Chapter – 3

Research Methodology
RESEARCH METHODOLOGY

3.1 Introduction

The best research is that which is reliable, verifiable and exhaustive so that it provides information in which we have confidence. The core concept underlying research is its methodology. A systematic process and methodology is needed to conduct a research in a successful manner. The methodology controls the study, dictates the acquisition of the data, and arranges them in logical relationships, sets up a means of refining the raw data, contrives an approach so that the meanings that lie below the surface of those data become manifest, and finally issue a conclusion or series of conclusions that lead to an expansion of knowledge. The entire process is a unified effort as well as an appreciation of its component parts.

Moreover, this section highlights the methodology and process used to conduct the present research. This section highlights the objectives and procedure of the study. Further, this section discusses the research methodology adopted for attaining the objectives of the study. Properly conducted research reduces the uncertainty level for the top management in making critical decisions. Hence it is extremely important to describe the research methodology here. This chapter deals with the methodology used in present study. The methodology comprises the models, and also the statistical and econometrical tools such as correlation, Chi – Square test, ANOVA, T – Test and so on.

3.2 Justification of the Present Study

The present study entitled “Business Intelligence for Competitive Advantage: A Case Study of Selected Insurance Companies in India” includes impact of business intelligence on competitive advantage. This field has remained untouched by the researchers due to no systematic research has been specifically conducted in this area and non availability of sufficient data. Hence, there is need and justification for comprehensive study to evaluate it. The present study aims to bridge such a gap and hence the present study has been taken up.
3.3 Research Design

Reliability and validity of the research required planning of inquiry, i.e. the detailed strategy of how the research would be conducted. A good research design depends on two aspects of its designing: first, specifying what one wants to find out, i.e., properly posing the problem or properly phrasing the issues to be studied or the logical structure of inquiry; and second, determining how to do it, i.e., collecting data through scientific and appropriate methods, using effective techniques of data analysis and rational and meaningful deductions. Therefore, the researcher had to take great care in the preparation of the research design. There are many types of research design and there was no standard or ideal research design to guide the researcher; much different research design may accomplish the same objectives. Broadly, research design can be of three types: (1) Exploratory (2) Descriptive and (3) Casual / Experimental. In the present study, since the scope of the study was very vast, mainly, descriptive research design had been adopted in order to get the main purpose of this study and also to achieve new insights into it.

3.4 Research Model

In order to draw the dynamic capability framework and current literature on business intelligence, information technology infrastructure, organizational agility, competitive advantage, and environment turbulence, this study developed a research model as shown in Figure 3.4.1.
3.5 Hypotheses Development

3.5.1 Indirect Effects of Business Intelligence on Competitive Advantage

Based on the process view of organizations and Porter’s value chain model, Pavlou and El Sawy (2006) proposed that dynamic capabilities in a new product development context were resource – enabling primary activities because they were directly involved with products and services development; therefore, business intelligence leveraging competences were resource – enabling secondary activities. Information system – related functions have been viewed that business intelligence as the platform on which other higher – order organizational capabilities can be built (Grant, 1995). Pavlou and El Sawy (2006) stated that “the higher the order of firm capabilities, the more immediate is their impact on competitive advantage.” Hence, their suggestions were accepted and applied in the study.

It was posited that organizational agility was a critical higher – order organizational capability in creating competitive advantage because, as argued in the literature review section, organizational agility was a dynamic capability with emphasis on speed and it helps to develop products and services that meet customer demands. The researcher also proposes that business intelligence is capability and resource that enable organizational agility. Business intelligence system is the platform on which organizational agility can be built. Therefore, business intelligence does not directly affect competitive advantage but, through organizational agility, have indirect impacts on competitive advantage. The first alternative hypothesis is as follows:

$H_{a1}$: Business intelligence will impact on competitive advantage more strongly in highly organizational agility conditions.

3.5.2 Relationship between Information Technology Infrastructure and Business Intelligence

Business intelligence systems are information systems built on top of existing information technology infrastructure in digitally enabled organizations. Business intelligence systems require access to data from a variety of sources and distribute data to different users and data interfaces, such as Web browsers on desktop computers, small screens on mobile devices, or as a data feed to other information
systems. Information technology infrastructure can help business intelligence easily and quickly access or integrate existing and new data sources. Information technology infrastructure can also help distribute data and information to different distributing channels and receiving devices.

It is reasonable to argue that information technology infrastructure can increase business intelligence performance because with information technology infrastructure, more information can be readily available when needed and coveted information can be available where and when it is needed. The rich and accurate information can make business intelligence systems be perceived as more useful. Therefore, our next alternative hypothesis is as follows:

$$H_{a2}:$$ Information technology infrastructure will positively impact on business intelligence.

3.5.3 Relationship between Business Intelligence and Organizational Agility

Based on the systems theory, organizations are systems. Organizational agility is an emergent property of organizations. According to the definition of organizational agility, the value of organizational agility comes from two dimensions: (1) sensing / detecting and, (2) acting / responding to environmental change. We further argue that the use of business intelligence in organizations will help increase organizational agility by improving an organization’s ability to sense / detect environmental changes.

The business intelligence’s contribution to organizational agility can also be found in the current IS research on the topic. The construct of information management capability (IMC) by Mithas et al. (2011) is an encompassing construct that includes functions provided by business intelligence. They defined IMC as the ability to (1) provide data and information to users with appropriate levels of accuracy, timeliness, reliability, security, and confidentiality; (2) provide universal connectivity and access with adequate reach and range; and (3) tailor the infrastructure to emerging business needs and direction. Mithas et al. (2011) found significant positive influences of IMC on three organizational capabilities: performance management capability, customer management capability, and process management capability.
In this research, we study the relationship between business intelligence and organizational agility, which includes customer agility, partner agility, and operation agility (Sambamurthy et al., 2003). Customer agility is an essential part of customer management capability, and operational agility is a part of the process management capability proposed by Mithas et al. (2011). Therefore, we have reasons to postulate that business intelligence use can enhance an organization’s agility. Furthermore, business intelligence collects, analyzes, and presents interpreted information to organization managers to help them make the right decision at the right time. Business intelligence can help organizational agility by detecting customer event patterns, identifying operational opportunities and bottlenecks, and revealing changes in partners’ assets and competencies to managers so that they can sense, act, or make timely decisions.

The strategic information technology alignment literature also provides support on the positive effect of business intelligence on organizational agility. For example, knowledge creation, sharing, and use have been studied as enablers of strategic information technology alignment (Reich and Benbasat, 1996; Kearns and Lederer, 2003; Preston and Karahanna, 2009). Owing to knowledge sharing between business and information technology executives, an organization can quickly respond to changes in market places and thus increase an organization’s agility. Knowledge creation, sharing, and use are the underlying arguments for the positive effect of strategic information technology alignment on agility (Tallon and Pinsonneault, 2011). Because business intelligence is an information system that helps managers make the right decisions at the right times, it is used across business units. It can create an environment for sharing newly found / created knowledge. Therefore, theories suggest the following alternative hypothesis:

\[ H_{a3}: \text{The level of business intelligence is positively related to organizational agility.} \]

### 3.5.4 Relationship between Organizational Agility and Competitive Advantage

As mentioned in the literature review section, the dynamic capability framework (Teece et al., 1997) theoretically argued that there existed a direct link between an organization’s dynamic capabilities and competitive advantage.
Teece et al. (1997) first defined dynamic capability as the routines and processes that integrate or reconfigure existing resources to create new resources that hopefully have strategic values. Using dynamic capabilities, organizations can build VRIN resources that are strategically critical in a competitive environment. Dynamic capability needs to act upon other operational capability and resources to improve / change / initiate other organizational resources (Helfat and Peteraf, 2003). However, in later theses, dynamic capability is further developed and slightly refined as an ability to build, integrate, or reconfigure internal and external resources to address changing environments (Eisenhardt and Martin, 2000) or as an ability to sense and shape opportunities and threats, to seize opportunities, and to maintain competitiveness through enhancing, combining, protecting, and when necessary, reconfiguring the organization’s resources (Teece, 2007). However, these definitions do not emphasize the factor of speed.

Organizational agility has been defined as the ability to detect and respond to opportunities and threats with ease, speed, and dexterity, and speed has been emphasized for agility in various information system research papers (Li et al., 2008; Sambamurthy et al., 2003; Tiwana and Konsynski, 2010; Tallon and Pinsonneault, 2011). Eisenhardt and Martin (2000) discussed some specific dynamic capabilities: (1) dynamic capability to integrate resources, such as product development routines; (2) dynamic capabilities to reconfigure resources within organizations to build new resources, such as copy, transfer, and recombine resources, especially knowledge – based resources; and (3) dynamic capabilities to gain and release resources, such as knowledge creation routines to build new thinking, alliance, and acquisition routines that bring new resources and exit routines to release resources that no longer provide competitive advantages.

From the definitions of organizational agility in the information system literature and dynamic capability in the strategic management literature and the researchers’ elaboration on these concepts, the researcher argue that organizational agility is a dynamic capability that detects opportunities and threats and reconfigures internal and external resources to respond to those opportunities and threats with speed. This connects organizational agility to dynamic capability and provides a basis to argue for and support the claim in the information system literature that
organizational agility has strategic value and can be the antecedent to competitive advantage.

Based on the review of the strategic management and information system literature, the researcher hypothesizes the relationship between organizational agility and competitive advantage as follows:

**Hₐ₄**: The level of organizational agility is positively related to competitive advantage.

### 3.5.5 Moderating Effects of Environmental Turbulence

One subject that is common for the discussed constructs was speed. Organizational agility is about the speed to sense and respond to changes. Business intelligence is about helping managers make the right decision at the right time quickly and increasing organizational agility. Information technology infrastructure flexibility is about making the information technology infrastructure malleable to quickly adjust to the ongoing changes in business environments. Obviously, the speed requirement varies among industries. An Internet company is probably more sensitive to customer changes than an educational institution. Therefore, a turbulent environment or a quickly changing environment in terms of customer demands and preferences will require organizations to respond more quickly and cost effectively to increase competitive advantages and to stay afloat.

Although El Sawy and Pavlou (2008) mentioned that the information technology infrastructure capabilities affect dynamic and improvisational capabilities in turbulent environments, the things that they showed information technology infrastructure could help were also the things that could be helped by business intelligence (e.g., effectively sensing the environment; acquiring, assimilating, and using knowledge by effectively coding, synthesizing, and sharing knowledge to generate new learning; and making information visible and accessible). Turbulent environments create more opportunities or crises for companies competing in them. Business intelligence can help organizations quickly sense those opportunities and threats. In turbulent environments, organizations will rely more on business intelligence to sense and more on information technology infrastructure to respond to opportunities and threats. Turbulent environments will amplify the effects of business
intelligence on organizational agility and in turn intensify the effects of organizational agility on competitive advantage.

In a highly turbulent environment, a flexible and adaptable information technology infrastructure is more valuable than in a less turbulent environment in providing supports for integrating data from different parts of operation to help managers make right decisions. The researcher posits that turbulent environments impact the relationships among business intelligence, information technology infrastructure, organizational agility, and competitive advantage. Therefore, the next three alternative hypotheses are as follows:

**H_{a5}:** Environment turbulence will reinforce the positive impact of information technology infrastructure on business intelligence.

**H_{a6}:** Environment turbulence will reinforce the positive impact of business intelligence on organizational agility.

**H_{a7}:** Environment turbulence will reinforce the positive impact of organizational agility on competitive advantage.

### 3.6 Survey Instrument Development

This study uses the existing survey instrument whenever it is possible since the existing measurement scales were examined according to well–recognized and standard scale development procedure. Moreover, the high reliability and validity of an instrument are essential for a high–quality survey instrument.

For the new instrument developed in this study, the researcher followed the same procedure of existing instruments. The researcher developed the instrument for the business intelligence system construct. All instruments for other constructs used in this study were adapted from existing instruments.

#### 3.6.1 Scale for Business Intelligence Use

In order to develop business intelligence instruments, the researcher referred to Burton and Straub’s (2006) discussion on system usage. They proposed that system usage is an activity that involves three elements: a user, a system, and a task. Therefore, they defined individual level system usage as an individual user’s employment of one or more features of a system to perform a task.
For executives in organizations, their usage of business intelligence can be classified as exploitive usage that refers to “usage that implements and executes one’s knowledge of one’s system and task” (Burton and Straub, 2006). The exploitive usage can be captured by two subs – constructs: cognitive absorption, which represents the extent to which a user is absorbed, and deep structure usage, which represents the extent to which features in the system, that relate to the core aspects of the task are used (Burton and Straub, 2006). The researcher believes that cognitive absorption is more related to individual task performance than to how much a system is used by a user.

The measurement indicators for business intelligence are mostly in the deep structure usage category. The researcher first selected features of business intelligence information systems that will be used by users. Then, we combined the selected features with corresponding tasks in order to measure the extent of business intelligence in the organization. The selected features are based on the inputs from academic researchers and industrial trade papers. The researcher further refined the features and the instrument with helps from several academic researchers who have done various researches on business intelligence and taught business intelligence classes in universities.

A convenience sample of thirty employees from life insurance industry were selected to pilot test the questionnaire in order to further refine the measurement scale. The researcher also used the pilot study to ensure the survey.

The reliability of the developed scale for business intelligence was assessed by using Cronbach’s $\alpha$ and composite reliability scores. The recommended threshold score is 0.7 for Cronbach’s $\alpha$ and composite reliability (Kline, 2005). An instrument with this score or above for Cronbach’s $\alpha$ and composite reliability indicates the internal consistency of reliability of the instrument indicators. The determinant and convergent validities of the measurement scale were also assessed by using recommended statistic tests.

### 3.6.2 Scale for Information Technology Infrastructure

We developed our indicators for measuring information technology infrastructure based on the scales from Duncan (1995), Byrd and Tuner (2000),
Tiwana and Konsynski (2010), and Tallon and Pinsonneault (2011). First, Duncan (1995) summarized the concept of information technology infrastructure and empirically showed that how information technology executives view information technology infrastructure. Duncan (1995) found three information technology infrastructure qualities: (1) connectivity; (2) compatibility; and (3) modularity. Byrd and Tuner (2000) defined the three proposed dimensions of information technology infrastructure flexibility by Duncan (1995).

Connectivity is “the ability of any technology component to attach to any of the other components inside and outside the organizational environment; compatibility is the ability to share any type of information across any technology component; and modularity is the ability to add, modify, and remove any software, hardware, or data components of the infrastructure with ease and with no major overall effect”.

Tiwana and Konsynski (2010) proposed to include the information technology standardization as a sub – dimension for measuring information technology modularity. Standardization refers to “the degree to which organization – wide standards and policies pre – specify how applications in an organization’s information technology portfolio connect and interoperate with each other” (Tiwana and Konsynski, 2010). The present measurement scale includes the standardization indicators in the information technology infrastructure modularity dimension.

Byrd and Tuner (2000) and Tallon and Pinsonneault (2011) tested the reliability and validity of the instrument for measuring information technology infrastructure. The results showed that the reliability of the instrument is high, as reflected by the high factor reliability score in Bryd and Tuner’s (2000) study and higher composite reliability scores (all higher than 0.85) for each of the dimensional constructs of information technology infrastructure. The validity of the instrument is sound, as reflected by the high loading score of each measurement indicator on its corresponding construct in Tallon and Pinsonneault’s (2011) study. We developed our scale for measuring information technology infrastructure mainly based on Tallon and Pinsonneault’s (2011) study.
3.6.3 Scale for Organizational Agility

Organizational agility refers to speed with which a firm can sense / detect market opportunities and threats and act / respond to those opportunities and threats by assembling and integrating internal and external resources, including assets, knowledge, and relationships (Hitt et al., 1998; Sambamurthy et al., 2003; Tallon and Pinsonneault, 2011). First, Sambamurthy et al. (2003) argued that there were three dimensions of organizational agility, namely, customer responsiveness agility, operational agility, and partnership agility.

Tallon and Pinsonneault (2011) devised a set of eight indicators to assess the organizational agility in each of these three dimensions. Tallon and Pinsonneault (2011) tested their scale’s reliability and validity. The reported composite reliability score for their agility construct was 0.862. This composite reliability score suggested that the scale for agility has the internal reliability. Their assessment also showed that the loading score of each measurement indicator on its corresponding factor (dimensions) exceeded the recommended threshold score of 0.5 (this cutoff value is very arbitrary), and each indicator had a higher loading score on its own construct than on the other constructs. These loading scores suggested that the scale had convergent and determinant validity. The researcher developed the measurement scale for organizational agility based on Tallon and Pinsonneault’s (2011) scale.

3.6.4 Scale for Environmental Turbulence

Environmental turbulence was defined as “general conditions of uncertainty” (Rai and Tang, 2010), with “unpredictability arising from unexpected changes in market demand and consumer preferences, new technology developments, and technological breakthroughs” (El Sawy and Pavlou, 2008). The general conditions of uncertainty may come from two aspects in modern business environment: market turbulence and technology turbulence. Market turbulence refers to “the rate of change in the composition of customers and their preferences,” and technology turbulence refers to the rate of changes in technology (Jaworski and Kohli, 1993).

Jaworski and Kohli (1993) developed a scale for measuring market turbulence and technology turbulence. The Crontach’s $\alpha$ value of the constructs were. The Crontach’s $\alpha$ reported by Jaworski and Kohli (1993) for market turbulence was 0.68,
which was a little bit lower than the recommended threshold value of 0.7 (Nunnally and Berbstein, 1994; Kline, 2005). However, Robinson et al. (1991) also argued that a Cronbach’s $\alpha$ value of 0.6 is acceptable. Jaworski and Kohli (1993) did not report the validity assessments of the scale. The reliability and validity of the scale were assessed in Pavlou and El Sawy’s (2006) study. Pavlou and El Sawy (2006) reported a score of 0.85 for the composite reliability, indicating a high internal reliability.

Convergent and discriminate validity was also confirmed by large average variance extracted (AVE) scores for the constructs. This study developed the measurement scale for environmental turbulence based on the studies of Jaworski and Kohli (1993) and Pavlou and El Sawy (2006).

3.6.5 Scale for Competitive Advantage

This study has extensively discussed the construct of competitive advantage in the literature review section. There are two model domains in competitive dynamics research that describe an organization’s competitive advantage from a different level: industrial (environmental) and organizational (firm) – specific level. Competitive advantages at the organizational – specific level come from cost efficiency leadership and quality differentiation (Porter, 1980; Teece et al., 1997). Competitive advantages at the industrial level come from an organization’s ability to interact with the five market forces in its market environment (Porter, 1980; Porter, 1985).

The information system literature has produced several scales to measure competitive advantage. However, some of them are specific to certain advantages in a specific industry. For example, Pavlou and El Sawy (2006, 2010) developed a competitive advantage scale for new product development. Nidumolu and Knotts (1998) developed a scale for measuring general competitive advantage. Nidumolu and Knotts (1998) derived their scales for measuring two dimensions of competitive advantage from manufacturing strategy research. One dimension is product cost efficiency, which describes the efficiency with which the organization produces its products; the other dimension is market responsiveness, which describes how timely the organization is in responding to market changes. This study argued in the literature review section that competitive positioning (advantage) determines organizations’ ultimate performance (Porter, 1980).
Nidumolu and Knotts (1998) assessed the reliability and validity of their scale. The Cronbach $\alpha$ was 0.81 and 0.83 for cost efficiency and market responsiveness, respectively. The factor loadings of the indicators on their own constructs were high except those of two indicators. This study developed the scale for measuring competitive advantage based on the measurement scale from Nidumolu and Knotts (1998). The reliability and validity of the developed scale were assessed again in this study.

3.7 Goodness of Measures

Measurement should be subjected to reliability and validity test before the research model assessment. Measurement reliability assesses if a measurement instrument is free from random error and is consistent, stable, and dependable. A reliable measurement scale does not imply a valid measurement scale. Measurement validity assesses whether a measurement instrument measures what it is supposed to measure (Rosnow and Rosenthal, 1998).

It is important to make sure that the instrument, which we develop in order to measure a specific concept, truly measures the concept which we set out to measure. Reliability and validity are the two main criteria for measuring the goodness of measures used in a research instrument. We report in this section the assessment of measurement reliability and validity of the scales used in this study.

3.7.1 Reliability of the Instrument

The reliability of a measure indicates the stability and consistency with which the instrument measures the concept. This helps us to assess the goodness of a measure (Sekaran and Bougie, 2010). Thus, it is important to assess the scale reliability. Scale reliability refers to the extent to which a scale can reproduce the same measurement results in repeated trials (Hair et al., 2003). The internal consistency of measures indicates the homogeneity of the items in the measure that captures the construct using only one administration of an instrument. Internal consistency is the degree to which the various measures of a multidimensional construct correlate with the scale (Hair et al., 2003).

The internal consistency reliability of a measurement scale is typically assessed using two statistics: one is the Cronbach’s alpha, and the other is the
composite reliability indicator. Table 3.7.1 displays the Cronbach’s alpha and composite reliability. These values are calculated after we dropped some indicators that have convergent and discriminate validity issues for their corresponding constructs. The suggested acceptable value of the Cronbach’s alpha for a reliable construct is 0.7 (Nunnally and Berbstein, 1994; Kline, 2005). The Cronbach’s alpha values for all constructs, except for partner agility, were higher than the suggested acceptable value.

These Cronbach’s alpha values show high reliability of all the measurement scales, except the scale for partner agility. The Cronbach’s alpha is calculated with the assumption that all measured indicators are equally weighted. To relax the assumption for calculating the Cronbach’s alpha, an alternative score, that is, composite reliability, was developed, which is considered a more accurate measurement of reliability than the Cronabch’s alpha (Fornell and Larcker, 1981; Chin, 1998a; Chin, 2010). The acceptable value for composite reliability is 0.70 or higher (Nunnally and Berbstein, 1994). All the constructs in the model of this study have a composite reliability value above the threshold value.

### Table 3.7.1

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Indicators</th>
<th>Cronbach’s α</th>
<th>Composite Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Intelligence</td>
<td>QB1,B2,QB3,QB4,QB5,QB6,QB7, QB8,QB9,QB10,QB11,QB12,QB13</td>
<td>0.873</td>
<td>0.886</td>
</tr>
<tr>
<td>IT Infrastructure</td>
<td>QI1,QI2,QI3,QI4,QI5,QI6,QI7,QI8, QI9,QI10,QI11,QI12,QI13,QI14</td>
<td>0.869</td>
<td>0.874</td>
</tr>
<tr>
<td>IT Connectivity</td>
<td>QI1,QI2,QI3,QI4</td>
<td>0.739</td>
<td>0.792</td>
</tr>
<tr>
<td>IT Hardware Compatibility</td>
<td>QI5,QI6,QI7,QI8</td>
<td>0.805</td>
<td>0.843</td>
</tr>
<tr>
<td>IT Modularity</td>
<td>QI9,QI10,QI11,QI12,QI13,QI14</td>
<td>0.823</td>
<td>0.843</td>
</tr>
<tr>
<td>Organizational Agility</td>
<td>QO1,QO2,QO3,QO4,QO5,QO6, QO7,QO8</td>
<td>0.869</td>
<td>0.891</td>
</tr>
<tr>
<td>Customer Agility</td>
<td>QO1,QO2,QO3</td>
<td>0.845</td>
<td>0.914</td>
</tr>
<tr>
<td>Operation Agility</td>
<td>QO4,QO5,QO6</td>
<td>0.730</td>
<td>0.759</td>
</tr>
<tr>
<td>Partner Agility</td>
<td>QO7,QO8</td>
<td>0.562</td>
<td>0.753</td>
</tr>
</tbody>
</table>
Environmental Turbulence | QE1,QE2,QE3,QE4,QE5,QE6,QE7, QE8 | 0.873 | 0.897
Market Turbulence | QE1,QE2,QE3,QE4 | 0.811 | 0.914
Technological Turbulence | QE5,QE6,QE7,QE8 | 0.882 | 0.923
Competitive Advantage | QC1,QC2,QC3,QC4,QC5,QC6,QC7 | 0.875 | 0.897
Product Cost Efficiency | QC1,QC2,QC3 | 0.752 | 0.843
Market Responsiveness | QC4,QC5,QC6,QC7 | 0.902 | 0.923

(QB= question of business intelligence, QI= question of information technology infrastructure, QO= question of organizational agility, QE= question of environment turbulence and QC= question of competitive advantage.)

The Cronbach’s $\alpha$ and composite reliability values of the contrasts in the model of this study suggest that the measurement instruments of this study are reliable. Although reliability is a necessary contributor to validity, it is not a sufficient condition for validity (Sekaran and Bougie, 2010). Therefore, examining the validity of the instrument becomes equally important. The discussion on the validity is explained in the subsequent section.

### 3.7.2 Validity of the Instrument

Validity is the extent to which a rating scale truly reflects the underlying variable that it attempts to measure (Parasuraman et al., 2004). Over the years, there is no consensus regarding types of validity. Yet the types of validity such as content validity, criterion – related validity and construct validity are generally discussed in the research papers. Authors such as Cooper et al. (2012), Sekaran and Bougie (2010) have also classified validity in accordance with the above – mentioned three types. Hence the following section outlines the validity tests conducted for the present study so as to measure content validity, criterion – related validity and construct validity.

#### 3.7.2.1 Content Validity

The content validity is the degree to which the content of the items adequately represents the universe of all relevant items under study (Cooper et al., 2012). This can be determined using judgment and panel evaluation. Content validity of an attitude scale is a sort of overall criterion that can be assessed only though a researcher’s subjective judgment (Parasuraman et al., 2004). In the present study,
the researcher has exercised the judgment through careful definition and analysis of conceptual and empirical frameworks, the product of an extensive literature review in the area of study. A panel of judges can attest to the content validity of the instrument (Sekaran and Bougie, 2010). Thus, the questionnaire was subjected to a panel of experts for their evaluation. The panel consisted of both practitioners and academicians. As a result, the face validity of the proposed instrument was confirmed.

3.7.2.2 Criterion Related Validity

Ping (2004) emphasized that, for new measures of previously measured constructs, criterion validity should be assessed. The criterion – related validity is established when the measure differentiates individuals on a criterion it is expected to predict. It can be established by predictive validity (Sekaran and Bougie, 2010).

Predictive validity indicates the ability of the measuring instrument to differentiate among individuals with reference to a future criterion (Sekaran and Bougie, 2010). The researcher needs to ensure that the validity criterion used is valid and the intended measure is judged in terms of four qualities i.e. relevance, freedom from bias, reliability and availability (Cooper et al., 2012). In the present study the criterion – related validity was established using predictive validity, adopting such as from Tallon and Pinsonneault (2011). All the items were captured and measured along Likert scales with a seven – point response format. A higher score indicated a more favorable response. The resulting correlation matrix is presented in the table 3.7.2.2.1. All the correlations are positive and statistically significant at 1% level of significance which has established predictive validity.
Table 3.7.2.2.1
Bivariate Correlations among the Constructs of the Research

| Construct Correlation | BI Conn | IT IT Conn | IT IT Hard | IT IT Mod | IT IT Cust | IT IT Agil | IT IT Oper | IT IT Agil | IT IT Agil | IT IT Part | IT IT Mark | IT IT Tech | IT IT Cost | IT IT Mark |
|-----------------------|---------|------------|------------|-----------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Business Intelligence | 1.00    |            |            |           |            |            |            |            |            |            |            |            |            |            |            |
| IT Connectivity      | 0.668   | 1.00       |            |           |            |            |            |            |            |            |            |            |            |            |            |
| IT Hardware Compatibility | 0.509  | 0.574   | 1.00       |           |            |            |            |            |            |            |            |            |            |            |            |
| IT Modularity        | 0.603   | 0.702     | 0.508      | 1.00      |            |            |            |            |            |            |            |            |            |            |            |
| Customer Agility     | 0.600   | 0.675     | 0.604      | 0.631     | 1.00       |            |            |            |            |            |            |            |            |            |            |
| Operation Agility    | 0.605   | 0.673     | 0.505      | 0.646     | 0.730      | 1.00       |            |            |            |            |            |            |            |            |            |
| Partner Agility      | 0.420   | 0.462     | 0.386      | 0.472     | 0.567      | 0.454      | 1.00       |            |            |            |            |            |            |            |            |
| Market Turbulence    | 0.446   | 0.494     | 0.423      | 0.418     | 0.523      | 0.556      | 0.582      | 1.00       |            |            |            |            |            |            |            |
| Technological Turbulence | 0.526 | 0.565    | 0.450      | 0.586     | 0.581      | 0.693      | 0.520      | 0.521      | 1.00       |            |            |            |            |            |            |
| Product Cost Efficiency | 0.532 | 0.604    | 0.546      | 0.585     | 0.617      | 0.591      | 0.412      | 0.451      | 0.528      | 1.00       |            |            |            |            |            |
| Market Responsiveness | 0.518   | 0.575     | 0.534      | 0.527     | 0.587      | 0.562      | 0.384      | 0.441      | 0.462      | 0.651      | 1.00       |            |            |            |            |

From the results of the analysis, we can assume that the modified measurement scale for all constructs in this study have predictive validity. Therefore, we can continue with our model assessments.

3.7.2.3 Construct Validity

According to Sekaran and Bougie (2010), the construct validity testifies how well the results obtained from the use of measure fit the theories around which the test is designed and assessed through convergent and discriminate validity.

Convergent validity is the degree to which scores on one scale correlate with scores on other scales designed to assess the same construct (Cooper et al., 2012).
Convergent validity is also assessed by calculating one way analysis of variance (ANOVA) (Bahia and Nantel, 2000; Parasuraman et al., 1988; Wong et al., 2001). The association between constructs was significant at less than 1 per cent level of significance as shown in table 3.7.2.3.1. It means that the group differences are significant and this reflects a good convergent validity.

Table 3.7.2.3.1
One Way ANOVA for Assessing Convergent Validity of Constructs

<table>
<thead>
<tr>
<th>Constructs</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Intelligence</td>
<td>24.219</td>
<td>0.001</td>
</tr>
<tr>
<td>IT Connectivity</td>
<td>28.381</td>
<td>0.001</td>
</tr>
<tr>
<td>IT Hardware Compatibility</td>
<td>23.463</td>
<td>0.001</td>
</tr>
<tr>
<td>IT Modularity</td>
<td>28.694</td>
<td>0.001</td>
</tr>
<tr>
<td>Customer Agility</td>
<td>29.622</td>
<td>0.001</td>
</tr>
<tr>
<td>Operation Agility</td>
<td>31.435</td>
<td>0.001</td>
</tr>
<tr>
<td>Partner Agility</td>
<td>17.029</td>
<td>0.001</td>
</tr>
<tr>
<td>Market Turbulence</td>
<td>13.205</td>
<td>0.001</td>
</tr>
<tr>
<td>Technological Turbulence</td>
<td>25.967</td>
<td>0.001</td>
</tr>
<tr>
<td>Product Cost Efficiency</td>
<td>23.458</td>
<td>0.001</td>
</tr>
<tr>
<td>Market Responsiveness</td>
<td>21.628</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Further as shown in table 3.7.2.3.1, the Cronbach’s alpha values of the constructs used in the study for constructs were more than 0.7. As suggested by Nunnally and Berbstein (1994), higher reliability implies convergent validity. As the validity tests such as content validity, criterion – related validity and construct validity were successful, the instrument could be termed as valid for the purpose of the study.
3.8 Research Methodology

Research is defined as a scientific and systematic search for pertinent information on a specific topic. Research in common parlance refers to a search for knowledge. It is not just a process of gathering information; rather, it is about answering unanswered questions or creating new knowledge or things which do not currently exist. In other words, research is an art of scientific investigation. Research as a “systematized effort to gain new knowledge.” Research comprises defining and redefining problems, formulating hypothesis or suggested solutions; collecting, organizing and evaluating data; making deductions and reaching conclusions; and at last carefully testing the conclusions to determine whether they fit the formulating hypothesis.

Research methodology is a way to systematically solve a research problem. A research design is the structure, or an outline of research that guides the process of research from the formulation of the research questions and hypotheses to reporting the research findings. Research methodology explains the research methods used in the context of research study and explains why a particular method or technique is opted over others so that research results are capable of being evaluated either by the researcher himself or by others. Why a research study has been undertaken, how the research problem has been defined, in what way and why the hypothesis has been formulated, what data have been collected and what particular method has been adopted, which technique of data analysis has been used and a host of similar other questions are usually answered when we talk of research methodology concerning a research problem or study. Whereas research methods means all those methods which are used by the researcher during the course of studying his research problem, based on the nature of research, purpose of research, research questions, sample selection, data collection methods, and data analysis techniques the research designs can be classified into one of three broad categories: (1) Quantitative research designs, (2) Qualitative research designs, and (3) Mixed – research designs.

Figure 3.8.1 gives a quick look at the methodology used to conduct the study and collect the data. The methods adopted at each step while conducting this study are highlighted in the figures and the relevance of these methods is explained under research methodology.
<table>
<thead>
<tr>
<th>Type of Research</th>
<th>Exploratory</th>
<th>Descriptive</th>
<th>Explanatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Philosophy</td>
<td>Positivism</td>
<td>Phenomenology</td>
<td></td>
</tr>
<tr>
<td>Research approach and Strategy</td>
<td>Deductive</td>
<td>Inductive</td>
<td>Quantitative</td>
</tr>
<tr>
<td>Research Method</td>
<td>Experiment</td>
<td>Survey</td>
<td>Case Study</td>
</tr>
<tr>
<td>Time Horizon</td>
<td>Cross Sectional</td>
<td>Longitudinal</td>
<td></td>
</tr>
<tr>
<td>Sampling Scheme</td>
<td>Probability / Random</td>
<td>Non Probability / Non Random</td>
<td></td>
</tr>
<tr>
<td>Simple – SRS</td>
<td>Stratified</td>
<td>Systematic</td>
<td>Convenience</td>
</tr>
<tr>
<td>Sample Design</td>
<td>Sample Unit</td>
<td>Sampling Technique</td>
<td>Sample Size</td>
</tr>
<tr>
<td>LIC, ICICI &amp; SBI</td>
<td>Convenience &amp; Judgment</td>
<td>300 Respondents of managers, employees and experts</td>
<td></td>
</tr>
<tr>
<td>Data Collection Source &amp; Method</td>
<td>Primary Source</td>
<td>Secondary Source</td>
<td></td>
</tr>
<tr>
<td>Observation</td>
<td>Questionnaire</td>
<td>Interview</td>
<td>Web Based</td>
</tr>
<tr>
<td>Self – Administered &amp; Interview Administered</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3.8.1 Research Design of the Research at a glance
3.8.1 Research Type

Initially, type of research is based on the nature of data. In the light of the nature of data, the present research is mainly descriptive and analytical research method. Descriptive or case – study research is a research in which a specific situation is studied either to see if it gives rise to any general theories, or to see if existing general theories are borne out by the specific situation. Descriptive research may be used when the object of the research is very complex. It involves describing a problem, context or a situation. The questions are more structured, reliant on prior ideas and methods.

A case study is a descriptive research where statistics and numerical data can also be used to describe. The study includes surveys and fact – finding enquiries of different kinds. The major purpose of descriptive research is to narrate the state of affairs as it exists at present. The main characteristic of descriptive research is that the research has no control over the variables; can only report what has happened or what is happening, however, researchers use descriptive research to discover causes even when they cannot control the variables. Most ex post facto research projects are used for descriptive studies in which the researcher seeks to measure such items as, frequency of an event, preferences, expectation and perception of people, or similar data.

In analytical research, on the other hand, the researcher has to use facts or information already available, and analyze these to make a critical evaluation of the corresponding facts and information. A descriptive study employs simple tools like averages and percentages for analysis where as an analytical study employs tools like correlation, regression, multivariate analysis and other advanced statistical techniques.

In the light of purpose of research, the researcher tried to test the impact of business intelligence on competitive advantage in selected life insurance companies in India, i.e. LIC of India, ICICI Prudential Life Insurance Co. Ltd., and SBI Life Insurance Co. Ltd.
3.8.2 Research Philosophy

Positivism and Phenomenology are the two philosophies about research process. Positivism was the outcome of scientific discoveries of 18th and 19th century, and it was clear that, a body of knowledge existed independent of whether people knew it or not. The aim of scientific research was to discover this knowledge. This led to the development of tools and techniques to collect and analyze data objectively.

Since numerical measures, as it exists, are obtained for different variables used in the current study, and various statistical techniques are applied to analyze the data, the philosophy employed here is positivism.

3.8.3 Research Strategy and Approach

This study is a quantitative and deductive research study as it aims at arriving at conclusions about some research questions based on the analysis of numerical data obtained from a sample to arrive at conclusion about the population under study.

Quantitative research gathers data that are in numerical form. The original data can be in non–numerical form such as statements that are re–coded on some specific numerical scale which can categorized based on their measurement type – nominal (e.g., gender), ordinal (e.g., university rank), interval (e.g., degrees Fahrenheit), and ratio (e.g., height in inches). This involves the generation of data in quantitative from which can be subjected to rigorous quantitative analysis in a formal and rigid.

This approach can be future sub–classified into inferential, experimental and simulation approaches to research. The purpose of inferential approach to research is to form a data base from which it is possible to infer characteristics or relationships of population. This usually means survey research where a sample of population is studied (questioned or observed) to determine its characteristics, and it is then inferred that the population has the similar / same characteristics.

Qualitative research, on the other hand, is concerned with qualitative phenomenon, i.e., phenomena relating to or involving quality or kind. Qualitative approach to research is concerned with subjective assessment of attitudes, opinions and behavior. Research in such a situation is a function of researcher’s insights and impressions. Such an approach to research generates results either in non–quantitative form or in the form which are not subjected to rigorous quantitative analysis. Quantitative data are generally non – numerical but have a greater variety of sources.
Induction is the formulation of general theories from specific observations, as opposed to deduction, which is the derivation of a new logical truth from existing facts. Deduction is a process of applying a generally accepted principle to a specific case falling under the general principle. A deductive theory – based research process focuses primarily on testing theories and specific research hypotheses that consider finding differences and relationships using numeric data and statistical methods to make specific conclusions about a given case. This method is appropriate for addressing specific problems or objectives.

In the present study, to arrive at conclusions about the importance of business intelligence for competitive advantage, and to test various hypotheses, numerical data is collected in a systematic order. The data is analyzed and interpreted to draw conclusions about hypothesis. Figure 3.8.3.1 represents the flow of steps involved in a deductive research.

![Figure 3.8.3.1 Process in Deductive research](image-url)
3.8.4 Research Method

Case study is an in-depth examination and intensive description of a single individual, group, and organization based on collected information from a variety of sources, such as observations, interviews, documents, participant observation, and archival records. The goal of the case study is to provide a detailed and comprehensive description, in narrative form, of the case being studied.

In the present study, survey method is employed. To collect primary data respondents are sampled and the required data are collected using a structure questionnaire.

3.8.5 Time Horizon

In cross sectional study a group of study units are studied at a point of time whereas in a longitudinal study a select group of individuals are observed or studied over a period of time. The changing values of the variable under study are noted and analyzed.

The present study is a cross sectional study as the data / opinion of a group of sampled individuals is collected in the time period between June 2013 and January 2014. Their demographic data and opinion about business intelligence for competitive advantage in select insurance companies in India is viable to change with time. We found that the cross – sectional survey method is appropriate for this study because we are interested in the current state of business intelligence and its impact on an organization’s current organizational agility and competitive advantages.

3.8.6 Population

The population of interest of this study is all the managers, employees, and experts of three life insurance companies (Life Insurance Corporation of India, ICICI Prudential Life Insurance Company, and SBI Life Insurance Company) in state of Karnataka that their companies are using business intelligence for various purposes. The researcher chose insurance managers as the primary respondents because they are the operation managers who use business intelligence and know the degree of their organizational agility and competitive advantage. The information technology infrastructure – related questions are business – oriented so that a manager without
technical knowledge can answer those information technology infrastructures – related questions.

The researcher also received the participants’ e-mail addresses, along with other information such as the contact’s title in the company, and the company name through IRDA Web site.

3.8.7 Sampling Scheme

In a research based on survey it is not feasible to study a population and collect data, especially when it is very large, due to constraints like time, money, access etc., but a researcher has to collect data to conclude about research questions. A sample can be considered for the study using any of the sampling schemes available and the results can be used to infer about the population. Sampling is the process of choosing actual data sources from a larger set of possibilities. The very different goals of qualitative and quantitative research lead to equally different procedures for selecting data sources from a larger population. In practical terms, every research project has to consider which kinds of data sources will be eligible for the study, regardless of whether those data sources consist of people to be interviewed, sites to be observed, or texts and other media to be examined. Stating the eligibility criteria that determine whether a given data source is included in the total population is technically known as defining a sampling frame.

Random or Probability sampling scheme ensures equal chance of selection into sample for every unit in the population. In stratified random sampling the population is divided into homogeneous groups / strata based on a stratification factor. This results in minimum variance within a stratum and maximum variance between strata. Then simple random sampling is used to select sample units from each stratum.

Non – probability sampling does not adopt the theory of probability. Selection of the sample units depends upon the enumerator or researcher. Convenience sampling is a method of selecting easily available population units as sample units for study.
Purposive / Judgment sampling is the method in which units are selected based on a predetermined decisive factor. This involves the selection of units which are expected to be the most appropriate ones for the study.

3.8.8 Sample Design

In most if the cases of research studies, it becomes almost impossible to examine the entire universe; the only alternative thus, was to resort to sampling. The present study is also of the same nature. A sample is a part of the population which is studies in order to make inferences about the whole population. Thus, a good sample would be a miniature version of the population, which would involve the following:

- Sample Unit (Unit of Analysis)
- Sample Techniques and
- Sample Size

3.8.8.1 Sample Unit

The sample unit is the individual, group, or other entity that is selected for the survey. This is also known as the unit of analysis when the survey data are examined statistically. Since the major objectives of the present study was to analyze the importance of business intelligence on competitive advantage in life insurance companies in India, three life insurance companies of India (Life Insurance Corporation of India, ICICI Prudential Life Insurance Company, and SBI Life Insurance Company) had been considered as sample unit. The considering of three life insurance companies of India as sample units for this study was on the basis of their respective market shares.

One of the major purposes of the present study was to assess the managers, employees and experts views and preference towards business intelligence, information technology infrastructure, organizational agility, competitive advantage and environment turbulence of three life insurance companies in India in the state of Karnataka; therefore, managers, employees and experts of selected life insurance companies were also considered as sample unit.

Respondents belong to three districts from the Karnataka state (Bangalore, Mysore, and Mangalore) had been considered as sample unit. The life insurance
companies of India selected above as sample units for this study again on the basis of their respective market shares and their popularity among the people in the state of Karnataka.

**3.8.8.2 Sampling Techniques**

In the present study, the selection of the sample and the units of sample were made on the basis of non–probability sampling technique, viz, “Convenience” and “ Judgment” sampling techniques, respectively. The data were obtained from the managers, employees and experts within the organizations from 10 office branches from each three selected life insurance companies in Karnataka State of India through appropriate questionnaires and interviews.

**3.8.8.3 Sample Size**

Sample size means the number of sampling units selected from the population for the purpose of investigation. No doubt, sample size must be sufficiently large so that we can have a representative sample. But, money and time constraints tend to limit the size of sample. The population addressed under the present study consists of life insurance companies in state of Karnataka. The sample unit included three leading Life insurance companies (based upon market share and their popularity) viz, Life Insurance Corporation of India, ICICI Prudential Life Insurance Company, and SBI Life Insurance Company.

To achieve research objectives of present study, data were collected from 300 respondents includes managers, employees, and experts of selected life insurance companies. Exhibit No. 3.8.8.3.1 indicates the details of samples of respondents.

**Table 3.8.8.3.1**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of Insurance Company</th>
<th>Sample Quota</th>
<th>% of Sample Quota</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Life Insurance Corporation of India</td>
<td>100</td>
<td>33.3</td>
</tr>
<tr>
<td>2</td>
<td>ICICI Prudential Life Insurance Co. Ltd.</td>
<td>100</td>
<td>33.3</td>
</tr>
<tr>
<td>3</td>
<td>SBI Life Insurance Co. Ltd.</td>
<td>100</td>
<td>33.3</td>
</tr>
<tr>
<td>Total</td>
<td>Three Companies</td>
<td>300</td>
<td>100</td>
</tr>
</tbody>
</table>
3.8.9 Data Collection – Source & Method

In research process, the result will be good if the data put in is good. If poor and unrelated data are collected, naturally poor and misleading conclusion will be drawn. Therefore, due consideration should be given to the type and method of data collection. There are two types of data: primary data and secondary data. Since the scope of the study was really very vast, both types of data have been collected.

Primary data was collected through the well-structured comprehensive questionnaire and interview. Set of questionnaire was prepared which have been given in Appendix.

This study used the existing survey instrument whenever it is possible since the existing measurement scales were examined according to well-recognized and standard scale development procedure. Moreover, the high reliability and validity of an instrument are essential for a high-quality survey instrument.

All instruments for other constructs used in this study were adapted from existing instruments. For the new instrument developed in this study, the researcher followed the same procedure of existing instruments. The researcher developed the instrument for the business intelligence system construct. The questionnaire was prepared in the two phases. In the first phase, unstructured in-depth interviews were conducted to create initial questionnaire. Further, expert opinions on the questionnaires were collected supported by extensive literature review of similar studies and improvements were made to the questionnaires. This necessitated some changes in the final version of the questionnaire. In the second phase, a pilot survey was also conducted with 30 employees of three each life insurance companies (Life Insurance Corporation of India, ICICI Prudential Life Insurance Company, and SBI Life Insurance Company) to evaluate how well the questionnaire was understood, and also to test alternative wordings of questions, alternative response options and determining whether some other response should be provided.

During the interview process, some weaknesses in the design were also found. Some of the respondents had reservations about some questions in the initial questionnaire, due to the sensitive nature of topic addressed. The survey also helped the researcher in rewording and restructuring the questionnaire. The validation of the questionnaire was done by the feedback from the academicians, practitioners and by the issues identified by relevant literature. Finally, the structured questionnaire was prepared and the survey was conducted by explaining the purpose of the research to the respondents.
The present study analysis was also based on the secondary data, which were collected from various international and national journals of repute, annual reports of various Government institutions of India like IRDA, RBI etc., text books, magazines of repute, annual reports of selected life insurance companies, annual reports of various financial institutions and commercial and social associations like CII, FICCI, Gartner, Oxford’s Economic survey etc. For this purpose researcher explored many libraries of various universities. Online libraries, Internet and online database were highly used for the purpose of data collection. Some important information was also compiled from the different international and national newspapers. The data collection period was eight months and the researcher went to respondents offices on Tuesdays and Fridays at local noon time to improve the response rate.

The questionnaire prepared for the purpose of data collection was distributed to more than six hundred respondents based on their willingness and were collected back after some time. In some cases where the respondent was unable to read and write, the researcher noted down the data (interview administered) depending upon the response. Some responses were also collected through e – mail. A total of 423 filled – in questionnaires were received of which 123 were incomplete in some respect and were discarded. Finally 300 responses were considered for the analysis.

### 3.9 Statistical Techniques Used

The primary data collected from the respondents were tabulated and analyzed using the Statistical Package for Social Sciences (SPSS) 16.0 version. Descriptive statistics were used to understand the characteristics of the respondents. The statistical tools were used in analyzing the data. For example, the Spearman Test was used to examine the relationships between variables, the Mann – Whitney U Test was used to assess the differences between the averages achieved from two companies, and also the Kruskal Wallis Test was used for assessing the comparisons between the three companies. Regression analysis was used to understand the effects of business intelligence and information technology infrastructure on competitive advantage by helping of organizational agility.

Reliability of the scale used in the study was tested using the Cronbach’s alpha for the scale and also for the constructs considered in the study. The validity of the construct was tested using the bivariate correlations among the constructs.