Methods and Materials

3.1 Overview

The term methodology is the system of methods used in the field of study. The evaluation of the assertion of knowledge in a research field, based on explicit rules and procedures can be termed as the methodology of a study (Ojo, 2009). This research is founded in the building of an e-commerce model to market Udupi jasmine. Empirical research is required along with the literature review to be able to achieve the research objective. The conceptual model for the study was built based on the literature review undertaken as explained in chapter 2. This chapter on research methodology includes various steps that are adopted in studying the research problem along with the logic behind them. The research study is based on a three-stage research design. In the first stage, research is focused to understand the working of the jasmine community-based enterprise along with the roles of various actors involved. This includes the study of ICT awareness and socio-economic impact of growing jasmine among growers. It also includes the study of ICT awareness and willingness to adopt ICT among agents. Price analysis is done to determine the factors affecting variations in jasmine price. In the course of study, various determinants that affect the jasmine trade will also be identified. In the second stage, an e-commerce model to market Udupi jasmine is proposed based on the various information collected during the first stage of the study. The third stage is the validation of the model using TAM.

The research was carried out using both quantitative and qualitative approach. For quantitative approach, survey tool was used as the research instrument and for qualitative approach research instrument used was focus-group discussions, personal interviews, expert opinion and literature review. The chapter begins with the research design and the process followed to undertake the research, followed by the techniques
used for sampling. The chapter continues with the methods used for data collection, measurement of the data and data analysis. While the reliability of the findings is crucial, the study ensures the integration of this aspect in the methodology of the study. With the aim of accomplishing the research objectives, this chapter focuses on the research techniques adopted and employed for the purpose of this study. Various constructs that are applicable for the study are also described in this chapter.

3.2 Research Design and process

Research design is a blueprint or a detailed plan of how a research study is done. It involves the operationalising of variables of research interest so that the variables can be measured, selecting a sample of study, collecting data to be used as a basis for testing the hypothesis, and analysing the results (Thyer & Holosko, 2016). The research design is described in Figure 3.1 respectively.

![Figure 3.1: Research Design.](image-url)
The purpose of the study is to develop an e-commerce model for marketing Udupi jasmine. This is achieved through both Exploratory Research Design (qualitative) and Descriptive Research Design (quantitative). One of the limitations of the quantitative approach is that the inferences made are through statistical data, which provides only brief prudent outline of important patterns. Hence a combination approach is used as it provides an in-depth view of the subject that is under research. The review of literature focused group discussion and expert opinion aided in the crystallisation of the objectives, development of the questionnaire and provide various inputs necessary for the development of the model. The descriptive study helped in analysis of various parameters that were collected during the exploratory research and validation of the proposed model. The research process is described in Figure 3.2 respectively.

Figure 3.2: Research Process.
3.3 Exploratory Research Design

The goal of exploratory research is to formulate research problems more precisely, concept clarification, obtaining insights, removing of impractical ideas, explanation gathering and formation of hypotheses. Generally, to carry out exploratory research literature review, focus group discussions and case studies are used. Exploratory research focuses on multiple methods and while using a naturalistic approach it provides a concise explanation to the subject matter (Denzin & Lincoln, 2011). While accessing the phenomenon to ask relevant questions, seek new insights, understand what is happening is an integral and valuable part of exploratory research (Yin, 2003).

The exploratory design is the simplest form of design and is loosely structured. It is conducted at the preliminary stage of research to explore and confirm the existence of research problem. Exploratory Design is used in the study of jasmine trade and the interaction of various actors involved, in Udupi jasmine growing regions of Shankarapura and surrounding villages of Udupi district. Individual jasmine growers, in the jasmine growing regions, were contacted on a regular basis to understand the working of the community-based enterprise and marketing techniques used. Similarly, agents and traders were also contacted to understand their techniques and process involved in reaching the customer.

The main objective was to explore and clarify the working of the trade, problems involved and ICT awareness among jasmine growers. Contacting the agents and the traders were undertaken to check the responses given by the growers and thus justify their responses. Bonoma (1985) suggests that qualitative methods search beyond mere glimpses of people or their behaviour and events. The qualitative study aims to describe the various factors such as socio-economic impact of jasmine cultivation, ICT awareness and usage in jasmine trade etc. among jasmine growers.
3.3.1 Focused Group Discussions

Focused group discussion is carried out to explore the variables conceptualised for the study and to develop the questionnaire (Sekaran & Bougie, 2016; Tashakkori & Teddlie, 2010). To facilitate the research objective, a Focused Group Discussion of jasmine growers from Udupi district was carried out. This approach is used to carry out discussions with a group of individuals associated with the problem under study. This small group consists of significant individuals representing the larger respondent population. The group consisted of Twenty-five jasmine growers along with the Udupi jasmine grower’s association head were selected as interviewees for detailed discussions to understand the various aspects of jasmine trade, factors affecting jasmine price and issues faced by jasmine growers. The focused group discussions gave significant indications to confirm the issues and problems related to marketing and sale of Udupi jasmine. The researcher is sure about true representation of farmers problems in general by the representatives in farmers group. Agents and traders too were subjected to a focused group study. Ten agents and two traders were the part of the focused group. The characteristics of their trading operations were studied, and the role agents and traders play in the community-based enterprise were analysed. Focus group discussions helped in developing the questionnaire which is aiming at finding reliable response from jasmine growers.

3.3.2 Expert opinion

The area research also involved experts in the field of agriculture in order to pool their valuable insights on the research problem. Expert Opinion is a common form of exploratory research that supplements shortage of organized data and specific information on the topic. Zonal Agriculture Research Station, Udupi District and National Bank for Agriculture and Rural Development (NABARD) were the point of
METHODS & MATERIALS

reference for expert opinion. With specific reference to Udupi jasmine, they were subjected to questions about the problems and trials related to production and marketing. The responses collected from experts were important indicators to frame questions in the consumers and farmers questionnaire used in both exploratory and descriptive research.

3.3.3 Collection of data
A number of factors such as practical and methodological issues affect the sample size and hence qualitative research experts argue that one cannot determine the answer to the question of “how many?” (Baker, S. E., Edwards, R., Adler, P., Becker, H. S., Doucet, 2012). Sandelowski, (2001) argues that numbers and evaluation of its adequacy in qualitative research, depends on a number of factors such as theoretical and epistemological approach, the nature of the phenomenon under investigation, features of the study, richness and quality of data, scope and aims of the study or experience and skills of conducting qualitative research by the researcher. Qualitative study often takes the form of a case study. A case study is not the representation of a single qualitative method, as an approach to research. The study of a small set of instances of a phenomenon can be simply referred to as case study. A preferred research approach when questions of process in other words “how” or “why” questions are being posed can be done using case study (Yin, 2003).

3.3.4 Case study 1- socio-economic impact and ICT awareness among growers.
Udupi jasmine growing regions are situated in Udupi taluk of Udupi district. Data collection was done in Shankarapura and nearby regions as Udupi jasmine is predominantly grown in those regions. A total of 240 households were selected in these jasmine growing regions and were subjected to a questionnaire. For the selection of sample random sampling and snowball sampling techniques were used. The selection
of individuals by a researcher can be done using snowball-sampling technique (N. Burns & Grove, 2006) as it provides the most extensive information about the phenomenon under research. The survey employed personal interview-based questionnaire. The questionnaire for the survey was built based on the inputs gained from the focused group discussions and expert opinion. The questionnaire focuses on demographic details, socio-economic aspect of jasmine trade, ICT awareness, etc. A pilot study was conducted prior to the finalization of the questionnaire. The results of the pilot study and expert inputs were incorporated before finalization of the questionnaire.

3.3.5 Case study 2- ICT awareness and willingness to adopt ICT among agents
From the focused group discussions, it was found that there are approximately 150 agents involved in the collection of jasmine flowers from the growers. While deciding the sample size good judgment and experience should be considered rather than depending on strict mathematical formulae (C.R.Kothari, 2004). Thus using an online sample size calculator (“Sample Size Calculator,” n.d.) a sample size of 108 was arrived, assuming a 95% confidence level and 5% margin of error. For the selection of the sample, snowball sampling technique was used. The questionnaire was designed to cover aspects like the use of ICT for jasmine trade and personal usage, necessary factors needed to fulfil the research objectives. In terms of jasmine trade facets such as mode of contact used for contacting growers and traders, daily jasmine price, adoption of ICT in automating the existing process etc. For ICT in personal usage aspects such as mobile banking, social networking, online shopping, computer usage etc was also used. The questionnaire was developed using the Guttman scale (Guttman, 1944).

The detachment of information from its original ecological context of “real world” is one of the major limitations of quantitative approach (Moghaddam, Walker, & Harre, 2003). As both quantitative and qualitative data collection occurs concurrently the
questionnaire is designed to include both close-ended and open-ended questions taking the concurrent nested model into account. Qualitative method is given less priority while the predominant quantitative method is given more priority.

Simultaneous collection of data during a single data collection phase is the primary advantage of concurrent nested model, thus the advantage of quantitative and qualitative data is provided for the study (Creswell, 2013). Hence questions pertaining to jasmine price variations, jasmine price details and associated questions on jasmine trade were also part of the questionnaire that was used to collect the responses from agents. Classifier model was used to check the willingness to use mobile application and to automate the existing process. The details are provided in the descriptive analysis section.

3.3.6 Case study 3- Udupi jasmine price analysis
Jasmine price is a critical factor in the jasmine trade. It has socio-economic implications corresponding to the jasmine grower. Hence jasmine price details were collected from the year 2010 for a period of six years and was analysed. Various factors that would affect the jasmine price were also studied. Inputs from the focused group discussions and expert opinions were critical in determining these factors.

Factors such as environment, production, auspicious occasions, festivals, etc. were taken into consideration based on the inputs provided. Average jasmine price from 1\textsuperscript{st} Jan 2010 onwards was collected and then plotted on to a graph. The average of six years was divided into four quarters namely Q1 – January to March, Q2 – April to June, Q3 – July to September, Q4 - October to December. The factors mentioned were then matched with the variations to determine the influence of identified factors with jasmine price.
3.4 Descriptive Research

To answer the questions of who, what, where, when and how, descriptive research is used. While collecting quantifiable facts descriptive research technique is considered efficient (A. C. Burns & Bush, 2014). Descriptive research was used for the validation of the e-commerce model and analyse the agent’s willingness to use a mobile application to automate the existing system. TAM, as proposed by Venkatesh and Davis (1996) was used to understand the willingness among the general public to use the e-commerce application for online jasmine trade. A web application was built using the model as reference, respondents were given a demonstration and were subjected to a questionnaire.

The primary target was the general public who were the consumers of the product. A total of 122 respondents from Mangalore and Udupi were interviewed based on quota sampling technique, the most important sample in the group of non-probabilistic samplings. Because of its minimalism and relatively good results, in market research quota sampling is generally used. By logic, quota sampling is the closest to probabilistic sampling from all non-probabilistic sampling techniques (Yang & Banamah, 2014).

The challenge of validation of the developed e-commerce model was met by face to face interaction with the selected jasmine buyers from both Mangalore and Udupi market. Even though it was a difficult proposition, the fieldwork was done in a justifiable manner with the purpose of understanding the response of jasmine buyers. As it is a support to the proposed model enough care was exercised by not prompting any answers from the buyers. The sample was chosen among the consumers with the condition that the chosen respondent shall be a jasmine buyer and has familiarity with online shopping.
3.4.1 Questionnaire Development for validation of model
An essential part of the development of any survey involves the process of framing a questionnaire, determination of the list of questions and designing the format of either written or printed questionnaire (Zikmund, 2003).

3.4.1.1 Consumer needs.
Udupi jasmine is coveted for its exquisite fragrance. It is a favoured flower in religious ceremonies, formal events and for personal use. The people of coastal Karnataka generally keep functions on auspicious days based on religious calendars. Consumers who prefer Udupi jasmine for their daily personal use generally buy it from flower markets. A web application was built based on the model and the application was demonstrated to the consumers who purchased jasmine from the market. A questionnaire was designed to cover necessary factors needed for the acceptance of the model among consumers. A pilot study was conducted to this effect and based on the pilot study the questionnaire was refined and modified. While doing so the expert opinion was also incorporated for the validation. The questionnaire consisted of two parts. The first part included a questionnaire for demographic details, jasmine buying purpose and frequency, online shopping details. The second part contained questions on a 5-point Likert scale regarding the different constructs of TAM scales namely Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Behavioural Intention (BI) and E-commerce Use (EU) and the same are shown in Annexure 1.

3.4.2 Survey Instrumentation
The measurement of the research instrument is based on the variables that are studied in the research (D. Cooper & Schindler, 2016). Primary data is collected from agents associated with the jasmine trade operating in and around Shankarapura region of Udupi taluk. Data from customers were collected from both Udupi taluk and Mangalore city.
Data from both these actors were collected through a structured questionnaire by adopting a personal interview technique. Personal interview technique was used as the respondents needed assistance to understand the questions in their local language generally Tulu and Kannada for both Udupi taluk and Mangalore.

Data from secondary sources were gathered from research studies done previously in a similar area of research, magazines in the field of agriculture marketing, reports published by Government of India etc.

3.4.3 Evaluation of the Goodness of Measure
The measurement of the research instrument is based on the variables that are studied in the research (D. Cooper & Schindler, 2016). Hence, to assess the “goodness” of the measure developed and be reasonably sure that the instrument measures the variables they are supposed to measure accurately, research instrument of reliability and validity is used (Sekaran & Bougie, 2010). The goodness of measure for any study is to measure research instrument based on the reliability and validity of the variables considered for research (Krishnaswamy, Sivakumar, & Mathirajan, 2009; Sekaran, 2003). For ensuring reliability, the study employed two dimensions of reliability viz., repeatability and internal consistency (Cooper & Schindler, 2002; Krishnaswamy et al., 2009).

1. Reliability: Reliability applies to an indication of the stability (or repeatability) and consistency (or homogeneity) with which the instrument measures the concept and helps to assess the “goodness” of a measure (Zikmund, 2003). Test-retest and internal consistency are the two factors employed by this study to ensure reliability (D. R. Cooper & Schindler, 2003).

Test-retest: Test-retest is the reliability coefficient that is obtained by repetition of the same measure on a second time (Graziano & Raulin, 2010). Test-retest method was used
on a small scale of twenty respondents representing agents and fifteen respondents representing consumers, twice in a period of twenty days. The consistency in the responses given between the two measures are the indicators of a high degree of reliability (Zikmund, 2003).

**Internal consistency:** An important requirement in using the questionnaire form of research instrument is that the instrument needs to be subject to the test of reliability and validity. Cronbach’s Alpha Coefficient was used as a measure to test reliability. The closer Cronbach’s alpha is to 1, the higher the internal consistency reliability (Sekaran, 2003). The Cronbach’s Alpha coefficient helps to examine whether all the items in the scale really tap into one factor. Generally, a Cronbach’s Alpha of 0.70 is considered a ‘satisfactory’ measure of internal consistency and reliability in measuring inter-item correlations which tap together to form a ‘Construct’.

In terms of the questionnaire administered to agents the value of 0.71 advocates a good internal consistency. Similarly, in terms of TAM variables the value of 0.75 (for perceived usefulness), 0.73 (for perceived ease of use) and 0.76 (for behavioural intentions) respectively, advocate a good internal consistency reliability for scales used in this research. A pilot study was conducted to measure the internal consistency. Bryman & Bell (2011) suggests that pilot study can reduce measurement error which is related to a faulty survey instrument.

If the alpha scores were less than 0.70 when measuring the factor, the same question was modified to bring back the alpha coefficient to 0.70 to measure good reliability in the final survey. Cronbach’s alpha measured was greater than 0.70, indicating that all constructs have internal consistency and scale reliability, as stated by Tavakol & Dennick (2011).
2. Validity
Blumberg, Cooper, & Schindler (2005) suggest validity as the extent to which an instrument measures what it asserts to measure. Content validity is used to determine whether the questionnaire adequately covers a content area. As determining whether a measure sufficiently covers a content area is not possible through a statistical test, hence content validity usually depends on the judgment of experts in the field (Zikmund, 2003). Hence the validity was determined by experts in the field and changes were incorporated accordingly based on the suggestions.

3.5 E-commerce web application development
The final facet of the research was for the validation of the proposed model. The proposed model was used as a guide to develop a web application. The goal was to develop a customized web application primarily concentrating on representing the model. This was necessary to gauge the acceptance of the model from the end-users that is jasmine buyers. The test application was built using Hypertext Markup Language (HTML), Cascading Style Sheets (CSS) and JavaScript. The web application incorporated the complete features as proposed by the model.

3.6 Data Processing and Analysis
Data analysis is the process of bringing order, structure and meaning to the mass of collected data (Marshall & Rossman, 2011). While searching for certain arrangements of relationship that exists among the groups of data along with the calculation of certain indices or measurements (C.R.Kothari, 2004). The data analysis is carried out for the qualitative and quantitative data gathered in the study. Qualitative data analysis was done on quantitative data collected for the exploratory research using deductive approach. Deductive approach starts with the assertion of general rule and proceeds from there to a specific conclusion. For the development of model various factors are
studied, analysed and inferences drawn from the data collected leads to the development of the model.

Quantitative analysis of the data is done using both descriptive and inferable statistics. Descriptive statistics is used to describe the important parameters that are inferred from inferential statistics. As Beaver, Beaver, & Mendenhall (1999) suggests from the information contained in a sample, inferential statistics objectives in a study are to make decisions, predictions and inferences about the characteristics of a population.

Various steps were followed in processing the collected data. For the analysis of data in order to apply the statistical tools, the questions in the questionnaire were grouped into several categories. In the case of the questionnaire administered for the agents, their responses are numerically coded in terms of 0 and 1 for dichotomous responses. Data collected from the questionnaire administered to the consumers were post-coded and were taken down using a five-point Likert scale (R Likert, 1932) with the format of 1 - Strongly disagree, 2 - Disagree, 3 - Neither agree nor disagree, 4 - Agree, 5 - Strongly agree. Coding is done so that the data can be transformed to be suitable for computer-aided analysis.

3.6.1 Statistical Analysis
Microsoft Excel 2016 was used to enter the data into the spreadsheet. Statistical Package for the Social Sciences (SPSS) was used for descriptive statistics such as sample size, mean, standard deviation, demographic details of the survey and to compute Cronbach's alpha and test-retest method for reliability test. For data collected from agents, K-Nearest Neighbour (K-NN) classifier model was used on the data set to predict the determinants that influence the willingness to automate the existing system. Classification technique aims to identify the characteristics that indicate the group to which each case belongs to. This can be used to understand the behaviour of both the
existing data and to predict how new instances will behave (Imandoust & Bolandraftar, 2013). Hence K-NN classifier model was used to predict the willingness of agents to automate the existing process.

To analyse the relationships between PU, PEOU, BI and EU in TAM, Structural Equation Modelling (SEM) technique was adopted. While dealing with the latent (unobserved) variables of constructs and their indicators (observed) variables Measurement model comes in handy. It focuses on the link between factors and their measured variables. “SEM technique is preferred for developing complex models. Various types of hypothesized models can be tested using SEM” (Schumacker & Lomax, 2010). For simultaneous estimation of a series of separate multiple regression techniques, SEM is the most efficient estimation technique (Joseph F. Hair, William C. Black, Barry J. Babin, 2010). Measurement model (CFA) and Structural models are components of SEM. The advantage of a structural model is that it allows the researcher to test the predicted relationships between independent and dependent variables. While using SEM the researcher can test the entire theoretical model in one analysis, unlike many other statistical techniques.

As TAM variables are inter-related, SEM is expressed using path analysis with model fit indices. Model fit determines the degree to which the SEM fits the sample data. While considering what constitutes an adequate fit there are no well-established guidelines. But the general approach is to establish that the model is identified, there is a convergence in the iterative estimation procedure, all estimated parameters are well within the range of permissible values, and that the estimated parameters standard errors have reasonable size (Marsh & Grayson, 1995).

There is no single statistical test in SEM that can best describe the strength of the model’s prediction. Instead, researchers have developed different types of measures, in
combination to assess the results. To assess, the model researchers use numerous goodness-of-fit indicators with reference to model fit. In SEM, ensuring the model fit is the most crucial step. According to Joseph F. Hair, William C. Black, Barry J. Babin, (2010) and Schumacker & Lomax, (2010), specific indices are Chi-square Mean/Degree of Freedom (CMIN/DF), Normed Fit Index (NFI), Goodness of Fit (GFI), Root Mean Square Error of Approximation (RMSEA), Adjusted Goodness of Fit (AGFI), and Comparative Fit Index (CFI). The wellness of different indices with different sample sizes, types of data, and ranges of acceptable scores are the major factors to decide whether a good fit exists (Hu & Bentler, 1999; MacCallum, Browne, & Sugawara, 1996). Hence based on the values of the fit indices a goodness of fit is established between TAM variables. Analysis of Moment Structures (AMOS) trial version was used to conduct SEM. Statistical significance was set at p-value < 0.005. A p-value of 0.05, a commonly used threshold, means that there is a 5% chance of achieving those results without there being a real effect. A p-value of 0.005 means there is only a 0.5% chance of result without having an actual effect (Johnson, 2013).

3.7 Summary
This chapter provides a complete description of the methodology followed in the study. The chapter gives an overview of the chapter followed by the research design and process describing how the study was conducted. It then explores the research techniques used namely exploratory research and descriptive research. The exploratory research encompasses focused group discussions and expert opinion that provide the basis for the development of the questionnaire and to select the respondents needed for the research. It then describes the data collection techniques used such as random sample and snowballing techniques. Three case studies namely socio-economic impact and ICT awareness among growers, ICT awareness and willingness to adopt ICT among agents
and Udupi jasmine price analysis were used to discuss various factors that determine the building of e-commerce model. Descriptive research encompasses the development of a questionnaire for the respondents for validation. The questionnaire formulated which is used in the survey technique for the collection of data was tested for the goodness of measurement using the reliability and validity tests. The processing of data and the statistical analysis selected are described. The findings and analysis are explained in chapters 4 and 5.