem in the suggested models. Thus it is generally wrong to consider the model as linear. Now the models could be considered as an index and their approval or rejection could be considered.

Full Logarithm regression model:

LROE=C(1) +C(2) *lVACA+C(3) *lVAHU+C(4) *LSTVA	The ninth hypothesis
LROA= C(1) +C(2) *LVACA+C(3) *LVAHU+C(4) *LSTVA	The tenth hypothesis
LEPS= C(1) +C(2) *LVACA+C(3) *LVAHU+C(4) *LSTVA	The eleventh hypothesis
LEP= C(1) +C(2) *LVACA+C(3) *LVAHU+C(4) *LSTVAl	The Twelfth hypothesis
LROE=C(1) +C(2) *VACA+C(3) *VAHU+C(4) *STVA+C(5) *DEBT+C(6) *LNJS	The thirteenth hypothesis
LROA=C(1) +C(2) *VACA+C(3) *VAHU+C(4) *STVA+C(5) *DEBT+C(6) *LNJS	The fourteenth hypothesis
LEPS=C(1) +C(2) *VACA+C(3) *VAHU+C(4) *STVA+C(5) *DEBT+C(6) *LNJS	The fifteenth hypothesis
LEP=C(1) +C(2) *VACA+C(3) *VAHU+C(4) *STVA+C(5) *DEBT+C(6) *LNJS	The sixteenth hypothesis

*LROE=C(1)+C(2)*LVACA+C(3)*LVAHU+C(4)*LSTVA*

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.152856	2.376367	0.064323	0.9505
C(2)	0.381462	0.272874	1.397943	0.2048
C(3)	1.181991	1.019957	1.158864	0.2845
C(4)	-0.078976	3.166169	-0.024944	0.9808

R-squared	0.909978	Mean dependent var	1.472927
Adjusted R-squared	0.871398	S.D. dependent var	0.607760
S.E. of regression	0.217950	Akaike info criterion	0.066185
Sum squared resid	0.332515	Schwarz criterion	0.210874
Log likelihood	3.635983	Hannan-Quinn criter.	-0.025021
F-statistic	23.58634	Durbin-Watson stat	1.107907
Prob(F-statistic)	0.000491		

The ninth hypothesis: LROE=C (1) +C (2) *LVACA+C (3) *LVAHU+C (4) *LSTVA

It is noticed that all the coefficients are not significant, but the amount of R-squared is 0.9 which is not acceptable and indicates that the 9th hypothesis has not been made clear.

*LROA=C(1)+C(2)*LVACA+C(3)*LVAHU+C(4)*LSTVA*

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	2.359437	1.881788	1.253827	0.2502
C(2)	1.168726	0.216083	5.408702	0.0010
C(3)	-0.881006	0.807679	-1.090786	0.3115
C(4)	5.582451	2.507214	2.226556	0.0613

R-squared	0.973504	Mean dependent var	-2.075910
Adjusted R-squared	0.962148	S.D. dependent var	0.887093
S.E. of regression	0.172589	Akaike info criterion	-0.400516
Sum squared resid	0.208510	Schwarz criterion	-0.255827
Log likelihood	6.202837	Hannan-Quinn criter.	-0.491722
F-statistic	85.72881	Durbin-Watson stat	1.438886
Prob(F-statistic)	0.000007		

The tenth hypothesis: lROA= C (1) +C (2) *lVACA+C (3) *lVAHU+C (4) *lSTVA

C (1), C (3) and C (4) coefficients are not significant.

The eleventh hypothesis:

LEPS= C (1) +C (2) *lVACA+C (3) *lVAHU+C (4) *LSTVA

LEPS=C(1)+C(2)*LVACA+C(3)*LVAHU+C(4)*LSTVA

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-5.570546	6.670045	-0.835159	0.4312
C(2)	-1.238304	0.765910	-1.616775	0.1500
C(3)	4.949102	2.862840	1.728739	0.1275
C(4)	-7.431842	8.886882	-0.836271	0.4306

R-squared	0.585221	Mean dependent var	5.710794
Adjusted R-squared	0.407458	S.D. dependent var	0.794717
S.E. of regression	0.611747	Akaike info criterion	2.130293
Sum squared resid	2.619643	Schwarz criterion	2.274982
Log likelihood	-7.716609	Hannan-Quinn criter.	2.039086
F-statistic	3.292150	Durbin-Watson stat	1.049841
Prob(F-statistic)	0.087940		

The amount of R-squared is 0.58 which indicates that the 11th hypothesis has not been made clear.

The twelfth hypothesis:
LEP= C (1) +C (2) *LVACA+C (3) *LVAHU+C (4) *LSTVA

LEP=C(1)+C(2)*LVACA+C(3)*LVAHU+C(4)*LSTVA

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	6.133974	5.512637	1.112711	0.3026
C(2)	-0.441702	0.633007	-0.697784	0.5078
C(3)	-3.502455	2.366070	-1.480283	0.1823
C(4)	10.44460	7.344801	1.422040	0.1980

R-squared	0.335975	Mean dependent var	-1.438915
Adjusted R-squared	0.051393	S.D. dependent var	0.519110
S.E. of regression	0.505595	Akaike info criterion	1.749125
Sum squared resid	1.789383	Schwarz criterion	1.893815
Log likelihood	-5.620190	Hannan-Quinn criter.	1.657919
F-statistic	1.180592	Durbin-Watson stat	2.508856
Prob(F-statistic)	0.383599		

All the coefficients are not significant, but the amount of R-squared is 0.33 which indicates that the model has not been made clear.

The thirteenth hypothesis: LROE=C (1) +C (2)*VACA+C (3)*VAHU+C (4)*STVA+C (5)*DEBT+C (6)*LNJS

LROE=C(1)+C(2)*LVACA+C(3)*LVAHU+C(4)*LSTVA+C(5)*LDEBT+C(6)*LLNJS

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	28.12145	4.741914	5.930402	0.0019
C(2)	-1.201287	0.210623	-5.703485	0.0023
C(3)	3.537090	0.408650	8.655558	0.0003
C(4)	-3.687934	1.031124	-3.576617	0.0159
C(5)	-1.674750	0.314075	-5.332331	0.0031
C(6)	-11.17935	1.648317	-6.782283	0.0011

R-squared	0.994309	Mean dependent var	1.472927
Adjusted R-squared	0.988619	S.D. dependent var	0.607760
S.E. of regression	0.064837	Akaike info criterion	-2.331418
Sum squared resid	0.021019	Schwarz criterion	-2.114384
Log likelihood	18.82280	Hannan-Quinn criter.	-2.468228
F-statistic	174.7292	Durbin-Watson stat	2.432564
Prob(F-statistic)	0.000013		

As it is noticed all the coefficients are significant and R-squared amount indicates that the model has been made clear by entering the controlling variables and taking the model in form of a representation into consideration.

The fourteenth hypothesis: loran=C (1) +C (2)*VACA+C (3)*VAHU+C (4)*STVA+C (5)*DEBT+C (6)*LNJS

LROA=C(1)+C(2)*LVACA+C(3)*LVAHU+C(4)*LSTVA+C(5)*LDEBT+C(6) *LLNJS

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	18.88466	8.316747	2.270679	0.0724
C(2)	0.057034	0.369408	0.154393	0.8833
C(3)	0.702160	0.716722	0.979682	0.3722
C(4)	3.135805	1.808467	1.733958	0.1435
C(5)	-1.301227	0.550849	-2.362219	0.0646
C(6)	-6.838760	2.890950	-2.365575	0.0643

R-squared	0.991784	Mean dependent var	-2.075910
Adjusted R-squared	0.983567	S.D. dependent var	0.887093
S.E. of regression	0.113717	Akaike info criterion	-1.207757
Sum squared resid	0.064656	Schwarz criterion	-0.990724
Log likelihood	12.64267	Hannan-Quinn criter.	-1.344567
F-statistic	120.7078	Durbin-Watson stat	2.868378
Prob(F-statistic)	0.000033		

All the coefficients are not significant, but the R-squared amount is acceptable (the model has co-linear status).

The fifteenth hypothesis: LEPS=C (1) +C (2)*VACA+C (3)*VAHU+C (4)*STVA+C (5)*DEBT+C (6)*LNJS

LEPS=C(1)+C(2)*LVACA+C(3)*LVAHU+C(4)*LSTVA+C(5)*LDEBT+C(6) *LLNJS

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	32.85369	28.85550	1.138559	0.3065
C(2)	-5.303524	1.281685	-4.137931	0.0090
C(3)	10.23748	2.486714	4.116869	0.0092
C(4)	-15.75641	6.274594	-2.511145	0.0538
C(5)	-5.639499	1.911207	-2.950752	0.0319
C(6)	-17.85908	10.03034	-1.780506	0.1351

R-squared	0.876762	Mean dependent var	5.710794
Adjusted R-squared	0.753524	S.D. dependent var	0.794717
S.E. of regression	0.394548	Akaike info criterion	1.280301
Sum squared resid	0.778342	Schwarz criterion	1.497335
Log likelihood	-1.041657	Hannan-Quinn criter.	1.143492
F-statistic	7.114371	Durbin-Watson stat	2.535353
Prob(F-statistic)	0.025233		

The C (1), C (4) and C (6) coefficients are not significant, but the low amount of R-squared indicates that the model has not been made clear.

The sixteenth hypothesis: LEP=C (1) +C (2)*VACA+C (3)*VAHU+C (4)*STVA+C (5)*DEBT+C (6)*LNJS

LEP=C(1)+C(2)*LVACA+C(3)*LVAHU+C(4)*LSTVA+C(5)*LDEBT+C(6) *LLNJS

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-73.73824	24.46685	-3.013802	0.0296
C(2)	1.226762	1.086753	1.128833	0.3102
C(3)	-7.132151	2.108509	-3.382557	0.0196
C(4)	15.67398	5.320288	2.946078	0.0320
C(5)	-0.252381	1.620531	-0.155740	0.8823
C(6)	28.15476	8.504822	3.310447	0.0212

R-squared	0.792341	Mean dependent var	-1.438915
Adjusted R-squared	0.584682	S.D. dependent var	0.519110
S.E. of regression	0.334541	Akaike info criterion	0.950339
Sum squared resid	0.559589	Schwarz criterion	1.167372
Log likelihood	0.773138	Hannan-Quinn criter.	0.813529
F-statistic	3.815592	Durbin-Watson stat	3.099896
Prob(F-statistic)	0.083988		

The C (2) and C (5) coefficients are not significant, but the amount of R-squared is 0.79 which indicates that the model has not been made clear.

Final discussion and conclusion

In every fifty companies such as the analyzed sample as it was shown from the results of software analysis, most of the conducted analyses by regression models have problems such as insignificance of coefficients or that the amount of R2 for the model is an amount less than the acceptable error level, i.e., 5% and some of the models have the two problems simultaneously.
The other problem is concerning the suggested Value Added Intellectual Coefficient (VAIC) in relation with the extracted data of the financial statements. There are different views given by accounting and financial experts to extract the data of financial statements for intangible assets of the company. The existing financial statements that were prepared according to the existing standards have serious shortcomings in many cases.

Suggestions

Since changing the used standards for the financial statements is a time-consuming and costly method, it is better to assess the type of approach. The results obtained in this study show the necessity of a changed approach as far as intellectual capitals of organizations and their intangible assets and study of their impact on the financial performance of the organization are concerned. As it was noticed with regard to the Value Added Intellectual Coefficient (VAIC), three elements of capital efficiency were used in this model, i.e., human capital and structural capital were used as entries and on the other hand the outcome of capitals is studied in comparison with the profit of each share, etc.

The conducted studies during this research raised questions why this model was used. Isn't it better to consider the three main elements of intellectual capital as the entries of the separated elements of each of these elements instead of using the efficiencies?

Could added value be used as a dependent variable instead of using variables such as outcome of capitals and dividends as the dependent variables of the research?

Putting all the mentioned points as above together, suggestion could be made to use combined model, i.e., to consider a combination of Value Added Intellectual Coefficient (VAIC) models, Public model and the model in which the added value is considered as an element dependent on the components of the intellectual capital. Authenticity or illegitimacy of this model requires studying the estimated relations among the variables.

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