Chapter 3

Research Framework and Methodology

Prosperity of tomorrow’s business no longer depends on amassing physical capital, but researchers, academicians and practitioners prophesy that future wealth creation and economic growth will primarily depend on intellectual capital. Value of intellectual capital would tend to become a mouthpiece for company’s performance. Keeping research objectives in mind the study proposes the following Research framework to investigate the relationship between Intellectual capital and corporate performance.

3.1 Research Framework.

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Dependent Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>(VACA, VAHU, STVA)</td>
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<table>
<thead>
<tr>
<th>IC</th>
<th>CP</th>
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<tbody>
<tr>
<td>Relationship among IC variables of companies from 4 major industries listed in NSE India.</td>
<td>H1</td>
</tr>
<tr>
<td>IC of four different industries studied</td>
<td>H2</td>
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<tr>
<td>Impact of IC for four different industries</td>
<td>H3</td>
</tr>
<tr>
<td>Impact and Prediction of IC for four different industries</td>
<td>H4</td>
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<td></td>
<td>H5</td>
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Figure 3.1 Diagrammatic representation of Research framework
3.2 CONCEPTUAL MODEL OF RESEARCH FRAMEWORK USING PARTIAL LEAST SQUARE –PATH MODELLING

In this PLS–PM model Intellectual Capital and Corporate Performance are treated as latent variables. Intellectual capital has three indicators VACA, VAHU and STVA and corporate performance has MV/BV, ROE, ROA, EPS and MCAP as indicators. Hence we draw up a formative model for this study. Such kind of analysis cannot be given by a multiple regression model and hence PLS-PM has been adopted for this study.

![Conceptual Model Diagram]

Figure 3.2 Conceptual Model

PLS is a suitable choice when compared with other SEM techniques in case where variables lack normal distribution. This method is highly recommended in case were formative than reflective models are studied. It is also useful in case of studies like this where theories are yet to be firmly defined. Moreover PLS-PM is less sensitive to mis-specifications.

Reasons for choosing PLS-PM over multiple regression are:
(i) There are multiple independent(X) and multiple dependent(Y) variables (ii) The data does not follow a normal distribution. The probability Plot with Anderson Darling test proves that data does not follow a normal distribution.

(ii) Multiple regression cannot be applied for a study which involves a reflective model where variables are captured by latent models.

3.3 TEST OF NORMALITY

The Anderson-Darling test is used to test if a sample of data came from a population with a specific distribution. It is a modification of the Kolmogorov-Smirnov (K-S) test and gives more weight to the tails than does the K-S test. The K-S test is distribution free in the sense that the critical values do not depend on the specific distribution being tested. The Anderson-Darling test makes use of the specific distribution in calculating critical values.

P-value < 0.05 = not normal.

normal = P-value >= 0.05

**FIGURE 3.3 NORMALITY PLOT FOR VAIC™**

![Probability Plot of VAIC](image-url)
FIGURE 3.4 NORMALITY PLOT FOR VACA

FIGURE 3.5 NORMALITY PLOT FOR VAHU
FIGURE 3.6 NORMALITY PLOT FOR STVA

Probability Plot of STVA

Normal

Mean 0.6753
StDev 0.2047
N 583
AD 10.786
P-Value <0.005

FIGURE 3.7 NORMALITY PLOT FOR ROE

Probability Plot of ROE

Normal

Mean 0.2073
StDev 0.09183
N 583
AD 1.596
P-Value <0.005
FIGURE 3.8 NORMALITY PLOT FOR ROA

FIGURE 3.9 NORMALITY PLOT FOR EPS
FIGURE 3.10 NORMALITY PLOT FOR MCAP

FIGURE 3.11 NORMALITY PLOT FOR MV/BV
The graphical charts listed above are the plots of normal probability versus data. The data for all the variables studied depart from the fitted line most evidently in the extremes, or distribution tails. According to Anderson-Darling test’s if the P-value is less than .05 (P-value < 0.05 = not normal) there is evidence that the data do not follow a normal distribution. The A-D test p values in all the above cases have P-value less than .05. Hence it is significantly proven that data does not follow a normal distribution. There is a slight tendency for these data to be lighter in the tails than a normal distribution because the smallest points are below the line and the largest point is just above the line.

3.4 HYPOTHESES DEVELOPMENT

Intellectual Capital has been considered as an important strategic asset. Many researchers (Seethamraju, 2000, Riahi-Belkaoui (2003), Patton (2007) have argued that IC have an important role in enhancing corporate performance and firm’s market valuation. Bassi et.al (2002) identifies a positive relationship between training given to employees and profit margin, return on asset, and ratio of market value to book value.

The strategic nature of intellectual capital makes it highly valuable and is argued to positively impact the corporate performance. Stewart (1997) argues that IC creates value to an organization. Riahi-Belkaoui (2003) found that there is positive relationship between intellectual capital and financial performance. Studies of Chen et al. (2005), Sofian et al. (2005), and Tan et al. (2007) have all found a positive relationship between intellectual capital and financial performance. All these studies indicate the importance and usefulness of intellectual capital as an indicator of corporate performance. Anyhow empirical Studies by Firer and William’s 2003 failed to find any
positive relationship between IC and traditional measures of financial performance.

In Indian context there have been very few studies which investigated the relationship between intellectual capital and corporate performance. Some studies found a positive relationship between IC and financial performance (Gosh and Mondal (2009) while many other (Kamath 2008, Venugopal and Subha (2012) has found that Indian markets are yet to mature to capture the full potential of intellectual capital and the predictive power of independent variables could not be statistically proven. The above reviews and studies shows the inherent need to delve into relationship between Intellectual capital and Corporate performance in order to understand their nature and impact of relationship.

The present study introduces a conceptual frame work that expands on previous methodologies (Botnis et al.2000; Chen et al.2005; Firer and Williams, 2003; Maditinos et al 2011; Riahi-Belkaoui (2003); Tan et.al 2007; Pulic 2000a, b) to investigate the relationship between IC and corporate performance and study the impact if IC on corporate performance. The hypotheses of the study are presented below.

The three components which measure intellectual capital are (i) VACA - measures the Capital Employed Efficiency (ii) VAHU – measures the Human Capital efficiency (iii) STVA – Structural Capital efficiency. The indicators which measure the corporate performance includes (i) Market value to book value (ii) Return on Asset (ROA) (iii) Return on Equity (ROE) (iv) Earnings Per Share(EPS) (v) Market Capitalization (Mcap). It would be interesting to investigate the significant relationship between the indicators which measure Intellectual Capital and Corporate performance. This would also increase the explanatory power of the conceptual framework. Thus it is hypothesized;
H1: There is significant relationship between various measures of IC (Intellectual Capital) and CP (Corporate Performance) variables

Empirical studies (Firer and Williams (2003); Gosh and Mondal (2009), Kamath (2007,2008) provides evidence that value creating efficiency of different industrial sectors are different. This research examines the intellectual value creation efficiency of different industries like Banking, pharmaceutical, Information technology and Electronic industry. The study proposes the following hypothesis to investigate whether the intellectual capital efficiency measured by VAIC™ is different for the industries studied.

H2: There is significant difference among the four industries with regard to variables like VACA, VAHU and STVA which measures IC

As cited earlier many studies have been successful in empirically exploring and finding positive relationship between IC and CP. But there are only very few studies which have tried to find out the impact of Intellectual capital on corporate performance and its predictive ability. This would help to statistically validate VAIC™ methodology. Pulic model describes the IC efficiency of a company can be described through VACA,VAHU and STVA It would also be helpful in understanding the effectiveness and reliability of this tool. Hence it is hypothesized;

H3: There is a significant impact of Intellectual Capital on Corporate performance

H4: Intellectual Capital performance can predict corporate performance
The last two hypotheses use multivariate analysis using PLS-PM. As per this method impact of the variables of one over another is measured by $R^2$ of the latent variable which shows the validity and strength of the model. H4 intends to look at the predictive ability of the model – which means the relevance of latent variable in explaining endogenous variable. H3 assesses the inner model, whereas H4 analyses the total model predictability.

### 3.5 VARIABLE DEFINITION

Two sets of variables have been identified for the purpose of this study. They include variables which measure intellectual capital which are treated as independent variables and variables which measure corporate performance which are dependent variables. Control variables like leverage, firm size etc could not be considered because of the lack of data availability over this whole period of study. This section deals with the definition and measure of variables taken for study.

**Independent Variables**

Independent variables used in this study are derived from Pulic’s method. Under this method the measure of IC would be determined using three comprehensive measures VACA, VAHU and STVA.

(i) Value added Capital Employed is denoted by VACA: It gives you the value created by spending one unit of Physical capital.

(ii) Value added efficiency of Human Capital VAHU is an indicator of the efficiency of value added by human capital employed.
(iii) Value added efficiency of Structural capital (STVA) shows the efficiency of structural capital in value creation.

(All the calculation for the above has been shown in the previous chapter)

**Dependent Variables**

For the purpose of this study five financial ratios have been used as proxies for company performance.

- They include MV/BV ROE, ROA, EPS, and MCAP.

Literature provides evidence for the use of various accounting and market based measures that maybe utilized as a proxy measures which are defined to capture the financial performance of companies. As such there is no specific theoretical perspective or empirical evidence supporting any specific proxy over another. The proxies used for this study has been widely used in prior literature.

The *Market-to-book value ratio* is simply calculated by dividing the market value (MV) with the book value (BV) of common stocks:

\[ MV = \text{Number of shares} \times \text{Stock price at the end of the year:} \]

\[ BV = \text{Stockholders’ equity - Paid in capital of preferred stocks.} \]

**Return on Equity (ROE):** ROE measures organizations profitability by revealing how much profit a company generates with the money shareholders have invested. It could be calculated as follows.

\[ \text{ROE} = \frac{\text{Net Income}}{\text{Shareholder’s Equity}} \quad (3.1) \]
**Return on assets (ROA):** ROA is an indicator of how profitable a company is in relation to its total assets. It gives an idea as to how efficient the management uses assets to generate earnings.

\[
\text{ROA} = \frac{\text{Net Income}}{\text{Total Assets}} \quad (3.2)
\]

**Earnings per Share (EPS):** The portion of a company's profit allocated to each outstanding share of common stock. Earnings per share serve as an indicator of a company's profitability.

\[
\text{EPS} = \frac{\text{Net Income} - \text{Dividends on Preferred stock}}{\text{Average Outstanding Shares}} \quad (3.3)
\]

**Market Capitalization:** The empirical analysis has also used market Capitalization to capture the impact of size of the firm on wealth creation. It can be calculated by multiplying outstanding shares of a company by current market price.

### 3.6 RESEARCH TOOLS

In order to accomplish the research objectives a mixed approach has been used to study the relationship between variables measuring intellectual capital efficiency and corporate performance. Various tools used for this study has been briefly listed below.

**Correlation Analysis:** Correlation analysis is done to measure the strength of linear relationship between variables. It makes no *a priori* assumption as whether one variable is dependent on other. But, instead it gives a degree of association between variables.

**One - way ANOVA:** One way ANOVA is a method which is used to study the sampled data relationships. This method is used to test the equality of three means at one time by using variances.
**PLS – Path Modeling**: Partial Least Squares Path Modeling (PLS-PM) is a statistical approach for modeling complex multivariable relationships (structural equation models) among observed and latent variables.

For this study PLS –PM is considered more appropriate for the following reasons:

- PLS delivers latent variable scores, i.e. proxies of the constructs, which are measured by one or several indicators (manifest variables).

- PLS path modeling avoids small sample size problems and can therefore be applied in some situations when other SEM methods cannot.

- PLS path modeling can estimate very complex models with many latent and manifest variables.

- PLS path modeling has less stringent assumptions about the distribution of variables and error terms.

- PLS can handle both reflective and formative measurement models.

In this study Intellectual capital performance and corporate performance are taken as latent variables. Physical capital measured by VACA, Human capital measured by VAHU and Structural capital measured by STVA are considered as manifest variables for measuring the latent variable intellectual capital performance.

Market to Book Value (MV/BV), Return on Assets (ROA), Return on Equity (ROE), Earnings per share (EPS), Market capitalization (MCAP)
are taken as manifest variables to measure the latent variable corporate performance.

3.7 DATA SOURCE

Data for the study are collected from Centre for Monitoring Indian Economy (CMIE) – Prowess. CMIE is an independent economic think-tank headquartered in Mumbai – India and has the largest data base on Indian economy and companies. Prowess is a database of the financial performance of over 27,000 companies. It includes all companies traded on the National Stock Exchange and the Bombay Stock Exchange. Prowess contains time-series data from 1989-90. It is updated continuously. The database is built from Annual Reports, quarterly financial statements, Stock Exchange feeds and other reliable sources. The database is normalized to enable inter-company and inter-temporal comparisons.