CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

Research methodology is the systematic way of solving the research problem. It is a science of studying how research is conducted scientifically. According to Holme et al. (1997), methods are a tool that can help to solve problems and reach new knowledge. There are several types of research methodology depending on the area of work and type of experiment and analysis required such as experimental research, observation research, specialized research, survey research, single-subject research, and so on. According to Bordens and Abbott (2008), each of the type represents different way of collecting and analyzing empirical evidence by following its logic.

In order to meet the objectives of this research a number of sub objectives and correlated factors have been selected for the purpose. The factors relevant for designing such a model were gathered from a number of conference proceedings, past reviews research papers, records of selected organizations, etc. Some of the factors surfaced after detailed discussions with IT practitioners and randomly selected respondents working at three different levels of the management in the organizations. To test the validity of a model primary data were collected using questionnaire-cum-interview method and was analyzed using statistical method.

Research Methodology for this research used was “survey research” due to its suitability to the research objectives. In addition, survey undertaken was done in two
modes during the course of this research i.e. survey questionnaires and interviews. In this work different methods of testing for validating the different perspective of the proposed model have been used.

3.2 Research Methods Used

The study has been carried out with a view to identify the various gaps existing in the present business model for small and medium enterprises and to fill the identified gap with this present work. The proposed model would be helpful in rectifying the shortcomings of the existing system. The study of the critical factors may help the organizations to use and implement the SOA system effectively within the organization.

Following methodologies are used at different phases during designing and implementation of proposed model. ‘Survey Research’ is at the core of each method used. Methodologies used are as follows:

- Interviews
- Survey Questionnaires
- Goal Question Metric Method
- Hypothesis
- Fuzzy Inference System
- Fuzzy TOPSIS
- Factor Rating
- Comparative Study
The present study is exploratory as well as descriptive in nature. It identifies 14 factors contributing towards the success and failure of proposed model. It provides an insight to develop an overall model for implication purpose.

3.2.1 Interviews

There are four types of interview structure: unstructured, structured, semi-structured and group interviews. “If the goal is to gain an overall impression of a subject, then an informal, unstructured interview is often the best approach. However, if the goal is to get feedback about a specific issue/model then structured interview is considered to be best method” (Preece et al., 2002).

As aim was to get both the overall understanding of the information system of enterprise and along with the perceived benefits and drawbacks related to them, hence, the most appropriate method is to conduct semi-structured interview. Researchers followed a Kvale (1996) method of conducting interviews that comprises of seven stages i.e. thematizing, designing, interviewing, transcribing, analyzing, verifying and reporting. Out of the seven steps, five steps were opted to validate the study (Figure 3.1), which includes:

Thematizing - formulating the purpose of an investigation and describe the concept of topic to be investigated before the interview starts.

Designing- plans the design of the study keeping in mind all the stages of investigation before the interview starts.

Interviewing- conduct the interview based on an interview guide.
Analyzing - choosing the appropriate method for analysis based on purpose and topic of investigation and the nature of interview material.

Verifying - ascertain the generalizability, reliability and validity of interview findings

Kvale (1996) described that crucial point of interviews is the formulation of the question, so one could get the correct information to come to a conclusion. Otherwise one would have got biased in the answers, and would have been inaccurate for the study. Hence, all types of questions were used in semi-structured interviews to get correct information in order to make appropriate conclusions.

3.2.2 Survey Questionnaire

In this research, survey questionnaire is chosen as the core methodology for data gathering and analysis. Because of the internet and technology today, not only collecting data through this method provides the most economic way of data collection in term of transportation but also result in reduced time. In general, survey questionnaire could potentially receive high respond rates from private networks due to ease of answering, editing and analysis.
The respondents were selected irrespective of their gender from the top, middle and lower level of management. The questionnaire covers dimensions of SOA implementation at Indian SMEs. To develop an effective SOA system, the various lifecycle phases like planning, implementation, stabilization, continuous updation, and performance were taken into account. The factors were identified and included in the questionnaire on the basis of literature and discussions with the IT system analysts, system developer management, user management, and business analysts.

Three sets of questionnaires, i.e., Set I, Set II and Set III were developed. The questionnaire prepared can be categorized into 3 sets as follows:

Set I- SOA design and implementation: Risk and Hindrance Factors
Set II -SOA system Implementation factors
Set III - Impact of SOA system implementation on business

The questionnaires are shown in appendix. A number of factors were identified and considered for the relevant study.

Structured evaluation questionnaires were used to record the difference in the companies undertaken. Questionnaire design was based on the literature study and exhaustive discussions with users and non-users of SOA systems. During pretesting of questionnaire the questions came as feedback and then these were incorporated in final form of the questionnaire. Finally, the structured questionnaire was floated in some of the companies. Self-structured close-ended questionnaire was used to collect primary data. A five-point likert scale was designed with each statement on usage of service based systems having five alternatives to choose from designed in the manner given below
• Value 5 represents **Very High**
• Value 4 represents **High**
• Value 3 represents **Moderate**
• Value 2 represents **Low**
• Value 1 represents **Very Low**

The Likert scale is relatively easy to construct compared to other scales. The process is to collect the large number of statements that meet two criteria:

i. To identify the relevance of the attribute being studied

ii. To identify the favorable and unfavorable position of that attribute.

Respondents were asked to give the level of their agreement to the usage of SOA systems. The pilot testing was done on 30 respondents in totality at three levels in different companies. Later final questionnaire was given to 245 respondents but actual response came from 198 respondents which included 36 from Top management, 105 from Middle level, and 57 from Lower level.

### 3.2.3 GQM (Goal Question Metric) Method

For designing questionnaire and metrics we adopt a method from Van Latum (1998). The method works in three stages. At first stage organizational goals are identified in context of business strategies. In second stage questions are raised that comply with the goal identified in first stage. The answers to these questions help to understand the critical factors and risks that may be associated in achieving business objectives. In third stage, metrics are designed to evaluate the model (Figure 3.2- source Van Latum, 1998).
In this study the last stage come up with the set of metrics which are capable to evaluate the proposed model. The designed metrics (questionnaire) was based on proposed model and then the responses were taken from industry persons. To evaluate it, average response was calculated. The industry people were asked to answer on 5 point scale, where each point has following significance.

- **Value 1** represents **Weak** support
- **Value 2** represents **Minimum** support
- **Value 3** represents **Average** support
- **Value 4** represents **Good** support
- **Value 5** represents **Strong** support

![Figure 3.2 Sample GQM Abstraction Sheet](image)
3.2.4 **Hypothesis Method**

In this research, a hypothesis is proposed to evaluate the acceptability of the proposed model. A hypothesis is a tentative statement about the relationship between two or more variables. A hypothesis is a specific, testable prediction about what you expect to happen in your study. Hypothesis predicts what the researchers expect to see, the goal of research is to determine whether this guess is right or wrong.

**Hypothesis:**

“Proposed Integrated SOA Model is more efficient in terms of cost and adaptability than traditional ERP systems”

- *T- Test* is used to test the hypothesis that the two independent samples come from same normal population

3.2.5 **Fuzzy Inference System (for reliability estimation)**

This research also proposed a fuzzy model of SOA reliability based on the effects of ad hoc requirements, dynamic binding, agility, migration, legacy system integration, and business & IT integration. So far, most of the research on software reliability engineering focused on system testing and system-level reliability growth models. Approach for the reliability analysis of evolving software systems is well-illustrated in Musa work (2004). Significant work done in the direction of reliability estimation of SOA systems is summarized in chapter 2 (Table 2.5).

Though the reliability of SOA systems cannot be completely estimated, it can be estimated to a larger extent by analyzing the SOA characteristics and identifying the corresponding requirements. Thorough study in this work has been done to identify the
characteristics and defined corresponding requirements. Firstly, fuzzy inference system is used and defined it for the fuzzy logic toolbox for estimating the reliability of the system based on some factors. Next, an adaptive neuro-fuzzy inference system for more reliable estimation is used. The process and algorithm is discussed in detail in chapter 6.

3.2.6 Fuzzy TOPSIS Method (for optimal service composition)

Technique for Order Performance by Similarity to Ideal Solution (TOPSIS) is a well-known method for classical Multi Criteria Decision Making (MCDM) problems; many researchers have applied TOPSIS to solve fuzzy multi criteria decision making (FMCDM) and fuzzy multi criteria group decision making (FMCGDM) problems in the past with different approaches (Wang et al., 2007).

So far, the diverse techniques have been presented based on different points of view for performing service composition. Approach used in this research to perform selection of optimal service composition is taken from the algorithm proposed by Mehdi et al. (2012).

Services are core components of any SOA based application, we need service composition to answer different request. There may be a number of service compositions to get the requested task and optimal composition of these services dynamically during runtime has always been an important factor of its success. SOA allow service brokers to execute business processes composed of loosely-coupled services offered by a multitude of service providers, and has been regarded as the main pragmatic solution for distributed environments. In such systems, each service may response the user request independently, however, many times we need service
composition to answer different request and there may be a number of compositions possible to get the requested task done. Hence, it is important to find one composition which is best based on certain user preferences or criteria.

To identify one among the available alternatives composition, an optimal composition based on several criteria like functionality closeness, integration complexity, performance, execution time and task complexity have been selected. In this research a novel idea for service composition in SOA is also proposed. The proposed approach is based on fuzzy multiple criteria decision making and used the Technique for Order Performance by Similarity to Ideal Solution (TOPSIS) based on the concept of positive and negative ideal solutions to find the optimal composition of services in any service oriented architecture. The results obtained from experiment indicate the validity and efficiency of the proposed approach.

3.2.7 Factor Rating Method

In this method certain factors of adoption are identified on the basis of which decision has to be made that whether the proposed integrated model is efficient in comparison to traditional ERP or not. The factors were compared and analyzed on a scale of 3 in terms of difficulties that may face with the proposed model and traditional ERP systems.

- Value 1 represents **Low difficulty**
- Value 2 represents **Moderate difficulty**
- Value 3 represents **High difficulty**
The study of factor rating is discussed in Chapter 6 which demonstrates the different factors of adoption with their score and weighted score. Based on the factors and their weighted score, their graphical analysis has also been done and is shown in chapter 6.

3.3 Questionnaire

Survey questionnaire is mainly used to collect quantitative information about opinions or factual information based on the research objectives. It could be adapted by almost every research if not majorly then at least at initial phase of data for analysis and identification of problem definition. (Campbell et al., 1953)

3.3.1 Designing Questionnaire

Designing a good questionnaire requires a systematic step to undergo while preparing and including questions for it. The steps followed to construct a questionnaire survey are as follows:

- Define a clearly objective of the study.
- Identify a suitable title for a questionnaire
- Select the questionnaire format

3.3.1.1 Defining clear objective of study

According to Bordens and Abbott (2008), identifying a clearly defined objective will keep you to focus on the behavior or attitude chosen for study in the questionnaire. Further it is suggested to avoid too much focus in a single survey questionnaire that may
leads to difficulty and sometimes ambiguity in summarizing and analyzing collected data in the future. In this research, after a thorough and careful observation of problem under study, questionnaires form were prepared and designed to conduct the survey. Table 3.1 depicts the sample title and objectives of the survey questionnaire in this work.

<table>
<thead>
<tr>
<th>Title</th>
<th>SOA DESIGN and IMPLEMENTATION - RISK and HINDRANCE FACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obj. 1</td>
<td>To identify risk factors in SOA system implementation.</td>
</tr>
<tr>
<td>Obj. 2</td>
<td>To identify risk factors encountered with migration to SOA system.</td>
</tr>
<tr>
<td>Obj. 3</td>
<td>To identify risk factors in planning and requirement analysis.</td>
</tr>
<tr>
<td>Obj. 4</td>
<td>To identify risk factors in system design of SOA</td>
</tr>
<tr>
<td>Obj. 5</td>
<td>To collect opinion regarding operation and security implementation of SOA system.</td>
</tr>
<tr>
<td>Obj. 6</td>
<td>To get better understanding and opinion if other risk factors exists.</td>
</tr>
</tbody>
</table>

Each objective comprises of set of questions which target to fulfill particular objective. It is important that before the respondents start to answer the questions, research objective is clearly explained to them. In this survey the respondents are expected to provide their experience and views on risk & hindrance factors that are expected during designing and implementation of SOA system in organizations.

3.3.1.2 Identify a suitable title for a questionnaire
It has been suggested by many researchers that it is always good to keep the title of your questionnaire more relevant and as close to area under study for which questionnaire has been designed. It is strongly believed that questionnaire title gives the first impression of your work and respondent who is filing the questionnaire would be able to understand the purpose of study.

3.3.1.3 Selecting the questionnaire format

Three types of questionnaire items were used in the questionnaire survey. Questionnaire forms were divided into sections, where each section may cover different type of questions.

- Open-ended item - allow respondents to answer the questions based on their own explanation without being restricted by a fixed set of possible responses.
- Partially open-ended item - usually includes partially open-ended questions that used to overcome the limitation of the open-ended and closed-ended questions.
- Restricted item (closed-ended item) -these types limit the respondents’ answers to a fixed set of possible responses. Questions include multiple choice questions, yes/no questions, scaled questions (rate from scale 1 to 5 for example), and so on.

3.3.2 Distribution of Question Type in the Questionnaire

Questions within the questionnaire were distributed in different sections based on the particular aspect of the objective defined. For ex. section ‘A’ used to gather respondents’ particulars such as job title, company, location, etc. It also ensures that the questionnaire responses were captured from different, position levels, areas, nature of
business and companies. Section ‘B’ may provide more basic questions that are easier to be answered. This is particularly aimed to make the survey participants comfortable with the questionnaire so that the remainder of the questions will not to be difficult to them. Likewise section ‘C’ may focus on the detailed levels of system. In general the final section of questionnaire allows respondents to give their opinions in open ended format. They are encouraged and provide flexibility to elaborate their answers. This is very helpful in analyzing and understanding the other dimensions of problem under study. Table 3.2 shows distribution of different format questions into sections.

Table 3.2 Sample Distribution of Question Type in the Questionnaire

<table>
<thead>
<tr>
<th>Section</th>
<th>Open Ended</th>
<th>Close Ended</th>
<th>Partially open Ended</th>
<th>Total Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>9</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>C</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
</tbody>
</table>

3.3.3 Conduct of Survey – Questionnaire Administration

Once we complete the initial study and ready with questionnaire, the next step is to determine the target respondents for the data collection and most importantly to determine how to administer it. To achieve this, few methods were used to distribute the questionnaire to the participant volunteers and get the responses from them. The methods include:

- Distributing the questionnaire in hardcopy
Online survey and
Electronic mail surveys

Before the invention of internet technology first method was the only way to collect data from respondents. After the invention of World Wide Web (WWW), now it becomes very easy to reach your target respondent. For survey questionnaire, online survey is assumed to be the best method. The significant advantages to using online survey include that the data can be collected easily and quickly, questionnaire was created electronically and posted on the Internet through online survey service providers like FreeOnlineSurveys.com, SurveyMonkey.com, GoogleDocs.com etc.

In this research, Google based docs.google.com was used for survey. Through the given URLs, the 198 participants from different companies working in different profiles were invited to answer the questions by visiting the specified URL which was created for this purpose.

The auto generated URL created by docs.google.com is:

- https://docs.google.com/forms/d/1k_p34EmXrbPfN-LKA0VrMyn3r-gTumfDrvRx2tFrAU/viewform
- https://docs.google.com/forms/d/1V0jYsQi0HtFmE184MR7W3NncWpwm0w80fusLQmLGpqc/viewform
- https://docs.google.com/forms/d/1BnaCVbayplcFDmXXITvL_S543O1eDmYEB950TsXEldo/viewform

Another method to administer the questionnaire is through electronic mail survey. This method is little restrictive in nature as it involved selective respondents to participate. In this method questionnaire form will be emailed to the selected
participants. One of the drawbacks of this method is that many of the email had move into junk mail automatically and this reduce the response rate from the receivers. It is always good to attach a letter of introduction, definition and explanation of the survey with the email containing questionnaire. Finally, follow up mailings with additional words of encouragement to participate were also sent out to the target respondents.

3.4 Data Collection

In this work, data is collected from two sources

i. Secondary data collection (through literature survey)

ii. Primary data collection (conducting interview and survey questionnaires from persons working in the SOA domain)

3.4.1 Secondary Data Collection

Secondary data was collected through magazines, internet, journals, and research articles on the subject. The study has been focused on reputed journals and websites of computer science, information technology and information systems covering research articles on service oriented computing, service oriented architecture and issues related to SOA. The survey is limited to time frame from year 2000 to year 20011. This period is divided into three blocks to better analyze their growth and compare certain factors. The articles were searched with search term SOA implementation issues, SOA research etc. After filtering from total 200 papers, 95 articles and paper were identified that are relevant for this study.
It is identified through literature survey that SOA is evolving as organization are moving from their legacy systems to SOA environment, it is further identified that this growth is further expected to grow for the benefits that SOA provides and ad-hoc nature it provides to changing needs of business.

To analyze the collected data, it has been into theoretical studies and empirical studies. Theoretical studies are further split into illustrative, conceptual and applied concepts. Conceptual studies describe structure, models or theories and provide explanation or reasons. Illustrative studies, basically try to guide the practice, offer recommendations for actions and explain action to be fulfilled whereas applied concept studies are a mixture of both conceptual and illustrative studies. They are mainly based on ideas, structures and speculations rather than on the systematic and direct observation of reality. Empirical studies have been divided into case studies and field studies.

### 3.4.2 Primary Data Collection

The primary data was collected by administering the questionnaire to participating respondents. Five-point scale rating was taken from the respondents by asking them to put a tick at one of the five-boxes. Respondents from the organizations who agreed to spend time were invited for partially structured discussion. Some of the respondents were interviewed to gain understanding of SOA system in the organizations.

The study adopted a descriptive type of research in which data was collected from various sources and analyzed to come up with conclusion. Primary data was
collected by visiting industry person, communicating face to face, conducting telephonic interviews, mailing metrics designed through GQM and getting online responses through a questionnaire uploaded on internet using googledocs.com.

For this research, companies with 10 to 150 employees in the NCR region were focused. The companies that were selected for the survey are from various sectors such as manufacturing of automotive components, polymer items, electrical and power equipment’s, IT, industrial items, companies involved in turnkey projects. The geographical regions that were covered in this study include SMEs located in the Delhi NCR region Sahibabad industrial area in Ghaziabad, Faridabad and Noida. A sample of questions formulated for an interview can be found in appendix.

3.5 **Pilot Test**

It is the process to evaluate the validity of the questionnaire, or piloting the questionnaire. According to Bordens and Abbott (2008), this is an acid test as to whether or not the instrument that has been designed is comprehensive, clear, understandable, and complete with respect to what it purports to measure.

To conduct the test, thirty of the survey participants were invited to participate in pilot test for the designed questionnaire. The question in the test is designed to fulfill the following objectives.

- To determine whether the survey question is relevant, easy to read and understandable.
- Question do not contain any ambiguity and restricted type question have only one obvious answer
To guarantee that the question directly links to the problem in study and is meaningful.

To test whether the question is too general in nature that causes the respondent difficult to answer.

Besides these objectives pilot test were done to assess the quality of the questionnaire, such as:

- Time taken to complete the questionnaire.
- Reactions of the respondent regarding instructions, definition of terms, content, and language.
- Whether response scale provide enough choices for responses.
- Any other opinions, comments, issues, suggestions or concerns.

### 3.5.1 Period of the Study

Primary data was collected from December 2010 to July 2013.

### 3.5.2 Sample Scheme

The respondents had been identified from various levels/business functions in each organization such as top management, IS management, functional heads, IT staff and users. Respondents were asked to give the level of their agreement to the usage of SOA systems. The pilot testing was done on 30 respondents in totality at three levels in different companies. Later final questionnaire was given to 245 respondents but actual response came from 198 respondents which included 36 from top management, 105
from middle level, and 57 from lower level. The division of each level that took participation in our research is shown in the following graph.

![Sample Distribution](image)

**Figure 3.3 Sample Distributions among Different Levels**

The primary data was collected through the questionnaire-cum interview method. It has been observed that increase in sample size will affect the results only marginally, whereas effort for it will be considerable. The sample size from a stratum had been determined on the basis of the following criteria:

- 100% of the population where sample size < 20
- 75% of the population where sample size >20

Tables 3.3 and Figure 3.4 shows the details of the sampling plan and its corresponding graph among different levels and different companies respectively.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Management Level</th>
<th>Population</th>
<th>Sample</th>
<th>Actual Response</th>
<th>% of respondent size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Top Level</td>
<td>68</td>
<td>49</td>
<td>36</td>
<td>72 %</td>
</tr>
<tr>
<td>2</td>
<td>Middle Level</td>
<td>163</td>
<td>120</td>
<td>105</td>
<td>87.5 %</td>
</tr>
<tr>
<td>3</td>
<td>Lower Level</td>
<td>105</td>
<td>76</td>
<td>57</td>
<td>76 %</td>
</tr>
</tbody>
</table>
3.6 Small and Medium Enterprises in India

Today, Small & Medium Enterprises (SMEs) industry occupies a position of strategic importance in the Indian economic structure due to its significant contribution in terms of output, exports and employment. The small scale industry accounts for 40% of gross industrial value addition and 50% of total manufacturing exports. More than 3.2 million units are spread all over the country producing about 8000 items, from very basic to highly sophisticated products. The SMEs are the biggest employment-providing sectors after agriculture, providing employment to 29.4 million people. However SMEs, which constitute more than 90% of total number of industrial enterprises, are now facing a tough competition from their global counterparts due to liberalization, change in manufacturing strategies, technological changes, and turbulent and uncertain market scenario.

The SMEs segment has lately come into the limelight, with increased focus from several government institutions, corporate bodies and banks, and is viewed as agents of growth. Shortage of studies, research thrust and limited expertise in the area of SOA keep the application of SOA in SMEs limited. A country like India whose major
economy is dependent on the small and medium enterprises is lacking behind due to unstructured information. Indian government promotes the growth in this sector. It is estimated that SMEs account for almost 90% of industrial units in India and 40% of value addition in the manufacturing sector. At the same time one has to understand the limitations of SMEs, which includes

- Low Capital base
- Concentration of functions in one / two persons
- Inadequate exposure to international environment
- Inability to face impact of WTO regime
- Inadequate contribution towards R & D
- Lack of professionalism

In spite of these limitations, the SMEs have made significant contribution towards technological development and exports. SMEs have been established in almost all-major sectors in the Indian industry such as:

- Food Processing
- Agricultural Inputs
- Chemicals & Pharmaceuticals
- Engineering; Electrical; Electronics
- Electro-medical equipment
- Textiles and Garments
- Leather and leather goods
- Meat products
• Bio-engineering
• Sports goods
• Plastics products
• Computer Software, etc.

India accorded high priority to small and medium enterprises from the very beginning and pursued support policies to make these enterprises viable and vibrant and over time, these have become major contributors to the GDP. Despite numerous protection and policy measures for the past so many years, SMEs have remained mostly small, technologically backward and lacking in competitiveness.

Indian SMEs are one of the most aggressive adopters of ERP Packages. In General, SMEs have limited funds and so their requirements are limited and have very small acute focus area. But, traditional ERP implementation products offer services that have larger focus area and always exceed their specifications in every way (including costs). This gap between the SMEs requirements and traditional ERP’s specifications need to be analyzed by the companies (traditional ERP providers) and the SMEs. Traditional ERP providers do not bring down their standards for the sake of the SMEs. Also it is not feasible for the latter to upgrade for the sake of the former. Compromise in either of the issues leads to direct monetary losses for either one party or both.

The study has been conducted to understand usage patterns and importance of alignment between IT and business processes in SMEs in India (Figure 3.5).
The SOA based model for integrating business values chain activities will concentrate on service discovery, service composition, and service granularity, defining Service Level Agreements (SLAs). To analyze the study various SMEs were interviewed in NCR region and has been found that SMEs are bound with certain limitations, most important among which is low budget. Other limitation found by M. Sharma et.al (2010) are low capital base, inadequate exposure to international environment concentration of functions in one / two persons, inadequate contribution towards R & D. etc.

3.7 Chapter Summary

The study adopted a descriptive type of research in which data was collected from various sources and analyzed to come up with conclusion. Primary data was collected by visiting industry person, communicating face to face, conducting telephonic
interviews, mailing metrics designed through GQM and getting online responses through a questionnaire uploaded on internet using googledocs.com

Some respondents were found to participate in the survey very eagerly; they willingly chose to fill the questionnaire themselves, cross checking the meaning whenever required. They found the questionnaire to be very simple and comprehensive. Most of the respondents considered it of utmost importance for them. However, some of the respondents in the survey were hesitant to participate. But overall response was satisfactory. Some of them gave verbal response, while others filled the questionnaire on their own. Many respondents expressed the need for more involvement of top management, more training and more interaction with IT staff at large.

Pre-testing of the questionnaire was done by taking thirty respondents which are expert in SOA domain in different organizations. The measures which give the feedback that the questionnaires are complete, relevant to the study and present scenario of the business. The content validity of the questionnaire was ascertained before actually taken input from the different peoples.

Various statistical and analytical techniques were used in this research at various phases to conclude results. The techniques used include interviews, survey questionnaire, GQM method, hypothesis, fuzzy inference system, fuzzy TOPSIS and factor rating method.
Chapter 3 References


