5.1 - Introduction

It has been evident from the review of many previous studies that:-

- The mixed results have been produced on analyzing the relationship of intellectual capital with the financial performance of IT industries in India. The positive relationship of intellectual capital with the financial performance have been found in some earlier studies (Clarke et al., 2011; Gan & Saleh, 2008; Mehralian et al., 2012; Young et al., 2009) while a negative and a weak relationship of intellectual capital with the financial performance is also found in some other researches (Abdulsalam, Al-Qaheri, & Al-Khayyat, 2011; Firer & Mitchell Williams, 2003; Gruian, 2011; Zeghal & Maaloul, 2010).

- Those studies which have interlinked VAICTM and financial performance of Indian firms have been compiled in Table–A2. It has also been confirmed that the Indian studies have also produced mixed results as in the case of foreign studies.

- The mixed results have been reported not only in case of VAICTM, but also among different components of VAICTM.

- Only a few studies have been conducted as yet, to examine the relationship of intellectual capital with the financial performance of information technology sector in India. The IT sector falls under the knowledge driven sector and its financial performance depends majorly on the intangible assets rather than on tangible assets.

- So it is important to gauge the relationship of intellectual capital or intangible assets with the financial performance of Indian IT sector.

5.2 - Objectives of the Study

The objective of the study has been drawn from the previous studies in Indian context (Bharathi Kamath, 2008; Mondal & Ghosh, 2012b; Pal & Soriya, 2012). The review of those studies has revealed that due to different industrial and geographical settings, the result varies considerably. This led to validate the relationship of intellectual
capital with the financial performance of Indian IT companies. The following objectives have been framed:

- To measure the financial performance of Indian IT sector from 2006 to 2016.
- To gauge the intellectual capital or intangible assets of the Indian IT sector from 2006 to 2016.
- To measure the impact of intellectual capital on financial performance of Indian IT industry.
- To find out the most significant component of intellectual capital in terms of financial performance.

5.3 - Development of Hypotheses

The present study explores this issue empirically by analyzing the impact of intellectual capital (IC), which has been measured through VAIC™ whereas the financial performance have been measured by ATO, ROE, ROA & MB which represents productivity, profitability and market valuation, respectively.

In this study a positive relationship between the financial performance and intellectual capital performance of Indian information & technology sector has been assumed by the author.

In the present study the relationship of intellectual capital along with the three components of VAIC™ with each financial indicator is examined. The three components of VAIC™ reflect the classification of intellectual capital into physical, human and structural capital. On the basis of reviewed literature we have formulated 4 major hypotheses, which break up further into 12 sub hypothesis. These hypotheses are as follows:

**H1. The VAIC™ is positively associated with productivity as measured by ATO.**

*H1a. The CEE is positively associated with productivity as measured by ATO.*

*H1b. The HCE is positively associated with productivity as measured by ATO.*

*H1c. The SCE is positively associated with productivity as measured by ATO.*
H2. The VAIC™ is positively associated with profitability as measured by ROA.

H2a. The CEE is positively associated with profitability as measured by ROA.

H2b. The HCE is positively associated with profitability as measured by ROA.

H2c. The SCE is positively associated with profitability as measured by ROA.

H3. The VAIC™ is positively associated with profitability as measured by ROE.

H3a. The CEE is positively associated with profitability as measured by ROE.

H3b. The HCE is positively associated with profitability as measured by ROE.

H3c. The SCE is positively associated with profitability as measured by ROE.

H4. The VAIC™ is positively associated with market valuation as measured by MB.

H4a. The CEE is positively associated with market valuation as measured by MB.

H4b. The HCE is positively associated with market valuation as measured by MB.

H4c. The SCE is positively associated with market valuation as measured by MB.

5.4 - Sample & Regression Models

The sample has been drawn from Indian Information & Technology sector for which the sectoral index of BSE namely BSE IT was selected. In all 51 companies of Information Technology (IT) sector for financial years ranging from 2006 to 2016 have been taken. The data which have been used in the analysis was extracted from the CMIE’s Prowess.

Model 1 to Model 8 examines the relationship between ATO, ROA, ROE & MB and the components of VAIC™. Physical Capacity & Log of Total Assets have been taken as control variables. These following regression equations depict the models:
### Table 5.1: Regression Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Regression Equations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>ATO = $\alpha + \beta_1 VAIC + \beta_2 PC + \beta_3 \log{\text{total assets}} + \mu$</td>
</tr>
<tr>
<td>2.</td>
<td>ATO = $\alpha + \beta_1 CEE + \beta_2 HCE + \beta_3 SCE + \beta_4 PC + \beta_5 \log{\text{total assets}} + \mu$</td>
</tr>
<tr>
<td>3.</td>
<td>ROA = $\alpha + \beta_1 VAIC + \beta_2 ATO + \beta_3 PC + \beta_4 \log{\text{total assets}} + \mu$</td>
</tr>
<tr>
<td>4.</td>
<td>ROA = $\alpha + \beta_1 CEE + \beta_2 HCE + \beta_3 SCE + \beta_4 PC + \beta_5 \log{\text{total assets}} + \mu$</td>
</tr>
<tr>
<td>5.</td>
<td>ROE = $\alpha + \beta_1 VAIC + \beta_2 ATO + \beta_3 PC + \beta_4 \log{\text{total assets}} + \mu$</td>
</tr>
<tr>
<td>6.</td>
<td>ROE = $\alpha + \beta_1 CEE + \beta_2 HCE + \beta_3 SCE + \beta_4 PC + \beta_5 \log{\text{total assets}} + \mu$</td>
</tr>
<tr>
<td>7.</td>
<td>MB = $\alpha + \beta_1 VAIC + \beta_2 ATO + \beta_3 PC + \beta_4 \log{\text{total assets}} + \mu$</td>
</tr>
<tr>
<td>8.</td>
<td>MB = $\alpha + \beta_1 CEE + \beta_2 HCE + \beta_3 SCE + \beta_4 PC + \beta_5 \log{\text{total assets}} + \mu$</td>
</tr>
</tbody>
</table>

**Source:** Compiled by the author.

### 5.5 - Variable Definitions

#### 5.5.1 - Measurement of dependent variables

Financial performance indicators are being considered as the best indicators for measuring the capacity of the company in accomplishing the long term objectives. Many researchers have used different financial indicators in their studies; some of them are as follows:

### Table 5.2: Dependent Variables of Various Studies

<table>
<thead>
<tr>
<th>Authors</th>
<th>Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firer &amp; Mitchell Williams (2003)</td>
<td>ROA, ATO, MB</td>
</tr>
<tr>
<td>Gan &amp; Saleh (2008)</td>
<td>ROA, ATO, MB</td>
</tr>
<tr>
<td>S. Ghosh &amp; Mondal (2009)</td>
<td>ROA, ATO, MB</td>
</tr>
<tr>
<td>Meherlal et al.(2012)</td>
<td>ROA, ATO, MB</td>
</tr>
<tr>
<td>M. Chen et al.(2005)</td>
<td>ROE, ROA, GR, EP</td>
</tr>
<tr>
<td>Chu et al. (2011)</td>
<td>ATO, ROA, ROE, MB</td>
</tr>
</tbody>
</table>

**Source:** Compiled by the author.

To conduct the research, four dependent variables ATO, ROA, ROE & MB have been adapted as a proxy measure to gauge the profitability, productivity, and market valuation – are used respectively.
1. Asset Turnover Ratio (ATO): it measures the productivity by dividing the income by total funds employed.

2. Return on Assets (ROA): it provides an overview about the efficiency of in the generation of earnings through the assets.

3. Return on Equity (ROE): show the earnings available to the equity shareholders and it is the ratio of the net incomes and the book value of total equity.

4. Market to Book Ratio (MB): is ratio of the total market capitalization (share price times number of outstanding common shares) and the book value of net assets.

5.5.2 - Measurement of independent variables

The VAIC™ Pulic (2000) is a technique for calculating the intellectual capital and all its components separately.

1. Capital Employed Efficiency (CEE) - indicates how much new value has been created by one invested unit of capital employed.

2. Human Capital Efficiency (HCE) – shows how much value added has been created by one money unit invested in the employees.

3. Structural Capital Efficiency (SCE) - indicates the share of SC in the created value.

The following equation formalizes the relationship algebraically:

\[
CEE + HCE + SCE = VAIC^{TM}
\]

The total value added is the difference of the output and input in the organization.

\[
VA = W + I + T + NI
\]

Where,

\[
W = \text{Wages & Salaries}
\]

\[
I = \text{Interest expenses}
\]
T = Taxes paid

NI = Profit after tax

- CEE = VA/CE

VA = Value added

CE = Capital employed

- HCE = VA/HC

HC = Human capital

- SCE = SC/VA

VA = Value added

SC = Structural capital = VA – HC

VAIC™ is the new value that has been created by investing a unit of money in each of the resources. Higher the coefficient, higher is the value creation by a particular resource (Pulic, 2004). CEE represents the efficient use of financial and physical capital in creating new value for firm. According to Pulic (2004), what productivity meant for a manual worker in the industrial age; HCE happens to be for a knowledge worker in the knowledge economy.

5.5.3 - Measurement of control variables:

1. Physical capacity (PC): measures the physical intensity of the companies i.e. how much fixed assets are there in proportion to total assets. It can be calculated in the following manner:

\[ PC = \frac{\text{Fixed assets}}{\text{Total assets}} \]

2. Natural log (Total Assets): is the proxy for the size of the firm:

\[ \text{Total Assets} = \log (\text{Total Assets}) = \text{Firm size} \]
5.6 - Method

The analysis has been carried out by panel data regression which has been conducted by using Stata 13.0. The estimators are BLUE and all the assumptions of CLRM have been verified.

The panel data is a combination of space element and time element. It is actually a blend of both cross section and time series data. In time series data the values of one or more variables have been observed for certain duration of time whereas in cross section data the values of many sample units have been collected for a particular point of time.

Some of the well known panel data sets are as follows:-

- In 1968 the Institute of Social Research at the University of Michigan had been started organizing the Panel Study of Income Dynamics (PSID). Every year the data about socioeconomic and demographic issues is being collected from almost 5000 families.

- The Survey of Income and Program Participation (SIPP) is organized by the Bureau of the Census of the Department of Commerce. The respondents are being interviewed quarterly about their economic condition.

- The German Socio-Economic Panel (GESOEP) had surveyed almost 1761 individuals every year between 1984 and 2002. They used to collect information regarding age, gender, satisfaction level, marital status and working hours of every person during that period.

Reasons for using panel data:

Baltagi (1995) lists the following advantages of panel data over cross section or time series data.

1. Since data is related with many issues so heterogeneity is always a matter of concern. The issues of heterogeneity have always been resolved with the help of panel data.
2. The panel data always gives more information and variability with less collinearity as it is the blend of time series and cross sectional elements.

3. The panel data is always a better way to study the element of change as it observes the repeated cross sections of observations. The rate of unemployment and job turnover should be studies with panel data.

4. The effects of changes are always gauged more precisely by the help of panel data in comparison to measure them by cross-section and time series individually.

5. The panel data is always a better option to study the most complicated behavioral models. The technological changes can be studied more precisely with the help of panel data as compared to cross section or time series data.

Finally the panel data makes the analysis easier in comparison with the cross-section or time series data. It is also not correct that the panel data is free from all the issues.

The three ways for panel data analysis are as follows:

1. *Pooled OLS model:* It dissolves the cross-section and time series elements of the data and pools all the observations for regression.

2. *Fixed effects least squares dummy variable (LSDV) model:* It allows each cross-section element to have its own (fixed) intercept value while gathering all the observations.

3. *Random effects model (REM):* It assumes that the intercept values are a random.
5.6.1: Theoretical Framework of the study

Source: Compiled by the author.

5.6.2: List of the Companies which have been taken for analysis

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Company Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>3I Infotech Ltd.</td>
<td>63 Moons Technologies Ltd.</td>
</tr>
<tr>
<td>Accelya Kale Solutions Ltd.</td>
<td>Aptech Ltd.</td>
</tr>
<tr>
<td>Aurionpro Solutions Ltd.</td>
<td>Axiscades Engineering Technologies Ltd.</td>
</tr>
<tr>
<td>Cigniti Technologies Ltd.</td>
<td>Cressanda Solutions Ltd.</td>
</tr>
<tr>
<td>Cyient Ltd.</td>
<td>Datamatics Global Services Ltd.</td>
</tr>
<tr>
<td>Eclerx Services Ltd.</td>
<td>Firstsource Solutions Ltd.</td>
</tr>
<tr>
<td>Geometric Ltd.</td>
<td>H C L Infosystems Ltd.</td>
</tr>
<tr>
<td>H C L Technologies Ltd.</td>
<td>Hexaware Technologies Ltd.</td>
</tr>
<tr>
<td>Hinduja Global Solutions Ltd.</td>
<td>Infosys Ltd.</td>
</tr>
<tr>
<td>Intrasoft Technologies Ltd.</td>
<td>K P I T Technologies Ltd.</td>
</tr>
<tr>
<td>Kellton Tech Solutions Ltd.</td>
<td>Lycos Internet Ltd.</td>
</tr>
<tr>
<td>Mastek Ltd.</td>
<td>Mindtree Ltd.</td>
</tr>
<tr>
<td>Moser Baer India Ltd.</td>
<td>Mphasis Ltd.</td>
</tr>
<tr>
<td>N I I T Ltd.</td>
<td>N I I T Technologies Ltd.</td>
</tr>
<tr>
<td>Nelco Ltd.</td>
<td>Nucleus Software Exports Ltd.</td>
</tr>
<tr>
<td>Oracle Financial Services Software Ltd.</td>
<td>Persistent Systems Ltd.</td>
</tr>
<tr>
<td>Polaris Consulting &amp; Services Ltd.</td>
<td>R S Software (India) Ltd.</td>
</tr>
</tbody>
</table>
This chapter has described all the aspects of research methodology. The objectives of the study have been framed after finding the research gap. This chapter also contains a detailed description of the hypotheses of the study. It provides all the information related to sampling and regression models. In the last part of the chapter, it gives a detailed description of all the variables which have been used in the study along with the method of their usage.