INTELLECTUAL CAPITAL OF THE VARIOUS MANUFACTURING SECTORS OF SOUTH AFRICA

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ABSTRACT

This study determines and compares the measure of intellectual capital imbedded in the various manufacturing firms and industries of South Africa. Labour, capital goods, resources and entrepreneurship are the established factors of traditional production. Economists realised that it is not the amount of labour that is important in the efficient production of output, but the value of capital and the attention shifted to human capital as an indicator of the elements imbedded in labour that makes it more productive. Firms and industries can enhance their profits, financial performance and international competitiveness when they enjoy the benefits from knowledge and technological spillovers, but not all firms do. It has been realised that the extent to which companies are able to become competitiveness and utilise spill overs, FDI and other development advantages depends on their absorption capacity. They must be able to apply what they obtain and learn from others to their local advantage. The world is moving from an industrial era to an information era as modern technology expands. All this implies that the factors of production of firms and industries must poses the necessary intellectual capital to become and stay competitive in today's fast changing markets. It is therefore important to measure this level of intellectual capital of South Africa's manufacturing industries and learn from the best. This paper uses data from the Johannesburg Securities Exchange and determine the Value Added Intellectual Capital Coefficient of the various firms listed mathematically. This coefficient differentiates between human capital efficiency, physical capital efficiency and the structural capital efficiency of firms. The average intellectual capital of the various firms and industries are then compared and conclusions are made in relation to the success of the best firms in the various sub-sectors.

JEL Codes:

D24 - Production; Cost; Capital; Capital, Total Factor, and Multifactor Productivity; Capacity
L23 - Organization of Production
D22 - Firm Behaviour: Empirical Analysis
L21 - Business Objectives of the Firm

Keywords: Intellectual capital; Production, Manufacturing; Factors of Production; Labour; Capital; Human Capital

Intellectual Capital of the Various Manufacturing Sectors of South Africa

WORK IN PROGRESS

1. INTRODUCTION

This study investigates the intellectual capital of the various manufacturing firms and industries of South Africa. It estimates and compares the measure of intellectual capital imbedded in the various manufacturing sub-sectors and attempt to determine if it really matters. The world is moving from an industrial era to an information era, where intellectual work, communication and information technology is supplanting manual work and traditional manufacturing methodology (Kleynhans & Drewes 2008:154).

According to Chu, Cha, and Wu (2011:250) Berzkalne and Zelgave (2014:888), traditional accounting methods do not fully capture knowledge-based intangible assets (Mehralian, Rajabzadch, Sadeh & Rasekh, 2012:139).

Emergence of the knowledge economy resulted in the shifting in strategy focus from tangible to intangible resources and these knowledge-based intangible assets are not captured through traditional financial accounting. Human capital, a component of intellectual capital, contributes positively to company's operational capabilities, enables companies to increase their earning potential and market value-book gap, Morris (2041:1-2).

Knowledge, according to Namvar, Fathia, Gholamin and Khavan (2015:145), influences firm's performance and competitive advantage, positively. Globalization information, technological advancement and the paradigm shift in economies from production-based to knowledge-based, led to knowledge being the source of social, economic and cultural development (Khalique, Shaari, Isa & Ageel, 2011:1946) and (Merhi, Umar, Saeidi, Hekmart & Naslmosavi, 2013:146) Chen, Cheng & Hwang(2005:161) emphasize the importance of the intellectual capital as a corporate strategic asset and a means to enhance financial performance and sustainable competitive advantage (Basuki & Kusumhwardhani, 2012:42).

In the new economy, intellectual capital is driven by information and knowledge. For South Africa's economy to become competitive there must be a transition from reliance on natural resources to intellectual capital, Firer and Stainbank (2003:26).

2. THEORY AND DEFINITIONS

In studies conducted by Morris (2014:601), Firer and Stainbank (2003:37) and Firer and Williams (2003:348), in South African firms, it was found that physical capital or tangible assets remains the most importance resource (Nazari & Herremans, 2007:601). Knowledge-based resources have become an important competitive advantage in the complex and dynamic global economy because knowledge enhances firm's performance.

Zéghal and Maaloul (2010:41) regard IC as the sum of all knowledge companies can use in conducting business to create value. Intellectual capital is regarded as a strategic asset because it has a positive influence on corporative performance, (Merhi, Umar, Saeidi, Hekmart & Naslmosavi, 2013:146) (Rehman, Rehman & Zahid (2011:9) provides additional value to stakeholders, Shakina and Barajas (2014:247).

Intellectual capital is a combination of intangible resources, namely, knowledge, skills, expertise, customer relationship, information, database organisational structures and innovations (Khalique & Bontis, 2015:225) that firms can use to obtain (Ståhle, Ståhle & Aho, 2011:532) human capital-structural capital competitive advantage (Claver-Coter & Zaragosa-Saez: 2015:201) (Xinyu, 2014:999) (Khan, 2014:303) (Mention, 2012:2). According to Hosomi (2014:4) and Aivazian and Afanasiev (2011:5), intellectual capital must not only be created but must be used to enhance corporate performance as well as corporate value and the increased role of intangible resources is a characteristic of the information and knowledge economies.

3. METHODOLOGY

The methodology to measure intellectual capital is the Value Added Intellectual Coefficient (VAIC), Firer and Williams (2003:351), Yalama and Coskun (2007:258), (Chu, Chan & Wu, 2011:252) (Xinyu, 2014:1000) (Vishnu, 2014:88) (Rheman, Rehman, Rehman & Zahid, 2011:11) which is the sum of the efficiencies of human, structural and capital employed.

The methodology used is VAIC.

VAIC is an analytical too that is easy to calculate standardized, consistent and verifiable & objective because the data is derived from audited financial statements. This method also enables comparative analysis between firms, sectors, industries and countries (Cheng, Cheng & Hwang, 2005:165)

Although VAIC has advantages, there are same disadvantages according to Chu, Chan and Wu (2011:253). Firstly the methodology is unable to handle companies with negative operating profit book value as a result of the Value Added does not give meaningful analysis. Secondly, the inverse relationship between human capital and structural capital may distort outcomes. Thirdly, the methodology is unable to sufficiently identify the synergistic effects for value creation from interaction of Human Capital, structural capital, technological advancement and automation. Fourthly, VIAC fails to accommodate Research & Development and Intellectual Property, Joshi, Cahill, Sidhu and Kansal (2013:268).

Data is collected from the financial statements of manufacturing companies listed in the Johannesburg Security Exchange (JSE) in the INET BFA database (previously McGregor BFA).

The International Standard Industrial Classification (ISIC) was followed and amended to the needs of the study. The iNET Bureau of Financial Analysis (BFA) data (which was McGregor BFA) is used because it is reliable and uses consistent formulas. "Published data" is also used due to the fact that it is reliable and rigorously audited. The problem with "adjusted" figures is that they might be altered incorrectly. Variables are used purely as proxies, with no concern on the share prices of a specific date (end of financial year is fine). Value added (VA) is calculated to isolate the component closest to Intellectual Capital.

This paper is arranged as follows: section 2, theory, section 3 literature, section 4 empirical findings & discussion and section 5 summary & recommendations.

Value Added Intellectual Coefficient (VAIC) is a measure of efficiencies of key resources in the company i.e. intellectual and physical capital, Chu, Chan, Wu (2011:251). VAIC measures how much new value & profit are created for material and intellectual resources invested (Jasour, Shagagi & Rezazadehi, 2013:1)

$$VA = Output - Inputs \quad (i)$$

$$VA = OP + D + A \quad (ii)$$

Where VA is Value Added, OP is operating profit, EC is total employees' expenses and D is depreciation and A is amortisation.

$$IC = HC + SC \quad (iii)$$

Where IC is intellectual capital, HC is human capital, salaries & wages and SC is structural capital. HC refers to the competencies of employees in the form of knowledge, expertise, attitudes, abilities, skills, experience, training, mentoring and coaching. SC refers to the organization's infrastructure, strategies, processes, procedures, policies, systems, and information communication technologies. Relational or customer capital is a subdivision of SC and it is the firms interaction with external stakeholders i.e. suppliers, customers, government, research and development partners.

$$VAIC = HCE + SCE + CEE \quad (iv)$$

$$HCE = VA/HC \quad (v)$$

$$SCE = SC/VA \quad (vi)$$

$$CEE = VA/CE \quad (vii)$$

$$SC = VA/HC \quad (viii)$$

Where HCE is the amount of the value-added generated per monetary unit invested in an employee, SCE is a measure of efficiency of value added and CCE refers to efficiency of physical and financial capital employed.

From equation (iii) ICE (intellectual capital efficiency) can be expressed as follows:

$$ICE = HCE + SCE \quad \text{(ix)}$$

Therefore equation (iv) can be written as:

$$VAIC = ICE + CEE \quad \text{(x)}$$

VAIC calculates the physical financial intellectual efficiencies based on the following assumptions:

1. Physical and intellectual capital define a company's added value

2. Added value is connected to the company's overall efficiency

3. Employees' cost in terms of salaries and wages are regarded as an investment rather than a cost.

The resource-based theory suggests that competitive advantage and better economic performance are achieved through efficient use of intangible assets. An increase in VAIC enhances market evaluation, earnings, profitability and productivity (Merhi, Umar, Saeidi, Hekmat & Naslmosavi, 2013:153), (Lazzolino & Laise, 2013:550) and (Pucar, 2012:249).

A higher coefficient of VAIC indicates a higher value creation using company resources, Zéghal and Maaloul (2010:43) because VAIC measures the new value created per invested monetary unit in each resource. Managers, investors and government can use the VAIC method to assess the performance of firms, sectors and industries (Zéghal & Maaloul, 2010:55) and formulate sound industrial policies and make relevant investment decision (Tseng, Lin & Yen, 2015:170).

Companies with high VAIC values are regarded as efficient and creating more value (Josh, Cahill, Sidhu & Kansal, 2013:271). Economic activity in many countries has, according to Ståhle, Ståhle and Lin (2015:23) shifted from production of physical goods to services thereby emphasising the importance of intangible assets. Capital, plant and machinery are gradually being replaced, in knowledge-based organistions, by employees' professional qualifications and technical proficiency (Vishnu & Gupta, 2014:83). Eighty (80) South African manufacturing companies listed in the Johannesburg Security Exchange were sampled. Twenty six (26) were

discarded due to lack of sufficient data. The sample consist of fifty four (54) from the following sectors: Food process, Basic metals, Non-metal mineral, Paper & Wood, Chemicals, Plastics, Pharmaceuticals, Electrical, Electricals and Transport. Competitive advantage and sustainable growth and development may be gained through amongst others, effective and efficient, management and maximization intellectual capital (Lazzolino & Laise, 2013:549) (Pucar, 2012:249) including measurement and reporting, (Ståhle *et al.,* 2005:17). Intellectual capital can be used to explain the gap between the firm's market and book values (Berkalne & Zelgave, 2014:887) and is also important in investment decision-making by management and investors, (Yalama & Coskun, 2007:263) (Kamath, 2007:118) has an influence on financial performance of organisations (Khan, 2014:303) (Iranmahd, Moeinaadin, Shahmoradi & Heyrani, 2014:1-4), efficient allocation of resources and the firm's operating efficiency (Lu, Wang & Kweh, 2014:65). Maditinos, Chatzoudes, Tsavidis and Theriou (2011:133) regard intellectual capital as knowledge that can be converted into value. Although research within intellectual capital measurement is at its infancy (Morris, 2014:15) and Marr, Gray and Neely (2003:441). Research in various countries and sectors found: Human Capital Efficiency (HCE) enhances profitability and productivity more than Structural Capital Efficiency (SCE) and Capital Employed Efficiency (CEE), Rehman et al. (2011:10)

4. Empirical analysis

SECT0R	CEE	HCE	SCE	VAIC
FOOD PROCESS	2.8085	13.6988	3.1117	19.6190
BASIC METALS	2.3505	-35.8446	4.2155	-29.2786
NON-METAL MIN	1.2441	7.0185	1.4032	9.66579
PAPER & WOOD	2.2738	13.96175	3.1175	19.3530
CHEMICALS	0.7843	3.7085	0.4989	4.9916
PLASTICS	0.5477	7.4752	1.1298	9.1528
PHARMACEUTICALS	1.9140	2.8627	0.5699	5.3466
ELECTRICAL	1.6762	7.7296	-1.0277	8.37816
ELECTRONICS	1.0697	8.1390	5.4278	17.1386
TRANSPORT	0.3516	4.8565	1.0452	6.2533
TOTAL	***15.0205***	***33.6059***	***19.4917***	***70.6203***
AVERAGE	***1.5020***	***3.36059***	***1.9492***	***7.0620***

Table 1. Manufacturing Sectors, source: McGregor BFA, 2015.

From Table 1 above, the following observations are made:

4.1 Capital employment efficiency (CEE)

Two leading sectors in this category are: Food process (2, 8085) and Basic metals 2, 3505). The two sectors whose capital employed efficiency is the lowest are: plastic (0, 5477) and transport (0, 3516). CEE indicates value added created by one unit of investment in capital employed (Berzkalne & Zelgave, 2014 symbolically it is defined as CEE = VA/CE (Xinyu: 2014).This means that CE > VA and capital Employed is greater in plastic & transport than value added because if VA/CE < I means that CE > VA and the reverse is true for food process and Basic metals the value created is in investment in capital employed is higher than in plastic and transport.

4.2 H**uman Capital Efficiency (HCE)**

The two leading sectors are: paper & wood and (13, 9618) and food process (136988) while the two lowest are: pharmaceuticals (2, 8627) and basic metals (-35, 8446).Berzkalne et al. (2014) defines HCE as value created by one unit of investment in employs and algebraically as:

HCE = VA/HC (Xingu: 2014)

For Paper & Wood and food process, the value created by investing in employees is higher indicating that VA>HC.

In pharmaceuticals, vertical though VA/HC > l it is lower. An exception is in Basic Metals where VA/HC <O but is VA >O because it is the same throughout so the other ratios would have been less than zero. According to Lazzolino *et al*. (2013) if HCE <l, then value added cannot cover salaries and wages, that means that there is value destruction in this case.

4.3 Structural Capital Efficiency (SCE)

Electronics (5, 4278) and basic metals are 4, 2155) the two highest while the two lowest are chemicals (0, 4989) and electrical (-10277). SCE is the efficiency in the firms systems procedures, data bases policies and rules and is defined algebraically as SCE = SC /VA (Rehman et al: 2011).For electronics and basic metals SCE >O and according to Lazzolino et al. (2013) there is value creation. The necessary condition for profit oriented firm to exist is met. Electrical (-1.0277) means that SC/VA < O which implies that SC<O, investment in the firms systems, procedures policies and values is below the acceptable level and profit making is under threat because VA-HC<O.

4.4 Value added Intelligence coefficient (VAIC) Food Process (196190) and paper and wood (19, 3530) are two top performance in this category while the two lowest are chemicals (4, 9916) and basic metals (-292786).

VAIC is a measure of the value –added or investment in each resource CE, HC and SC the higher the value of VAIC, the higher is the efficiency in utilization of the resources and the higher is the value created for the firm , Nazari and Herremans (2007) , Joshi , Cahill ,Sidhu and Kansal

(2013), Berzkalne et al.(2014)and Maditinos et al.(2011). Of particular interest is Basic Metals whose VAIC is negative .Because VAIC = CEE + HCE +SCE (Rehman *et al.,* 2011) from table 1 it is clear that HCE for Basic metals is also negative and it is the cause of the VAIC's negative .It also indicates the importance and magnitude of HCE on VAIC.

Thus the higher the value of HCE, the higher will be VAIC. Thus total efficiency is heavily dependent on the efficiency of human capital.

6. SUMMARY

Food process has the highest CEE, HCE, VIAC, P/B and P/E. Basic metals have the highest CEE, SCE and P/B. Paper and wood perform better in HCE and VAIC and Electronics perform well in SCE and P/E.

Sectors that are not performing well are; Transport, plastics, chemicals, pharmaceuticals, electrical and non-metal minerals

In terms of the VAIC research done to date the above imply that in the food process, Basic metals, paper and wood and electronics, resources are utilized effectively and efficiently to create value and there is also efficient allocation of resources.

It was however, expected that pharmaceuticals, chemicals and electrical sectors would have high values of HCE and VIAC given that their operations are knowledge-intensive but this is not the case here.

The high values of SCE in electronics and basic, knowledge-intensive, sectors is not surprising because SCE is the efficiency of utilizing company systems, procedures, policies, databases, networks, IT, process manuals intellectual property, copyrights, patents, technologies and strategies.

7. RECOMMENDATIONS

South African managers and stakeholders should apply necessary interventions to ensure that efficiency in plastic, pharmaceuticals, chemicals and electrical sectors is improved especially in HC because these sectors are strategic importance and are knowledge-intensive. It is also recommended that SA companies;

- increase tremendously, the investment in training and development of intellectual capital i.e. HCE

- management must take serious effort to understand the measurement & monitoring, disclosure and management of IC

- managers, investors and government can use VAIC method to assess companies / sectors / industries in terms of Value Added and Intellectual Capital through better economic policies and improvement in the management of the new economy.

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