

# **Intellectual Capital Efficiency: Evidence from Bangladesh**

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## **Abstract**

The study investigates associations, first, between a firm's intellectual capital and market value, and second, between a firm's intellectual capital and financial performance in the context of Bangladeshi companies selected from three different industries - banking, textiles, and pharmaceuticals. This was investigated through applying Ante Pulic's (1998) framework of Value Added Intellectual Coefficient (VAIC). Most of the previous analyses on intellectual capital focused only one industry, although Pulic informed that VAIC is a standardized measure that could be applied over a range of companies of different sizes, taken from different sectors and across different countries. Findings from this study should assist to determine if Bangladeshi firms appear to continue relying on traditional resources for wealth creation, or if they are shifting towards a greater reliance on intellectual capital factors of production in determining profitability and market valuation.

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## **1 Introduction**

### **1.1 Background**

Financial statements, prepared by following commonly accepted accounting principles, have rarely been agreed upon to be a sufficient measure of corporate performance to assist in objective evaluation of a firm in the market, as evident by the growing gap between market and book values of a firm (Al-Ali, 2003; Hussain *et al.*, 2010; Lev and Daum, 2004; Lev, 2001; Lev and Radhakrishnan, 2003; Lev and Zaowin, 1999). This apparent deficiency of traditional financial accounting methods has induced many researchers to carry out investigations on the role of intellectual capital, an element not fairly recognized in the financial statements, in identifying the relationship between share price on the stock market and the book value extracted from the financial statements (Cezair, 2008; Hussain *et al.*, 2010; Lev, 2001). Intellectual capital plays a significant role in the modern approach to value creation and hence the management of intellectual capital has evolved as the core of enterprise operation in the present knowledge era (Gu and Lev, 2001; Lee and Guthrie, 2010). Considering the perceived growing importance of intellectual capital in business organizations, this study attempted to investigate the role of intellectual capital in explaining the relationship between a firm's market value and financial performance by taking evidence from Bangladeshi companies (Hussain *et al.*, 2010).

Although a firm's market and book values have hardly ever been exactly the same, the gap between market and book values in most countries have been

increasing at an alarming rate over the past few years (Lev, 2001). This increasing gap has drawn wide attention for researchers to explore any invisible value unattended in the financial statements (Lev and Radhakrishnan, 2003; Lev, 2001; Lev and Zaowin, 1999). Lev (2001) documented that, over the period of 1977-2001, the market to book value ratios of S&P 500 corporations have increased by five times (from slightly over 1 to above 5). This implies that over 80% of corporate market value has not been reported in financial statements. Edvinson and Malone (1997) stated that the source of economic value is no longer simply captured by the production value of material goods, but also the creation and utilization of intellectual capital.

Recent studies suggest that knowledge and information are subject to increasing returns, as opposed to the decreasing returns typical of the traditional resources like physical assets (Bontis *et al.*, 1999; Mohiuddin *et al.*, 2006), which implies that knowledge and information become even more valuable to companies than before. Having a sound knowledge base in the corporation means that in the future years, the company can start leveraging that base to create even more knowledge, thereby increasing its advantage on the competitors (Arthur, 1996). The fact that investors and financial markets attach value to the skills and expertise of CEOs and other top management (Bontis, 2001) can be understood by observing stock prices reacting to changes in management. If intellectual capital did not exist in organizations then stock prices would not have reacted to actions such as changes in management, an element of human capital not recognized in financial statements as assets (Bontis, 2001). This fact questions the reliability and adequacy of accounting mechanisms that companies use, developed a few centuries ago to help merchants in the feudal era, to make the key success factors of the information age visible (Mohiuddin *et al.*, 2006). Unfortunately, being invisible and intangible, a measurement value of knowledge cannot be captured very well by any of the traditional measures—accounting or otherwise, that corporations master in their everyday operations (Chen *et al.*, 2005). Intellectual

capital can be an objective proxy for the value of corporate knowledge (Hussain *et al.*, 2010; Mohiuddin *et al.*, 2006). Companies therefore require a reliable, accurate, and adequate measure of financial performance which objectively reflects the intrinsic components of intellectual capital and sufficiently demonstrates its true impact on company value at the market to narrow the gap between book and market values.

## 1.2 Research Questions

Consistent with the twofold purpose of the study, there are two broad research questions. First, is there a relationship between intellectual capital and the market value of an enterprise? Second, is there a relationship between intellectual capital and the financial performance of an enterprise?

A company with vast amount of financial capital in its overall firm value may have a small amount of intellectual capital. Similarly, a company with a relatively smaller money value of capital may have a large portion of its firm value derived from intellectual capital sources (Hussain *et al.*, 2010; Mohiuddin *et al.*, 2006). To address this, one refers to as greater proportional market value, which can be tested through a standard ratio such as the market to book value. The companies with greater intellectual capital will experience better financial performance, which can be measured through indicators such as return on assets (ROA), return on equity (ROE) and growth in revenue (Mohiuddin *et al.*, 2006).

The following statement is proposed for this research:

“Companies in Bangladesh with greater intellectual capital have higher proportional market value and better financial performance.”

## 2 Literature Review

### 2.1 Definitions of Intellectual Capital

Intellectual capital, in its simplest sense, refers to the contributions of resources that have no basis on sources of tangible elements or characteristics (Itami, 1991). However, it does not only revolve within the realm of intangible assets, but as Edvinsson and Malone (1997) suggests, captures both mental labor and the competence or expediency of an institution's processes, databases, brands, and systems (Appuhami, 2007). Numerous definitions of intellectual capital covering its scope and functionality have been given by researchers in recent times. Nevertheless, the definition given by Itami (1991), the pioneer of works on intellectual capital, is widely recognized in the academic arena. Itami (1991) defined intellectual capital as intangible assets comprising of technology, brand name, reputation, customer information and corporate culture that are invaluable to a firm's competitive power (Mohiuddin *et al.*, 2006; Muhammad *et al.*, 2006; Low and Kalafut, 2002). There seems to be an inherent relationship between intellectual capital in a firm and the knowledge instilled in workers. Where as Bontis (1999) defined intellectual capital as the knowledge of both individual workers and the organization, Pulic (2001) purported that all employees and their abilities create value at the various organizational processes which is in turn translated in the market as intellectual capital. In the same go, Lonnqvist (2004) defined intellectual capital as those consisting of non-physical resources of value related to the capabilities of employees, resources of the organizations, the manner in which an organization is operated, as well as the relationship of an organization's internal bodies with the shareholders. In fact, the theory of stakeholder view (Donaldson and Preston, 1995), which demonstrates that stakeholder relationship constitutes all the forms of relationship of a firm with its stakeholders such as investors, government, customers, employees, suppliers and the general public is a premise on which the concept of intellectual capital is

developed (Appuhami, 2007).

The importance of non-physical resources illustrated from these definitions suggests that intellectual capital can be identified as a prominent source of competitive advantage of various organizations, which influences the level of innovativeness and creativity that not only lead to the increase of business performance at the micro-level (Muhammad *et al.*, 2006) but, if applied rigorously in most firms across a wide variety of industries, it can also contribute effectively to a country's economic growth at the macro-level (Mohiuddin *et al.*, 2006). Several researchers observed that although intellectual capital is considered important for the competitiveness of many companies regardless of the industry, it is especially useful for knowledge-intensive companies as their resources, in large part, are intangible (Kujansivu and Lonnqvist, 2005; Shiu, 2006; Stewart, 2001; Sveiby, 1997). The usefulness of intellectual capital in knowledge-intensive firms is complemented by management thinker Drucker (1993), who declared the arrival of a new economy, referred to as the 'knowledge society' (Mohiuddin *et al.*, 2006). Drucker (1993) claimed that knowledge is not just another resource alongside the traditional factors of production (i.e. land, labor and capital) but it is in fact the only meaningful resource today (Bontis, 2001; Pulic, 2004). The various components of intellectual capital can be described as a combination of the monetary value of human labor and the intrinsic values of technology, processes, brands and systems (Kujansivu and Lonnqvist, 2005; Muhammad *et al.*, 2006). According to Mohiuddin *et al.*, (2006), intellectual capital usually consists of the implicit or experimental knowledge and innovativeness of the employees, the infrastructure of human capital and upgrading processes of structural capital and external relationships of the firm (e.g. customers' capital).

## **2.2 Human Capital**

Several studies (Appuhami, 2007; Aston, 2005; Bontis, 1999; Bozbura, 2004; Sullivan and Sheffrin, 2003) referred to human capital as the stock of skills

and knowledge embodied in the ability to perform labor so as to produce economic value. Hence it can be described as the skills and knowledge gained by a worker through education and experience (Sullivan and Sheffrin, 2003). Aston (2005) supported the view by pointing out that human capital consists of personnel attributes such as knowledge, skills and expertise (Appuhami, 2007). Bozbura (2004) suggested that human capital can be recognized as an accretion of general knowledge acquired by employees during their work tenure, leadership skills, the ability to take risks while performing the job and making decisions, and the ability to solve problems (Appuhami, 2007). Several scholars informed that the human capital can be developed so as to enhance the efficiency of tangible and intangible assets within an organization (Appuhmi, 2007; Bontis, 1999; Fitz-enz, 2001).

A notable feature of human capital is that it is always owned by individuals who have it, unless it is saved in a tangible format or incorporated in some manner in the structures, procedures and systems of the organization (Mohiuddin *et al.*, 2006; Muhammad *et al.*, 2006). Therefore continuous enhancement and strengthening of intellectual capabilities and resources are necessary to create a larger pool of talents and high caliber professionals in the organization (Muhammad *et al.*, 2006; Zeti, 2005). Human capital should evaporate as employees leave the firm, since human capital depends on capabilities of employees such as competence, commitment, motivation, loyalty, and similar attributes. Hence although human capital is being recognized as the heart of creating intellectual capital; it may disappear as employees exit (Bontis, 1999; Mohiuddin *et al.*, 2006). In the context of globalization, high class human capital today has become a prerequisite to success and not merely opulence (Muhammad *et al.*, 2006). As a result, companies in the present knowledge era invest significant amount of their money in human capital development in order to achieve competitive advantages in the global market (Appuhami, 2007; Ulrich, 1997).

## 2.3 Structural Capital

Structural capital comprises of enabling structures that allow the organization to exploit intellectual capital (Muhammad *et al.*, 2006). These structures range from tangible items offered by an organization, such as patents, copyrights, trademarks, databases, software systems and processes to intangibles such as corporate culture, accountability, efficiency, and trust among employees (Seetharaman *et al.*, 2004). Ashton (2005) described structural capital as comprising of various types of internal and external value drivers. Internal value drivers of a firm includes processes, routines, databases, customer files, work literature or manuals, and organization structures while external value drivers include issues such as relationships with customers, suppliers and alliance partners (Appuhami, 2007).

Structural capital results from outputs, products or systems created by the firm over time and are not necessarily embedded within an individual or employee. Hence unlike human capital, structural capital remains within an organization even after employees leave (Appuhami, 2007; Mohammad and Aida, 2007; Mohammad *et al.*, 2006). In this connection, Edvinsson (1997) suggested that the management should try to transform the firm's human capital knowledge into structural capital components to ensure value creation in the long run (Appuhami, 2007). Organizations possessing strong structural capital are highly likely to develop a supportive corporate culture permitting their employees to try new things in the workplace, to learn, and to practice those (Bontis *et al.*, 2000).

## 2.4 Measuring Intellectual Capital through the Value Added Intellectual Coefficient (VAIC<sup>TM</sup>) Model

The Value Added Intellectual Coefficient (VAIC<sup>TM</sup>), developed by Ante Pulic through a series of studies conducted from 1993 to 1997, is an analytical tool for measuring intellectual capital to evaluate the performance of a company

(Boremann, 1999; Pulic, 1998, 2001, 2002; Van der Zahn *et al.*, 2004). VAIC<sup>TM</sup> enables a firm to measure its value creation efficiency (Pulic, 2001, 2002). Referring to the concept of the Scandia Navigator Value Scheme (Edvinsson, 1997), Pulic (2001) identified that a firm's market value is created by physical and intellectual capital. The VAIC<sup>TM</sup> method uses financial statements of a firm to calculate the efficiency coefficient on three types of capital - human capital and structural capital (which constitutes intellectual capital) as well as capital employed (Boreman, 1999; Edvinsson, 1997; Pulic, 1998, 2001, 2002). The evaluation of performance includes evaluation of the efficiency of capital value added and the intellectual potential value added, which are expressed respectively by capital value added coefficient and intellectual potential value added coefficient (Pulic, 1998; Zhang *et al.*, 2006). Hence despite using accounting data, VAIC<sup>TM</sup> focuses on the efficiency of resources that create the value of the firm, rather than focusing on the costs of a firm (Boremann, 1999; Pulic, 1998, 2000). The capacity of the enterprise using the capital and intellectual capital for value added is termed as 'Intellectual Capacity', while 'Value Added Intellectual Coefficient' is used to express the sum of capital value added coefficient and intellectual potential value added coefficient (Zhang *et al.*, 2006). Since VAIC<sup>TM</sup> is calculated as the sum of capital employed efficiency, human capital efficiency and structural capital efficiency, a higher value for VAIC<sup>TM</sup> demonstrates a greater efficiency in the use of firm capital (Muhammad *et al.*, 2006). Referring Drucker's (1993) crucial organizational necessity of developing knowledge workers for the present era, Pulic (2004) described the VAIC<sup>TM</sup> model as:

It meets the basic requirements of contemporary economy of a 'measurement system' indicating the real value and performance of a company, region or nation, enabling benchmarking and predicting future abilities in a relatively objective way. It is useful to all participants in the value creation process – employers, employees, management, investors, shareholders and business partners and can be

applied at all levels of business activity.

There are three major benefits of applying the concept of VAIC<sup>TM</sup>: First, the VAIC method provides a standard and consistent basis of measuring the value of intellectual capital and thereby firm value, allowing effective conduct of an international comparative analysis using a large sample across various industrial sectors (Pulic and Bornemann, 1999). Hence it facilitates both time-series and cross-sectional studies across different industries for firms of different sizes. Second, all data used in the VAIC<sup>TM</sup> calculation is based on audited information taken from financial statements (Pulic, 1998, 2000) such as the balance sheet or the profit and loss account, and therefore, the calculations can be considered as objective and verifiable (Roos *et al.*, 1997; Sullivan, 2000). Third, VAIC<sup>TM</sup> is a straightforward technique that enhances cognitive reasoning and enables ease of calculation by various internal and external stakeholders (Schneider, 1999). Ease of calculation is a feature that has enhanced the universal acceptance of many traditional measures of corporate performance such as ROA or market-to-book value (Sullivan, 2000).

## 2.5 Application of the VAIC<sup>TM</sup> Model

The VAIC<sup>TM</sup> model applied in the study used data from the financial statements to calculate the efficiency of capital employed, structural capital and human capital by using five different steps. The first step involved calculation of the Value Added (VA<sub>it</sub>) by all the resources of the firm during the period concerned, referred to as t. VA<sub>it</sub> is noted as the difference between the outputs and inputs of the firm during the time period in concern, as this output surplus indicates the amount of wealth created during the period:

$$VA_{it} = OUTPUT_{it} - INPUT_{it} \quad (1)$$

For equation (1) OUTPUT<sub>it</sub> is the total income generated by the firm from all products and services sold during the period of t, and INPUT<sub>it</sub> represents all the

expenses incurred by the firm during the period  $t$  except cost of labor, tax, interest, dividends and depreciation.

This calculation of the value added by a firm is derived from the Theory of Stakeholder View (Donaldson and Preston, 1995) which holds that any party that either influences or is influenced by a firm's activities have a stake (or interest) in the firm including parties such as vendors, employees, customers, directors, the government as well as community members as a whole. In this connection Riahi-Belkaoui (2003) viewed value added by a firm as a wider performance measurement than simple accounting profit that only calculates the return attributable to the shareholders of a firm. Riahi-Belkaoui (2003) further suggested the following formula for calculating the value added of a firm for a particular time period  $t$  to be the net earnings retained for a period, as follows:

$$R_{it} = S_{it} - B_{it} - DP_{it} - W_{it} - I_{it} - D_{it} - T_{it} \quad (2)$$

where:

$R$  = retained earnings for the period

$S$  = net sales revenue obtained for the period

$B$  = cost of goods sold plus all operational and other expenses in the period apart from labor, taxation, interest, dividend and depreciation

$DP$  = depreciation charged during the period

$W$  = wages and salaries paid to the employees for the period

$I$  = interest expenses paid during the period

$D$  = dividends paid to the shareholders for the period

$T$  = taxes for the period

The elements in equation (2) can be rearranged as follows:

$$S_{it} - B_{it} = DP_{it} + W_{it} + I_{it} + D_{it} + T_{it} + R_{it} \quad (3)$$

For equation (3), the left hand side shows the difference between net revenues and all expenses excepting wages, interest, dividend, tax and depreciation. Hence one may say that the expression  $(S-B)$  is the total value generated by the firm during the particular time period. The right hand side shows how the firm has distributed

its generated revenue among the stakeholders. It includes wages and salaries paid to the employees, interest paid to debt-holders, taxes paid to the government, dividend and retained earnings paid to the shareholders and the provision for depreciation allocated to shareholders. Hence according to the theory of Stakeholder View (Donaldson and Preston, 1995) the right hand side of equation (3) is the total value added to the firm during the given period, and hence can be written as follows:

$$VA_{it} = DP_{it} + W_{it} + I_{it} + D_{it} + T_{it} + R_{it} \quad (4)$$

where  $VA_{it} = I_{it}$  (total interest expenses) +  $DP_{it}$  (depreciation expenses) +  $D_{it}$  (dividends) +  $T_{it}$  (corporate tax) +  $R_{it}$  (profits retain for the period) +  $W_{it}$  (wages and salaries, and other training costs for the period)

The following steps involve the calculation of Value Added Intellectual Coefficient (VAIC<sup>TM</sup>) and the efficiency coefficients of the three components - capital employed, human capital and structural capital following Pulic (2000) and Firer and Williams (2003).

Capital employed efficiency has been calculated by Value Added Capital Employed coefficient as follows:

$$CE_{VAit} = VA_{it} / CE_{it} \quad (5)$$

where  $CE_{it} = \text{Capital Employed} = \text{Physical Assets} + \text{Financial Assets}$

$= \text{Total Assets} - \text{Intangible assets at the end of t period}$

$CE_{VAit} = \text{The value created by one unit of capital employed during the t period}$

The Value Added Human Capital Coefficient has been calculated as follows:

$$HC_{VAit} = VA_{it} / HC_{it} \quad (6)$$

where  $HC_{it} = \text{investment in human capital during the t period or total salary and wages including all incentives and training schemes}$

$HC_{VAit} = \text{value added by one unit of human capital during the period of t}$

The Value Added Structural Capital Coefficient has been calculated as follows:

$$SC_{VAit} = SC_{it} / VA_{it} \quad (7)$$

where  $SC_{it}$  = structural capital during the period  $t$  calculated by the difference between Value Added and Human Capital ( $VA_{it} - HC_{it}$ )

$SC_{VAit}$  = the proportion of total Value Added accounted by structural capital

Finally, the Value Added Intellectual Capital Coefficient ( $VAIC_{it}$ ) has been calculated by adding the coefficients of efficiency for each of the three components:

$$VAIC_{it} = CE_{VAit} + HC_{VAit} + SC_{VAit} \quad (8)$$

where  $VAIC_{it}$  denotes corporate value creation efficiency on firm resources.

## 2.6 Applications of the VAIC™ model to Measure Corporate Performance

The potential of VAIC™ to provide a standardized and consistent measure of corporate performance is motivated by growing trace in literature, much of the research stemming from the work of Pulic (1998). Over the years, VAIC™ has been used in both academic research publications (Firer and Williams, 2003) and in the industry (Pulic, 2000, 1998). Bornemann *et al.* (1999) found that companies which manage their intellectual capital better owned stronger competitive advantage than their rivals, and enterprises which strengthen their own intellectual capital management often perform better than other companies. Pulic (2000) identified that firm's market value have been created by capital employed (physical and financial) and intellectual capital, and he further found a significant relationship between the average value of intellectual capital VAIC and the firm's market value by using data of 30 UK companies from 1992 to 1998. Using survey data in a pilot study Bontis (1998) obtained a very strong and positive relationship between Likert-type measures of intellectual capital and business performance. Bontis *et al.* (2000) found that intellectual capital has a profound relationship with business performance regardless of industry sector in Malaysia. On the basis of

resource-based stakeholder views, Riahi-Belkaoui (2003) documented a significant positive relationship between intellectual capital and financial performance, using 81 US multinational enterprises.

Williams (2001) discovered that companies with higher level of VAIC™ try to reduce their disclosure in respect of intellectual capital when the performance reaches a threshold level since it might reduce competitive advantages. Moreover, to investigate the impact of intellectual capital on traditional measures of corporate performance like ROA, ROE, turnover, and market to book value ratio using 75 public companies in South Africa, Firer and Williams (2003) found that the associations between the efficiency of value added (VA) and profitability, productivity and market valuation are mixed. Mind *et al.* (2005) found that intellectual capital has a positive impact on market value and financial performance and identified positive impact of research and development expenditure on profitability and firm value using a sample of listed companies in Taiwan. Research performed by Mavridis (2004) confirmed the existence of significant performance differences among various sets of Japanese firms. Carrol and Tansey (2001) used the example of the technology giant Intel Corporation to illustrate that proper recognition and utilization of intellectual capital helps a company to become more efficient, effective, productive and innovative. The researchers demonstrated that Intel's business success is driven by the ability to use intellectual capital for maintain and extending intellectual capital and bringing significant returns to the shareholders. A study conducted by Pulic (2004) showed that in the present era of value creation, quantity is not relevant. In Taiwan, Wang and Cheung (2004) suggested an integrated theoretical model to investigate the impact of intellectual capital on business performance. Using the data of 80 listed technological firms in Taiwan, Shiu (2006) suggested that firms could transfer its intangible assets such as intellectual capital to high value added products or services. Thus it can be seen, in theory research, scholars generally point out that there are positive relevant relationships among intellectual capital and the market

value of enterprises, stock prices, business performance, and also that intellectual capital can build and maintain business performance and competitive advantage (Edvinsson and Malone, 1997; Stewart, 1997).

### 3 Methodology

#### 3.1 Development of Hypotheses

First, this study attempts to examine the role of intellectual capital in determining the market value of a firm. While intellectual capital is expected to play a significant role in explaining the market value of a firm one can hypothesize that:

*H<sub>1</sub>*: Companies in Bangladesh with greater intellectual capital efficiency tend to have higher market to book value ratios, ceteris paribus.

Each component of intellectual capital can be independently hypothesized as follows:

*H<sub>1</sub>* (a): Companies in Bangladesh with greater capital employed efficiency tend to have higher market to book value ratios, ceteris paribus.

*H<sub>1</sub>* (b): Companies in Bangladesh with greater structural capital efficiency tend to have higher market to book value ratios, ceteris paribus.

*H<sub>1</sub>* (c): Companies in Bangladesh with greater human capital efficiency tend to have higher market to book value ratios, ceteris paribus.

Second, the study attempts to examine the role of intellectual capital in influencing financial performance. While the growth of intellectual capital has been treated as an indicator of business success, one can hypothesize that:

*H<sub>2</sub>*: Companies in Bangladesh with greater intellectual capital efficiency tend to have better financial performance, ceteris paribus.

Each component of intellectual capital can be independently hypothesized in the light of having better financial performance as follows:

*H<sub>2</sub> (a)*: Companies in Bangladesh with greater capital employed efficiency tend to have better financial performance, *ceteris paribus*.

*H<sub>2</sub> (b)*: Companies in Bangladesh with greater structural capital efficiency tend to have better financial performance, *ceteris paribus*.

*H<sub>2</sub> (c)*: Companies in Bangladesh with greater human capital efficiency tend to have better financial performance, *ceteris paribus*.

### **3.2 Sample Selection Procedure**

For the research, data has been collected from companies listed in the Dhaka Stock Exchange (DSE) representing three distinct industries—banking, textiles and pharmaceuticals. These three industries have been assumed to roughly represent the majority of firms listed in the DSE, as these industries represented the highest number of company in the stock exchange, and are the largest in terms of market capitalization. Companies were selected on the basis of availability of information necessary for conducting the study and the readiness of Annual Reports. Hence the sampling procedure could be termed as convenience sampling. The total number of companies used in the study is 30. The sample size has not been derived using any specific formula. Out of 30 companies, there were 11 banking institutions, 10 textile firms and 9 pharmaceutical companies.

### **3.3 Data Sources**

The data used is secondary in nature, comprising of information extracted from Annual Reports of the financial year 2007-08 of the chosen companies. The share price or market value information for the companies was extracted from the website of DSE. The designated methods from some of the reviewed studies, particularly those examining intellectual capital through the concept of Value Added Intellectual Coefficient (VAIC<sup>TM</sup> method) have been applied extensively in

the study.

### 3.4 Regression Model

The study has utilized a multiple linear regression model to identify the relationship between share price denoting market value and the three components of intellectual capital coefficient VAIC<sub>it</sub>: capital employed efficiency (CE<sub>VAit</sub>), human capital efficiency (HC<sub>VAit</sub>), and structural capital efficiency (SC<sub>VAit</sub>). Following Appuhami (2007), no other independent variable has been added in the multiple regression equation to facilitate investigation of the full explanatory power of the components of VAIC<sup>TM</sup>. The multiple regression model is as follows:

$$CSP_{it} = \alpha_0 + \alpha_1 HC_{VAit} + \alpha_2 CE_{VAit} + \alpha_3 SC_{VAit} + \varepsilon_{it} \quad (9)$$

For (9),

CSP<sub>it</sub> = change in share price over the period t (calculated as the percentage change in share prices between the beginning and end of the period t)

$\alpha_0$  = intercept or default regression coefficient

$\alpha_1$ ,  $\alpha_2$  and  $\alpha_3$  = regression coefficients of the independent variables

$\varepsilon_{it}$  = error term indicating factors not accounted for in the model

## 4 Results

### 4.1 Descriptive Statistics

Table 1 presents descriptive statistics considering the 30 sample companies for all of the variables included in the study. None of the items were found to be missing. The descriptive statistics includes mean, median, standard deviation, variance, minimum, and maximum figures from the list of 30 companies examined. The variables examined included Return on Assets (ROA), Return on

Equity (ROE), Revenue Growth (RG), Value Added Capital Employed ( $CE_{VA}$ ), Value Added Human Capital ( $HC_{VA}$ ), Value Added Structural Capital ( $SC_{VA}$ ), Value Added Intellectual Capital (VAIC), Change in Share Price (CSP), and Market to Book Value Ratio (M/B).

Table 1: Descriptive Statistics

	ROA	ROE	RG	$CE_{VA}$	$HC_{VA}$	$SC_{VA}$	VAIC	CSP	M/B
N	30	30	30	30	30	30	30	30	30
Missing	0	0	0	0	0	0	0	0	0
Mean	0.03365	0.141142	0.15448	0.20213	6.05974	0.290547	6.552823	0.22576	2.22205
Median	0.01995	0.165980	0.18483	0.10894	4.60003	0.782052	5.530931	0.00712	1.56545
Std. Deviation	0.04766	0.177628	0.24546	0.23062	4.85730	2.006124	5.828111	0.55835	1.79178
Variance	0.00227	0.03155	0.06025	0.05319	23.5934	4.024537	33.96687	0.31176	3.21047
Minimum	-0.06745	-0.51515	-0.43145	0.01951	0.08977	-10.1391	-10.0188	-0.33219	0.31000
Maximum	0.15588	0.55517	0.63648	1.22241	19.0082	0.94739	20.06654	2.15520	7.20338

Multiple modes exist. The smallest value is shown

Return on Assets (ROA), Return on Equity (ROE) and Revenue Growth (RG) were the three measures of financial performance included in the study. These ratios indicated the profitability rate of a firm through utilization of assets and financial capital, and the rate at which the turnover has changed during 2007 respectively. Average ROA for the sample of 30 companies was 3.37% and resided within a range of -6.75% to 15.59%. Pharmaceutical firms had the highest ROA averaging 7.48% followed by textile firms (1.69%), indicating that the least profitable of the three sectors studied was banking, with an average ROA of 1.52%. The standard deviation of ROA for the entire sample was 4.76%, which, compared to the mean ROA of 3.37%, is very high, indicating significant variation in profitability of the firms, perhaps a result of including three diverse sectors in the study. Average ROE was 14.11% and owing to the diversity of the three industries, the standard deviation of ROE is high at 17.76%. The banking sector

had the highest ROE with an average of 22.06% closely followed by pharmaceuticals (21.09%), leaving textile firms with the lowest mean ROE (-0.09%). Three firms had negative ROA and ROE indicating that they encountered a net loss during the period, all being textile firms. The contrasting patterns of ROA and ROE between the different industries imply that while banks are good at generating profit with sufficient utilization of equity, pharmaceuticals are better at generating profit through making efficient use of assets.

The three intellectual capital coefficients—Value Added Capital Employed ( $CE_{VA}$ ), Value Added Human Capital ( $HC_{VA}$ ) and Value Added Structural Capital ( $SC_{VA}$ )—were added together to calculate the intellectual capital coefficient Value Added Intellectual Capital (VAIC). Conforming to the findings of studies including Van der Zahn *et al.* (2004), Pulic (2002, 2001), Boremann (1999), Edvinsson (1997), Zhang *et al.* (2006), Muhammad *et al.* (2006), Pulic and Bornemann (1999), and Appuhami (2007), the Value Added Human Capital ( $HC_{VA}$ ) coefficient is much larger than Value Added Capital Employed ( $CE_{VA}$ ) or Value Added Structural Capital ( $SC_{VA}$ ). As these intellectual capital coefficients are arbitrary units, it is not useful to interpret them like financial ratios. It can only be said that the highest VAIC coefficients have been found to exist in the banking sector, with a mean value of 12.06, followed by pharmaceutical firms (4.40) and textiles (2.43). One can hence say that banking institutions possess more intellectual capital elements than pharmaceutical firms and textile firms contain the least intellectual capital elements among the three sectors studied. The change in share price (CSP) during the year was necessary for developing a linear relationship between market value of the firms and intellectual capital coefficients. The study indicated that, although different industries exhibited differing characteristics, on average, share prices have risen on firms in the DSE. Between the sampled 30 companies, the share price has increased between 22.58% on average, ranging from a 216% price increase to a 33.22% price fall, with a high standard deviation of 55.84%. All banks examined suffered from share price

plunges, averaging a share price drop of 17.19% during the year. One but all pharmaceutical firms experienced share price rises with the sector averaging 28.38%. Despite lower ROA and ROE, all textile firms experienced share price rises, averaging a significant 61.1%.

The market to book value ratio averaged 22.21 times, implying that there is a significant gap between the market and book values of the firms. This gap is most prominent with pharmaceutical firms, where the market value is as high as 3.99 times the book value, and followed by banks (M/B ratio 1.50:1) and textiles (M/B ratio 1.41:1). These findings are similar to those of Firer and Willimas (2003), who concluded that the surging gap between the market and book values of the companies indicate the failure of financial statements to adequately measure a firm's value at the market and therefore advocated the need to consider intellectual capital for gauging the true value of a firm.

## 4.2 Inter-Item Correlations

According to Cooper and Schindler (2003), correlation analysis measures the strength of association between two or more variables. Table 2 presents the correlation matrix with the nine variables studied—Return on Assets (ROA), Return on Equity (ROE), Revenue Growth (RG), Value Added Capital Employed ( $CE_{VA}$ ), Value Added Human Capital ( $HC_{VA}$ ), Value Added Structural Capital ( $SC_{VA}$ ), Value Added Intellectual Capital (VAIC), Change in Share Price (CSP), and Market to Book Value Ratio (M/B).

The correlation matrix is composed of an almost even share of positive and negative correlations among the variables. Most of the correlations, whether positive or negative, are moderate, implying reasonable but not very strong strength of association between the variables. The three variables representing financial performance of a firm - ROA, ROE and revenue growth have moderately positive correlations (ROA and ROE  $r=0.467$ ; RG and ROE  $r=0.593$  and ROA

and RG  $r=0.294$ ), implying that companies which gained revenue increases during the year have generally managed to experience increases in ROA and ROE as well.

Table 2: Correlation Matrix

	ROA	ROE	RG	CE <sub>VA</sub>	HC <sub>VA</sub>	SC <sub>VA</sub>	VAIC	CSP	M/B
ROA	1.000	.467	.294	.721	-.222	.100	-.122	-.064	.384
ROE		1.000	.593	.170	.294	.174	.311	-.348	.235
RG			1.000	.128	.345	.337	.409	-.351	.161
CE <sub>VA</sub>				1.000	-.289	.129	-.157	-.059	.259
HC <sub>VA</sub>					1.000	.350	.943	-.448	-.254
SC <sub>VA</sub>						1.000	.641	-.033	.106
VAIC							1.000	-.387	-.165
CSP								1.000	.159
M/B									1.000

The correlations between the intellectual capital coefficients, are however, mixed. Where as human capital coefficient and capital employed coefficient have weak negative correlation ( $r=-0.289$ ), the correlation of structural capital coefficient with human capital ( $r=0.35$ ) and capital employed coefficients ( $r=.0129$ ) are weak positive. Hence the weakness of intellectual capital coefficients indicate that the variables are not strongly associated, and probably that capital employed, structural capital and human capital components function quite independently in an organization. It can be assumed that a firm with significant structural capital to contribute in its business may not decide to pay a lot of money to its employees in the form of salaries and wages and hence or may not be knowledge intensive to the degree to which it can have a significant reserve of human capital. Similarly, a firm with a large amount of human capital may not have a similar bulk of

structural capital in the form of systems, processes, structures and brands. Hence the intellectual capital coefficients are reasonably independent of one another as explained by their weak correlation coefficients. The Value Added Intellectual Capital Coefficient (VAIC) showed a strong positive association with human capital coefficient ( $r=0.943$ ), which can be explained by the high value of human capital coefficient compared to the other two coefficients—the VAIC for most of the 30 companies is almost entirely composed of the human capital coefficients owing to the far smaller arbitrary values of the other two coefficients. VAIC further has a positive association with structural capital coefficient ( $r=0.641$ ) but has a weak negative relationship with capital employed coefficient ( $r=-.0157$ ).

Weak correlations, both positive and negative, could be observed between the financial performance measures and intellectual capital coefficients. For instance, structural capital coefficient has weak positive association with ROA ( $r=0.1$ ), ROE ( $r=0.174$ ) and revenue growth ( $r=0.337$ ). Human capital coefficient has moderately weak positive associations with ROE ( $r=0.294$ ) and revenue growth ( $r=0.345$ ), but has weak negative relationship with ROA ( $r=-0.222$ ). Similarly, capital employed coefficient has weak positive relationships with ROA ( $r=0.17$ ) and revenue growth ( $r=0.128$ ). However, with a correlation coefficient of 0.721, Value Added Capital Employed has a strong positive association with ROA. VAIC has moderately positive relationships with ROE ( $r=0.311$ ) and revenue growth ( $r=0.409$ ) but has a weak negative association with ROA ( $r=-0.122$ ). Therefore the results of correlations indicate that strong, specific relationships between the financial performance measures and intellectual capital measures cannot be conclusively established, although intellectual capital coefficients can act as a weak indicator of financial performance and profit generation.

The change in share price was found to be negatively related to both financial performance measures and intellectual capital coefficients. This conforms to the results of descriptive statistics that the changes in financial performance have little, if at all, any influence in share prices for Bangladeshi

firms. The change in share price has moderately weak negative relationships with ROE ( $r=-.0348$ ), revenue growth ( $r=-.0351$ ), and human capital coefficient ( $r=-.0448$ ) and VAIC ( $r=-.0387$ ). This probably indicates that individual investors at the stock market have been more attracted to companies that have suffered from profit and financial intricacies, the reason of which is fairly difficult to explain using accepted business rationale. Factors beyond speculation, such as gossip or rumors about share prices are more seriously considered by a large proportion of investors rather than paying attention to sophisticated financial analysis, which is why financial performance has had little correlation with changes of share price in the market.

The market to book value ratio has weak positive relationships with the three financial performance measures - ROA ( $r=0.384$ ), ROE ( $r=0.235$ ) and revenue growth ( $r=0.161$ ). This is somewhat expected as positive financial performance has lead to increasing firm values at the market. On the contrary, the market to book value ratio has weak associations with intellectual capital coefficients although the correlations are both negative and positive. Where as capital employed coefficient ( $r=0.259$ ) and structural capital coefficient ( $r=0.106$ ) have weak positive associations with the M/B ratio, human capital coefficient ( $r=-0.254$ ) and VAIC ( $r=-.165$ ) have weak negative associations with the M/B ratio. This indicates that intellectual capital elements play a very limited role in determining the market values of the firm. Only the change in share price has a weak positive association with the M/B ratio ( $r=0.159$ ), implying that share price raises increases the value of the firm at the market.

### 4.3 Regression Results

The study conducted multiple analysis taking the sample of 30 firms in the following format:

$$CSP_{it} = \alpha_0 + \alpha_1 HC_{VAit} + \alpha_2 CE_{VAit} + \alpha_3 SC_{VAit} + \varepsilon_{it}$$

where:

$CSP_{it}$  = change in share price over the period t (calculated as the percentage change in share prices between the beginning and end of the period t)—dependent variable

$\alpha_0$  = intercept or default regression coefficient

$CE_{VA}$ ,  $HC_{VA}$  and  $SC_{VA}$  = independent variables Capital Employed Efficiency ( $CE_{VA}$ ), Human Capital Efficiency ( $HC_{VA}$ ) and Structural Capital Efficiency ( $SC_{VA}$ )

$\alpha_1$ ,  $\alpha_2$  and  $\alpha_3$  = respective regression coefficients of the independent variables

$\varepsilon_{it}$  = error term indicating factors not accounted for in the model

Tables 3 and 4 present the results of multiple regression analysis, as follows:

Table 3: Descriptive Statistics

	Mean	Std. Deviation	N
Change in Share Price	.2257604	.5583581	30
Capital Employed Efficiency	.2021304	.2306230	30
Human Capital Efficiency	6.0597420	4.8573067	30
Structural Capital Efficiency	.2905474	2.0061249	30

Table 3 depicts the mean and standard deviation of the sampled 30 companies for the dependent variable—Change in Share Price and three independent variables—Capital Employed Efficiency ( $CE_{VA}$ ), Human Capital Efficiency ( $HC_{VA}$ ) and Structural Capital Efficiency ( $SC_{VA}$ ). The mean value of human capital coefficient is far larger than the other two independent variables because of its comparatively larger arbitrary values. Both human and structural capital coefficients have high standard deviations, indicating the different natures of businesses involved in the study employing different degrees of manual and

automated capital.

Table 4: Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.524	.275	.191	.5022550	.275	3.280	3	26	.037

a. Predictors: (Constant), Structural Capital Efficiency, Capital Employed Efficiency, Human Capital Efficiency

b. Dependent Variable: Change in Share Price

From the model summary it can be observed that the correlation coefficient R is 0.524, which means that there is a moderately strong correlation between the three independent variables (taken together) and the resulting changes in the dependent variable - the independent variables, taken together, go in the same direction as the dependent variable.

The R Square from the regression model is 0.275, which means that 27.5% of the changes in the dependent variable is measured or explained by the regression model. This is not unexpected as there can be numerous factors influencing the change in share price and not just intellectual capital coefficients. Such factors could be expectations about future revenue generation or profit growth, the prospect of paying dividends, the present financial situation of a company in terms of liquidity, solvency, profitability or efficiency of a company or simply speculation about the company and its ability to achieve sustainable. In the tested regression model the only independent variables taken were the three intellectual capital coefficients in order to study the full explanatory power of the regression model. In light of the independent and dependent components of the regression equation, an R Square of 27.5% is not at all unsatisfactory.

The Adjusted R Square is 0.191 which means that 19.1% of the variation in the dependent variable is explained by the regression model, after imposing penalty for adding unnecessary components within the independent variables. This

is quite satisfactory considering the large number of other independent factors that could influence the change of share price in a firm. One point to note is the gap between R Square and Adjusted R Square, which is 8.4%, indicating that some unwarranted components reside within the three independent variables. This could be a result of accumulating companies from three different industries with varying characteristics diversifying the sample, rather than taking a single industry where all companies basically depict a degree of uniqueness in their financial statements.

The results of individual t-tests are as depicted in Table 5 as follows:

Table 5: Results of t-Test

	Unstandardized		Standardized	T	Sig.	95% Confidence	
	Coefficients		Coefficients			Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	.750	.201		3.732	.001	.337	1.162
CE <sub>VA</sub>	-.624	-.437	.258	-1.428	.165	-1.522	.274
HC <sub>VA</sub>	-6.840E-02	-.022	.595	-3.113	.004	-.114	-.023
SC <sub>VA</sub>	5.795E-02	.051	.208	1.129	.269	-.048	.164

a. Dependent Variable: Change in Share Price

The calculated t-statistics for two of the independent measures - CE<sub>VA</sub> (t=-1.428), HC<sub>VA</sub> (t=-3.113), were been found to be smaller than the critical t-value of 0.645 at 5% significance level; they were not found to be individually significant in determining the changes in share price. However, the structural capital coefficient SC<sub>VA</sub> produced a t-statistic of 1.129 which is higher than the critical value of 0.645 and is significant at 5%. Hence the results of t-test suggest that individually, only the structural capital coefficient can be said to play a significant role in determining changes in share price. This result is complementary to the findings of correlation study and points out the inefficiency of the stock market in Bangladesh that intellectual capital components have little,

if at all, any influence in share prices for Bangladeshi companies.

The results of joint significance are as depicted in Table 6 as follows:

Table 6: Results of F-Test

	Sum of Squares	Df	Mean Square	F	Sig.
Regression	2.482	3	.827	3.280	.037
Residual	6.559	26	.252		
Total	9.041	29			

a. Predictors: (Constant), Structural Capital Efficiency, Capital Employed Efficiency, Human Capital Efficiency

b. Dependent Variable: Change in Share Price

The F-ratio calculated is 3.280. The critical F-statistic for numerator degrees of freedom is 3 (as there are three independent variables) and denominator degrees of freedom as 26 is 1.135. Since the calculated test statistic is greater than the critical value, the test is significant. Hence it can be said that taken together, the three independent variables—intellectual capital coefficients, play a significant role in determining the change in share price. This result is overwhelming considering the insignificant outcomes of the t-test.

#### 4.4 Reliability Tests

Reliability refers to the extent to which a scale produces consistent results if repeated measurements are made (Malhotra, 2004). Cronbach's alpha (or coefficient alpha) is the most commonly used measure to judge the internal reliability of factors or constructs (Bryman and Bell, 2003). Internal reliability helps to provide an idea of the coherence between the variables, the degree to which the different independent variables in a query set measure the dependent variable, and are reliable measures of performance. The results of the reliability

test are given in Table 7 below:

Table 7: Cronbach Alpha Coefficients

Factors	Items	Cronbach's Alpha
Intellectual Capital and Coefficients	Capital Employed Efficiency	0.7285
	Human Capital Efficiency	
	Structural Capital Efficiency	
	Value Added Intellectual Coefficient	
Financial Performance Measures	Return on Asset	0.6214
	Return on Equity	
	Revenue Growth	

Malhotra (2004) asserted that the Cronbach's alpha generally varies from 1 to 0 and a value of 0.60 or above is normally regarded as satisfactory for internal reliability. The reliability tests show that all the constructs are at or above this cut-off point. The results of reliability tests indicate that the findings from the 30 sampled companies are consistent and coherent with one another and internal reliability between the variables is sufficiently high. The Cronbach's alpha for intellectual capital and its coefficients is 0.7285 while the same for financial performance measures is 0.6214 and both tests confirm that the internal data taken from the 30 sample companies are reliable for the purpose of conducting the tests.

#### 4.5 KMO and Bartlett's Test of Sphericity

Factoring the output for each variable shows the Kaiser-Meyer-Olkin measure (KMO) of sampling adequacy, and the results are depicted below:

Table 8: Results of KMO and Bartlett's Test of Sphericity

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.320
Bartlett's Test of Sphericity	Approx. Chi-Square	489.084
	Df	36
	Sig.	.000

Since the calculated KMO value is 0.320, it can be said that the sample size of 30 and the data collected from the sample variables is too few to merit factor analysis.

## 5 Empirical Findings

The empirical results of the study imply that for companies in Bangladesh, intellectual capital and its components do not have significant influence in determining either the financial performance of a firm or its value at the market. Despite the existence of gap between the market and book values of firms, companies with relatively poor financial performance with low revenue growth or lower ROA and ROE experienced higher gain in share prices, and therefore experienced increases in market value. On the contrary, companies with relatively better financial performance statistics suffered from stagnant or even declining market values. The existence of weak correlations within the financial performance measures as well as within the intellectual capital components implied that significant associations could not be established between a company's intellectual capital, market value and financial performance; intellectual capital at best could only be termed as a weak indicator of financial performance and market value. The change in share price was negatively associated to financial performance measures as well as intellectual capital coefficients, indicating the inefficiency, ineptness or incompetence of firms in the Bangladeshi stock market

and the mechanisms that drive the value of companies in the stock market. The regression analysis has developed a linear model for estimating the change in share price with intellectual capital coefficients. The outcomes of t-Test, F-Test, and reliability tests generally confirm that the results derived from the study regarding the weak relationships between a firm's market value and financial performance through the conjunction of intellectual capital is valid. The result of KMO Test further suggests that the sample size of 30 companies and the utilization of nine variables in the study is too low to facilitate a data screening and reduction technique like factor analysis.

## **6 Concluding Remarks**

In order to test the validity of the research statement a sample of 30 listed Bangladeshi companies was chosen and their intellectual capital coefficients were calculated by using the VAIC<sup>TM</sup> methodology proposed by Pulic (1998) and Riahi-Belkaoui (2003). The outcome was analyzed and tested by applying standard statistical techniques. The results could not unequivocally establish either a relationship between intellectual capital and market value or one between intellectual capital and financial performance, although some minor traces existed.

The study was unable to identify an exact relationship between intellectual capital, market value and financial performance for Bangladeshi firms. This outcome could however be attributed to the various inefficiencies existent within the Bangladeshi stock market mechanism. Marginal evidence regarding the significance of intellectual capital in influencing market value and financial performance of firms could be traced from the study. Finance as a business function has an important role to play in managing knowledge assets and understanding and communicating the sources of firm's value. Disagreements exist on what should be the most useful technique of reporting financial performance, and how intellectual capital components can be adequately

integrated in financial statements (Mohiuddin *et al.*, 2006). Hence to determine the best mechanism, experimentation with different variables and construct is invaluable.

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