

Measuring Intellectual Capital using VAIC Calculator

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Abstract

Value Added Intellectual Coefficient Calculator or VAIC calculator is a calculator to compute efficiency level of firms' resources. VAIC is based on the assumption that both, intellectual capital and physical capital, are a function of production and mathematically computed as $VAIC = ICE + CEE$. Intellectual capital efficiency (ICE) is the sum of human capital efficiency (HCE) and structural capital efficiency (SCE), which are proxies for intellectual capital and capital employed efficiency (CEE) represents physical capital. To use this calculator, two simple steps are taken; **step 1** is the input level by keying-in operating profit (OP), employee costs (EC), depreciation (D), and amortisation (A) in order to generate value added (VA) via this equation: $VA = OP + EC + D + A$ and total assets (CE), **step 2** is the output level whereby the calculator will generate efficiency scores of HCE through $HCE = VA/HC$, SCE through $SCE = VA - HC/VA$, CEE through $CEE = VA/CE$ and ultimately the calculator will compute the value of VAIC. This paper has two objectives, to illustrate the use of the calculator and to discuss the contribution of the calculator. The VAIC calculator is an innovated product as it is unique, simple to operate, user-friendly and the first of its kind. The VAIC calculator will assist and guide firms' managers and policy makers in the allocation of firms' resources.

Keywords: Human Capital Efficiency, Structural Capital Efficiency, Capital Employed Efficiency, VAIC Calculator.

Introduction

The literature on intellectual capital has documented the significance of intellectual capital towards firms' value and growth. Intellectual capital is regarded as a key value driver in knowledge economy and label as a source of firms' competitiveness (Sveiby, 1997; Stewart, 1997; Wood, 2003, Cabrita and Vaz, 2005). In addition, intellectual capital has gained

increasing attention from both academics and practitioners over the last two decades (Nimtrakoon, 2015). Despite the significance of intellectual capital towards firms' value and growth, intellectual capital is not easily identified, captured and reported in the financial statements. This may be attributed to the adoption of certain accounting standards such as Malaysian Financial Reporting Standards 138 (MFRS 138). MFRS 138 on intangible assets states that the recognition of internally generated assets such as goodwill, customer-related, technology-related in the financial statement is prohibited. It implies that the identification and measurement of intellectual capital, which is intangible in nature, by firms is not accommodated by traditional accounting practices (Nimtrakoon, 2015).

Given the aforementioned reasons, this paper is introducing a web-based application product called VAIC calculator to compute intellectual capital. This paper has two objectives, first is to illustrate the use of the calculator and second is to discuss the contribution of the calculator to compute efficiency level of firms' resources. The remaining parts of this paper are divided into literature review, methodology, discussion and conclusion.

Literature Review

This paper adopts the construct and definition of intellectual capital put forward by Bontis (1996); Edvinsson and Malone (1997); Stewart (1997); Roos and Roos (1997) that is the components of intellectual capital consist of human capital, structural capital and relational capital. Human capital comprised the individual employees and the organisation. The individual employees refer to the employee's personal attributes, technical competence and creativity, the organisation refer to the team work and healthy working environment. Structural capital encompasses all knowledge stored in organizational infrastructures such as databases, organizational procedures, patents, trademarks and organizational capability that supports employees' productivity. Meanwhile, relational capital is the link that the organisation has with its external environment such as customers, suppliers, resource providers, banks and shareholders. Several valuation models have been introduced by scholars to measure intellectual capital. Each valuation model has advantages and disadvantages (Sydler, Haefliger and Pruksa, 2014). However, this paper adopts the valuation model proposed by Ante Pulic (1998) which is called Value Added Intellectual Coefficient or VAIC model. VAIC model has a number of advantages (Nimtrakoon, 2015). First, VAIC offers a straightforward and simple method in measuring the value of intellectual capital which allows stakeholders to examine and evaluate overall resources and their value creation efficiency. Second, the data is obtained from audited corporate financial reports, therefore VAIC is objective and verifiable. Third, VAIC makes cross-organizational or cross-national comparison possible because similar source of data that is the audited corporate financial reports. Fourth, the firms can use VAIC to evaluate their own intellectual capital and firms performance (Fier and Williams, 2003; Chen, Cheng and Hwang, 2005; Goh, 2005; Tan, Plownan and Hancock, 2007; Young, Fang and Fang, 2009; Laing, Dunn and Hughes-Lucas, 2010; Nimtrakoon, 2015). Despite the numerous advantages, there are several limitations associated with VAIC as intellectual capital efficiency measurement tool (Joshi, Cahill, Sidhu and Kansal, 2013). VAIC does not include several components which are regarded intellectual in nature such as research and development expenditure, intellectual property, relational capital. Chang (2007) argued that research and development expenditure as well as intellectual property are positively related with firms' market value and profitability, suggesting additional information on intellectual capital is omitted by VAIC. Another limitation of VAIC discussed in the literature is its inability to measure intellectual capital in firms with negative operating profit, therefore

VAIC does not generate valuable analysis in firms with more input than output (Chu, Chan and Wu, 2011). In addition, Stahle, Stahle and Aho, 2011 questioned the validity and appropriateness of VAIC by claiming that VAIC is designed to measure the efficiency of the firms' human capital and capital investment rather than the overall intellectual capital. Despite the limitations, the VAIC model is used in this paper because of the widely acceptance of this model in the literature of intellectual capital. This is based on the findings of Volkov (2012) which stated that as of June 2012, VAIC model of Pulic (1998) has been used in 46 researches and has been cited by 2373 researches (Hamidreza and Ruzita, 2013, p.68).

Methodology

Several steps are taken in order to establish the value of VAIC (Pulic,1998). **Step 1** is to establish the Value Added (VA). VA is derived from the equation: $VA = OP + EC + D + A$, where OP is operating profit, EC is employee costs, D is depreciation, and A is amortisation. **Step 2** is to establish efficiency scores namely HCE, SCE and CEE. To compute human capital efficiency (HCE) the equation is: $HCE = VA/HC$, human capital (HC) represents the investment made by the firm on its employees. It includes salary, wages and all incentives paid to employees. This ratio gives the contribution made by every unit of money invested in human capital to the value added in the firm. In other words, HCE is an indicator of value added by the human resources employed by the business (Joshi *et al.*, 2013). To compute structural capital efficiency (SCE) the equation is used: $SCE = VA - HC/VA$, SCE indicates the proportion of total VA accounted by structural capital. SCE shows how much of the firm's value creation is generated by the structural capital (Joshi *et al.*, 2013). To compute capital employed efficiency (CEE) the equation is: $CEE = VA / CE$, capital employed (CE) represents the total assets of the firm (Ulum, Ghazali and Purwanto, 2014). CE is a measure of physical capital. This ratio gives the contribution made by every unit of physical capital to the value added in the firm. VAIC is the sum between intellectual capital efficiency and physical capital and mathematically expressed as $VAIC = ICE + CEE$. VAIC is an indicator of a firm's intellectual capital efficiency. VAIC is used as a performance measurement tool where the greater the value of VAIC indicating the higher level of intellectual capital efficiency of the firm (Joshi *et al.*, 2013).

Discussion And Conclusion

To use the calculator, two simple steps are taken. Step 1 requires extraction of data from the annual report of the firm such as operating profit, employee costs, depreciation, amortisation and total assets. To illustrate the use of the VAIC calculator, data from the audited annual report of Maybank from 2011 to 2015 is employed as follows:

Year	Operating Profit RM 000	Employee Costs RM 000	Depreciation RM 000	Amortisation RM 000	Total Assets RM 000
2011	3,496,858	2,096,715	104,363	22,801	451,594,837
2012	7,743,826	4,708,888	223,646	38,869	494,756,723
2013	8,730,327	4,943,884	268,692	28,368	560,318,784
2014	8,948,458	5,019,296	331,175	19,185	640,299,956
2015	8,940,302	5,765,147	374,649	13,241	708,344,503

Source: www.maybank.com.my/annual-report

The above data will be keyed-in into the calculator for each year. The VAIC calculator will generate VA and the efficiency scores of HCE, SCE, CEE and ultimately VAIC is computed for each year. To compute value added, efficiency scores and VAIC, the following steps are applied by the calculator: **Step 1: Input level** To key in operating profit, employee costs, depreciation, amortisation and total assets. **Step 2: Output level** VAIC calculator will generate value added, efficiencies scores and ultimately VAIC through these equation $VA = OP + EC + D + A$, $HCE = VA/HC$, $SCE = VA-HC/VA$, $CEE = VA / CE$, $VAIC = HCE+SCE+CEE$.

The computed efficiency scores are as follows:

Year	Value Added RM 000	HCE	SCE	CEE	VAIC
2011	5,720,737	2.73	0.6335	0.0127	3.37
2012	12,715,229	2.70	0.6297	0.0257	3.36
2013	13,971,271	2.83	0.6461	0.0249	3.50
2014	14,318,114	2.85	0.6494	0.0224	3.52
2015	15,093,339	2.62	0.6180	0.0213	3.26

The above shows an upward trend of value added creation of the firm over the five-year period. The firm has created more value in 2015 as compared to 2011, an increase of 164% (15,093,339 - 5,720,737 / 5,720,737). The firm has relatively high HCE compared to SCE and CEE. According to Goh (2005) more than 80 per cent of value created in all domestic banks is attributed to human capital and this is due to the fact that the banking sector is a service sector where its customer rely heavily on human capital. The firm's HCE in 2011 stood at 2.73, it means for every RM1 invested in human capital, the firm managed to create RM2.73 from its employees. This ratio slightly reduced to 2.70 in the following year but increased to 2.83 in 2013 and increased further to 2.85 in 2014. These ratios indicated increased value creation capability from the firm's human capital. However, it reduced to 2.62 in 2015, a reduction of 8% (2.85-2.62/2.85). In fact, all the efficiency scores dropped in 2015, implying that the firm is experiencing diminishing efficiency. This phenomenon may suggest that there are redundant resources in 2015 that have not been effectively utilized. With regards to VAIC of the firm, which is the sum of HCE, SCE and CEE, the average efficiency level over the five-year period was 3.40 indicating that for every RM1 invested, the firm would be able to generate RM3.40. The VAIC calculator is equipped with embedded formulae which make it very convenient to the users and the targeted users are firms managers and stakeholders.











As a conclusion, the VAIC calculator contributes towards the measurement of intellectual capital in firms and it has characteristics which are unique, simple to operate, user-friendly and first of its kind. This innovated product has several practical implications. The information produces by VAIC calculator will assist firms to formulate their strategy, assess strategy execution, assist in diversification and expansion decisions, use the information as a basis for compensation and to communicate measures to stakeholders (Marr, Gray and Neely, 2003). Nevertheless, there are some limitations associated with the VAIC calculator. The calculator is only able to compute the efficiency scores without interpretation and estimation features. Therefore, for future innovation project, VAIC calculator 2.0, interpretation of the computed efficiency scores and estimation features may be installed.

Acknowledgement

This paper is not a research paper rather the paper discusses about an innovated product which facilitates the measurement of intellectual capital. This is version 1 which concentrated merely on computation of VAIC. For our next project, VAIC calculator 2.0, we expect to install estimation features and interpretation of the efficiency scores. We would like to extend our acknowledgement to the organising committee of AIIIC2018 for allowing us to present the paper at Asia Innovation and Invention Conference 2018.

Overview Of The Vaic Calculator

Abstract

Menu	
	Abstract
	Value Added
	Human Capital Efficiency
	Structural Capital Efficiency
	Physical Capital Efficiency
	VAIC
	Trend Analysis
	Graph
	Estimation
	Prediction

BACKGROUND

VAIC is used to measure capital and it has a number of advantages. First, VAIC offers a straightforward and simple method in measuring the value of intellectual capital which allows stakeholders to examine and evaluate overall resources and their value creation efficiency. Second, the data is obtained from audited corporate financial reports, therefore VAIC is objective and verifiable. Third, VAIC makes cross-organizational or cross-national comparison possible because similar source of data that is the audited corporate financial reports. Fourth, the firms can use VAIC to evaluate their own intellectual capital and firms performance.

METHODOLOGY

Step1 - Input Level

a. $VA = OP + EC + D + A$
 b. $CE = \text{Total Assets}$

Step2 - Output Level










Stage 1

a. $HCE = VA / HC$
 b. $SCE = VA - HC / VA$
 c. $CEE = VA / CE$










Stage 2

$VAIC = ICE (HCE+SCE) + CEE$

Total Value Added

Menu	
 Abstract	Operating Profit (OP) : <input type="text"/>
 Value Added	Employee Costs (EC) : <input type="text"/>
 Human Capital Efficiency	Depreciation (D) : <input type="text"/>
 Structural Capital Efficiency	Amortisation (A): <input type="text"/>
 Physical Capital Efficiency	Value Added : <input type="text" value="0"/>
VAIC	<input type="button" value="Reset"/> <input type="button" value="Submit"/>
 Trend Analysis	
 Graph	
 Estimation	
 Prediction	

Total VAIC

Menu	
 Abstract	Intellectual Capital Efficiency: <input type="text"/>
 Value Added	Human Capital Efficiency : <input type="text"/>
 Human Capital Efficiency	Structural Capital Efficiency : <input type="text"/>
 Structural Capital Efficiency	Physical Capital Efficiency : <input type="text"/>
 Physical Capital Efficiency	VAIC : <input type="text" value="0"/>
VAIC	<input type="button" value="Reset"/> <input type="button" value="Submit"/>
 Trend Analysis	
 Graph	
 Estimation	
 Prediction	

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