4. Research Methodology:

For addressing the research hypotheses stated in the previous sub-section, Positivism (also referred to as Naive Realism) has been adopted as the research paradigm in this dissertation. According to Wahyuni (2012), research paradigm describes the philosophical outline of the subject being studied and has implications for research design and methodology of the study. The positivist approach being applied in this study shall lead to deductive inferences (for hypotheses testing), reproducibility of this study and generalization of results. Crossan (2003) enunciates that positivism invariably employs quantitative research methods for investigating the causal relationships. Accordingly, this dissertation is a quantitative study wherein secondary data on firms belonging to Pharmaceutical, Information Technology (Software firms) and Healthcare sectors has been collected and used to address the hypotheses. The sample data has been collected from ‘Capitaline’ database and Annual Reports of the companies over a decade long period (2002-2013). Such an extended period has been selected by many other researchers including Abdulsalam et al. (2011), Chen et al. (2005), Kamath, (2008), and Pal and Soriya (2012). A decade long period has provided enough data to produce robust results for this kind of research method. It is also helpful in understanding the trends in IC efficiency, if the researcher intends so.

For empirical testing of the hypotheses on Indian Pharmaceutical sector, data on 29 firms has been used. Most of these firms have been classified as ‘large’ by the Capitaline database and they are into bulk drugs production and formulations. Some of the sample firms are Indian subsidiaries of multinational pharmaceutical companies. Apart from Capitaline, data has been collected from Annual Reports as well. Only standalone financial figures have been collected to maintain the parity
between Indian firms and subsidiaries of foreign firms. The time period of the sample data sample extends from the year 2003 through 2013. After removing the cases of negative values for predictor and predicted variables, 253 firm-year data were left for each variable. For testing the stated hypotheses, linear regression has been applied on the pooled data to determine the strength of relationships between the variables.

For IT sector, publicly available data on ten large Software companies of India, as classified by Capitaline, has been used. These firms provide a range of IT services and a significant portion of their revenue comes from foreign markets. Wherever required, data has been collected from their Annual Reports as well. The period of this study extends from 2002 to 2013. After having removed the cases of negative values for predictor and predicted (performance) variables, eighty five firm-year data has been obtained for empirical testing of the proposed hypotheses. Linear regression has been applied on the pooled data to determine the strength of relationships among the variables.

For research on the Healthcare sector of India, secondary data has been collected from ‘Capitaline’. Relevant information on twenty five hospitals and medical research centres has been collected from year 2002 through 2013. After pooling data and excluding all the cases of negative values for dependent and independent variables, 129 firm-years data were retrieved for each variable. Linear regression equation was developed for each hypothesis and applied on this data set to derive meaningful outcomes.
5. The VAIC™ Model:-

The VAIC™ model was proposed by Pulic in 1993 (Pulic, 2004). It measures the efficiency of Intellectual Capital and its components by using accounting data of a firm. In VAIC™, two components of IC have been envisioned– Human Capital (HC) and Structural Capital (SC). In addition, efficiency of physical and financial capital of a firm has also been estimated through the inclusion of Capital Employed (CE) in the model. In VAIC™, ‘Value Added’ (VA) has been used as a benchmark of success of a business entity. This indicator has been estimated as follows:

\[ VA = OP + EC + D + A \]  

(1)

Where, \( OP \) = Operating Profit;  
\( EC \) = Employee Cost;  
\( D \) = Depreciation; and,  
\( A \) = Amortization

Pulic (2008) asserts that in knowledge economy, measures / indicators of business performance / success have changed. Hence, he advocates reinterpretation of the accounting data to capture the changing economic realities of a firm. Accordingly, he does not treat salaries and wages as a part of expenses. Rather, they are considered as investment by a firm. Therefore, in VAIC™, Employee Cost of a firm has been taken as a representation of its Human Capital. Further, Structural Capital is a dependent indicator in the equation. It is obtained as the difference between Value Added and Human Capital of a firm. This is because,

\[ \text{Value Added (VA)} = \text{Human Capital (HC)} + \text{Structural Capital (SC)} \]

Therefore,  
\[ SC = VA – HC \]  

(2)

The final equation is:  
\[ \text{VAIC}^{\text{™}} = ICE + CEE \]  

(3)
Here, VAIC™ = Value Added Intellectual Coefficient;

ICE = Intellectual Capital Efficiency Coefficient; and,

CEE = Capital Employed Efficiency Coefficient

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, 2008). 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; ICE happens to be for a knowledge worker in the knowledge economy. Now, ICE is the summation of the efficiencies of HC and SC. Hence,

\[
ICE = HCE + SCE
\]  (4)

On replacement of this value of ICE in eq. (3) we get,

\[
VAIC™ = HCE + SCE + CEE
\]  (5)

Pulic (2004) derives the values of these variables in following manner:-

\[
HCE = \frac{\text{Value Added (VA)}}{\text{Human Capital (HC)}}
\]  (6)

\[
SCE = \frac{\text{Structural Capital (SC)}}{\text{Value Added (VA)}}
\]  (7)

\[
CEE = \frac{\text{Value Added (VA)}}{\text{Capital Employed (CE)}}
\]  (8)

\[\text{Figure 1 – VAIC™ model of Ante Pulic (2004)}\]
5.1. Critical commentary on VAICTM Model

Ante Pulic’s VAICTM model has definite merit over other methods of measuring Intellectual Capital. While most of the IC measurement models suffer from the problem of subjectivity, VAICTM is free from it. This is because its computation is based on audited financial data which is publically available. Hence, apart from managers internal to the organization, external stakeholders desirous of assessing Intellectual Capital efficiency can also use this model. Since VAICTM model facilitates objective measurement of variables; there is greater validity of results obtained. Moreover, it is simple to apply and interpret and can be used for cross-sectional comparisons as well (Mehralian et al., 2012; Clarke et al., 2011; Chan, 2009; Firer and Williams, 2003).

Irrespective of its popularity, VAICTM model has been facing criticism on certain grounds. Some of the limitations of this model have been indicated by Chu (2011) and Mehralian et al., (2012). They contend that this model does not produce useful results for the firms having negative values of ‘Value Added’. This apart, the reverse relationship between Human Capital and Structural Capital is theoretically problematic. Another weakness of this model is that the interaction effect between the components of IC has not been discussed. In addition to these inadequacies, Ståhle et al. (2011) point out that Relational Capital has not been included in the model. Further, the authors criticize the case of perfect superimposition between Human Capital and Structural Capital. Iazzolino and Laise (2013) also validate this theoretical position taken by Ståhle et al. (2011).
5.2. Rationale and merits of the proposed model:-

This dissertation addresses some of the criticisms of VAICTM by presenting an extended and modified variant of the model. It has been termed as E-VAIC. The present research should be viewed as an improvement over other studies using VAICTM model. Criticisms of VAICTM notwithstanding, most of the scholars have applied this model in its pure form. Only the geographical locations and industry settings have changed. The shortcomings of the model have remained largely unaddressed in such research studies.

Few researchers (such as Chang, 2010; Chang and Hsieh, 2011; Chen et al., 2005; Phusavat et al., 2011) who have attempted to expand VAICTM by adding new variables like Research and Development (R&D) Expenditure, Advertising Expenditure and Intellectual Property Rights, have done so by merely measuring these new variable alongside other variables of the model. The original equation has been kept unaltered. Therefore, issues such as non-inclusion of Relational Capital and interdependency between HC and SC have remained unresolved. Among these studies, the one by Chen et al., (2005) is worth mentioning. In their work, the authors have attempted to measure Relational Capital in addition to the other components of IC. Advertising Expenditure has been used as a proxy for RC. However, analogous to other studies, the basic equation of VAICTM model has been left undisturbed in this case as well.

Apparently, the work of Chen et al., (2005) is closest to the present study. If it were taken as a reference point to elucidate the novelties of the E-VAIC model presented in this dissertation, three noticeable differences could be observed. First, in contrast to Chen et al., (2005), this research does not treat Relational Capital as an add-on to the
original VAIC™ model. Rather, RC has been incorporated in the overall schema of E-VAIC which has ultimately extended the basic equation. It has been estimated by using the aggregate of Advertising, Marketing, Selling and Distribution expenses.

The second noticeable difference is that the E-VAIC model does not present any case of conceptual interdependency and perfect superimposition between Human Capital and Structural Capital as seen in VAIC™. There is no presupposition that IC is sum of HC and SC only. Rather, each component of IC has been represented by a suitable proxy (as suggested by IC literature) to compute its value. A linear and additive relationship has been assumed between the efficiencies of Intellectual Capital and its components. This has helped in removing the problem of mutual dependency among variables and has made it possible to incorporate new variable, Relational Capital, in the original VAIC™ model. Hence, E-VAIC is accommodative in approach. In comparison, Chen et al., (2005) have not endeavoured to resolve this criticism of VAIC™.

Another conspicuous lead provided by this thesis is regarding the computation of variables in the model. VAIC™ model uses the concept of ‘Value Added’ to calculate the efficiencies of IC and its components. All the variables of this model are in the form of ratios. Tied to his proposition of inverse relationship between HC and SC, Pulic (2004) uses Value Added (VA) as numerator for calculation of Human Capital Efficiency and as denominator for computing Structural Capital Efficiency. Nevertheless, the concept of efficiency is best described by the ratio of output to input. Hence, in the proposed model, Value Added always appears as the numerator (output) quantity.
6. Proposed Model – Extended and Modified VAIC™ (E-VAIC)

Contemporary literature increasingly agrees that IC can be sub-divided into three components – Human Capital, Structural Capital and Relational or Customer Capital (Hsu and Fang, 2009; Martín-de-Castro et al., 2011; Martínez-Torres, 2006; Seetharaman et al., 2004; Subramaniam and Youn dt, 2005). But in VAIC™, Pulic (2004) misses out on Relational Capital. In the extended and modified model of VAIC™ proposed in this study, all the three components have been included in the VAIC™ equation. Consequently, the Eq. (5) derived earlier changes to:

\[ E-\text{VAIC} = HCE + SCE + RCE + CEE \]  

Here, \( RCE = \text{Relational Capital Efficiency Coefficient} \), and;

\[ E-\text{VAIC} = \text{Extended and Modified VAIC™} \]

The proxy selected for Human Capital is Employee Cost i.e. the investment in salaries and wages of people in an organization (Pulic, 2004). In addition to employee cost, the expenses towards Directors’ Remuneration have also been included to compute HC. In view of the dominant role played by the directors in policy making process of a firm, it is reasonable to include this expense under Human Capital.

For Structural Capital, the cumulative figures of Administrative Expenses (Jhunjhunwala, 2009; Liebowitz and Suen, 2000) and Research and Development (R&D) Expenses (Jhunjhunwala, 2009; Liebowitz and Suen, 2000; Sydler et al., 2013; Vishnu and Gupta, 2014) have been used as the indicator. These items denote the organizational processes and innovation-related activities of a firm.

Relational Capital is the new variable in this model. It has been estimated through the expenses related to Advertising, Marketing, Selling and Distribution activities of a firm (Jhunjhunwala, 2009; Nazari, 2010; Sydler et al., 2013). The assumption is that
such expenses are incurred to establish and maintain relationship with external stakeholders.

In accordance with Pulic (2004), Capital Employed (CE) has been selected as the proxy to represent the Physical and Financial capital of a firm. In general terms, CE is the value of all the assets employed in a business. As stated in Section -4, the data for this research has been collected from the ‘Capitaline’ which calculates Capital Employed as the aggregate of Paid-up Equity capital, total reserves (excluding revaluation reserves) and total debt. Supporting VAIC™, Iazzolino and Laise (2013) assert that with proper interpretation, Value Added Income Statement is capable of measuring value created through intangibles. Similar logic has been applied to the selection of proxies. It is assumed that if the chosen proxies are appropriately interpreted, they capture elements of HC, SC and RC. While selecting proxies, following factors have been considered:-

(1) **Literature on IC**: Intellectual Capital, being intangible, is difficult to measure. Its valuation has to be done through indirect means. Existing literature on Intellectual Capital, Knowledge Management and related domains describes about probable surrogates of HC, SC and RC. After review of literature, suitable proxies have been selected from the financial statements.

(2) **Data availability**: Review of literature reveals that authors, especially those applying survey and case study methods, have used multiple proxies for calculation of each component of IC. In contrast, scholars using accounting data-based methods have reinterpreted the financial statements to select proxies. Use of accounting data restricts a researcher’s choices for selection
of proxy because the relevant data may not be reported by a firm. Hence, those indicators have been selected for which data are available.

(3) *Extensively reported data:* While data on a particular proxy may be available, possibility is that it might not be widely reported across industries. For example, literature suggests R&D expense as an indicator for Structural Capital. However, data on this indicator may not be reported by certain sectors. In such cases, Administrative Expenses can be a better proxy for SC due to its wider reporting. VAIC™ model is commendable on this account because the indicators chosen to measure the variables are widely reported, making it possible to apply this model in multiple industry settings.

After selection of the proxies, different variables of E-VAIC have been computed. The efficiencies of the variables (Inputs) have been benchmarked against Value Added (VA) which appears as the numerator quantity (Output) in all the ratios. In order to distinguish the nomenclature of variables from those used in VAIC™ model, suffix –VA (Value Added being the success parameter) has been added in the variables. Hence,

HCEVA = Human Capital Efficiency Coefficient
\[ = \frac{VA}{(Employee\ Cost + Director’s\ Remuneration)} \] (10)

SCEVA = Structural Capital Efficiency Coefficient
\[ = \frac{VA}{(Administrative\ Expenses + R&D\ Expenses)} \] (11)

RCEVA = Relational Capital Efficiency Coefficient
\[ = \frac{VA}{(Advertising, Marketing, Selling & Distribution\ Expenses)} \] (12)

CEEVA = Capital Employed Efficiency Coefficient
\[ = \frac{VA}{Capital\ Employed} \] (13)
When Relation Capital is added in the Pulic’s model, Eq. (4) changes to:

$$ICEVA = HCEVA + SCEVA + RCEVA$$

Here, ICEVA denotes the efficiency of Intellectual Capital. It is the aggregation of the efficiencies of HC, SC and RC. After modifications, Eq. (9) can be rephrased as:

$$E-VAIC = HCEVA + SCEVA + RCEVA + CEEVA$$

![Diagram](image)

*Figure 2: The extended and modified VAIC™ (E-VAIC) model*

Where E-VAIC is the new value added for every monetary unit invested in these resources. Value Added (VA) is one of the distinguishing features of the VAIC™ model (Iazzolino and Laise, 2013). Firer and Williams (2003), opine that in comparison to other financial returns, Value Added is a better way of assessing firm’s performance. Although Stähle et al. (2011) criticize the use of VA; scholars such as Riahi-Belkaoui and Fekrat (1994) have found this performance measure to be consistent and stable. Morley (1979) has provided detail assessment of Value Added statements. The author asserts that it is preferable to use Net Value Added rather than
Gross Value Added. According to Morley (1979), Value Added statement lacks standardization and hence, it may be calculated in different ways. In this dissertation, the formula of net VA used by Pal and Soriya (2012) has been applied because it is simpler to calculate and gives more robust results for independent variables. This has been derived after rearranging the net VA statement as shown in Riahi-Belkaoui and Fekrat (1994). Hence,

\[ \text{Value Added (VA)} = W + I + T + NI \] (14)

Here,  
\( W \) = Wages and Salaries;  
\( I \) = Interest expenses;  
\( T \) = Taxes; and,  
\( NI \) = Net Income.
7. Description and Operationalization of Variables

7.1. Dependent Variables:

Measures of organizational performance have been taken as dependent variables for regression equation. In accordance with the existing research studies on VAICTM, three measures of firm performance have been considered to facilitate cross-sectional as well as longitudinal study. These are:-

(1) **Return on Assets (ROA)** (Chang and Hsieh, 2011; Clarke et al., 2011; Firer and Williams, 2003; Gan and Saleh, 2008; Ghosh and Mondal, 2009; Junior et al., 2010; Kamath, 2008; Mehralian et al., 2012; Morariu, 2014; Pal and Soriya, 2012; Phusavat et al., 2011; Shiu, 2006)

(2) **Return on Equity (ROE)** (Chang and Hsieh, 2011; Chen et al., 2005; Clarke et al., 2011; Gruian, 2011; Maditinos et al., 2011; Pal and Soriya, 2012; Phusavat, et al., 2011; Tan et al., 2007)

(3) **Return on Sales (ROS)** (Hoskisson et al., 1993; Palich et al., 2000; Tallman and Li, 1996).

The three dependent variables have been estimated as:-

i. ROA – Net Income divided by Average Total Assets (15)

ii. ROE – Net Income divided by Average Equity of Shareholders (16)

iii. ROS – Calculated as EBITDA divided by Net Sales (17)

Here, EBITDA is the operating profit and is an acronym for Earnings before Interest, Taxes, Depreciation and Amortization. To compute ROA, the predominant practice is to use Total Assets (TA) as the denominator. However, since the net income is a flow measure and TA is a static quantity, use of average total asset is preferable and is consistent with the matching principle of Accounting (Jewell and Mankin, 2011).
7.2. Independent Variables:-
Following measures of Intellectual and Physical Capital are the independent variables:

1. For VAICT™
   i. HCE
   ii. SCE
   iii. CEE

2. For E-VAIC
   i. HCEVA
   ii. SCEVA
   iii. RCEVA
   iv. CEEVA

7.3. Control Variables:-
Most of the past studies interlinking IC and firm performance have controlled for firm size, leverage and industry (Abidin et al., 2009; Clarke, et al., 2011; Firer and Stainbank, 2003; Zéghal and Maaloul, 2010;). However, in this study no control variables are being used for following reasons:-

   (1) This dissertation work has been conducted separately on three industries. Hence, the issues related with inter-sectoral differences do not arise.

   (2) The firms selected herein are of comparable size. For example, in IT sector, only large Software firms have been selected as sample. This takes care of scale-related concerns.

   (3) All the variables used in the regression equations are in the form of ratios. This further reduces the need for incorporating control variables in the model.
7.4. Making the Variables Operational:

For empirical investigation of the hypotheses, regression equation has been applied on the proposed model (E-VAIC) as well as the VAIC™ model. The equations used for testing the hypotheses H1a, H1b and H1c are:

\[
\text{Performance (ROA; ROE; ROS)} = \alpha_i + \beta_i (\text{Intellectual Capital Efficiency}) + \epsilon_i \quad (18)
\]

\[ (i = 1, 2, 3) \]

Where, ‘i’ stands for performance parameter

The second set of hypotheses (H2a, H2b and H2c) study the effect of Physical capital efficiency of performance of firms. Therefore, the resulting regression equations are:

\[
\text{Performance (ROA; ROE; ROS)} = \alpha_i + \beta_i (\text{Physical Capital Efficiency}) + \epsilon_i \quad (19)
\]

\[ (i = 1, 2, 3) \]

For measuring the impact of efficiencies of components of Intellectual Capital on the performance of firms in India, the E-VAIC model has been used. Corresponding regression equations for hypotheses H3, H4 and H5 shall be:

\[
\text{Performance (ROA; ROE; ROS)} = \alpha_i + \beta_i (\text{HCEVA}) + \epsilon_i \quad (20)
\]

\[ (i = 1, 2, 3) \]

The regression equations used for the hypotheses H6 through H8 are:

\[
\text{Performance (ROA; ROE; ROS)} = \alpha_i + \beta_i (\text{SCEVA}) + \epsilon_i \quad (21)
\]

\[ (i = 1, 2, 3) \]

In order to address the hypotheses H9, H10 and H11, these equations have been applied:

\[
\text{Performance (ROA; ROE; ROS)} = \alpha_i + \beta_i (\text{RCEVA}) + \epsilon_i \quad (22)
\]

\[ (i = 1, 2, 3) \]
To address the research hypotheses H12a, H12b and H12c, a comparative analysis between the proposed model (E-VAIC) and VAIC™ has been done. The resultant regression equation is:

\[
\text{Performance (ROA; ROE; ROS)} = \alpha_{(i,j)} + \beta_{(i)} (E-VAIC) + \beta_{(j)} (VAIC™) + \varepsilon_{(i,j)} \quad (23)
\]

\(i = 1, 2, 3; j = 1, 2, 3\)

Where, ‘i’ stands for E-VAIC; ‘j’ stands for VAIC™

Generally speaking, \(\alpha = \) Intercept or constant term

\(\beta = \) Regression coefficient of the independent variables

\(\varepsilon = \) Residual or error term