CHAPTER - IV
EMPIRICISM ON PRIOR STUDIES: META ANALYSIS APPROACH

Over the last two decades, corporate governance has received a great deal of public interest for its apparent importance for the economic health of corporations. Falling stock markets, corporate failures, dubious accounting practices indicate that the entire economic system upon which investment returns have depended is showing signs of stress that have undermined investor’s confidence. Corporate failures have been the result of fraudulent accounting and other illegal practices, many of the same companies exhibited actual corporate governance risks such as conflicts of interest, inexperienced directors, overly lucrative compensation, or unequal share voting rights (Anderson and Orsagh, 2004). In the face of such scandals and malpractices, there has been a renewed emphasis on corporate governance.

Corporate governance phenomenon as adopted by Organization for Economic Cooperation and Development (OECD) defines it as – “Corporate governance is the system by which business corporations are directed and controlled. The corporate governance structure specifies the distribution of rights and responsibilities among different participants in the corporation, such as, the board, managers, shareholders and other stakeholders and spells out the rules and procedures for making decisions in corporate affairs. By doing this, it also provides the structure through which the company objectives are set and the means of attaining those objectives and monitoring performance”. Thus, corporate governance includes the relationship of a company to its shareholders and to society; the promotion of fairness, transparency and accountability; reference to mechanisms that are used to “govern” managers and to ensure that the actions taken are consistent with the interests of key stakeholder groups. The key points of interest in corporate governance therefore include issues of transparency and accountability, the legal and regulatory environment, appropriate risk management measures, information flows and the responsibility of senior management and the board of directors.
While "no single universal model of corporate governance exists nor is there a static, final structure in corporate governance that every country or enterprise should emulate" (Commonwealth Association for Corporate Governance, 2000), transparency and disclosure are key attributes of any model of good corporate governance. Research is increasingly showing that good corporate governance can lead to improved share price performance. A company that is honest and direct with its shareowners inspires their confidence. By building such trust, companies can be assured of the continued support of their investors. In contrast, their shareholders will not trust companies that engage in non-transparent or related-party transactions or do not disclose market-sensitive information promptly. Such companies will therefore not be valued as highly as their more transparent rivals, and they will find it harder to raise additional funds and may open themselves to hostile takeovers.

Corporate governance system focuses to assure that the managers of a corporation maintain healthy and sustainable corporate performance over the long term, thereby, resulting in a superior performance. Any organization having its corporate governance practices in place is a futuristic organization, laying the roadmap for its development. With the evolution of the information technology function which has been significant in recent years, IT is proving to be a strategic partner in corporate governance mechanisms. IT, once focused on administering corporate technology and fulfilling requests, is becoming far more of a collaborative business partner. As such, IT has become a critical supporter and enabler of many corporate objectives including healthy governance to enhance overall performance of the organization. Researchers and business managers consider IT as an enabler for improved organizational efficiency and competitiveness. Measurable performance improvements resulting from IT investment can help sustain investment in future IT initiatives. Despite the importance to researchers, managers, and policy makers of how IT contributes to organizational performance, there is uncertainty and debate about what we know and don’t know. A review of the literature reveals that studies examining the association between information technology and organizational performance are divergent in how they conceptualize key constructs and their interrelationships.
Several streams of research are concerned with assessing the organizational performance implications of information technology, each bringing its own theoretical and empirical toolkit to bear upon similar research questions. IT business value research examines the organizational performance impacts of information technology. Researchers have adopted myriad approaches for assessing the mechanisms by which IT business value is generated and for estimating its magnitude. Previous research has shown that information technology may indeed contribute to the improvement of organizational performance (Brynjolfsson and Hitt, 1996; Kohli and Devaraj, 2003; Mukhopadhyay, et al., 1995). Moreover, the dimensions and extent of IT business value depend on a variety of factors, including the type of IT, management practices, organizational structure, as well as the competitive and macro environment (Brynjolfsson, et al., 2002; Cooper, et al., 2000; Dewan and Kraemer, 2000). The term IT business value is commonly used to refer to the organizational performance impacts of IT, including productivity enhancement, profitability improvement, cost reduction, competitive advantage, inventory reduction, and other measures of performance (Devaraj and Kohli, 2003; Hitt and Brynjolfsson, 1996; Kriebel and Kauffman, 1988). For example, Mukhopadhyay, et al. (1995) refers to the “business value of IT” as the “impact of IT on Firm performance.”

Nowadays, IT has become crucial in the support, sustainability, and growth of the business. This pervasive use of technology has created a critical dependency on IT that calls for a specific focus on IT governance. IT governance consists of the leadership and organizational structures and processes that ensure that the organization’s IT sustains and extends the organization’s strategy and objectives (ITGI, 2003; Van Grembergen, 2001). Today, IT governance is high on the agenda and many organizations are implementing IT governance practices into day-to-day operations. IT governance efforts at many organizations have historically focused on risk reduction, cost containment, and regulatory compliance. However, as the business increasingly leverages IT to streamline business processes and enable revenue-producing products and services, IT governance practices are also being used to ensure that IT is responding to and prioritizing business demands in a way that enhances competitive positioning and thus revenue growth and profitability. The
primary goals for information technology governance are: assure that the investments in IT generate business value and mitigate the risks that are associated with IT. Within these two larger goals, five domains (focus areas) of IT governance are identified, three of which are drivers and two are outcomes (ITGI, 2003). Drivers include IT strategic alignment, IT resource management, and IT performance management. Outcomes include IT risk management and IT value delivery (ITGI, 2003). These can be achieved by implementing an organizational structure with well-defined roles for the responsibility for information, business processes, applications, infrastructure that is well communicated across the organization. Sound IT governance models ensures transparent IT decision-making processes, clear IT accountabilities, accepted and actionable IT measurements, IT outcomes that contribute to the overall performance of the organization with low governance overhead.

Development of new information technologies is being made rapidly today and this creates new business opportunities and threats. If companies desire to respond fast enough to changes they need a flexible infrastructure. This infrastructure has to be cost effective which can meet the business needs today, and be flexible in order to be able to support future business needs. It is often difficult to evaluate value received from IT investments and especially to evaluate them in advance. IT governance plays an important role when it comes to organizational learning about value received from an IT investment. With an effective IT governance, mechanisms can be created and through them potential value can be debated within the organization.

4.1 RESEARCH FRAMEWORK

In purview of revealing the “Role of Information Technology in Corporate Governance” a research framework has been developed in this section which constitutes all the steps undertaken to achieve the following objectives:

1. To synthesize results from prior studies to determine whether there is an empirical support for a relationship between information technology and its applications, and Firm performance.

2. To synthesize results from prior studies to determine whether there is an empirical support for a relationship between corporate governance and Firm performance.
3. To synthesize results from prior studies to determine whether there is an empirical support to state importance of IT governance understanding and awareness for organizations to achieve a better alignment between business and IT so as to attain edge over competitors.

4. To contribute to the conceptualization of information technology for corporate governance.

Keeping the objectives stated into consideration, the research framework followed in this chapter is graphed and presented in figure 4.1.

**Figure: 4.1**

*Research Framework for Meta Analysis of Prior Studies*
The above figure demonstrates the stages followed in this part of thesis. This framework starts with identifying the research dimensions under which study has been carried out and specifying the hypotheses laid for further analysis. The next step elaborates the implementation of meta-analysis technique which has been formulated in a sequential process (discussed ahead). The step of graphical presentation of results through forest plots has been incorporated in the meta-analysis process itself. The framework ends with conclusion of results derived from empirical analysis of literature.

4.1.1 IDENTIFICATION OF RESEARCH DIMENSIONS AND RESEARCH QUESTIONS

Using the integrative approach as a lens through which objective and findings of literature available were interpreted, three research questions were identified corresponding to the three domains of research i.e. determining the relationship between IT and Firm performance, determining the relationship between corporate governance and Firm performance, and depicting the importance of IT governance for attaining business value through competitive excellence. Studies emphasizing directly on Firm performance fall into two groups. The first group comprises the studies examining the whether IT is associated with Firm performance, leading to first research question: Is IT and its applications contribute to improve financial efficiencies of the corporate houses? The second group of studies analyses how corporate governance practices generate business value. These studies incorporate transparency and disclosure norms as key CG practices, stated as second research question: Is following corporate governance norms helpful in business value generation?

To be specific, first two research questions are:

**RQ1- Does IT has positive impact on Firm performance?**

**RQ2- Does transparency and disclosure norms (CG Practices) have positive impact on Firm performance?**

Finally, studies in the third domain explore the level of understanding and awareness of organizations regarding the importance of IT governance (specifically the five
key areas as defined by ITGI, 2003 i.e. IT strategic alignment, IT resource
management, and IT performance management. Outcomes include IT risk
management and IT value delivery) stating why IT governance has become
necessary for attaining the competitive advantage. Correspondingly, research
question three is stated as: Does organizations consider IT governance and its five
key focus areas as basic element for strategically becoming successful organization?

**RQ3 – Does understanding the relative importance of IT governance and its
five focus areas help organizations to attain competitive advantage?**

These three research questions were framed under three dimensions of literature
namely, IT, CG and ITG. Literature was comprehensively reviewed to facilitate
knowledge accumulation and providing base for carrying out this section.

4.1.2 DEVELOPMENT OF RESEARCH HYPOTHESES

The following hypotheses have been developed and tested in this chapter:

1. IT has a general positive association with various measures of Firm performance
   and there is no significant difference among the results indicated by sample
   studies.

2. CG has a general positive association with various measures of Firm performance
   and there is no significant difference among the results indicated by sample
   studies.

3. IT governance mechanism has a general positive tendency for effective IT
   alignment so as to achieve competitive advantage and there is no significant
difference among the results indicated by sample studies.

4.1.3 IMPLEMENTATION OF META ANALYSIS FOR EMPIRICISM AND
GENERALIZATION

Research questions were examined by employing meta-analytical methods to
aggregate findings derived from a growing body of primary quantitative research
initiatives surrounding the relationship between IT and its impact on Firm
performance, CG and its impact on Firm performance, and understanding IT governance mechanism and its relative importance for organizations as an important element to attain edge over competitors. A meta-analysis is a statistical technique that summarizes and aggregates the results of similar quantitative studies (Lipsey and Wilson, 2001). This technique allows the researcher to analyze and summarize one or more summary statistics, called effect sizes, across several studies (Lipsey and Wilson, 2001). In statistics, a meta-analysis refers to methods focused on contrasting and combining results from different studies, in the hope of identifying patterns among study results, sources of disagreement among those results, or other interesting relationships that may come to light in the context of multiple studies.

A meta-analysis is an appropriate method for evaluating past research on the relation between IT and Firm performance, CG and Firm performance, and ITG and competitive advantage since it provides a method for summarizing and unifying results regarding this relation inscribed in literature. One of the primary advantages of a meta-analysis is the potential to address biases that may influence a conventional literature review (Lipsey and Wilson, 2001; Moody, 1990; Wolf, 1986). Such biases include a variety of researcher biases affecting the selection of studies and the synthesis of seemingly incongruent study findings. Other biases specifically pertaining to meta-analysis include publication bias and statistical biases related to the combination of potentially heterogeneous effect sizes derived from primary studies with diverse samples and methodological approaches (Wolf, 1986). The research design presented below was formulated to address such biases. The steps of research design followed in this section for quantitative research synthesis are outlined in a figure no.4.2: (a) define the domains of study, (b) establish inclusion and exclusion criteria to select studies, (c) search and select studies, (d) code and classify studies, and (e) analyze studies and explicate research results. These steps constitute the process of meta-analysis.
Figure 4.2
Meta Analysis Process

1. Define the domains of study
2. Establish inclusion and exclusion criteria to select studies
3. Search and select studies
4. Code and classify studies
5. Analyze studies and explicate research results


**Step 1 Domains of the Study**

The first step which involves defining the key concepts of IT, CG and ITG has already been discussed earlier. The conclusions outlined in the research dimensions step provide the basis for the next step of selecting studies that address the identified research questions and objectives in a manner congruent with the conceptual definitions.

**Step 2 Criteria for Selection of Studies**

The selection of relevant studies can be a primary source of researcher bias. One way of overcoming this bias is to formulate explicit inclusion and exclusion criteria that provide unambiguous direction to the selection process. The selection criteria should accurately represent the substantive domain of inquiry as well as consider the degree to which studies with different methodological characteristics can be meaningfully combined into a common metric (Hall, Tickle-Degnen, Rosenthal and Mosteller, 1994; Lipsey and Wilson, 2001; White, 1994). Therefore, the selection criteria according to substantive and methodological inclusion criteria and general exclusion criteria was outlined while considering Lipsey and Wilson’s (2001) recommendation to specify “(a) the distinguishing features of a qualifying study, (b) the research respondents, (c) key variables, (d) research design, (e) cultural and linguistic range, (f) time frame, and (g) publication type”. This recommendation formed the basis for the selection criteria used in this meta-analysis as described below.

**Step 2.1 Substantive Inclusion Criteria:**

The substantive inclusion criteria for the determination of relevant studies were as follows:

1. Descriptive studies that quantitatively estimated the relationship between IT applications and Firm performance.

2. Descriptive studies that quantitatively estimated the relationship between corporate governance practices and Firm performance.

3. Descriptive studies that quantitatively estimated the relationship between IT

governance mechanism and enhancement in Firm excellence over competitors.

4. Studies that operationalized IT applications impact on Firm performance in a manner that is consistent with the conceptualization and subjective nature of these vary concepts.

5. Studies that operationalized corporate governance practices (with special focus on transparency and disclosure) impact on Firm performance in a manner that is consistent with the conceptualization and subjective nature of these vary concepts

6. Studies that operationalized IT governance understanding as important element for organizations to attain edge over competitors in a manner that is consistent with the conceptualization and subjective nature of these vary concepts.

In consideration of these substantive criteria, it should be noted that the selection of studies was not constrained by demographic or other sample characteristics because the research questions pertaining to IT, CG and ITG were applied to number of firms from varied industries.

**Step 2.2 Methodological Inclusion Criteria:**

In addition to these substantive inclusion criteria, the selection of studies was also guided by methodological inclusion criteria. Selected studies were:

1. Quantitative or descriptive studies that provided sufficient statistical data to calculate an estimated effect size i.e. statistics pertaining to the relationship between IT applications and Firm performance.

2. Quantitative or descriptive studies that provided sufficient statistical data to calculate an estimated effect size i.e. statistics pertaining to the relationship between corporate governance practices and Firm performance.

3. Quantitative or descriptive studies that provided sufficient statistical data to calculate an estimated effect size i.e. statistics pertaining to the relationship between IT governance understanding and organizational performance leading to competitive advantage.

4. Studies that described the method used to conduct the study (experiment or survey) and instruments that defined or measured the multiple dimensions of Firm performance.
5. Studies that were published in a time frame of 1992 to 2012. (Though unpublished studies were also considered for analysis purpose)

Methodological inclusion criteria accounting for the quality of studies were not considered in the selection process because the limitations of available research reports do not necessarily enable the coder to accurately evaluate the rigor of each study (Lipsey and Wilson, 2001). The determination of study quality was generally constrained by the extent of the research report. In addition, in consideration of the domain of inquiry and its stage of development, it was found that an insufficient number of highly rigorous studies were identified. As stated by Lipsey and Wilson (2001), “many areas of research, especially those that deal with applied topics, provide virtually no perfect studies and the ones closest to textbook standards may be conducted in circumstances that are unrepresentative of those in which the meta-analyst is most interested”. Methodological characteristics, however, were coded and thereby, accounted for in the statistical analysis.

**Step 2.3 Exclusion Criteria:**

The following types of studies were not included in this meta-analysis:

1. Case studies and studies that did not report primary research findings.

2. Studies of an exclusively qualitative design.

3. Studies that did not operationalize relationships’ between:
   a. IT applications and Firm performance.
   b. Corporate governance practices and Firm performance.
   c. IT governance understanding and organizational performance leading to competitive advantage

4. Studies that did not report their findings in the English language.

5. Studies that were published before the calendar year 1992.

The selection criteria was originally tested and refined by applying them to five preselected studies each under three research dimensions. The final selection criteria were integrated into a selection criteria coding form (see Appendix A) allowing all
studies (categorized into three research dimensions each) that were reviewed to be labeled according to the criteria, under purposive sampling. This was done to facilitate subsequent analysis of types of studies that were systematically excluded. The selection process started with identifying potentially relevant studies by screening the titles, keywords and abstracts of the citations derived from the comprehensive database search described in the next step. The inclusion and exclusion criteria were used to distinguish those studies that clearly were not representative of the population of studies of interest to this meta-analysis from studies that were. Studies that were identified as being of potential interest were marked for retrieval. Several challenges pertaining to the reliable identification of potentially relevant studies became apparent throughout this process. These challenges were mostly regarding the identification of studies that might have operationalized IT, CG and ITG importance with Firm performance respectively in accordance with the conceptual foundations of this meta-analysis. Though the manner in which the concepts of IT, CG and ITG importance with Firm performance respectively were operationalized was sufficiently discussed in the research design section of the articles that were reviewed, the original citation information (i.e., the title, the keywords and the abstracts) often did not provide much information about how these concepts were actually operationalized in the study. Therefore, it was difficult to ascertain from the citation information which operational definitions were used to represent the concepts associated with IT, CG and ITG respectively.

To address this difficulty, several guidelines were constructed to expedite the identification of potentially relevant operationalizations of IT, CG and ITG respectively during the screening process. First, studies using the terms “information/data processing” or “e-commerce” or “data governance” or “global governance” or “board governance” or “administrative governance” or “e-governance” were excluded when there was no indication in the citation information that the concepts were more broadly operationalized. In addition, studies that used subscales constructed to measure the effectiveness of IT and CG, impact of IT, impact of CG practices on Firm performance respectively and also measuring the benefits a firm could accrue from IT governance were only included if the subscale
was mentioned as a separate measure in the citation information.

Similar guidelines were formulated to expedite the process of identifying possibly relevant operational definitions of Firm performance. Instruments that exclusively measured qualitative outcomes were not considered to be representative of the concept of perceived Firm performance underlying the theoretical framework of this meta-analysis. Similarly, instruments that exclusively measured one domain of financial performance were also excluded.

On the whole, the initial screening of potentially relevant studies was an iterative process throughout which selection criteria and guidelines for selection were clarified and refined. Various ambiguous citations were also considered and consensus was reached based on the selection guidelines. Consequently, since this initial screening process relied entirely on the information that was available in the citation provided by the electronic databases, some studies might have been excluded when insufficient or misleading information was presented. Nevertheless, when in doubt, the general rule at this stage was to err toward over-inclusion rather than accidental exclusion of potentially relevant studies.

**Step 3 Searching and Selecting Studies**

The purposive sampling procedure for this meta-analysis was guided by the selection criteria as well as by an extensive search strategy which was designed to construct a sample of studies that was congruent with the research questions and conceptual definitions underlying this meta-analysis. According to Hedges (1994), “the sampling procedure must be designed so as to yield studies that are representative of the intended universe of studies”. Hedges explains that, although the notion of “exhaustive sampling” is used to achieve a sufficiently representative sample of studies, one should not assume that the aggregated sample of studies involves the complete extent of variability that may be present in the universe of potential studies pertaining to the domain of inquiry. This relates particularly to the issue of publication bias or the “file drawer problem” as discussed by Glass, McGaw, and Smith (1981). White’s (1994) modes of searching were used to obtain the sample of representative studies. These modes included: (a) footnote chasing: reviewing bibliographies of selected articles, (b) consultation, (c) searches in subject
indexes: electronic database searches, (d) browsing, and (e) citation searches of electronic databases.

The computerized database searches were based on White’s (1994) recommendation to use “natural language terms” as well as “controlled-vocabulary terms” to compose a comprehensive search statement. Natural language terms are those terms directly associated with the domain of inquiry such as may be revealed in abstracts or the full text of potential studies of interest. Controlled vocabulary terms involve subject headings and descriptors that are used for indexing. In addition, Clarke and Oxman (2000) recommended reviewing keywords or subject indexes associated with a pre-selected collection of studies to ensure that the list of search terms is comprehensive as well as specific to the domain of interest. Reviewers also need to consider that different indexes may use different keyword (Clarke and Oxman, 2000). Reed and Baxter (1994) pointed out that the selection of relevant terms should be based on a “clear definition of the topic, which

1. precisely reflects the scope as well as the limits of the search,
2. includes all important concepts,
3. indicates relationships among concepts, and
4. provides criteria for inclusion/exclusion of materials”.

Based on these recommendations, a list of terms/keywords associated with IT, CG, ITG, Firm performance and competitive advantage was constructed to direct the search process. Conceptual terms related to IT and ITG included: information technology, IT, IS, computerization, IT impact, MIS, IS investment, IT investment, IT capabilities, IT resources, IT infrastructure, IT assets, IT strategy, IT structure, IT practices, IT governance, ITG, governance framework, IT risk, IT return, strategic use of IT, business/IT partnership, business/IT alignment, strategic alignment, IT management, IT performance management, IT resource management, IT risk management and IT value delivery. Conceptual key words that reflect this study’s conceptualization of corporate governance included corporate governance, CG, transparency, disclosures, CG norms, code of corporate governance, board of directors, corporate reporting, auditing, governance reporting, ethics, CG

These terms were validated by reviewing the subject headings and descriptors in each of the databases and by reviewing the citation information of several pre-selected studies in relation to each database. Computerized citation searches also provide a good basis for retrospective and prospective retrieval of potentially relevant published study reports (White, 1994). Citation searches were initiated after the completion of other database searches and identification of a sample of articles for inclusion. Selected articles were then subjected to manual footnote chasing by reviewing the reference lists. Information Systems Research (INFORMS) and ScienceDirect were the main outlets for the given study that provided studies to constitute a fair number of sample studies. Another concern, particularly for meta-analysis, is the importance of limiting the potential of publication bias or “the file drawer problem” by attempting to retrieve unpublished studies (Rosenthal, 1984; White, 1994). So, attempt was made by online search to include unpublished studies as well. Although efforts were made to retrieve unpublished studies, it must be recognized that only a small portion of the unpublished literature was retrieved for the purpose of analysis.

**Step 3.1 Overview and Results of the Search Process:**

The above suggestions for effective literature searches were combined to formulate a comprehensive sequential search strategy. Search firstly began with pre-selecting several studies that clearly reflected the selection criteria. Each database was then searched for these studies to identify keywords and subject headings used to classify potential studies of interest. This process was used to identify substantive as well as methodological terms that were representative of the respective concepts of study in
each database. An initial search string of keywords was framed on the basis of pre-selected studies. The initial search string was used to search the titles, abstracts, subject headings and keywords of all databases. Some additional terms pertaining to the topic of study were derived from the review of databases leading to development of comprehensive string of keywords (stated earlier).

The next step in the search strategy was to compile all the retrieved citations into a single database, to be categorized into three dimensions. Each citation was then screened manually by reviewing the titles, keywords and abstracts in accordance with the exclusion criteria. In total more than 800 citations were screened and duplicate retrievals were removed from the cumulative database. In addition to the above, reference lists of 103 studies related to IT and ITG dimension and 127 studies on CG dimension of potential interest were reviewed to identify additional studies.

The comprehensive database of studies consisted of more than 1000 citations that were screened in accordance with the selection process described earlier. A total of 253 both published and unpublished studies (48 studies related to IT dimension, 131 studies related to CG dimension and 74 studies related to ITG dimension) were selected for retrieval after the screening process was completed. At this stage, some of the studies could not be retrieved and some were excluded because of the exclusion criteria. The remaining studies were then examined in terms of the availability of sufficient statistical data to calculate an effect size. This resulted in exclusion of those studies which did not provide any explicit quantitative information about the relationship on concerned concepts. These studies were originally selected because they contained the appropriate operational definitions. Based on this selection process, 64 studies (19, 16 and 29 studies under IT, CG ad ITG dimensions respectively) were identified for inclusion in the final analysis. With the proceedings in analysis section, some of the studies were further excluded making a sample size of 44 studies (16, 12 and 16 studies under IT, CG ad ITG dimensions respectively). The brief description of key findings of the sample studies in tabulated form is given in Appendix B.
Step 4 Coding and Classifying the Studies

The next step in the meta-analysis process was to assign codes to the studies and their respective variables that were of potential interest and to allow smoothness in statistical analysis. According to Stock (1994), items for coding should be selected on the basis of substantive as well as methodological considerations. However, many of these considerations only become apparent as a study progresses and as the researcher becomes increasingly familiar with the domain of inquiry and the statistical challenges and biases that need to be addressed (Stock, 1994; Woodworth, 1994). Developing a code book is therefore seen as an iterative process that develops throughout the data collection phase of the study design (Stock, 1994). Nevertheless, a priori coding of items can be planned in anticipation of substantive and methodological study characteristics that may systematically affect the homogeneity of effect sizes (Lipsey and Wilson, 2001; Stock, 1994).

The general format of the code book developed for this meta-analysis (see Appendix C) for classifying study variables reflecting substantive and methodological considerations associated with IT, CG and ITG consisted of the following categories: particulars of a study, status of publication, source of retrieval, variables of the study, operational definitions of the study variables, scope of the study, objectives of the study, hypotheses of the study, research methodology, sampling details, and findings and conclusion. Both the selection criteria form and code book were derived from the study of Sawatzky (2002).

Step 5 Analyzing the Studies

Once the coding process was completed, the next step in the meta-analysis was the selection of an appropriate effect size statistic and the use of statistical methods to combine those effect sizes across studies (Moody, 1990). Various experts in the field of meta-analysis methodology have formulated extensive statistical procedures for calculating effect sizes and weighting mean effect sizes. In the present study, meta-analysis methodology developed by Neyeloff, et al. (2012) has been followed. Neyeloff, et al. (2012) constructed a step-by-step guide to carry meta-analysis using both fixed effects and random effects models. If heterogeneity is low, then fixed effects model can be used, which assumes the effect size is same in the parameter population and differences in studies are just from sampling error. The underlying assumption of a fixed effects model is whether the universe of all conceivable
studies that address the study question is sufficiently similar to the sample of studies used for the analysis (Hedges, 1994). In other words, “the studies gathered for a meta-analysis are a representative sample of a known universe with known characteristics” (Hunt, 1997). The assumptions underlying the fixed effects model are difficult to support considering the conceivably diverse sample characteristics and operationalizations associated with varied concepts of IT, CG and ITG. An alternative is the use of a random effects model where, in consideration of the wide diversity of studies, it could be assumed that sources of variance associated with the distribution of the effect sizes are likely to be randomly distributed. Hedges (1994) explained that in this model “the study sample is presumed to be literally a sample from a hypothetical collection (or population) of studies”. The variability in the random effects model is therefore much larger and will result in a more conservative combined effect size. An additional benefit of the random effects model is that generalizations based on the findings of a random effects model can be applied to a large variety of situations that do not need to reflect the particular characteristics of the sample of studies used in the meta-analysis.

This homogeneity of variance assumption was examined by determining the significance of the Q statistic, which provided an estimate of the degree of heterogeneity in the distribution. The Q statistic was calculated by comparing the error variances associated with each effect size and the significance was determined using a Chi-Square distribution. Naturally, the effect sizes derived from fairly diverse sample characteristics and operational differences associated with the measurement of IT and Firm performance, CG and Firm performance, and ITG and competitive advantage were unlikely to be homogenously distributed. So, in the present study random effects model has been applied for analysis.

**Step 6 Interpreting and Explicating the Research Results**

The analysis part was carried out under three categories, for each of the three dimensions separately i.e. IT and Firm performance, CG and Firm performance, and ITG and competitive advantage. The results derived from analysis have been interpreted and presented through tables and forest plots for respective dimensions. Forest plot is a convenient and intuitively easily understood manner of presenting effect sizes and their confidence intervals in a graphic manner. The overall summary effect is often represented on the plot as a vertical line. If the confidence intervals
for individual studies overlap with this line, it demonstrates that at the given level of confidence their effect sizes do not differ. The summary effect is commonly plotted as a diamond, the lateral points of which indicate confidence intervals for this estimate. The forest plots graphed in the study have been discussed with their relative interpretations.

4.1.3.1 DIMENSION I: IT AND FIRM PERFORMANCE

Step i. Calculating Independent Effect Size

After compiling all the information from the final selection of 19 studies in a comprehensive database, independent effect size of each study was calculated on the basis of responses of population from each respective study. The distribution of primary effect sizes was analyzed for skewness (refer Figure 4.3). As demonstrated in figure 4.3, the original distribution of responses of population (outcome) is positively skewed (Skewness statistic = 1.262, SE = 0.524; Kurtosis statistic = 0.504, SE = 1.014). As depicted in figure 4.3, these 19 studies are not evenly distributed. The reason behind this is the inclusion of three studies having unitary outcome. If these three studies are excluded distribution of outcomes is evenly defined (see figure 4.4). For new constituted sample i.e. 16 studies, distribution of outcome is still positively skewed (Skewness statistic = 0.755, SE = 0.564; Kurtosis statistic = 0.520, SE = 1.091)

Figure 4.3

Histogram of Distribution of Outcome of IT dimension (19 studies)
Step ii. Calculating Q and Effect Summary

The Q test measures heterogeneity among studies, and works like a t test. It is calculated as the weighted sum of squared differences between individual study effects and the pooled effect across studies, with the weights being those used in the pooling method. Q is distributed as a chi-square statistic with k (number of studies) minus 1 degrees of freedom. The hypothesis for this dimension is that all studies are equal. To test that, Q was calculated and compared against a table of critical values. To apply formula of Q, standard error (SE), variance (Var), individual study weights (w), weighted effect size (w*es) and other necessary variables like w*es^2 and w^2 were calculated. The fixed effect homogeneity analysis of 19 studies resulted in a significant Q-value (Q_{0.05, df=18} = 616.045), which indicates that the variance in the sample of effect sizes are heterogeneously distributed and could not be accounted for by sampling error alone. Since Q value is much higher than 28.869, the critical value for 18 degrees of freedom found in a chi-square distribution and also I^2 denotes high degree of heterogeneity. Therefore the random effects model has been
used for the further analyses.

In random effect model, it is assumed that variability is not only due to sampling error, but also to variability in the population of effects, in this model the weight of each study is adjusted with a constant (v). With the value of constant v, new weight for each study was calculated and here also, analysis of 19 studies resulted in a significant Q-value \( Q_{0.05, df = 18} = 64.123 \). But at this stage, three studies with unitary effect size were excluded. So, net sample of studies revealing the relationship between IT and Firm performance is found 16.

The random effect homogeneity analysis of 16 studies revealed significant Q-value \( Q_{0.05, df = 15} = 23.7932 \). The computed value of Q is found less when compared with critical values of table (i.e. 24.996) at 0.05 level of significance. Hence, the hypothesis stating that “IT has a general positive association with various measures of Firm performance and there is no significant difference among the results indicated by sample studies” is accepted. The same picture is also demonstrated by the value of \( I^2 \) which is 36.95%, so the results signify moderate heterogeneity. For net sample studies, effect summary was calculated to provide an indicator of the presence and strength of the relationship between IT and Firm performance. The value of effect summary (n= 16) is found 0.37033 and value of standard error (SEes) is found 0.0261.

**Step iii. Tabulation and Graphical Interpretation**

Table 4.1 demonstrates the rates of each study and effect summary at 95 % confidence interval. Despite of writing the names of author and year of study, respective study codes are shown in the table. The effect summary for the given model is 37.033 (95% CI: 31.91-42.14)
### Table 4.1
Table of Random Effect Model (Dimension 1)

<table>
<thead>
<tr>
<th>Study Code</th>
<th>Rate (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT 1</td>
<td>45.83 (30.2 - 61.4)</td>
</tr>
<tr>
<td>IT 2</td>
<td>67.89 (60.9 - 74.8)</td>
</tr>
<tr>
<td>IT 3</td>
<td>43.20 (37.4 - 48.9)</td>
</tr>
<tr>
<td>IT 4</td>
<td>29.34 (28.2 - 30.4)</td>
</tr>
<tr>
<td>IT 5</td>
<td>37.58 (27.7 - 47.4)</td>
</tr>
<tr>
<td>IT 6</td>
<td>37.76 (27.6 - 47.8)</td>
</tr>
<tr>
<td>IT 7</td>
<td>38.00 (31.1 - 44.9)</td>
</tr>
<tr>
<td>IT 8</td>
<td>27.99 (24.5 - 31.4)</td>
</tr>
<tr>
<td>IT 9</td>
<td>18.17 (15.1 - 21.3)</td>
</tr>
<tr>
<td>IT 10</td>
<td>30.56 (24.8 - 36.2)</td>
</tr>
<tr>
<td>IT 11</td>
<td>40.00 (35.8 - 44.1)</td>
</tr>
<tr>
<td>IT 12</td>
<td>25.00 (20.9 - 29.1)</td>
</tr>
<tr>
<td>IT 13</td>
<td>31.70 (25.7 - 37.6)</td>
</tr>
<tr>
<td>IT 14</td>
<td>51.27 (40.1 - 62.4)</td>
</tr>
<tr>
<td>IT 15</td>
<td>22.68 (20.5 - 24.7)</td>
</tr>
<tr>
<td>IT 16</td>
<td>55.70 (51.1 - 60.3)</td>
</tr>
<tr>
<td>Effect Summary</td>
<td>37.03 (31.9 - 42.1)</td>
</tr>
</tbody>
</table>

*Source: Study results on primary effect sizes of respective sample studies.*

Figure 4.5 is displaying the rates of each sample study under research dimension I and effect summary in a forest plot. The rates are basically the outcome of individual studies in percentage form. Outcome of each of the 16 studies (blue highlights) in figure 4.5, is denoted by symbol of square whereas the diamond symbol shows effect summary. However, two studies which have generalized the
impact of Firm performance on IT, for their respective sample firms are highlighted by red color.

Figure 4.5
Forest Plot of Random Effect Model (Dimension 1)

IT AND FIRM PERFORMANCE

Figure 4.5 clearly demonstrates moderate heterogeneity among sample studies. The vertical line drawn in the figure highlights the effect summary and corresponding extent to which studies were scattered on the basis of their variables, sample size and response rate, subjects and their characteristics, measuring techniques, time frame and place, assumptions, and results.

4.1.3.2 DIMENSION II: CG AND FIRM PERFORMANCE

Step i. Calculating Independent Effect Size

As for dimension I, independent effect sizes of sample studies were computed, independent effect sizes of each study constituting sample for studying dimension II, were also calculated on the basis of responses of population from each respective study. In dimension II, initial number of sample studies was 16. The distribution of primary effect sizes of 16 sample studies was analyzed for skewness (refer Figure 4.6). Figure 4.6 shows the original distribution of responses of population (outcome) is positively skewed (Skewness statistic =0.061, SE = 0.564; Kurtosis statistic = -1.364, SE = 1.091). As depicted in figure 4.6, these 16 studies are not
evenly distributed. This is due to the inclusion of four studies whose response rate is less than 10 percent. To validate the results, four studies were excluded for analysis purpose. Figure 4.7 displays the distribution of outcome for new constituted sample i.e. 12 studies, which is still positively skewed (Skewness statistic = 0.136, SE = 0.637; Kurtosis statistic = -1.716, SE = 1.232)

**Figure 4.6**
Histogram of Distribution of Outcome for CG dimension (16 studies)

![Histogram of Distribution of Outcome for CG dimension (16 studies)]

**Figure 4.7**
Histogram of Distribution of Outcome for CG dimension (12 studies)

![Histogram of Distribution of Outcome for CG dimension (12 studies)]
**Step ii. Calculating Q and Effect Summary**

The Q test which measures heterogeneity among studies was carried out for dimension II. The hypothesis for this dimension is also that all studies are equal. To test that, Q was calculated and compared against a table of critical values. To apply formula of Q, necessary variables were computed as mentioned in dimension I. In random effect model, analysis of 16 studies resulted in a significant Q-value (Q \(_{0.05,\text{df}=15}\) = 34.914). For 16 studies value of \(I^2\) is found 57.03 % which denotes existence of high degree of heterogeneity. At this stage, four studies were excluded having response rate less than 10 per cent. So, net sample of studies considered to reveal the relationship between CG and Firm performance is 12. The random effect homogeneity analysis on 12 studies revealed significant Q-value (Q \(_{0.05,\text{df}=11}\) = 12.971). The computed value of Q is found less when compared with critical values of table at 11\(^{th}\) degree of freedom (i.e. 19.675) at 0.05 level of significance. Hence, the hypothesis stating that “CG has a general positive association with various measures of Firm performance and there is no significant difference among the results indicated by sample studies.” is accepted. The same result is inferred by the value of \(I^2\) which is only 15.195% demonstrating low heterogeneity among sample studies. For net sample studies, effect summary was calculated to provide an indicator of the presence and strength of the relationship between CG and Firm performance. The value of effect summary (n= 12) is found 0.4845 and value of standard error (SEes) is found 0.08687.

**Step iii. Tabulation and Graphical Interpretation**

The rates of each study and effect summary at 95 % confidence interval are displayed by table 4.2. Study codes are shown in the table despite of the respective names of author and year of study. The effect summary for the given model is 48.45 (95% CI: 31.41-65.47)
<table>
<thead>
<tr>
<th>Study Code</th>
<th>Rate (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CG 1</td>
<td>89.33 (78.6 – 100)</td>
</tr>
<tr>
<td>CG 2</td>
<td>14.17 (12.9 – 15.4)</td>
</tr>
<tr>
<td>CG 3</td>
<td>97.54 (90.7 – 104)</td>
</tr>
<tr>
<td>CG 4</td>
<td>19.49 (17.1 – 21.9)</td>
</tr>
<tr>
<td>CG 5</td>
<td>71.42 (51.6 – 91.2)</td>
</tr>
<tr>
<td>CG 6</td>
<td>14.15 (11.9 – 16.3)</td>
</tr>
<tr>
<td>CG 7</td>
<td>9.40 (7.5 – 11.2)</td>
</tr>
<tr>
<td>CG 8</td>
<td>50.00 (41.1 – 58.9)</td>
</tr>
<tr>
<td>CG 9</td>
<td>83.33 (60.2 – 106)</td>
</tr>
<tr>
<td>CG 10</td>
<td>22.11 (18.9 – 25.2)</td>
</tr>
<tr>
<td>CG 11</td>
<td>48.62 (40.5 – 56.6)</td>
</tr>
<tr>
<td>CG 12</td>
<td>70.70 (69.3 – 72.1)</td>
</tr>
<tr>
<td>Effect Summary</td>
<td>48.45 (31.4 – 65.4)</td>
</tr>
</tbody>
</table>

*Source: Study results on primary effect sizes of respective sample studies.*

Figure 4.8 is presenting these rates and effect summary with the help of forest plot. The rates were computed by multiplying the effect sizes by 100 to have the outcome of individual studies in percentage form. Outcome of each of the 12 studies (blue highlights) in figure 4.8, is denoted by symbol of square whereas the diamond symbol shows effect summary. However, red shaded square symbols represent the outcomes of the four studies which have emphasized on revealing the CG disclosure practices only, of their respective sample firms.
Figure 4.8
Forest Plot of Random Effect Model (Dimension II)

The random effect analysis provided 15.195 % as the value of $I^2$ which denotes low heterogeneity but vertical line drawn in the figure 4.8 highlights the effect summary and corresponding extent to which studies are scattered and it clearly demonstrates distantly scattered outcomes of the sample studies, this may be due to the differences among studies on the basis of their variables, sample size and response rate, subjects and their characteristics, measuring techniques, time frame and place, assumptions, and results.

4.1.3.3 DIMENSION III: ITG AND COMPETITIVE ADVANTAGE

Step i. Calculating Independent Effect Size

Independent effect sizes of each study constituting sample for studying dimension III, were also calculated on the basis of responses of population from each respective study. For dimension III, initial number of sample studies considered was 29. The distribution of primary effect sizes of 29 sample studies was also analyzed for skewness. Figure 4.9 shows that the original distribution of responses of population (outcome) is negatively skewed (Skewness statistic = -0.394, SE = 0.434, Kurtosis statistic = -1.671, SE = 0.845). From 29 studies, 7 studies were dropped as the response rate of respondents in such studies was less than 10 per cent and hence, number of studies constituting sample turned out to be 22. The distribution of outcome of the 22 studies (refer figure 4.10) is also found negatively skewed
(Skewness statistic = -0.421, SE = 0.491, Kurtosis statistic = -1.566, SE = 0.953). Further to validate the results, six studies having unitary effect size each were excluded for analysis purpose. Figure 4.11 displays the positively skewed distribution of effect size for new constituted sample i.e. 16 studies (Skewness statistic = 0.022, SE = 0.564, Kurtosis statistic = -1.845, SE = 1.091)

Figure 4.9
Histogram of Distribution of Outcome of ITG dimension (29 studies)

Figure 4.10
Histogram of Distribution of Outcome of ITG dimension (22 studies)
Step ii. Calculating Q and Effect Summary

The Q test for measuring heterogeneity among studies was carried out for dimension III as well. The hypothesis for this dimension is also that all studies are equal. To test the same, Q was calculated and compared against a table of critical values at 0.05 level of significance. To apply formula of Q, necessary variables were computed as mentioned in dimension I. In random effect model, analysis of 29 studies resulted in a significant Q-value (Q,0.05, df = 28 = 166.798). For 29 studies value of I² is found 83.21% which denotes existence of very high degree of heterogeneity. At this stage, seven studies were excluded having response rate less than 10 per cent. The random effect homogeneity analysis on rest of the 22 studies revealed significant Q-value (Q,0.05, df = 21 = 48.32). The computed value of Q is found more than the critical value of table at 21 degree of freedom (i.e. 32.671). The heterogeneity level among studies, denoted by I² is valued 56.54% which is also high. Further six studies having unitary effect size were excluded. So, net sample of studies considered to reveal the relationship between ITG and competitive advantage is 16. By homogeneity analysis of 16 studies Q value is found significant (Q,0.05, df = 15 = 31.08). On comparing the computed value of Q with tabulated value at 15th degree of freedom, Q value is found more (31.08 > 24.996). Hence, the hypothesis stating that “IT Governance mechanism has a general positive tendency for effective IT alignment so as to achieve competitive advantage and there is no significant
difference among the results indicated by sample studies’ is rejected. The value of I² for the sample studies is found 51.73% demonstrating moderate heterogeneity among sample studies. For net sample studies, effect summary was calculated to provide an indicator of the presence and strength of the relationship between ITG and competitive advantage. The value of effect summary (n= 16) is found 0.45742 and value of standard error (SEs) is found 0.17316.

Step iii. Tabulation and Graphical Interpretation

The values of random effect model effect sizes were multiplied by 100 to have the outcome of individual studies in percentage form. Table 4.3 displays the rates of each study and effect summary at 95 % confidence interval. Here, instead of the names of author and year of study, respective study codes are shown in the table. The effect summary for the given model is 45.74 (95% CI: 11.80-79.68)

<table>
<thead>
<tr>
<th>Study Code</th>
<th>Rate (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITG 1</td>
<td>90.00 (48.4 – 131)</td>
</tr>
<tr>
<td>ITG 2</td>
<td>85.31 (80.1 – 90.4)</td>
</tr>
<tr>
<td>ITG 3</td>
<td>85.32 (80.2 – 90.6)</td>
</tr>
<tr>
<td>ITG 4</td>
<td>22.00 (17.4 – 26.5)</td>
</tr>
<tr>
<td>ITG 5</td>
<td>82.22 (55.7 – 108)</td>
</tr>
<tr>
<td>ITG 6</td>
<td>46.29 (33.4 – 59.1)</td>
</tr>
<tr>
<td>ITG 7</td>
<td>11.44 (9.9 12.9)</td>
</tr>
<tr>
<td>ITG 8</td>
<td>13.41 (11.3 – 15.4)</td>
</tr>
<tr>
<td>ITG 9</td>
<td>11.00 (8.9 – 13.1)</td>
</tr>
<tr>
<td>ITG 10</td>
<td>33.55 (30.6 – 36.4)</td>
</tr>
<tr>
<td>ITG 11</td>
<td>10.56 (8.7 – 12.3)</td>
</tr>
<tr>
<td>ITG 12</td>
<td>52.04 (50.1 – 53.9)</td>
</tr>
<tr>
<td>ITG 13</td>
<td>15.06 (13.1 – 16.9)</td>
</tr>
<tr>
<td>ITG 14</td>
<td>60.00 (11.9 – 108)</td>
</tr>
<tr>
<td>ITG 15</td>
<td>84.35 (69.5 – 99.2)</td>
</tr>
<tr>
<td>ITG 16</td>
<td>77.14 (67.9 – 86.3)</td>
</tr>
<tr>
<td>Effect Summary</td>
<td>45.74 (11.8 – 79.6)</td>
</tr>
</tbody>
</table>

Source: Study results on primary effect sizes of respective sample studies.
The rates and effect summary values are demonstrated in figure 4.12 with the help of forest plot. Symbol of square denotes value of effect sizes of respective sample studies whereas the diamond symbol shows effect summary.

**Figure 4.12**

*Forest Plot of Random Effect Model (Dimension III)*

The vertical line drawn in the figure 4.12 represents the effect summary and correspondingly the extent to which studies are scattered. It clearly demonstrates distantly scattered outcomes of the sample studies, which may be due to the differences among studies on the basis of their variables, sample size and response rate, subjects and their characteristics, measuring techniques, time frame and place, assumptions, and results. The heterogeneity is also inferred from the computed value of $I^2$ which is 51.73%.

**4.1.4 CONCLUSION**

The results of this meta-analysis can only be interpreted correctly when potential limitations associated with the meta-analysis process are taken into consideration. One criticism relates to the issue of sampling bias. Clearly, the results of the meta-analysis are largely determined by the selection of studies included in the analysis. The primary method employed to address this potential bias is the establishment of explicit inclusion and exclusion criteria to guide the selection process. Other major criticism is of “the apples and oranges phenomenon”. The criticism of comparing
apples with oranges pertains to the argument that “logical conclusions cannot be
drawn by comparing and aggregating studies that include different measuring
techniques, definitions of variables and subjects because they are too dissimilar”
(Wolf, 1986). This criticism is certainly of concern in the present meta-analysis.
Another important limitation relates to the inability to use the results to draw
conclusions about the causal nature of the relationship between research dimensions.
Also, the sample of 44 studies is too small to examine the variables that might
explain how IT, CG and ITG affects Firm performance and ability to attain
competitive advantage. A final concern pertains to the generalizability of the results.
As a rule, results derived from a meta-analysis are more generalizable than any one
study because the resulting effect size represents a greater variety of primary sample
characteristics than can be achieved through a single primary study.

In conclusion, results of this meta-analysis revealed various findings pertaining to
the conceptualization of IT, CG and ITG as a distinctive concept that relates to Firm
performance and Firm ability to attain competitive advantage. The implications are
mostly theoretical in nature and raise questions about the commonly assumed
multidimensional conceptualization of Firm performance and Firm ability to attain
competitive advantage. The findings demonstrate the value of meta-analytical
methods in revealing general characteristics of conceptual relationships that are
easily obscured by isolated primary research findings. On the other hand, other
questions pertaining to the nature and direction of the relationship between IT, CG
and ITG with Firm performance and Firm ability to attain competitive advantage
remain largely unanswered and indicate the need for continued primary research.
Ongoing qualitative meta-analyses are needed to further explicate the meaning of the
findings of this meta-analysis pertaining to the relationship between above
mentioned variables.

Though various concerns pertaining to the overall body of research on IT, CG and
ITG are identified, of primary concern is the wide diversity of instruments/predictors
used to measure Firm performance. Further research is needed to validate whether
these measures can indeed be combined to provide a conceptualization of Firm
performance that is broadly defined yet remains conceptually distinct from other
concepts such as the dimensions commonly associated with IT, CG and ITG.