CHAPTER III

METHODOLOGY

This chapter deal with the methodology which comprises selection of the study area, types of data and information used, sampling techniques and tools used for analysis of data. The methodology adopted for evaluation of the objectives of the present study is described under following heading.

3.1. Location

3.2. Sampling technique

3.3. Nature and sources of data

3.4. Statistical analysis

3.1. LOCATION

The present study was carried out in Junagadh district of Gujarat state. Junagadh district located at 21°31′ N 70°27′ E. The district is located on the Kathiawar peninsula in western Gujarat. It is surrounded by Rajkot district (North), Porbandar district (North-West), Amreli district (East). To the south and west is the arabian sea. Talukas of Junagadh are: Junagadh city, Bhesan, Junagadh rural, Keshod, Malia, Manavadar, Mangrol, Mendarda, Vanthali and Visavadar. The temperature hardly rise more than 38 °C. Temperatures typically range from 10 °C to 42 °C. The important rivers of Junagadh district are the Ojhat, Uben, Hiran, Raval, Madhuvanti and Machhundri. Major crop grown in the district are wheat, oilseeds, cotton, mango, banana, onion and vegetables & spices crops. Junagadh is a largest producer of groundnut and garlic in the state contributing 26 per cent and 34 per cent respectively in total production. The average annual rainfall is 787 mm. Total area of the Junagadh district is 8,846 kilometer square. As per 2011, census, the population of Junagadh district is 27,43,082 with population density of 277 person per square kilo meter. It had a literacy rate of 76.88 per cent in 2011.

For the present study Junagadh district was selected because Junagadh district occupies significant share in area and production of wheat. The climatic condition and soil is favorable for wheat cultivation in this district. So that Junagadh district was purposively selected for the study.
Methodology

3.2. SELECTION OF SAMPLE

3.2.1. Sampling technique

Two stage sampling technique was adopted as per the objectives of the study. At the first stage, Junagadh district was selected. At the second stage, 100 farmer was selected purposively. Three fertilizer manufacturing company was selected randomly in Junagadh district to estimate consumer preferences towards fertilizers by using conjoint analysis.

3.3. NATURE AND SOURCES OF DATA

Primary data and secondary data was used in this study.

3.3.1. Primary data

Primary data required for the study was collected from the questionnaire, face-to-face interview with the farmers given in Annexure-I and Annexure-II respectively. Primary data means data related to the objectives like, socio- economics profile (age, family size, education, annual income, gender, social status, farm size, etc.), factors influencing consumption of fertilizers (fertilizer consumption in wheat, area under crop, farm gross income, extension participation, etc.), resource use efficiency (yield of wheat, quantity of seed, expenses on labour
and plant protection chemicals, irrigation charges, etc.). Data were collected during the month March to April 2017.

3.3.2. Secondary data

Secondary data used for exploratory research and secondary data includes data collection from interaction with the company guide. Such as brands, price, mode of payment, etc. was collect from company websites and annual reports if any requires. The data were taken during the period of the year 2016 to 2017.

3.4. MEASUREMENT OF VARIABLES

The variables under study were selected on the basis of extensive review of literature on the subject. Only the most relevant variables were selected. In dependent variables fertilizer consumption for wheat and yield of wheat was selected and in independent variables area under crop, farm gross income, extension participation, experience in farming, irrigation, education, quantity of seeds, expenses on labour, manure, plant protection chemicals and fertilizer etc. was selected.

3.4.1. Measurement of dependent variable

3.4.1.1. Fertilizer consumption for wheat

A fertilizer is any material of natural or synthetic origin that is applied to soils or to plant tissues to supply one or more plant nutrients essential to the growth of plants. Fertilizer is a necessary for the crop. Total fertilizer applied or consumed in a wheat crop by the farmers is called total fertilizer consumed in/or a wheat. Fertilizer consumption for a wheat was measured in a kilogram per hector.

3.4.1.2. Yield of wheat

A crop yield is a measurement of the amount of a crop that was harvested per unit of land area. Crop yield is the measurement often used for a cereal, grain or legume and is normally measured in metric tons per hectare (or kilograms per hectare). Crop yield can refer to the actual seed generation from the plant. For example, a grain of wheat yielding three new grains of wheat would have a crop yield of 1:3. Yield of wheat was measured in a kilogram per hector.
3.4.2. Measurement of independent variable

3.4.2.1. Area under crop

Area refers to a total cultivated area under the wheat at a respondent’s farm. It was a main factor affecting the consumption of the fertilizer. Because if more area under the wheat cultivation more fertilizer consumed by the famers. The area under the crop was taken in the hector.

3.4.2.2. Farm gross income

Farm gross income is a income which earn by the production of a crop. In farm gross income total income incurred by the wheat production was taken. Farm gross income was taken as a total rupees per hector.

3.4.2.3. Extension participation

Extension participation refers to a programs organized by the government for famers. By this programs farmers can get information about cultivation practices, fertilizer dose, soil testing, etc. which help farmers to improve production. The score of one was given to respondents who taken a part in the program and zero was given to them who were not taken part in any programs.

3.4.2.4. Irrigation

Irrigation is the application of controlled amounts of water to plants at needed intervals. Irrigation helps grow agricultural crops, helps maintain landscapes, and helps revegetate disturbed soils in dry areas and during periods of inadequate rainfall. Irrigation is an important source of farming. Without irrigation production was not possible. In irrigation total expense of irrigation of a wheat during whole season was taken as a rupees per hector.

3.4.2.5. Education of farmers

Education is the process of producing desirable changes in the behaviour of an individual. In this study, this variable referred to the amount of formal education obtained by the farmers in terms of their level of education. The score of zero was given to quantify education level of illiterate farmers, while one score was given to each standard of education of the respondents. The respondents were classified into five groups; illiterate, up to primary education (up to 7th standard), up to higher secondary education (8th to 12th standard), graduate and post graduate.
3.4.2.6. Experience in farming

It refers to the actual number of years put into the farming by the respondents. The respondents were grouped into three categories as less than 15 years, 15 to 30 years and above 30 years of experience. Numerical score 1 was assigned to each year of experience in cultivation.

3.4.2.7. Quantity of seed

A seed is an embryonic plant enclosed in a protective outer covering. The formation of the seed is part of the process of reproduction in seed plants, the spermatophytes, including the gymnosperm and angiosperm plants. Seed is a one of most important input in farming. In this quantity of wheat was taken as an input for a production. Quantity measured in a kilograms per hector.

3.4.2.8. Expenses on labour

For the management of weed, irrigation and other practices farmers needs a labour. For hiring a labour farmers has to pay a charges which called expenses on labour. Expenses on labour measured in a rupees per hector.

3.4.2.9. Expenses on plant protection chemicals

Crop protection is the science and practice of managing plant diseases, weeds and other pests (both vertebrate and invertebrate) that damage agricultural crops and forestry. Agricultural crops include field crops (maize, wheat, rice, etc.), vegetable crops (potatoes, cabbages, etc.) and fruits. The crops in field are exposed to many factor. The crop plants may be damaged by insects, birds, rodents, bacteria, etc. Plant protection chemicals also measured in a rupees per hector.

3.4.2.10. Expenses on manure

Manure is organic matter, which can be used as organic fertilizer in agriculture. Manures contribute to the fertility of the soil by adding organic matter and nutrients, Animal manure, such as chicken manure and cow dung has been used for centuries as a fertilizer for farming. It can improve the soil structure (aggregation) so that the soil holds more nutrients and water and therefore becomes more fertile. It also contains some nitrogen and other nutrients that assist the growth of plants. Expenses on manure also measured in a rupees per hector.
3.4.2.11. Fertilizer expenditure

A fertilizer is any material of natural or synthetic origin that is applied to soils or to plant tissues to supply one or more plant nutrients essential to the growth of plants. As water soluble fertilizer leads to fast absorption of nutrients and carriers. It can meet specific crop demands at particular crop growth period, which ultimately helps in development at various physiological stages of the crop. Fertilizer expenditure also measured in a rupees per hecort.

3.4. STATICAL ANALYSIS

For the socio economic profile of grower, tabular analysis was used. Other analytical measurements like multiple regression analysis, Cobb- Douglas production function, conjoint analysis is worked out according to the objective.

3.4.1. Multiple linear regression analysis

Multiple linear regression analysis is an extension of simple linear regression analysis, used to assess the association between two or more independent variables and a single continuous dependent variable. The multiple linear regression equation is as follows:

\[ Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + u \]

Where \( \hat{Y} \) is the predicted or expected value of the dependent variable, \( X_1 \) through \( X_p \) are \( p \) distinct independent or predictor variables, \( b_0 \) is the value of \( Y \) when all of the independent variables (\( X_1 \) through \( X_p \)) are equal to zero, and \( b_1 \) through \( b_p \) are the estimated regression coefficients. Each regression coefficient represents the change in \( Y \) relative to a one unit change in the respective independent variable. In the multiple regression situation, \( b_1 \), for example, is the change in \( Y \) relative to a one unit change in \( X_1 \), holding all other independent variables constant (i.e., when the remaining independent variables are held at the same value or are fixed). Again, statistical tests can be performed to assess whether each regression coefficient is significantly different from zero. Multiple linear regression model will be used to predict the influence of various factors (X), on the fertilizer consumption (Y), i.e. purchasing decision of fertilizer’s. The formula are as under (Suroto et al., 2013).

\[ Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + u \]  \[ \text{......................... (1)} \]

Where,

\[ a = \text{Intercept} \]

\[ u = \text{error term} \]
Methodology

\[ y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \epsilon \] …………………………………..(2)

3.4.2. Cobb- Douglas production function

The Cobb-Douglas Production Function, given by Charles W. Cobb and Paul H. Douglas is a linear homogeneous production function, which implies that the factors of production can be substituted for one another up to a certain extent only. This production function was fitted to the data to estimate resource use efficiency with respect to each of the explanatory variables. The fitted equation was as under (Pawar and Haral, 2013).

Linear model:

\[ Y = a \cdot x_1^{b_1} \cdot x_2^{b_2} \cdot x_3^{b_3} \cdot x_4^{b_4} \cdot x_5^{b_5} \cdot x_6^{b_6} \cdot e \] …………………………………..(2)

Cobb-Douglas model:

\[ \log Y = \log a + b_1 \log x_1 + b_2 \log x_2 + b_3 \log x_3 + b_4 \log x_4 + b_5 \log x_5 + b_6 \log x_6 + \log e \] …………………………………..(3)

Where,

- \( a \) = Intercept
- \( u \) = error term
- \( b_1, b_2, \ldots, b_6 \) = Regression Coefficients
- \( Y \) = Yield of wheat (kg/ha)
- \( x_1 \) = Quantity of seed (kg/ha)
- \( x_2 \) = Expenses on Labour (Rs/ha)
- \( x_3 \) = Expenses on plant protection chemicals (Rs/ha)
X₄ = Irrigation charges (Rs/ha)
X₅ = Expenses on manure (Rs/ha)
X₆ = Fertilizer expenditure (Rs/ha)

3.4.3. Conjoint analysis

Conjoint analysis is a statistical technique used in market research to determine how people value different attributes (feature, function, benefits) that make up an individual product or service. The objective of conjoint analysis is to determine what combination of a limited number of attributes is most influential on respondent choice or decision making. A controlled set of potential products or services is shown to respondents and by analyzing how they make preferences between these products, the implicit valuation of the individual elements making up the product or service can be determined. These implicit valuations (utilities or part-worths) can be used to create market models that estimate market share, revenue and even profitability of new designs (Oyatoye et al., 2013).

In this table, brand of three companies were selected. In which Indomag is a brand name of T. J. Agro chemicals and fertilizer Pvt. Ltd., Ankur is a brand name of Dharti Agro Pvt. Ltd. and Magvan is a brand name of Vanita Agro Pvt. Ltd. And price were 720, 880 and 750 respectively. Mode of payment was selected as a third variable. It means which type of scheme preferred by the farmers. In mode of payment two levels cash and credit were selected.

Table 3.1 Preferred technological attributes of products and their associated level

<table>
<thead>
<tr>
<th>Sr. NO.</th>
<th>Brand</th>
<th>Price</th>
<th>Mode of Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>INDOMAG</td>
<td>720</td>
<td>Cash and credit</td>
</tr>
<tr>
<td>2</td>
<td>ANKUR MAGNESIUM SULPHATE</td>
<td>880</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>MAGVAN</td>
<td>750</td>
<td></td>
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</tbody>
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