CHAPTER - 2
RESEARCH DESIGN

This chapter indicates a blueprint of how the research has been carried out by explaining its vivid aspects like the study period, sources of data collection, sample size and composition, variable description and data analysis tools.

Research methodology is the foundation on which any study is built. It is a total set of means of discovering new information or confirming existing information (Marais & Pienaar-Marais, 2016). There would be more consensus on the standard of research methodology if the discipline is more monolithic. Obversely, the more inter-disciplinary or multi-disciplinary a field of study, such as business and management, the wider the spectrum of research methodology would have to be. The terms research methodology and research design are used inter-changeably. Research design of a study refers to a roadmap which explains the route that will be adopted by a researcher to achieve the objectives. It explains the study period, population, sample selection, data sources, variables and tools of analysis used in the study. Research design is considered to be the most crucial part of the study as it determines the quality, reliability and validity of the conclusions drawn by it.

The research design in the present study describes the time frame of the study i.e., period for which the data was collected for analysis and the reasons for the choosing this period. Further, it states the sampling procedure used, including the population, sample selection and sample composition. It also highlights the sources that have been used for collection of data. With regards to social sciences research, the concept of data is usually seen to be uncomplicated because it is considered as something to be collected and analysed in order to arrive at a research conclusion. This study uses secondary data i.e., data that has been already collected by someone else, either for some general purpose or some specific research project (Gupta and Gupta, 2004). Data collection through this method provides a prompt and economical solution. The final section of this chapter gives a detailed explanation of the variables that have been used in the study. It also elucidates the tools of analysis that have been employed to test each of the hypothesis.
2.1 STUDY PERIOD

The study has been carried out for a six year period i.e., 2010-2015. The reasons for undertaking the empirical analysis for the above period are:

a. This was the period in which the short term liquidity management policies of majority of the firms was put to question as a result of the global crisis of 2007. This had further put the governance structures of various corporates through severe tests as the board is the major policy maker of a firm's working capital stratagem.

b. The new Companies Act, 2013 was passed in this period replacing the earlier act of 1956. The provisions related to governance of the companies specially the internal governance mechanisms like board of directors and audit committees, were amended the most by the new act.

c. The period coincides with the era of second generation financial reforms.

2.2 SAMPLE SELECTION

A large group of companies form a part of the Indian corporate sector which is governed by a well-established framework from the past four decades. This formed the foundation of the corporate governance system in India. In order to enhance corporate governance practices, numerous initiatives have been taken up by Securities and Exchange Board of India (SEBI) for fulfilment of two objectives viz., investor protection and market development. For example new disclosure norms had been set up for streamlining the reporting practices, investor protection laws have been formulated, preferential allotment disclosure had been introduced and lot more (Monalisa, 2011).

The Kumar Manglam Birla Committee recommendations were implemented by SEBI through the enactment of the clause 49 of the listed agreement. These provisions were first applied to companies in the BSE-500 Index on August 9, 1999. Therefore, the analysis of this study has been confined to all the companies that are included in the BSE-500 index for a six year financial period from 2010 to 2015. The reasons for this are:

- BSE ranks second in the world, in terms of number of domestic companies listed on any stock exchange. Moreover, it has more number of quoted companies as compared to either the London or Tokyo Stock Exchange.
• 93% of the total market capitalization on BSE is represented solely by BSE-500 index, covering all 20 major industries of the Indian economy.

The available literature on working capital management suggests that the requirement of working capital varies over industries, sectors and time (Corelli, 2016). Any business, if run efficiently, would result in free flow of funds. In all the other cases, they get trapped in working capital cycle of the firm, restricting the company’s ability to grow. This situation becomes more meaningful in case of manufacturing companies because they are capital intensive in nature and comparatively more sensitive to macro-economic fluctuations (PricewaterhouseCoopers, 2014). The working capital needs, along with the metrics of working capital, vary across industries. Filbeck & Krueger (2005) stated that there are significant difference between industries with respect to their working capital measures across time and the same measures can change significantly over time within the industry also. The study also probed that these changes were primarily due to macro-economic factors such as interest rates, competition, rate of inflation, etc. Ganesan (2007), has put forward that the firms which operate in less competitive sectors focus more on cash conversion by minimizing receivables, while the firms in more competitive sectors have a relatively higher level of receivables. Therefore, under this study, the sample division has been done on the basis of different industries in manufacturing sector as the concept of working capital efficiency is more valid for this sector.

The sample for the study comprises of BSE-500 index firms. Firstly, all the financial services providing firms were excluded because they are subject to tight regulatory controls which leaves them with a very small margin to manoeuvre their funds. Out of the remaining non-financial firms, manufacturing firms were extracted. Secondly, all these manufacturing firms were then categorized into nine major subsets based on their industry classification given in the CMIE PROWESS database as on May, 2016. Thirdly, the companies whose corporate governance reports were missing, for any of the year under study, were also excluded. Finally, companies which have financial year ending other than 31st March were also deleted. Table below summarises the sample selection procedure.
Table 1.1: Summary of Sample Selection Procedure

<table>
<thead>
<tr>
<th>CRITERION</th>
<th>NUMBER OF COMPANIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial sample of BSE-500 index firms as on June 7, 2016.</td>
<td>500</td>
</tr>
<tr>
<td>Deleted financial services sector companies</td>
<td>(78)</td>
</tr>
<tr>
<td>Non-financial services firms</td>
<td>422</td>
</tr>
<tr>
<td>Deleted non-manufacturing firms</td>
<td>(123)</td>
</tr>
<tr>
<td>Manufacturing firms</td>
<td>299</td>
</tr>
<tr>
<td>Deleted companies with missing CG reports for any of the years under study</td>
<td>(16)</td>
</tr>
<tr>
<td>Deleted companies which had financial year other than ending 31st March</td>
<td>(21)</td>
</tr>
<tr>
<td><strong>Final sample</strong></td>
<td><strong>262</strong></td>
</tr>
<tr>
<td>Observations used in the analysis ( no. of years under study * no. of firms in the final sample i.e. 262*6)</td>
<td>1572</td>
</tr>
</tbody>
</table>

The final sample of 262 firms was classified into the following main industrial heads viz., automobiles, capital goods, fast moving consumer goods (FMCG), food and agro-based products, infrastructure developers, mining and mineral products, pharmaceuticals, Textile and miscellaneous manufacturing. The proportionate composition of each of these industries, with respect to the complete sample, has been explained below with the help of a pie-chart diagram.

**Figure 2.1: Industry wise Sample Composition**
The above diagram depicts that the sample is fairly diversified. There are no large number of firms belonging to few major industries. This heterogeneity would facilitate in adequate generalization of the findings and conclusions.

2.3 DATA SOURCES

The data has been drawn from the PROWESS database maintained by the CMIE (Centre for Monitoring Indian Economy). CMIE is one of India's leading business information providing firm, which dispenses economic and business information databases. Apart from this, it also develops specialised analytical tools to deliver such information to its customers who can use it for the purpose of decision making and research. Established in 1976, CMIE has built its presence in all the operational blocks, which form a part of the information chain in the business environment today. From extensive primary data collection and information product development to business analytics and data forecasting, CMIE excels in providing all such services. It is relied upon by a wide range of business enterprises, academia and government organisations, for providing the most recent and authentic data related to business and economics.

Prowess is a subscription service from the CMIE. It is a database which provides information related to the financial performance of Indian companies. The company annual reports are the principal source from where this information is extracted. All the listed and unlisted companies are covered under it. Apart from this, benchmark and peer comparisons, ratio analysis and funds-flow analysis are some of the well-formatted interpretative tabulations provided by this software. This database has formed the basis of several published empirical studies in India (Sharma & Kumar, 2011), (Bagchi & Khamrui, 2012), (Viswanathan, Palanisamy, & Mahesh, 2016).

According to the provisions of Clause 49 of the listed agreement, all listed Indian companies are required to file a corporate governance report, which discloses the details about the composition and functioning of the board of directors along with the information related to the three important committees viz., the audit, the compensation and the nomination committees. Although the clause was enacted by SEBI in 2000, its implementation was done in a phased manner, wherein large companies were asked to abide with the regulations by March 2001 followed by the
smaller companies, which were to comply to the same by March 2003. The timeline of the study lies between 2010-2015. Therefore, most of the governance data with respect to board size, board independence, audit committee size and audit committee independence was available in the database. For the sample firms on which the data was not available, the information was extracted by visiting their respective websites and downloading their annual reports for this period. CEO-Duality and CEO-Tenure were two variables on which the data was not directly available on PROWESS. Therefore, this information was extracted either from the company website or from Bloomberg. Headquartered in Midtown Manhattan, New York City, Bloomberg is a private financial software, data and media company. Its Indian team has established working relationships with key government associations and regulatory bodies in order to ensure full compliance to the local requirements.

In addition to the above data, the study also required data on working capital efficiency variables viz., average collection period, average payment period, inventories conversion period, cash conversion cycle, size of the cash holdings and current ratio. This data was obtained from the company financial statements and the PROWESS database.

2.4 VARIABLE DEFINITION

The study aims to examine the relationship between corporate governance and working capital efficiency. The variables used to measure corporate governance are board independence, board size, CEO-duality, CEO-tenure, audit committee size and audit committee independence. Working Capital Efficiency has been quantified in terms of average collection period, average payment period, inventory conversion period, cash conversion cycle, size of the cash holdings and current ratio of the firms. This specification is very similar to those which have been used in the existing studies on corporate governance and working capital management and can be represented as follows:

\[ \text{Working Capital Efficiency} = f (\text{board independence, board size, CEO-duality, CEO-tenure, audit committee size, audit committee independence, control variables}) + \text{error} \]
This section describes the measurement of the variables used in the study. As the data has been analysed using a regression model, three types of variables viz., independent, dependent, and control variables have been explained. Section 2.4.1 explains the independent variables, dependent variables have been explained in section 2.4.2 followed by control variables in section 2.4.3.

2.4.1 Governance or Independent Variables

This section provides a detailed information on the measurement of the governance variables that have been incorporated in the study. Six corporate governance measures have been used viz., board size, board independence, CEO-Duality, CEO-tenure, audit committee size and audit committee independence. All of these are internal governance measures. The computation of these attributes has been done on the basis of prior studies.

The expounding constructs have been operationalised as follows:

1. Board Size

The existing literature on corporate governance suggests that a larger board, with more number of directors forming a part of it, has two competing effects viz., greater performance management efficiency and on the contrary diversity of thought in the decision-making process which makes it more rigid in nature, with lesser room for flexibility. However, Yermack (1996) found that "smaller boards were more efficient as they provided increased precision in their decision making processes". Companies which have large board sizes, usually have to face two types of issues viz., increased co-ordination and communication issues because of more members and decrease in the efficiency of the directors to control the functioning of the management.

In contrast to this, Harris and Raviv's (2006) model of boards, "trades off additional monitoring services with free riding as it predicts that larger boards will provide optimal monitoring only when the managers' opportunities to consume private benefits are high". Therefore, it becomes important to test the functionality of this factor with regards to efficiency in working capital decision-making. For the purpose of this study, board size is measured as the total number of directors forming a part of the board of the sample firms. The cessation of any director during the year and non-
appointment against his position has been considered as vacant position. (Gill and Shah, 2012; Gill and Shah, 2013).

2. Board Independence

The board of any business firm comprises of inside directors and outside (or independent) directors. Board independence refers to the number of independent directors forming a part of the board. The inside directors provide knowledge which is firm or project specific in nature, which can actually assists the board in understanding the firm’s business in detail. In contrast to this presence of outside directors on the board encourages objectivity in the decision making process because of two reasons viz., they bring along with them additional proficiency and secondly they are not related to the owners/promoters/directors of the firm. According to Harford et. al. (2008), "As composition of the boards become more independent, their monitoring effectiveness increases which in turn helps to reduce managerial opportunism and entrenchment which in turn avoids expropriation of firm's resources and enhances firm performance." Therefore, it becomes necessary to study the impact of this variable on working capital efficiency also. It has been measured as the number of independent members on the board as a percentage of total members (Gill and Shah, 2013; Harford et. al., 2008).

3. CEO-Duality

CEO Duality is a situation which occurs when the Chairman of the board is also the CEO of the firm. There are some views which support this proposition and others which are against this proposition. As found by Gill and Shah (2013), "splitting the roles of the CEO and the board chairman creates an agency cost of monitoring the behaviour of the non-CEO Chairman." However, according to Dahya and Travlos (2000), "duality creates a clear cut leadership which promotes a sharper focus on company objectives and promotes more rapid implementation of decisions". Therefore, it becomes essential to study this variable with respect to the efficiency in short-term decision making. It has been measured with the help of a dummy variable which is assigned value 1 if same person occupied the post of the Chairperson and the CEO and 0 for otherwise (Kyereboah-Coleman, 2007; Gill and Shah, 2013).
4. CEO-Tenure

It refers to the time period (number of years) a person has been serving as a CEO of the firm. Research on CEO-Tenure suggests that CEOs learn adaptively, for a decade or more of their tenures, before their experience in decision making actually starts to adversely affect the firm performance (Miller, 1990). However, CEO obsolescence is strongly affected by the external environment conditions like an economic slowdown. As the period under this study is post-recession period, it becomes important to study the influence of this factor on working capital efficiency. It has been measured as a sum total of the number of years a person has been serving as a CEO of the firm (Dahya and Travlos, 2000; Kyereboah-Coleman, 2007; Gill and Shah, 2013).

5. Audit Committee Size

It refers to the number of directors which form a part of the audit committee. The size of the audit committee has a positive impact on the efficiency in management of working capital (Kyereboah-Coleman, 2007). Larger audit committees are likely to include members with wide-range of expertise to undertake multi-facet decision-making which ultimately turn out to be more effective (Baxter, 2007). Therefore, it becomes essential to study this relationship in an emerging market like India. For the purpose of the study, this variable has been measured as the number of directors who are a member of this committee for the sample firms.

6. Audit Committee Independence

It refers to the number of directors who are independent and are also a member of the audit committee (Karim et al., 2016), (Kliem, 2002), (Kyereboah-Coleman, 2007). In context of this study, it has been articulated as a continuous variable, representing percentage of independent directors that constitute the audit committee of that particular sample firm. It has been measured in a similar approach as the board independence i.e., number of Independent Directors in the Audit Committee.

2.4.2 Working Capital Efficiency or Dependent Variables

All the working capital efficiency measures are taken as dependent variables in this research model. Six measures have been used viz., average collection period, average payment period, inventory conversion period, cash conversion cycle, size of the cash
holdings and current ratio. In order to remain consistent with the previous studies, these variables have been taken from Kyereboah-Coleman (2007), Gill and Shah (2013), Dittmar et. al., (2003).

The expounding constructs have been operationalised as follows:

1. **Average Collection Period**

   It depicts the duration of the time taken to convert receivables into cash i.e. how long it takes for a company to collect their money from their customers. In other words, it highlights the efficiency with which cash is collected from its creditors. Mathematically, it is calculated by taking the ratio of accounts receivables of the firm with the sales of the firm and then multiplying the amount by 365. The average collection period for sample firms has been computed as:

   \[
   \text{AVERAGE COLLECTION PERIOD} = \left( \frac{\text{Accounts receivables}}{\text{Sales}} \right) \times 365 \text{ days}.
   \]

2. **Average Payment Period**

   It refers to the time taken by the company to pay off it's creditors. The shorter length of this period indicates quick and prompt payment to the creditor. But very short period is also an indication that the company might not be taking full advantage of the credit terms and conditions provided to it by its suppliers. In other words, it accentuates the creditworthiness of the firm. For the purpose of this study, the average payment period has been computed as:

   \[
   \text{AVERAGE PAYMENT PERIOD} = \left( \frac{\text{Accounts payables}}{\text{Cost of goods sold}} \right) \times 365 \text{ days}.
   \]

3. **Inventory Conversion Period**

   Inventory Conversion Period refers to the time period in which the company must invest in cash in order to convert it's raw materials into sales. It is the time required for obtaining the raw materials for a product, manufacturing it and then ultimately to sell it. Therefore, it is an asset utilization ratio which indicates the duration for which the goods remain in the inventory or are unsold. A longer inventory conversion period
indicates blocking of scarce funds which could be employed elsewhere. Moreover, it can also lead to high maintenance and handling costs in some cases. Inventory conversion period for sample firms has been calculated using the following formula:

\[
\text{INVENTORY CONVERSION PERIOD} = \left( \frac{\text{Inventory}}{\text{cost of goods sold}} \right) \times 365 \text{ days}.
\]

4. Cash Conversion Cycle

The most common measures in assessing the firm's liquidity position is current ratio and it's variants like acid/quick ratio. However, these measures have a drawback. They cannot be used to examine the nature of an asset or liability with respect to its "nearness" to cash. According to FASB, liquidity is described as an asset’s or liability’s potential to be able to be converted into cash, which is termed as its "nearness" to cash. These static measures fail to account for, the time involved in conversion of current assets to cash or the time involved in paying off the current liabilities. Therefore, another estimate of liquidity, termed as Cash Conversion Cycle (CCC) comes into picture. It is a measure of liquidity which incorporates this element of time.

Introduced in 1980, CCC expresses the length of time used by the firm to sell it's inventory, collect receivables and pay its creditors. The shorter the CCC, the more liquid the firm's financial position is (Richards & Laughlin, 1980). Jose et.al. (1996), termed it as a dynamic measure of continuous liquidity management, wherein two types of financial information are considered viz., balance sheet information and information regarding income statements. CCC can have either a positive or a negative value (Hawawini et al., 1986). A positive value indicates that number of days a company is borrowing are less than the period for which it is awaiting payment from customer. Conversely, a negative value implies the minimum number of days required by a firm, to receive cash from its sales before it must pay to its suppliers. Therefore, every company should try to minimize its CCC as a shorter CCC signifies efficient cash management of the company. The cash conversion cycle of the firms has been computed as:

\[
\text{CASH CONVERSION CYCLE} = (\text{No. of days A/R} + \text{no. of days inventory} - \text{no. of days A/P}).
\]
5. Size of the Cash Holdings

Size of the Cash holding is defined as the quantity of cash available with the firm, in the form of cash in hand, cash at bank or readily convertible investments, which can be further employed in physical assets or distributed to the investors (Gill and Shah, 2012). Opler et al. (1999), states that "Managers have a greater preference for cash, because it reduces firm risk and increases their discretion." Because it receives the prime attention of the investors and analysts, size of the firms' cash holdings is regarded an important asset on firms' balance sheets. This attention gets profound during the times of recession. It is because of this fact that the credit crunch, which started in late 2007, questioned the liquidity management capabilities, with which the firms operated throughout the world. As a result, companies which had sufficient cash in hand, could easily escape to fall prey to the extremely costly and restrictive credit markets (Subramaniam et al., 2011). The literature on liquidity fairly highlights the significance of this component. Therefore, it becomes essential to evaluate the sample firms on this aspect also. For the purpose of this study, the size of the firm cash holdings has been measured as:

\[
\text{SIZE OF CASH HOLDINGS} = \log \text{of average cash in hand and at bank.}
\]

6. Current Ratio

The ability of a firm, to meet its short term commitments, is usually assessed by the current ratio of that firm. The current ratio is nothing but a comparison of the current assets with respect to the current liabilities. As the working capital is also equivalent to the difference between current assets and current liability, or as the working capital is the excess of Current Assets over current liability, this ratio is also called working capital ratio. This ratio works with cash and near-cash assets of a business on one side, and the immediate or short-term payment obligations on the other side (Saleem & Rehman, 2011). Literature also reveals that CR is the most important liquidity measure as it has a significant impact on the firm's profitability. However, this impact was found to differ across industries and firm size (Eljelly, 2004). For the purpose of study, it has been computed as:

\[
\text{CURRENT RATIO} = \frac{\text{Current assets}}{\text{current liabilities}}.
\]
Once the values of the above variables have been calculated for the individual firms in the sample, an industry average has been computed. In order to study the efficiency aspect, the ratio of each variable has been taken with respect to this industry average. For Average Collection Period, Inventory Conversion Period, Size of the Cash Holdings and Current Ratio, industry average has been divided by the individual value of the variable. In case of Average Payment Period and Cash Conversion Cycle, individual value of the variable has been divided by the industry average. A value greater than one indicate that the firm has managed its short term assets and liabilities efficiently and a value less than one highlighted the inefficiency in management. Thereafter, these ratio values had been put in the panel data regression equations to study the relationship between governance variables and working capital efficiency.

2.4.3 Control Variables

In addition to the above discussed variables, a number of other measures have been included as control variables in the study. The control variables have the ability to strongly impact the dependent variable. Therefore, they are held as constants while testing the relationship between dependent and independent variables. These control variables are non-corporate governance in nature and their inclusion is fundamental for the study as they may influence the level of working capital efficiency of the sample firms. This will ensure that the statistical tests which have been performed on the sample firms focused more precisely on difference created by variations in the governance factors. Following have been introduced as the control variables in the study and have been selected with reference to the existing studies. (Gill and Shah, 2013; Kyereboah-Coleman, 2007; Jamalinesari and Soheili, 2015; Valipour et. al., 2012).

1. Sales Growth

It usually takes a certain amount of invested working capital (receivables, inventory, payables and cash) to maintain sales. Certain alterations in this working capital effects sales. For example, sales of a firm could be adversely affected by tightening of credit provisions, shrinkage of inventory levels and lengthening of payment terms to the suppliers. Additionally, the growth corporations also tend to have greater inventory conversion rates, higher cash velocity and a shorter collection period from debtors
Therefore, it becomes essential to control for this variable. Sales growth has been used to measure an increase in sales over the study period. It has been measured as the difference between the current year sales and the previous year sales, divided by the previous year sales.

**SALES GROWTH = (Current year sales- previous year sales) / previous year sales.**

2. **Firm Size**

It has been observed that size of the firm also impacts working capital efficiency (Gupta, 1969). Smaller-sized corporations have high inventory turnover, high cash velocity, and low average collection period. Primarily, this is because they feel a strong constraint in the availability of investment funds and have to restrict themselves in economising their present resources. Thus, it becomes essential to control for this variable. It has been measured as a natural log of book value of total assets.

**FIRM SIZE = log (total assets)**

3. **Firm Performance**

Firm performance is one of the most relevant construct in strategic management research. The impact of Working capital management on firm performance has been a subject of empirical research for long in the developed countries. However, in case of emerging economies which are characterized by nascent financial markets, the importance of this relationship becomes all the more relevant (Bhatia & Srivastava, 2016). Therefore, it becomes essential to control for this variable. This study implements one of the most widely used accounting based measures called Return on Assets (ROA) as a construct of financial performance and has been measured as:

**ROA = PBIT / Average assets x 100**

Table below presents the specifications of the variables used in the study. It accentuates the names, symbols, definition and the source of all the variables used in the study.
Table 1.2: Variable specifications used in the study

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>VARIABLE</th>
<th>SYMBOL USED</th>
<th>DEFINITION</th>
<th>SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>CORPORATE GOVERNANCE / INDEPENDENT VARIABLES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Board Size</td>
<td>Number of directors on the board</td>
<td>Annual reports</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Board independence</td>
<td>Percentage of independent directors on the board</td>
<td>Annual reports</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>CEO-Duality</td>
<td>Dummy variable which takes the value one if CEO or managing director holds the position of the chair on the board.</td>
<td>Prowess / Annual Reports</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>CEO-Tenure</td>
<td>Number of years a person serves as the CEO of the firm.</td>
<td>Prowess / Annual reports / Bloomberg</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Audit committee size</td>
<td>Number of Directors on the Audit Committee</td>
<td>Annual report</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Audit committee independence</td>
<td>Number of independent directors on the audit committee</td>
<td>Annual reports</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>WORKING CAPITAL EFFICIENCY / DEPENDENT VARIABLES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Average collection period</td>
<td>Ratio of accounts receivables to sales multiplied by 365</td>
<td>Prowess</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Average payment period</td>
<td>Ratio of accounts payables to COGS multiplied by 365</td>
<td>Prowess</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Inventory conversion period</td>
<td>Ratio of inventories to COGS multiplied by 365</td>
<td>Prowess</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Cash conversion cycle</td>
<td>Average collection period plus inventory conversion period minus average payment period</td>
<td>Prowess</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Size of cash holdings</td>
<td>Log (cash in hand and at bank)</td>
<td>Prowess</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Current ratio</td>
<td>Ratio of current assets to current liabilities</td>
<td>Prowess</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>CONTROL VARIABLES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Sales growth</td>
<td>Ratio of change in sales to previous year sales</td>
<td>Prowess</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Firm size</td>
<td>Log (total assets)</td>
<td>Prowess</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Firm performance</td>
<td>Return on assets (ROA)</td>
<td>Prowess</td>
<td></td>
</tr>
</tbody>
</table>
2.5 TOOLS OF ANALYSIS

The study has applied co-relational and non-experimental research design. The data was analysed using Statistical Package for the Social Sciences 21.0 (SPSS 21.0) and Eviews 9. Correlation and Panel Data Regression Model had been applied to study the impact of Corporate Governance on Working Capital Efficiency.

2.5.1 Analysis of Corporate Governance Practices

The first objective of the study pertained to analysis of corporate governance practices of the sample firms. The entire sample of nine industries was divided on the basis of their working capital efficiency score, obtained by applying the working capital efficiency index, into two sub-categories viz., low in working capital efficiency firms and high in working capital efficiency firms. Summary statistics of mean and standard deviation had been applied to study the corporate governance mechanisms with respect to magnitude of working capital efficiency. Thereafter, a combination of parametric and non-parametric tests i.e. a Paired sample t-test and Wilcoxon Signed-Rank Test were applied to all the sample firms combined, in order to examine if these corporate governance practices had changed over time or not.

Paired sample t-test is used to compare two means, when those means have been originated from a common entity. It is used to analyse situations in which the same set of participants have been used in each of two experimental conditions (Field, 2009). This test first compares the mean differences that exist between the samples \(D^T\) to the difference that are expected to be existing between population means \(\mu_D\), and then calculates the standard error of the differences \(sD/\sqrt{N}\). No differences between the population means are expected to exist if the null hypothesis is found to be true (hence \(\mu_D = 0\)). The t-statistic is calculated as follows:

\[
t = \frac{\bar{D} - \mu_D}{s_D/\sqrt{N}}
\]

The Wilcoxon Signed-Rank Test (Wilcoxon, 1945) is used in situations involving a comparison of two sets of scores, wherein these scores have been extracted from the same participants. It is calculated on the basis of differences that exist between scores in two similar type of situations. This test is used to calculate the extent to which pairs
of variables differ with respect to each other and ultimately these differences are ranked by this test on their absolute basis. Subsequently, the z statistic is computed by summing up the total positive and negative ranks. Under the null hypothesis of no differences, z is a standard normal variate with mean 0 and variance 1 for large samples (Malhotra & Dash, 2010).

There might arise a conditions in which assumptions for the Wilcoxon signed ranks test are fulfilled but the assumptions of the t-test are violated. In such cases, the results pertaining to Wilcoxon signed ranks test are considered to be more accurate in determining the differences between the two populations means because it makes fewer and less stringent assumptions in comparison to the Paired t-test. Moreover, the Wilcoxon Signed Ranks Test outcomes are considered equally powerful in situations where conditions are considered to be more favourable for the Paired t-test.

2.5.2 Analysis of Working Capital Efficiency of sample firms

The second objective of the study pertains to the measuring and examining of the working capital efficiency of the selected Indian manufacturing firms. The Working Capital Efficiency Index developed by Bhattacharya (1997) has been used for this purpose. It comprises of two sub-indexes viz., the performance index and the utilization index. The performance index has been computed by using the below stated formula:

$$PI_{WCM} = \frac{I_s \sum_{i=1}^{n} W_i(t-1)}{W_t}$$

where $PI_{WCM}$ = Working Capital Management performance index of the firm

$I_s$ = Sales index of the firm defined as $S_t / S_{t-1}$.

$W_i = $ Individual group of current assets.

$N = $ Number of current assets in the group.

$t = $ current year

The second sub-index is the utilization index which has been calculated using the following formula
\[ U_{WCM} = \frac{A_{t-1}}{A_t} \]

where \( A = \text{Current assets} / \text{Sales} \).

Lastly, the working capital efficiency index has been computed which is a product of performance index and the utilization index.

\[ EI_{WCM} = PI_{WCM} \times UI_{WCM} \]

This index was computed for all the individual sample firms over a period of six years. Thereafter, a company average was computed for all the firms in the nine different industries. Out of these company average values, an industry average had been computed. In order to measure the efficiency, a ratio of the individual company average and the industry average was determined. A value less than one would indicate that the company is less efficient, a value equal to one indicated that the firm is efficient and a value greater than one would signify that the firm more efficient than its competitors in the industry. In other words, a greater value than one would indicate a higher level of efficiency. Further, in order to statistically test the efficiency scores, a simple t-test had been applied on the final scores in order to obtain the p-value and the t-statistic.

2.5.3 To examine the effect of Corporate Governance practices on the Working Capital Efficiency

The third objective of the study aimed to examine the relationship between corporate governance practices and the working capital efficiency of selected sample firms during the period under study. Univariate and multi-variate techniques were used to achieve this objective.

a) Descriptive Statistics

Various measure of central tendency and variation like mean, median, range and standard deviation form a part of descriptive statistics. The characteristics of the variables under study have been examined using central tendency and dispersion. The Pearsons’ correlation coefficient have been determined to study the relationship of variables under study. It can be calculated using the following formula.
\[
    r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{n(\Sigma x^2) - (\Sigma x)^2} \sqrt{n(\Sigma y^2) - (\Sigma y)^2}}
\]

where \( r \) = correlation coefficient

\( X \) = value of \( X \) variable

\( Y \) = value of \( Y \) variable

**b) Panel Data Regression Analysis**

A Panel Data Regression was the econometric model applied to the study. Although, Ordinary Multiple Regression can also be used on panel data (cross-sectional time series data), but the regression coefficient estimates derived from this method are expected to be omitted to variable bias. Variable bias refers to a situation which occurs when there is one variable or a set of variables in the regression model that cannot be controlled for and they effect the dependent variable. By using panel data regression models, it is possible to check for such problems as these variables can be controlled even without actual observation of them. Observation here means recording the changes that are taking place in those variables over the period under study. Moreover, panel data regression models also capable on controlling omitted variables that differ on cross-sectional basis like industry-wise, firm-wise, country-wise, etc. but are constant across the study period.

In order to control for the unobservable company heterogeneity and to obtain consistent estimates of the coefficients, the panel data model had been used. There have been various studies which concluded that company characteristics might lead to spurious relations between dependent and independent variables as they are difficult to measure accurately (e.g. Himmelberg et al., 1999; Banos-Caballero et al., 2014; Aktas et al., 2015). However, this disappears when company heterogeneity is taken into account. Therefore, econometrics of panel data have been applied in the study to control for this kind of endogeneity in the model through the individual company effects (Ballesta & Meca, 2007).
Panel data analysis is a bi-dimensional regression analysis which facilitates investigation of a causal relationship between data that has both spatial and temporal dimensions. The spatial dimension pertains to the set of cross sectional units of observations which could be anything like companies, commodities, states, countries or even groups of people or individuals. Whereas, the temporal dimension of the data pertains to the periodic observations related to a specific variable that characterizes these cross-sectional units.

Panel data can enrich empirical analysis which might not be possible by using only time-series or cross-sectional data. It facilitates the provision of more informative data with greater variability and reduced collinearity among variables by combining time series of cross section observations with more degrees of freedom and improved efficiency (Baltagi, 2008). The basic panel methods require at least two "waves" of measurements. The data must include:

- A time-invariant unique identifier for each unit (for eg. the sample firms in this study).
- A time-varying outcome (the dependent and independent variables).
- An indicator for time (the study period under the study).

A data set used in panel data analysis involves $n$ number of entities or subjects, each of which includes $T$ number of observations measured from 1, over $t$ number of years. This results into total number of observations as $nT$. 
There are two types of panels in the panel data models viz. a balanced panel and an unbalanced panel. In a balanced panel dataset, the number of time periods $T$ is the same for all individual entities $i$. Contrarily, if it variates, then the study deals with an unbalanced panel. It is fairly important to know the reason for the absence of data i.e., there might be situations in which the data is missing randomly. Therefore, identifying the reason for this missing data, whether it is randomly-missing data or non-randomly missing data is of utmost importance. With regards to the present study, the data set involved a balanced panel of 262 firms for the period of six years resulting in 1572 observations.

Furthermore, panel data regression has two models viz., the Fixed effects and the Random effects. These models ease the removal of omitted variable bias in the variables by measuring change within a group. Fixed effects model is used to control for unobserved heterogeneity, when heterogeneity is constant over time and correlated with independent variables. When using fixed effect model, it is assumed that something within the individual may impact or create a bias in the predictor variables and this needs to be controlled for. This is the rationale behind the assumption of the correlation between entity’s error term and predictor variables. Fixed effects model helps to assess the net effect of predictors on outcome variables by neutralising the effect of time-invariant characteristics. It also assumes that these time invariant characteristics are unique to the individual and should not be correlated with other individual characteristics.

**Figure 2.3: Difference between Normal OLS and Fixed Effects Model of Regression**
The equation for fixed effects model is

\[ Y_{it} = \beta_1 X_{it} + \alpha_i + u_{it} \]

where
- \( \alpha_i \) is the unknown intercept for each entity
- \( Y_{it} \) is the dependent variable
- \( X_{it} \) is one independent variable
- \( \beta_1 \) is the coefficient
- \( u_{it} \) is the error term

If it is observed that the differences across entities have some influence on the dependent variables, the random effects models is used. The rationale behind applying a random effects model is that, unlike the fixed effects model, the discrepancy across various entities is assumed to be random and uncorrelated with the predictor or independent variables included in the model. According to Torres-Reyna (2008), "The crucial distinction between fixed and random effects is whether the unobserved individual effect embodies elements that are correlated with the regressors in the model, not whether these effects are stochastic in nature or not".

Time-invariant characteristics, in this model, can play the role of explanatory variables because it assumes that entity's error term is not correlated to the predictors. It is more advantageous to use a random effects model because it provides more degrees of freedom than the fixed effects model and can estimate coefficients for explanatory variables which are constant over time also.

The equation for random effects model is

\[ Y_{it} = \beta X_{it} + \alpha + u_{it} + e_{it} \]

where
- \( \beta \) is the coefficient
- \( X_{it} \) is one independent variable
- \( \alpha \) is the unknown intercept for the entity
- \( u_{it} \) is the between entity error
- \( e_{it} \) is the within entity error

While analyzing the data, to decide between fixed or random effects, a Hausman test has been run. It basically tests whether the unique errors are correlated with the
regressors or not. The Hausman test checks for a more efficient model against a less efficient, but a consistent one, to make sure that the final results obtained are not only efficient but consistent also. This test assumes the null hypothesis stating that the preferred model for the analysis of a particular dataset is random effects against the alternative hypothesis that the preferred model is fixed effects. A significant p value (p > 0.05) indicates that random model should be applied and vice-versa.

c. Multicollinearity

The inferences which are drawn, by using the regression models, are often incited by the relationship between the regressor variables. The predictors are said to be orthogonal if there is no linear relationship that exists between them. Unfortunately, in most of the regression models used for analysis, the regressors are not found to be orthogonal i.e., there is some level of association between them. In some situations, the predictor variables used in the regression model are perfectly related to each other. When analysis is performed using such cases, the final results that are obtained can be misleading and might not provide a conclusive evidence. These types of situations, in which linear dependencies exist between the regressors, are said to suffer from the problem of multicollinearity.

Multicollinearity is a situation in which the independent/predictor variables are highly correlated among themselves, thus making it difficult to study the individual impact generated by each of them upon the dependent variable. A high level of collinearity among dependent variables may lead to abominable results like the regression coefficient values tend to be more unstable, wide inflation of the standard errors of the coefficient and the model values becoming incorrect. Therefore, it becomes very essential to test for multicollinearity before conducting the analysis.

In order to assess the problem of multicollinearity, it is important to evaluate the extent to which each independent variable is related to/or predicted by another independent variable. Variance Inflation Factor (VIF) shows how the variance of an estimator is inflated by the presence of multicollinearity. A larger value of VIF indicates a more collinear relationship between the variables. Even though there is no fixed cut off limit for VIF values, literature suggests that a value of 10 and above is an acceptable level to check the existence of collinearity (Myers, 1990). The collinearity
tolerance is the inverse of VIF. Larger the value of VIF, the more troublesome or
collinear the variables are, whereas a smaller value of tolerance, the lesser is the
collinearity among the variables (Gujrati, 2004). A tolerance statistic below 0.1
indicates the problem of multicollinearity (Bowerman and O’Connel, 1990).
Multicollinearity, in this study, was checked using SPSS. The VIF and the tolerance
values for all the dependent variables have been reported. All the values obtained
were below the rule of thumb.

2.5.4 Panel Regression Models

In order to study the impact of dependent variables on the independent variables, the
following regression models have been formulated.

1. \( ACP = \alpha + \beta \text{(Board Size)} + \beta \text{(Board Independence)} + \beta \text{(CEO Tenure)} + \beta \text{(CEO Duality)} + \beta \text{(Audit Committee Size)} + \beta \text{(Audit Committee Independence)} \).

2. \( APP = \alpha + \beta \text{(Board Size)} + \beta \text{(Board Independence)} + \beta \text{(CEO Tenure)} + \beta \text{(CEO Duality)} + \beta \text{(Audit Committee Size)} + \beta \text{(Audit Committee Independence)} \).

3. \( INV = \alpha + \beta \text{(Board Size)} + \beta \text{(Board Independence)} + \beta \text{(CEO Tenure)} + \beta \text{(CEO Duality)} + \beta \text{(Audit Committee Size)} + \beta \text{(Audit Committee Independence)} \).

4. \( CCC = \alpha + \beta \text{(Board Size)} + \beta \text{(Board Independence)} + \beta \text{(CEO Tenure)} + \beta \text{(CEO Duality)} + \beta \text{(Audit Committee Size)} + \beta \text{(Audit Committee Independence)} \).

5. \( CH = \alpha + \beta \text{(Board Size)} + \beta \text{(Board Independence)} + \beta \text{(CEO Tenure)} + \beta \text{(CEO Duality)} + \beta \text{(Audit Committee Size)} + \beta \text{(Audit Committee Independence)} \).

6. \( CR = \alpha + \beta \text{(Board Size)} + \beta \text{(Board Independence)} + \beta \text{(CEO Tenure)} + \beta \text{(CEO Duality)} + \beta \text{(Audit Committee Size)} + \beta \text{(Audit Committee Independence)} \).

where ACP - Average collection period
INV - Inventories conversion period  
APP - Average payment period  
CCC - Cash Conversion Cycle  
CH - Cash Holdings  
CR - Current Ratio.

2.6 CHAPTER SUMMARY

This chapter details the research methodology which has been adopted in the study to test the hypothesis formed in chapter one. This involves articulating the time period and the sources from which data will be collected. Further, it gives a detailed description of the sample firms involving data collection viz., total number of firms included in the sample along with the sector wise composition of the sample. A comprehensive definition of dependent, independent and control variables has also been given in a sub-section of this chapter. Lastly, it also describes the research tools which have been used for testing the hypothesis.

The study uses empirical data to investigate the issues regarding working capital efficiency and the relationship between corporate governance and working capital efficiency. All the data collection was secondary, using the CMIE PROWESS database and the annual reports of the sample firms for a six year period 2010-2015.

The scope of the study is focused on only manufacturing firms of India because the concept of working capital is most relevant for these firms. The sample firms is a subset derived from BSE-500 listed firms. These have been further categorized into nine major sectors viz., Automobiles, Capital Goods, Fast Moving Consumer Goods (FMCG), Food And Agro-Based Products, Infrastructure Developers, Mining And Mineral Products, Pharmaceuticals, Textile, Miscellaneous Manufacturing. The final sample consisted of 262 firms with a total of 1572 observations.

The study involves three types of variables viz., dependent, independent and control variables. Corporate Governance has been measured using board size (BS), board independence (BI), CEO-duality (CEO-D), CEO-tenure (CEO-T), audit committee size (ACS) and audit committee independence (ACI), all of which are the independent variables. The dependent variables involved working capital measures viz., average collection period (ACP), average payment period (APP), inventory conversion period
(ICP), cash conversion cycle (CCC), size of the cash holdings (CH) and current ratio (CR). In order to derive more accurate results, sales growth (SG), firm size (FS) and firm performance (FP) have been included as control variables.

In order to investigate the relationship among the variables explained above, an extensive set of statistical tools had been applied using majorly two types of statistical softwares i.e. SPSS and EVIEWS 9. These are descriptive statistics, Pearson correlation coefficient, one-sample t-test, Paired t-test, Wilcoxon signed-rank test and Panel data regression.

Table 1.3 : Research Methodology at a glance

<table>
<thead>
<tr>
<th>S.NO.</th>
<th>OBJECTIVE</th>
<th>NULL HYPOTHESIS</th>
<th>METHODOLOGY</th>
<th>VARIABLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>To examine and measure corporate governance of selected Indian manufacturing firms.</td>
<td>There is no significant change in the corporate governance variables over the study period.</td>
<td>Paired sample t-test and Wilcoxon Sign-Rank test.</td>
<td>Board size (BS), board independence (BI), CEO-duality (CEO-D), CEO-tenure (CEO-T), audit committee size (ACS) and audit committee independence (ACI).</td>
</tr>
<tr>
<td>2.</td>
<td>To examine and measure working capital efficiency of selected Indian manufacturing firms.</td>
<td>The sample firms do not have an efficient working capital management.</td>
<td>Working Capital Efficiency Index developed by Ghosh &amp; Maji (2003) which is ( EI_{WCM} = PI_{WCM} \times \frac{1}{UI_{WCM}} ) where ( EI_{WCM} ) is efficiency index, ( PI_{WCM} ) is the performance index, ( UI_{WCM} ) is the utilization index, one sample t-test.</td>
<td>Net sales index, individual group of current assets, number of current assets.</td>
</tr>
<tr>
<td>3.</td>
<td>To examine the effect of corporate governance practices on the working capital efficiency of selected Indian manufacturing firms.</td>
<td>There is no significant relationship between corporate governance and working capital efficiency.</td>
<td>Correlation, panel data regression.</td>
<td>Working capital efficiency ratios as dependent variables and CG measures as independent variables.</td>
</tr>
</tbody>
</table>