Chapter 4

Research Design and Methodology
4.0 Introduction

This chapter deals with the Design used in the Research and the Methodology adopted for research.

4.1 Research Design

Research Design is the framework for the compilation, measurement and examination of data; hence it is the conceptual frame by which the research is to be carried out. The present chapter describes the methodology of this research. It explains about pilot study, sampling process, survey methods, Data collection Instruments, procedures and tests for data analysis, limitations of the study.

4.2 Research Methodology

Initially, a literature survey was conducted on the effectiveness of information systems in travel industry from customer standpoint for obtaining a thorough view of previous studies in the particular subject and also to find out the important variables related to it. In addition, it helps to develop the theoretical framework. The literature from the published reports, books, articles, full text from National and International journals were the major secondary sources of data. Bibliographical databases, abstracts, documents from various websites were also utilized. Thus the literature survey helps to develop a framework for research questions designed for the study.

4.3 Objectives of the study

Based on the information gathered from the secondary data, it was decided to study the effectiveness of information systems in the travel industry from the customer perspective. The target respondents are the travellers who use online reservations for their travel need and the travel agents who use the travel reservation systems for travel reservations of their customers. The study aims to discover the underlying motives, desires, and experiences of travellers on online travel reservation system in terms of quality by conducting in-depth interviews. The technological acceptance of
the travel reservation systems are also assessed from the perspectives of travel agents. Those experiences can also be expressed in terms of quantity by an extensive survey. At this point the research methodology contains a combination of qualitative and quantitative forms of inquiry, also called as ‘Triangulation’ (Dawson, 2002).

The main objectives of the study are:

1. To evaluate the effectiveness of the existing information systems in the travel industry.
2. To check the efficiency levels at which the current online distribution systems operate and to check the effective utilization levels.
3. To check corrective measures need to be applied, if any, in the current operational scenario.
4. To assess whether existing technology/technological developments, actually cater to the growth expected in future.
5. To understand the gaps that exist in the current channels of distribution as well as the upcoming and expected channels especially when technological advancements happen at a rapid pace.
6. To understand and suggest the various strategies that need to be adopted by customers with major technological advancements in the travel industry.
7. To understand the importance and the role information systems play in the era of rapid technological advancements.
8. To check the efficacy and importance of the traditional information channel at a time when it poses threat from other media like web, mobile etc.
9. To check the competitiveness of the traditional channels with other mediums like mobile commerce and various information dissemination techniques.
10. To understand customer perspective on information systems - benefits sought by them against benefits received currently.
4.4 **Questionnaire**

A questionnaire was used as a device for collecting the data for research. Questionnaire is the best mode in a survey, when the researcher is familiar with the variables necessary to be measured in a big and dispersed sample size (Mischkind, 1986). In the beginning, a well defined objective is the pre requisite in designing a questionnaire and it involves a well defined plan before initiating the project. We have to look into significant points to be covered and ensure that stability is maintained. In a newly designed questionnaire it is very important to test the developed instruments for consistency and practicality (Saane, Sluiter, Verbeek, & Frings-Dresen, 2003). Thus, a questionnaire has to satisfy the scale fine tuning and validation.

4.5 **Reliability**

An evaluation of statistical reliability is necessary before further validation scrutiny. Reliability refers to degree of consistency or steadiness of a scale. Inaccurate scale will lack consistency of measuring the same item to the magnitude. There are methods to measure reliability and they are Test-retest technique, multiple forms, inter-rater, Split half reliability. During the present time, especially for field surveys, internal consistency is assessed by using Cronbach’s alpha. An alpha value of 0.70 or above is considered to be criterion for proving strong internal constancy, alpha value of 0.60 or above is cogitated to be significant (Cronbach & Meehl, 1994)

4.6 **Scale refinement and validation**

Validity is the most critical evaluation and indicates the degree to which instrument measures what it is believed to measure. It can also be considered as utility or the extent to which differences found with a measuring instrument reflects the true differences among those to be tested (Koeske, Kirk, Koeske, & Rauktis, 1994). Empirically validated scales can be used directly in the field for different programs. A scale for a construct is useful for application by different researchers in different studies only if it is statistically reliable and valid. Content validity, construct validity and face validity are the major types of validity (Berelson, 1952)
4.7 Different approaches to scale refinement and validation

This section discusses on the various approaches for the refinement of the scale and validation of data.

4.7.1 Content validity

Content validity is a Non statistical type of validity that involves “systematic examination of the test content to determine whether it covers a representative sample of the behaviour domain to be measured” or the extent to which a measuring instrument provides adequate coverage of the topic under study. If the instrument contains a representative sample of the universe, the content validity is good; its determination is mainly judgmental and intuitive (Shadish, Cook, & Campbell, 2002) It can also be determined by using a panel of persons who shall judge how well the measuring instruments meet the standard, but there is no numerical way to express it. Accordingly, the researcher consulted various experts and academic professionals in travel industry for this purpose and hence ensured that the questionnaire so prepared for the customer centric analysis of the effectiveness of information systems is measured with sufficient content validity.

4.7.2 Face validity

Face validity is an estimate, whether the test appears to measure a certain criterion, but it does not guarantee that the test actually measures phenomena in that domain and is very close to content validity. The content validity depends upon a theoretical basis for assuming a test that it is assessing all domains of a certain criterion, meanwhile face validity relates to whether the test appears to be a good measure (Haynes, Richard, & Kubany, 1995). This judgment is made on the face of the test, thus it can also be judged by the experts in the field.

4.7.3 Convergent validity

Convergent validity refers to the degree to which a measure is correlated with other measures that is theoretically predicted with and one of the approaches to the construct validity. Otherwise, it is estimated by comparing it to the measure of the
same concept developed through other methods to assess how well the items are together. This involves empirical and theoretical support for the interpretation of the construct (Bagozzi, Yi, & Philips, 1991). Constructs are theoretical or unobserved (e.g. latent variables or factors). Each item in the scale is treated as different approach to measure the construct. Accordingly, by using CFA each item in the scale is checked with the help of coefficient called bentler-bonett fit index (NNFI or TLI). A scale with TLI value of 0.9 or above is an indication of strong convergent validity. It has been observed that TLI values of each construct as well as overall TLI values are more than 0.90 and this indicates strong convergent validity of the instrument. (Siebert & Siebert, 2005)

4.7.4 Confirmatory Factor Analysis

In social research works, researchers should apply measures with good reliability and validity that are appropriate in diverse populations (Abbott, 2003). Development of psychometrically sound measures is an expensive and time consuming process, and CFA is one step in the development of process, because researchers often do not have the time or resources to develop a new measure, they have to use existing measures (Greeno, Hughes, Hayward, & Parker, 2007) However, while using existing measure, it is important to examine whether the measure is appropriate for the population included in the study. In these circumstances, CFA can be used to examine whether the original structure of the measure works fit in the population thus tests the specific aspect of validity (Harington, 2009) A fundamental feature of CFA is its hypothesis-driven nature.

In CFA, the researcher specifies the number of factors and the pattern of indicator factor loading in advance, thus the researcher must have a firm and prior sense, based on past evidence and theory of the factors that exists in the data. It is applied for four major purposes namely, psychometric evaluation of measures (questionnaires), construct validation, testing method effects and testing measurement in variance (across groups or population) (Brown, 2006). CFA focuses on the relationship between observed measures or indicators (eg. Test items, Test scores etc), and latent (unobserved) variables or factors, deals specifically with measurement models. Structural Equation Model (SEM) includes the structural model or casual path among
the latent variables. Thus it provides a quantitative method for testing substantive theories (Raykov & Marcoulides, 2006)

### 4.8 Models for the Research - The technology acceptance modelling (TAM)

Advances in computing and information technology are changing the way people meet and communicate. People can meet, talk, and work together outside traditional meeting and office spaces. For instance, with the introduction of software designed to help people schedule meetings and facilitate decision or learning processes, is weakening geographical constraints and changing interpersonal communication dynamics. Information technology is also dramatically affecting the way people teach and learn.

As new information technologies infiltrate workplaces, home, and classrooms, research on user acceptance of new technologies has started to receive much attention from professionals as well as academic researchers. Developers and software industries are beginning to realize that lack of user acceptance of technology can lead to loss of money and resources. In studying user acceptance and use of technology, the TAM is one of the most cited models. The Technology Acceptance Model (TAM) is an information systems theory that models how users come to accept and use a technology. The model suggests that when users are presented with a new software package, a number of factors influence their decision about how and when they will use it.

This study aims at examining the effectiveness of the information systems in the travel agents from a customer standpoint by adapting the technology acceptance model (TAM) (Davis, 1989). Accordingly, we use the structural equation modelling to develop the technology acceptance model in assessing the effectiveness of travel information systems.
4.9 Pilot study

A pilot study was conducted for testing the appropriateness of the research questions and methods adopted. The pilot study not only helps in selecting the appropriate data collection strategy but also helps to check whether random sampling was appropriate for the sampling technique. In addition, the significance about the questionnaires also tested through the pilot study. The pilot study was conducted with a pre designed questionnaire to 62 respondents from the travellers and 48 travel agents. On the basis of findings from the pilot study, the questionnaire is further refined and this refined questionnaire was used for the final data collection. The design of the questionnaire was carefully done keeping in mind, the variables under study. The key areas to be measured was identified and grouped under each heading.

The questionnaire was self developed in consultation with the supervisor and after discussions with Senior Managers in the Travel industry; it was closed in form made on the basis of 5 point Likert scale. Summated Scales or Likert type scales takes less time to construct and can be easily used in respondent-centered and stimulus-centered opinion research studies of this sort (Edwards & Kenney, 1946). Demographic questions were included in the beginning of the questionnaire, which is followed by wide-ranging points to the above mentioned variables.

The validity and accuracy of final judgment is most crucial and depends heavily on the extent to which data collected in the first place. The quality of data will greatly affect the conditions and hence very much importance must be given to this process and every possible precaution should be taken to ensure accuracy while collecting the data. One of the major problems in this path is sample size justification. Sample size calculation is concerned with how much data we require to make a correct decision on a particular research. More the data, more accurate would be the decision and there will be less error of the parameter estimate. This doesn’t necessarily mean that more is always best in sample size calculation. As a result, in the present study the researcher calculated the sample size using power analysis on the basis of information obtained from the pilot study. The power analysis gives that a sample of 393 or more from travellers and 97 from travel agents is adequate for the study (MacCallum, Browne, & Sugawara, 1996).
4.10 Survey

The study has been done from a large sample of travellers and travel agents who use travel information systems, in a particular time period of six months, it is essentially cross-sectional. Moreover, the variables that exist were selected, observed, recorded, and analyzed. So, survey method is the best approach for a quantitative research, with the help of a structured questionnaire. It helps to understand the possible relationships between the data and the unknowns in the universe (Ernest, 1978)

4.11 Universe and Sample

The universe selected for this research is the state of Kerala. Selection is based on various factors as defined in Chapter 3.

The sample size was determined as 393 from travellers and 97 for travel agency customers based on power analysis and the actual responses received were 419 from the travellers and 118 from the travel agents. The sample was derived based on the understanding of the respondents. Since the travel agents are familiar with the tools they work on a regular basis, the data collected from them is prone to be more accurate while the sample size of the travellers determined at a higher amount since the error can be expected at a higher rate due to ignorance of certain aspects.

4.12 Data preparation for analysis

The data collected has been processed and analyzed by various methods. “As data are collected, they should be examined for completeness, comprehensibility, consistency and reliability.” (Selltiz, 1959)

4.12.1 Data Editing

The collected questionnaire were checked for its completeness and edited as required. Since most of the questionnaire were collected personally by the researcher, it was possible to check and edit the questionnaire in front of the respondents, when required. But in the case of indirect questionnaire collection approach, data was editable in a limited way, since all the respondents were not contactable again.
4.12.2 Coding

Once the editing of data was completed, next stage was the coding of the responses. Each item in the questionnaire was given unique code using number. For example, items in the questionnaire 1 are coded as 1 for ‘Strongly Agree’, 2 for ‘Agree’, 3 for ‘No opinion’, 4 for ‘Disagree’ and 5 for ‘Strongly Disagree’. The demographic responses like experience, category, age etc were also coded using numbers. The responses were then keyed to a SPSS program.

4.13 Data analysis method

The method used in the study is exploratory as it utilizes scoring of the variables. The collected data contains both the qualitative and quantitative data. Accordingly, the study uses both qualitative and quantitative techniques for the analysis of data. The statistical analysis comprised of two stages. The first stage examined the descriptive statistics of the measurement items and assessed the reliability and validity of the measure applied in this study. The second stage tested the proposed research model and this involves assessing the contributions and significance of the manifest variables path coefficients (Grimm & Yarnold, 2000).

The computer program, Statistical Package for the Social Sciences (SPSS version 20) is used to analyze the data. In the case of the ranking questions, the researcher has adopted the weighted average techniques with values starting from the highest possible rank to the lowest and weight as the number of respondents. The weighted mean is calculated for each category and ranks are assigned on the basis of the values of the weighted mean. The mean, standard deviation, percentage and frequencies were first calculated to get the initial reaction of the respondents to each item in the questionnaire. Thus all the items were analyzed using descriptive statistics.

One sample Z test was used to investigate the level of effectiveness of information systems. To explore the significant difference in response, an independent Z-test was utilized. ANOVA test was applied to find out any difference in responses caused by demographic variables. The acceptable level of significance was P<.05.
Confirmatory factor analysis was used to explore the relationships between independent and moderating variables and to describe the construct of the theoretical framework. This was done using the software AMOS 7 (Arbuckle, 2006a). In the confirmatory factor analysis, first a theoretically supported model was developed for each factor, a path diagram of casual relationships was constructed and, the parameter estimated in the model were examined based on the goodness of fit measures available in AMOS output (Byrne, 2001).

By using Structural Equation Modelling (SEM), it is a common practice to use a variety of indices to measure the model fit. In addition to the ratio of the $\chi^2$ statistic to its degree of freedom, with a value less than 5 indicating acceptable fit, researchers recommended a handful of fit indices to assess model fit (Kline, 2005). These are the Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Normed Fit Index (NFI), Standardized Root Mean Residual (SRMR), and the Comparative Fit Index (CFI). According to the usual procedures, the goodness of fit is assessed by checking the statistical and substantive validity of estimates (i.e. no estimates lie out of the admissible range, as the case for negative variances or correlations larger than one and, no estimates lack a theoretical interpretation, as the case for estimates of unexpected sign), the convergence of the estimation procedure, the empirical identification of the model, the statistical significance of the parameters, and the goodness of fit to the covariance matrix. Since complex models are inevitably misspecified to a certain extent, the standard $\chi^2$ test of the hypothesis is perfect fit to the population covariance matrix is given less importance than measures of the degree of approximation between the model and the population covariance matrix. The root mean squared error of approximation (RMSEA) is selected as such a measure (Gignac, 2006).

The measures of “goodness of fit” followed in this research are,

**Absolute fit measures**

Likelihood ratio Chi-square statistic (p): usually greater than 0.05 or 0.01 is the level of acceptable fit.

Goodness of fit index (GFI): higher values closure to 1.0, indicates better fit.
Root mean square error of approximation (RMSEA): values ranging from .05 to 0.08 are acceptable.

Root mean square residual: smaller values are better.

*Incremental fit measures*

Tuker-Lewis Index (TLI): A recommended value of TLI is 0.09 or greater. The value closure to 1.0 indicates perfect fit.

Normal fit Index (NFI): A recommended value of NFI is 0.09 or greater. The value closure to 1.0 indicates perfect fit.

Adjusted goodness-of-fit index (AGFI): A recommended value of AGFI is 0.09 or greater. The value closure to 1.0 indicates perfect fit.

*Parsimonious fit measures*

Normal Chi-square (CMIN/DF): Lower limit 1.0 and upper limit 2.0/3.0

Parsimonious goodness-of-fit index (PGFI): the value closure to 1.0 indicates perfect fit (Thompson, 2004)

Considering the above values, a conclusion was reached about the final model of each factor and their relationships. Correlation was then exercised to explore the relationships among the factors of independent and moderating variables. Moreover, multiple regressions were applied to investigate the association between independent and moderating factors (Cohen, Cohen, West, & Aiken, 2003)

### 4.13.1 Coefficient of variation

The coefficient of variation (CV) is the most commonly used technique particularly in studies like this to compare the variability of two or more than two series of their relative variation. The series, for which the coefficient of variation is greater, is said to be more variable or conversely less consistent, less uniform, less stable or less homogeneous. The formula for calculating correlation coefficient is;

\[
C.V = \frac{\text{Standard deviation} \times 100}{\text{Mean}}
\]
4.13.2 Mean percentage Score

To identify the level of satisfaction of the variables we use the Mean percentage score, which is calculated using the formula:

\[
MPS = \frac{\text{Mean score of the variable} \times 100}{\text{Maximum possible score}}
\]

4.13.3 Tests

Chi square- test of Independence, T-test, Z test and One way ANOVA

To test the hypothesis, that two attributes are associated or not, the Chi-square test for independence has been applied. Chi-square is measured as

\[
\chi^2 = \sum \frac{(O-E)^2}{E},
\]

where \(O\) refers to the observed frequencies and \(E\) for the expected frequencies (the ratio of the product of the row total and column total to the grand total).

4.13.3.1 One Sample Z-Test

One sample Z- Test is a statistical procedure used to examine the mean difference between the sample and the known value of the population mean. In one sample t-test, the population mean is known.

\[
Z = \frac{(\bar{x} - \mu_0)\sqrt{n}}{s}
\]

4.13.3.2 Two Sample Z- test

The Independent-Samples Z Test procedure compares means for two groups of cases. Ideally, for this test, the subjects should be randomly assigned to two groups, so that any difference in response is due to the treatment (or lack of treatment) and not to other factors.

The test Statistics is

\[
Z = \frac{(\bar{x}_1 - \bar{x}_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}
\]
4.13.3.3 One-Way ANOVA

The One-Way ANOVA procedure produces a one-way analysis of variance for a quantitative dependent variable by a single factor (independent) variable. Analysis of variance is used to test the hypothesis that several means are equal. This technique is an extension of the two-sample t test. Besides, for determining that differences exist among the means, researcher wants to know which means differ. For this purpose, a post hoc test (multiple regression) was adopted. Contrasts are tests set up before running the experiment and post hoc tests are run after the experiment (Mac Callum, 2003)
4.14 Framework of research study

Figure 4.12

Framework of the research study

- RESEARCH OBJECTIVES
  - Survey of literature
  - Preliminary analysis, Pilot study
  - Determine parameters of Survey
  - Questionnaire design
  - Survey
  - Descriptive Analysis Modelling
  - Interpretation of Result
  - Conclusion and Suggestion