
Application of Modified VAIC™ Model for Measuring Intellectual Capital Performance

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Abstract

Present economy is considered as knowledge economy since the source of economic value is no longer depend upon the production of material goods but the creation of intellectual resources. In this new economy conventional measurement systems are not adequate for intellectual capital performance measurement. Alternately, Pulic's Value Added Intellectual Capital (VAIC™) gained popularity among the researchers for measuring intellectual capital performance. It is a performance indicator comprising of three efficiency indicators namely, human capital efficiency, structural capital efficiency and physical capital efficiency. In calculating VAIC™, Pulic excludes relationship capital, an important element of intellectual resources. We extend the formula of VAIC™ to include relation capital in the model. Present study makes an attempt to examine efficiency of intellectual capital management of 30 Indian knowledge companies comprising leading software and pharmaceutical companies during the period 2010 to 2014. From the study results it is revealed that intellectual capital is playing an important role in the value creation process of sample companies. Study results also show that inclusion of relation capital in the VAIC model extends the explanatory power of the model.

Key Words: Intellectual Capital, Human Capital, Structural Capital, Relational Capital, VAIC™, Profitability

1. Introduction

Present economy is termed as knowledge economy where information, knowledge and information technology are considered as strategic assets. In this new economy tangible assets are fast becoming secondary assets as application of intangible assets like employee capability and competency, management philosophy, culture, innovative process and customer loyalty etc. have increased manifold to create value. All invisible assets which are employed in the business are collectively called as intellectual assets or intellectual capital. Intellectual capital is associated with the main source of individual, organizational as well as national competitiveness in today's knowledge economy (Wigg, 1997). Several empirical studies show the significance of intellectual capital at corporate level. Canadian Institute of Chartered Accountants' survey concludes that intellectual assets are crucial for firm's success (Ghosh and Wu, 2007). Abernathy et al., (2003) estimate that investment in intellectual capital creates twice fruits as compared to the same amount of investment in physical assets.

Being intangible the components and application of intellectual capital in the business organization is invisible. Since intellectual capital is crucial for organizations like knowledge intensive, therefore, it is necessary to measure for better management. For measurement of intellectual capital there is no unique model which can be used to measure the organizational intellectual capital. The feature of intangibility vitiates the intellectual capital measurement methods. However, today Pulic's (2000) VAIC™ has gained popularity among the researcher to measure the value creation efficiency of organizational intellectual capital. This model is extensively used in wide range of empirical researches to examine the relationship value creation efficiency of intellectual capital and corporate financial performance.

The purpose of the present study is to examine the empirical validity of VAIC™ model. That is the underlying proposition of the Pulic's (2000) model is examined in this study. The analysis is based on a sample of 30 software and pharmaceutical companies operating in India.

2. Intellectual Capital

The term 'intellectual capital' has been defined by different researchers differently. There is no precise agreement on the definition of intellectual capital. Generally, the term "intellectual capital (IC)" is used to refer as intangible assets or intangible business factors of the company, which have a significant impact on its performance and overall business success, although they are not explicitly listed in the balance sheet (if so, then under the term goodwill).

Researchers categorized all non- physical assets and resources of an organization into several components. Popular components include human capital, structural capital and relation or customer capital.

Human Capital: The roots of human capital can be found in the smith's economic theories, where he defined contribution of human capital is important to the organizational performance and to the economic growth of the country as well. Human capital includes the knowledge and efficiency that employees take with them when they leave the firm. It encompasses knowledge, skills, experience and ability of people. Roos et. al. (1997) argues that employees generate IC through their competence, their attitude and their intellectual agility. Competence includes skills

and education, while attitude covers the behavioral component of the employees' work. Intellectual agility enables one to change practices and to think of innovative solutions to problems.

Structural Capital: From the organizational perspective structural capital includes all non-human resources of knowledge like, data bases, organizational charts, executive instructions of the processes, strategies, administrative programs, so in other words, the content of such issues is much more higher than its material value (Roos et al., 1997). Structural capital is that part of intangible assets that stays within the firm at the end of the working day. Therefore, development and use of such structural components such as information and information technology it is possible to reduce costs and enhance profitability.

Relation Capital: Relation capital includes all resources that linked to the external relationships of the firm with customers, suppliers or other stakeholders. Therefore, relational capital is the knowledge that is embedded in the relationships with any stakeholder that affects the firm's life. Capello and Faggian (2005) assumed that relational capital is a combination of different kind of relationships – market relationships, power relationships and cooperation – accordingly, practiced within the firms, institutions and people that are embedded with a high sense of cooperation .

3. Intellectual Capital and Organizational Performance

In reality the wealth of modern economy no longer depends upon Physical assets whereas intangibles assets become very vital resources for value creation. Various theoretical and empirical researches highlighted that intellectual capital is associated with the main source of individual, organizational as well as national competitive advantage in today's economy. Researchers also believe that intellectual capital can be used for improvement of business profitability and to enhance corporate value also (Chen et al.2005; Chan 2009b; Ghosh et al. 2009). Intellectual capital theorists (Barney, 1991; Grant, 1991, 1996; Sveiby, 1997) also agree that it is more valuable resource than physical resources. Riahi-Belkaoui (2003) mentioned that intellectual capital is the only resources that satisfy the characteristic of strategic assets like valuable, rare, imperfectly imitable and hardly substitutable and capable of generating sustainable competitive advantage. However, Galabova et al. (2011) state that intellectual capital theory is not the extension of resource based theory (RBV) but include many factors related to the MBV. More specifically, they argue that intellectual capital based strategy are driven by both resource and market based considerations.

Last few years several empirical studies are conducted to find out the strategic importance of intellectual capital on corporate financial performance. One of such study was conducted by Bontis et al (2000), with the aim to investigate the three components of intellectual capital, i.e. human, structural and customer capital in the service and non-service industries in Malaysia and business performance. The study revealed that structural capital has great influence on business performance of both industries. Human capital also important in both the industries, but it had greater influence on the structure of a non service- based than a service-based firm. The study result of Hitt et al. (2001) proved the role of intangible capital more dominant compare with tangible capital. Tseng et al. (2005) measured four types of intellectual capital (i.e. human capital,

organizational capital, innovative capital and relational capital), and investigated the influence of intellectual capital on corporate value. They found that innovative capital and relational capital positively affect corporate value directly; human capital and organizational capital affect corporate value indirectly. And the roles of these types of intellectual capital on corporate value vary with different industries. It is considered among the researchers that the growing gap between a company's market value and book value may be the consequence of not considering intellectual capital information in financial statements (Edvinsson and Malone, 1997; Lev and Sougiannis, 1996; Lev, 2001). According to Chen et al. (2005) the conservative accounting principles restrain firms' in reporting intellectual capital in their financial statements. However, if the market is efficient, investors will place higher value on company's having higher intellectual capital (Chen et al., 2005; Riahi- Belkaoui, 2003; Firer and Williams, 2003) and leads to growing difference between firm's market value and book value. This proposition also supported by Yount et al. (2004) and Skinner (2008) and maintained that IC intensive companies are valued more in the stock market than the other companies.

Empirical researches also conducted to examine how intellectual capital is evaluated in the capital market. Pulic (2000) finds positive relation between market value added (MVA) and intellectual capital of 30 'FTSE 250' companies. Baruch Lev (2003) states that in efficient capital market investors can reasonably price the listed companies using the information about intellectual capital. Lev and Radhakrishnan (2003) finds that organizational capital has some explanations to the firm's market value. Firer and Williams (2003) empirically investigated the association between intellectual capital and market value of firms using data from 75 publicly traded companies in South Africa. Their result showed that physical capital can significantly positively influence firms' market value, but human capital has a significant negative effect on market value and the relationship between structural capital and market value isn't statistically significant. Chen et al. (2005) also analyzed the relationship between intellectual capital and corporate value, but they used a sample of listed companies from Taiwan during 1992-2002. They found that although physical capital and intellectual capital both have significant positive effects on corporate value, but the effect of physical capital is much larger than that of intellectual capital. In a study it is revealed that the physical assets of Bangladeshi banks are important resources for investment decisions rather than human and structural resources (Najibullah, 2005). Shiu (2006) applied a quantile regression method to re-examine the relationship between intellectual capital and market value using data from listed companies of Taiwan in 2003. He finds that intellectual capital does have a significant positive role on market value, but the strength and significance of the roles vary with different firms' market value level. Ghosh and Wu (2007) examined whether intellectual capital information are considered or not for firm valuation in the Taiwan stock market. They find that intellectual capital is significant explanatory variables for firm's market value. Wang (2008) finds positive relationship between intellectual capital and market value of US S & P's 500 electronic companies. K. H. Chan (2009) also finds no association between intellectual capital and stock market valuation of Hong Kong based companies and he concludes that 'the effect of IC on market valuation may not be universal and uniform'. In another study by Zeghal, D. and Mlaaloul, A. (2010) in UK context finds that value added intellectual capital coefficient (VAIC) is significantly and positively related to stock market performance as measured by market to book ratio of high-tech industry only. They also find significant and positive association between value added capital employed (VACA)

and financial and stock market performance of high-tech, service and traditional industry. Finally, authors concluded that UK companies physical and financial capital remain important to stockholders and stakeholders due its significant role in the value creation process. The study results of Salamudin, N. et al. (2010) shows that developing higher intangible assets tend to show better financial performance of Malaysian companies and investors also place higher value on firms having higher intangible assets. Additionally, their study results also indicate that there is a positive trend in intangible assets development in Malaysian stock market. In a recent study conducted by Dimitrios and his colleagues (2011) to investigate the association of intellectual capital and market value of 96 Greek companies and empirical results show that investors take only human capital into their consideration in determining the real value of the company. Maditinos et al. (2011) finds that investors of 96 Greek companies take only the human capital of a company to determine the real value of the company. The empirical findings of Mehralian et al. (2012) suggest that the performance of Intellectual capital of Iranian pharmaceutical industry cannot explain the market valuation of sample companies. In a recent study by Pal and Soriya (2012) on Indian context find that IC of Indian pharmaceutical and textile industry are not valued in the Indian stock market. Though their study is based on only one year data (2010) and the study is conducted on that period when Indian capital market was more sensitive due to the economic slowdown in western countries.

Based on above literature reviews, we hypothesize that;

H₁: Intellectual Capital has influence to corporate financial performance in Indian companies

4. VAIC™, Value Added Intellectual Capital

The Value Added Intellectual Coefficient™ (VAIC™) methodology developed by Ante Pulic (2000) forms the underlying measurement basis for the independent variable in the present study. In his words VAIC™ is an analytical procedure designed to enable management, shareholders and other relevant stakeholders to effectively monitor and evaluate the efficiency of VA by a firm's total resources and each major resource component. VAIC™ is the sum of two indicators. These are: (i) Capital Employed Efficiency (CEE) – the indicator of VA efficiency of capital employed; and (ii) Intellectual Capital Efficiency (ICE) – the indicator of VA efficiency of company's Intellectual Capital base. Intellectual Capital Efficiency, on the other hand, is composed of (a) Human Capital Efficiency (HCE) – the indicator of VA efficiency of human capital; and (b) Structural Capital Efficiency (SCE) – the indicator of VA efficiency of structural capital.

Following equation (1) formalizes the VAIC™ relationship algebraically:

$$VAIC^{TM}_i = CEE_i + HCE_i + SCE_i$$

Where:

- VAICTM_i = VA intellectual coefficient for company *i*;
- CEE_i = capital employed efficiency coefficient for company *i*;
- HCE_i = human capital efficiency coefficient for company *i*; and
- SCE_i = structural capital efficiency for company *i*.

Pulic (2000) states that higher the VAIC™ coefficient, the better will be the efficiency of VA by a firm's total resources. The first step in calculating CEE, HCE and SCE is to determine a firm's total

VA.

This computation may be done with the help of the following algebraic equation:

$$VA_i = I_i + DP_i + D_i + T_i + M_i + R_i + WS_i$$

Where: VA for firm *I* is computed as the sum of interest expenses (I_i); depreciation expenses (DP_i); dividends (D_i); corporate taxes (T_i); equity of minority shareholders in net income of subsidiaries (M_i); and profits retained for the year (R_i) and the wages and salaries (WS_i).

Alternatively VA can be calculated by deducting operating expenses (materials, maintenance, other external costs) from operating revenues. (Pulic, 2000).

According to Pulic (2000), CEE is the ratio of total VA divided by the total amount of capital Employed (CE) where capital employed is defined as the book value of a firm's net assets. Equation (3) presents the CEE relationship algebraically:

$$CEE_i = VA_i / CE_i$$

Where:

CEE_i = capital employed efficiency coefficient for company *i*;

VA_i = VA for firm *i*; and

CE_i = book value of the net assets for firm *i*.

Consistent with the views of other leading IC researchers Pulic (2000) argues total salary and wage costs are an indicator of a firm's human capital (HC). HCE, therefore, is calculated as the ratio of total VA divided by the total salary and wages spent by the firm on its employees. Equation (4) shows this relationship algebraically:

$$HCE_i = VA_i / HCE_i$$

Where: HCE_i = human capital efficiency coefficient for company *i*; VA_i = VA for firm *i*. and HCE_i = total salary and wage costs for firm *i*.

In order to calculate SCE, it is first necessary to determine the value of a firm's structural capital (SC). Pulic (2000) proposes a firm's total 'VA less its human capital' is an appropriate proxy of a firm's SC. That is:

$$SC_i = VA_i - HCE_i$$

Where: SC_i = Structural capital for company *i*; VA_i = VA for firm *i* and HCE_i = total salary and wages spent by the firm *i*.

Based on prior empirical research findings, Pulic (2000) argues that there is a proportionate inverse relationship between HC and SC in the value creation process. According to him, the less Human Capital participates in value creation, the more Structural Capital is involved. Consequently, Pulic (2000) suggests the following formula for calculating SCE which is the ratio of a firm's SC divided by the total VA: SCE_i = SC_i / VA_i

Where: SCE_i = structural capital efficiency coefficient VA for company *i*; SC_i = Structural capital for company *i*; and VA_i = VA for firm *i*.

Recently, VAIC™ method has gained popularity among the researchers to measure intellectual ability of companies. K.H. Chan (2009a) supports the adoption of this technique as an effective method of measuring intellectual capital efficiency because:

- It produces quantifiable, objective and quantitative measurements without the requirement of any subjective grading and awarding of scores or scales. It aids further

computation and statistical analysis by using a large sample size that may run into thousands of data items collected over a period of time.

- It provides indicators that are relevant, useful and informative to all stakeholders, but not just shareholders, and with which they may also identify and compare the key components of IC in order to assess company performance.
- It uses financially oriented measures so that any indicators, relations or ratios computed may be used for comparison along with traditional financial indicators commonly found in business, which are based on monetarily derived units or measures.
- It uses very simple and straight forward procedures in the computation of the necessary indexes and coefficients, which may be simple to understand, especially for management and business people who are accustomed to traditional accounting information.
- It makes use of public or published financial data so that it may enhance the reliability of the measurement, and improve data availability.

Besides these advantages the VAIC model is not free from limitations. First one is that, it is assumed in the calculation of structural capital efficiency that there is inverse relationship between human capital and structural capital, that less structural capital is required if more human capital is employed in the business. Because of this inverse relationship the calculation of SCE indicator is opposite (structural capital is divided by value added) that of the other two indicators, i.e, HCE (value added is divided by human capital) and CEE (value added is divided by capital employed). Therefore, SCE cannot exceed one where as other two indicators can. Second one is the impact of relation capital is not considered in the model. Another limitation of this model is the determination of structural capital (SC) value. In the model Pulic determines it through deducting human capital (HC) from value added (VA). Therefore, it does not represent the true value of structural capital. Here, we determine the value of structural capital by considering company's investment in administrative and management activities.

In this study we calculate VAIC of sample companies assuming that there is no inverse relationship between human capital and structural capital. That is structural capital and human capitals are independent to each other and the requirement of structural capital does not depend upon the human capital. Structural capital is so important like human capital. Therefore, SCE is calculated by using following formula

$$SCE (M) = \frac{VA}{SC}, SC = \text{Structural Capital}$$

Secondly the impact of relation capital is considered in this study. Here, relation capital is considered as an element of intellectual capital and all types of marketing and sales promotion

expenses are considered as investment in relation capital to strengthen the external relationship of the organization. Therefore, those expenses are considered as company's relation capital. Therefore, the value creation efficiency of relation capital RCE is calculated by using following formula

$$RCE = \frac{VA}{RC}, RC = \text{Relation Capital}; \text{ and}$$

Therefore, the modified VAIC model (value creation efficiency of intellectual capital) is as follows,

$$VAIC(M) = HCE + SCE(M) + RCE + CEE$$

Here, VAIC(M) – modified Value added intellectual capital, HCE- Human capital efficiency, SCE(M)- modified Structural capital efficiency, RCE – Relational capital efficiency, CEE – Capital employed efficiency.

5. Sample

The data used in this empirical study are collected from published annual reports of respective company and from Capitaline Database. The study confined to 30 software and pharmaceutical companies for the period 2010 to 2014. These companies are selected on the basis of market capitalization and are listed in the Indian stock market.

6. Measures of Dependent variables

For the purpose of conducting the analysis in the present study one dependent variables namely profitability, has been used. Following two commonly used proxy measures of profitability are applied in this study.

1) Return on Assets (ROA): - Profitability shows the degree to which a firm's revenues exceed over cost. It is the ratio of the net income (less preference dividends) divided by the book value of total assets as reported in the annual reports; (Williams and Firer,2003; Chen, Cheng and Hwang ,2005;).

2) Operating profit to Sales (OPS): It is a ratio of operating profit to sales. This performance is the operating profitability which represents an economic surplus acquired through the difference between income and production costs (Cappelletti and Khouatra, 2004).

7. Control variables

For the purpose of empirical analysis this study uses correlation and multiple regressions as the underlying statistical tests. In conducting the liner multiple regressions analyses following control variables are have been included to segregate the influence of intellectual capital.

1. Size of the Firm (SIZE): - Size of the firm as measured by the natural log of total assets is used to control for the impact of size on wealth creation through economies of scale, monopoly and bargaining power (Riahi-Belkaoui, 2003).

2. Leverage (DER): -Financial leverage and debt structure as measured by total debt divided by book value of total assets is used to control for the impact of debt servicing on corporate

performance and wealth creation (Riahi-Belkaoui,2003).

3. Physical capital intensity (PC): Physical capital intensity as measured by a ratio of a company's fixed assets to its total assets (Firer and Stainbank, 2003; Firer & Williams, 2003 ;) is used to control for the impact of fixed assets on corporate performance. The assumption is that company's fixed assets have significant impact on company's financial performance.

4. Age: age of the organizations is measured by differentiating year of incorporation from the respective years under consideration of this study.

8. Empirical Models

Following two regression models are be used in this study where Model-1 related with VAIC calculated on the basis of Pulic's(2000) proposition and Model 2 related with VAIC calculated in equation above.

$$\text{Profitability}_{it} = \beta_0 + \beta_1 \text{VAIC}_{it} + \beta_2 \text{Control Variables}_{it} + \epsilon_{it}$$

(Model 1)

$$\text{Profitability}_{it} = \beta_0 + \beta_1 \text{VAIC(M)}_{it} + \beta_2 \text{Control Variables}_{it} + \epsilon_{it}$$

(Model 2)

9. Results Followings two tables show the empirical results of our study.

Table: 1: Regression results where profitability is measured by return on assets

Table: 2: Regression results where profitability is measured by operating profit to sales

* denotes significance at 5% level and ** denotes significance at 10% level

Independent Variables	Dependent Variables OPS				
	MODEL-1		MODEL-2		
	Coefficients	t-statistic	Coefficients	t-statistic	
Constant	0.153	1.247	Constant	0.083	0.920
VAIC	0.541	3.141*	eVAIC	0.580	4.879*
DER	-0.031	-0.182	DER	-0.180	-0.886
PC	0.192	1.124	PC	0.269	1.319
SIZE	0.069	1.407**	SIZE	0.069	1.320**
AGE	-0.095	-0.552	AGE	0.032	0.164
Adjusted R ²	0.346		Adjusted R ²	0.480	
F-Value	2.542**		F-Value	10.571*	

Independent Variables	Dependent Variables ROA				
	MODEL-1		MODEL-2		
	Coefficients	t-statistic		Coefficients	t-statistic
Constant	-0.012	-0.158	Constant	-0.008	-0.183
VAIC	0.288	1.822**	eVAIC	0.885	6.961*
DER	-0.031	-0.131	DER	-0.239	-1.858**
PC	0.106	0.456	PC	0.110	0.861
SIZE	0.060	1.277**	SIZE	0.064	1.510**
AGE	-0.182	-0.866	AGE	0.207	1.609
Adjusted R ²	0.271		Adjusted R ²	0.692	
F-Value	1.351**		F-Value	10.342*	

10. Discussion and Conclusions

In the knowledge economy intellectual capital is considered as important strategic assets for value creation. Organizations are investing enormous sums of money for building such intellectual assets base. But, there is no well accepted model to measure intellectual capital in the accounting and finance literatures. In this situation Pulic’s VAIC model gives an idea about the value creation efficiency of company’s intellectual capital and the model is widely applying in the empirical researches. The main advantage of this model is the simplicity and based on the audited financial information. Researchers and practioners have raising questions about the constitution of the model. The main criticism against this model is the inverse relationship HC and SC in the value creation process. Another is the non-inclusion of relation capital in the model.

Present study is conducted to examine the rationality of these criticisms against this model. The empirical examination is based on data of 30 (15 software and 15) pharmaceutical companies for the period 2008 to 2011. In this study first model takes the original VAIC model, second model includes the VAIC assuming that SC has direct impact in the value creation and the third component of intellectual capital i.e, relation capital is considered in calculating VAIC.

The empirical results show that VAIC in the two models is significant in two cases. But the explanatory power of the model is greater in second model than first model. In the first model Independent and control variables explain 27% and 35% variation in dependent variable respectively which is statistically significant. In the second model the explanatory power increased to 69% and 48%. Study results also show that sample size has significant positive impact on the profitability. Therefore, empirical results support the inclusion of relation capital in building the VAIC model. The findings of the study do not support the inverse relationship between human capital and structural capital. Another finding of this study is that marketing and sales promotion expenses may be representative of relation capital (RC) of the company. However, before generalization about the findings of this study more detailed study is required on large sample size covering different industries.

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