Chapter 4

Research Design and Methodology

4.1 Description and Demographic Details of Nashik Rural Area

Nashik has a personality of its own, due to its mythological, historical, social and cultural importance. This city is situated on the bank of the River Godavari, the 2nd largest river in India. It is also one of the important holy rivers for the Hindus. Nashik has a glorious historical past. As stated in the mythology, Lord Rama, the emperor of Ayodhya, made Nashik his abode during his 14 years in exile. Lord Laxman Cut the nose of ‘Shurpnakha’ a demon and thus this city was named as ‘Nashik’.

Nashik District is located between 73.16 degree and 75.16 degree East Longitude and between 18.33 degree and 20.53 degree North Latitude at Northwestern part of the Maharashtra, at the altitude of 565 meters above mean sea level. This District has great mythological milieu. The Godavari River of Nashik originates from Mt. Bramhagiri in Trimbakashwar, which is one of the most vital Hindu places and also one of the 12 Jyotirlingas.

Nashik has a sufficient rail and road connectivity. The Nashik-Mumbai highway is now four-lane, while widening work is also in progress on the Nashik-Pune highway. It has been completed in Pune district, while it is in progress in Ahmednagar and Nashik districts. The existing Ozar airport is already in expansion mode, while air cargo lot has been set up near Janori village, close to Nashik. Besides, an international airport is also being set up in Shirdi.

Local industries get a favorable climate and soil condition in the rural areas of Nashik district. At present, industries in Nashik are in an enhanced state and industrialists are keen to set up base in the city. The city has better infrastructural facilities.
4.2 Description of Manufacturing Industry in Nashik District

Mahindra & Mahindra Ltd, Bosch Ltd, TDK Epcos, MICO, Siemens, Crompton Greves, Kirloskar, Reymond steel, Jindal, Brook Bond, L & T, CEAT, VIP, Carbon Everflow, Garware, Jyoti Structures, Samsonite, Datar Switch Gears, Glaxo India, etc. are some of the large industries established in Nashik. Industries in Nashik have not been adversely affected though there is a global recession. At present, Nashik has come out as one of the fastest developing cities in the country. In the next few years, it will undoubtedly be a major industrial hub of the country.

India Security Press, Hindustan Aeronautics Ltd., Currency Note Press and Thermal Power Station, etc. are some of the important Public Sector establishments located in the District. These industries have brought the District on the National & International map. Moreover, the District also has national level institutes like (I) Dr. Babasaheb Ambedkar Institute of Rural Technology & Training run by KVIC and (ii) Indian Institute of Numismatic Studies & Research at Trimbakeshwar.

MIDC developed big industrial area, as per the policy of the Govt. of Maharashtra on Industrialization in rural areas almost all the Blocks of this District have been covered under Cooperative sector. It is remarkable to mention here that the cooperative Industrial Estate of Sinnar is one of the largest Cooperative Industrial Estate in the country and functioning efficiently. Federation of Cooperative Industrial Estates awarded to the Sinnar Cooperative Industrial Estate. Eight Cooperative Industrial Estates have provided all required infrastructure facilities to the units for their establishment and functioning.

The Associations of Industrialists are very active. They help to solve the problems of the industrialist with positive approach. The Nashik Industries and Manufacturers’ Association (NIMA) is organising an Exhibition on big scale regularly. This helps for industrial growth in the District as well as to find market for the existing products.

Apart from Grapes, Onion and Vegetables, many industrial products are also being exported from Nashik. To facilitate the export a Container Freight Station has been started at MIDC Ambad by the Central Government.
To meet the requirements of trained personnel and skilled people, training arrangements have been made at Govt. ITI, Private ITI, Polytechnic Colleges, and Engineering Colleges. All these institutes are imparting training in more than 35 trades. Besides these some private training institutes conduct small duration courses in many technical trades.

In remote areas like Surgana Block, many tribals are engaged in Carpet weaving. Export quality carpets are prepared in and around Umbarthan (Tal. Surgana) NABARD has selected Yeola Block for Development of Paithani Cluster.

The District Industries Centre has been set up to render all assistances under one roof to the potential entrepreneurs for starting their own industries.

The Khadi and Village Industries Board (KVIB) is implementing various schemes for promotion to the rural and cottage industries such as Special Component Plan for SC. Margin Money Scheme and DRI scheme. KVIB operates in two ways. They sponsor proposals to the banks under above schemes and also conduct training courses. A National level Training Institute is situating in Nashik on Trimbak Road to cater training needs of various trades.

For extending assistance to the entrepreneur in establishing their units, Industrial Estates have been established at various centers.

Co-operative Industrial Estates:
  a) Nasik
  b) Sinnar
  c) Yeola
  d) Manmad
  e) Kalwan
  f) Pimpalgaon(Baswant)
  g) Malegaon
  h) Chandwad
Maharashtra Industrial Development

a) Satpur  
b) Ambad  
c) Peth  
d) Dindori  
e) Sinnar  
f) Vinchur  

Climate in the District is also suitable for allied activities such as Dairy, Poultry, and Sheep & Goat rearing. There are two large units of poultry viz. C & M Groups and Ashok Kumar Hatcheries in Nashik. Few years back some farmers have tried to establish medium sized goat rearing units under stall-fed conditions. However the results are not encouraging. Dairy has been identified as Key activity under S.G.S.Y. in almost all the blocks. The district has unlimited potential for dairy activity. Allied activities also have very good scope, as the gigantic market of Mumbai is at the doorstep of the District.

4.2.1 The status of the Special Economic Zone in Sinnar near Nashik

The MIDC and India bulls are jointly setting up the multi-product Special Economic Zone (SEZ) on 2,500 acres near Malegaon MIDC. The SEZ will be spread over 1,500 acres, while a coal-based thermal power project, also a joint venture between MIDC and India bulls, is coming up on 1,000 acres. Total capacity of the thermal power project will be 2,700 MW, to be developed in two phases. In the first phase, 1,350 MW power will be generated and the rest of the power in the second phase. Testing of the power project for 240 MW will be conducted in the month of September. Besides, the process for acquisition of 172 hectares for the proposed 32-km railway line between Odha railway stations to Gulvanch village for transporting of coals for the proposed power project is also in progress.
4.2.2 Industrial growth of Nashik District now and in the next few years

Industrial Estates and industries are coming up very fast in almost all parts of the District. The Industries Center, Nashik is co-ordinating the Industrial Development of the District. There are MIDC and Co-operative Industrial Estates. A separate Co-operative Industrial Estate for women has also been established. Setting up four Industrial Estates at Malegaon, Sinnar, Satana and Manmad by MIDC has been approved and the work is in progress. Similarly two Co-operative Industrial Estates at Nandgaon and Kadwa are being established shortly. Some industries in Gonde and Wadivarhe, near Nashik were also established. Nashik's growth will be spectacular in the next few years. Good rail and road connectivity, good climate and abundant water are the salient features of Nashik. The district has been identified for the purpose of establishment of Wine Park and Food Park. The climate here is conducive for industries. Air connectivity will also be very good in the next few years. Today, Nashik has emerged as one of the few fastest developing cities in the country. It will definitely be a major industrial hub of the country in the next few years.

Fig 4.1 Map of Nashik District
4.3 Problem Areas and future plans

In this huge industrial area, manufacturing industries are many in numbers in Nashik district. Information and Communication Technology are used to perform the various functions in industry. ICT helps to enhance the performance of the organization. Industrial area developed in rural area. Rural area itself has various problems of water, electricity and education. While implementing ICT in the manufacturing industries in the rural area of Nashik district there are some problems and it is a dire need to give the solutions to face problems. In this competitive world to develop any industry it is necessary to adopt modern technology and change the view of persons. The present study is an investigation to understand the role of Information and Communication Technology on organizational performance in manufacturing industries in the rural area of Nashik district. The method of research provides the tools and techniques by which the problem is approached.

The study is limited to those manufacturing companies who are implementing Information and Communication Technology in the rural area of Nashik district.

4.4 Type of research

Research can be classified in many different ways on the basis of the methodology of research, the knowledge it creates, the user group, the research problem it investigates. There are different types of research based on practical or theoretical aspect.

This study is based on qualitative research. This type of research methods involve describing in details specific situation using research tools like interview, surveys and observations. Qualitative research is primarily exploratory research (Kothari 2004). It is used to increase an understanding of underlying reasons, opinions and motivations. In qualitative data collection methods vary using unstructured or semi-structured techniques. Some common methods include focus groups (group discussions), individual interviews, and participation/observations. The sample size is typically small, and respondents are selected to fulfill a given quota. So it is useful for each and every method. The present research was undertaken exploratory research design
which helped to decide on the focus of the study. Research questions were mainly concern with organizational performance, identifying the role of ICT in manufacturing industries and discussed some problems to implement ICT.

4.5 Hypotheses of the Study

Following are the Hypotheses for research study

1) Effective utilization of Information and Communication Technology enhances the productivity of manufacturing industry.
2) Lack of resources especially related to technology, infrastructure and trained people cause difficulties for using Information and Communication Technology in the rural area.
3) There is a significant variation in the organizational performance before and after the use of ICT in manufacturing industry.

4.6 Sample design

Random sampling method have been adopted to select the sample size from the leading manufacturing industries in the rural area of Nashik district those who are practicing and having information and communication technological infrastructure. The most of the social scientist argue that the random sampling is the best technique to obtain data. According to Kerlinger (1986), “A sample drawn at random is unbiased in the sense that no member of the population has anymore chance of being selected than any other members”. Kerlinger continues “Random sampling is an objective which produced divorce from our own predilections and biases”. The researcher contacted the representation of each company and asked necessary information. The representatives of each company are given the information keeping their confidentiality due to organizational constraints and privacy.

In this section the researcher described the population from which sample for the study is to be drawn. In this research convenience sampling has been used. The method of convenience sampling is also called the chunk. A chunk refers to that fraction of population being investigated which is selected neither by probability nor
by judgment but by convenience. The nature of sample, the procedure of drawing sample and the justification for selecting the sample must be indicated so that the results of the study may be critically examined and interpreted.

As per the record from District Industries Center, Nashik (Data collected from 2007 to 2013), total manufacturing industries are 1281 in the rural area of Nashik district.

These industries are distributed as follows:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Categories of Mfg Ind.</th>
<th>No. of Manufacturing Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Micro</td>
<td>904</td>
</tr>
<tr>
<td>2</td>
<td>Small</td>
<td>360</td>
</tr>
<tr>
<td>3</td>
<td>Medium</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Total Mfg. Industries</td>
<td>1281</td>
</tr>
</tbody>
</table>

Table 4.1 Distribution of Manufacturing Industries

Total manufacturing Industries are 1281

When the rural area of Nashik district is considered, it has been found that as per District Industrial Centre data there are totally 1281 manufacturing industries. These industries are classified according to their turnover as per the table no. 4.2 shown below.
<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Average Turnover of Mfg Ind.</th>
<th>No. of Manufacturing Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Below 10 Lakhs</td>
<td>330</td>
</tr>
<tr>
<td>2</td>
<td>10L to 30 L</td>
<td>285</td>
</tr>
<tr>
<td>3</td>
<td>31 L to 50L</td>
<td>165</td>
</tr>
<tr>
<td>4</td>
<td>51 L to 70 L</td>
<td>84</td>
</tr>
<tr>
<td>5</td>
<td>71L to 90L</td>
<td>61</td>
</tr>
<tr>
<td>6</td>
<td>91L to Below 2 Cr</td>
<td>136</td>
</tr>
<tr>
<td>7</td>
<td>2 Cr to 5 Cr</td>
<td>94</td>
</tr>
<tr>
<td>8</td>
<td>5 Cr to 10 Cr</td>
<td>45</td>
</tr>
<tr>
<td>9</td>
<td>10 Cr to 30 Cr</td>
<td>44</td>
</tr>
<tr>
<td>10</td>
<td>30 Cr to 50 Cr</td>
<td>16</td>
</tr>
<tr>
<td>11</td>
<td>50 Cr to 70 Cr</td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>Above 70 Cr</td>
<td>16</td>
</tr>
</tbody>
</table>

**Total Mfg. Industries**

1281

**Table 4.2 Manufacturing Industries as per Turnover**

During the pilot survey when the researcher visited sample companies from the rural area of Nashik district, it was observed and also told by HR managers and/or production managers or executives that the company having turnover below Rs. 2 Corers will not be able to afford effective use of ICT in the manufacturing unit.

Hence the researcher has decided to focus on the manufacturing companies having turnover Rs. 2 Corers and above.

Observing Table 4.2 it is clear that the manufacturing industries having turnover below Rs. 2 Corers are 1061. Thus the effective population size of the manufacturing industries in the rural area of Nashik district having turnover Rs. 2 Corers and above are 220 manufacturing units. All these units were considered as population for the present research study. Being the population size itself is not very
large the researcher is concern with guide has decided to keep the sample size as 50% of the population. Thus obtained sample size is $220 \times \frac{50}{100} = 110$.

The researcher has selected 110 manufacturing units by using simple random and convenient sampling method. Actual sample for the study surveyed 110 units of the manufacturing industry and as such data obtained is presented and used for arriving at conclusions and testing the research hypotheses.

**Distributions of Samples are as given below:**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Average Turnover of Mfg Ind.</th>
<th>No. of Manufacturing Units</th>
<th>No. of Manufacturing Units Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2 Cr to 5 Cr</td>
<td>94</td>
<td>47</td>
</tr>
<tr>
<td>2</td>
<td>5 Cr to 10 Cr</td>
<td>45</td>
<td>22</td>
</tr>
<tr>
<td>3</td>
<td>10 Cr to 30 Cr</td>
<td>44</td>
<td>22</td>
</tr>
<tr>
<td>4</td>
<td>30 Cr to 50 Cr</td>
<td>16</td>
<td>08</td>
</tr>
<tr>
<td>5</td>
<td>50 Cr to 70 Cr</td>
<td>05</td>
<td>03</td>
</tr>
<tr>
<td>6</td>
<td>Above 70 Cr</td>
<td>16</td>
<td>08</td>
</tr>
<tr>
<td>Total Mfg. Industries</td>
<td><strong>220</strong></td>
<td><strong>110</strong></td>
<td></td>
</tr>
</tbody>
</table>

*Table 4.3 Distribution of Samples*

The empirical data has been collected from the manufacturing industries in the rural area of Nashik district through the proper questionnaires with the company representative. The research also specified the source of data and procedure for data collecting. It is stated that the following procedure: As the study is exploratory and empirical in nature, both primary as well as secondary sources of data collection shall be tapped. The main purpose of data collection means select the data from the total population which has been decided by the research area. Prior any data collection, first prepare the questionnaire, fix appointment with employer from the different organization or enterprises.
4.7 Design of Questionnaire

Questionnaire can be used to collect both quantitative and qualitative data. As mentioned in the research type it is survey type or qualitative research. To conduct survey from the various manufacturing industries made structured questionnaire. Questionnaire is widely employed tool for data collection in research. To collect the primary data, researcher used structured questionnaire, which is made by covering all the aspects/topics of the study. Questions are frame so that objectives of the research are going to fulfill. Questionnaire has been divided into 4 parts:

Section A - Demographic and General Data
This section deals with demographic and general information about address, phone no.etc.

Section B - Technology
Deals with information related to computer technology, Internet connection, and speed of Internet etc.

Section C - Role of ICT
This section gives the information of ICT and its applications used in various departments of manufacturing industries.

Section D - Productivity
This section provides the data before using ICT and after using ICT.

Section E - Organizational Performance Outcomes
This section gives change in the result of the organizational performance using ICT

Section F - Degrees of Difficulty in implementation of ICT
This section deals with problems or difficulties while implementing ICT in the various departments in the manufacturing industries.
To test / measure the questionnaire reliability and validity of research instrument are used. Reliability is consistency of measurement over time, the most commonly used technique to estimate reliability is with a measure of association, the correlation coefficient, often termed reliability coefficient. Typical methods to estimate test reliability in behavioral research are: test-retest reliability, alternative forms, split-halves, inter-rater reliability, and internal consistency.

**Internal consistency:** Internal consistency concerns the reliability of the test components. Internal consistency measures consistency within the instrument and questions how well a set of items measures a particular behaviour or characteristic within the test. For a test to be internally consistent, estimates of reliability are based on the average inter-correlations among all the single items within a test.

Cronbach’s Alpha method was selected for the present study. A Cronbach's Alpha is an index of reliability associated with the variation accounted for by the true score of the "underlying construct." This measures internal consistency reliability among a group of items combined to single scale. That is, it is a reflection of how well the different items complement each other in their measurement of different aspects of the same variable of quality.

Alpha coefficient ranges in value from 0 to 1 and formatted questionnaires or scales, the higher the score, the more reliable the generated scale is. A Cronbach's Alpha can be written as a function of the number of test items and the average inter-correlation among the items. For this study, initially a pilot survey was conducted and information was collected from 20 companies. Questionnaire has been divided into 3 part; first general information and for other two parts reliability test has been conducted. Cronbach’s Alpha value for part “E and F” is 0.668. Cronbach Alpha value for section C is 0.9. This value shows the reliability test is highly acceptable range even for that part of questionnaire which includes HR dept, finance, maintenance and MIS.

Validity tries to assess whether a measure of a concept really measures that concept, that is, the extent to which the concept measures the thing it was designed to measure. There are two types of validity-- Internal and External validity.
• Internal Validity is of four types Face Validity, Content validity, Criterion validity and Construct validity.

• External Validity includes the ability to generalize the results of study to other situations.

The face and content validity of the research instrument was confirmed by getting advice through discussions and expert opinion of five senior managers of manufacturing industry.

4.8 Pilot Study

For this study, initially a pilot survey was conducted and information was collected from 15 manufacturing companies. After collecting data from the companies data was tabulated and analyzed. Data analysis of the various sections is as follows:

**Analysis of Section D:**

To check whether the productivity has changed after use of ICT in manufacturing organizations 10 different parameters have been used. To know whether the change before and after use of ICT is significant, paired “t” test has been applied at 14 degrees of freedom and 95% confidence level the results obtained are shown in the table below
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Mean Difference</th>
<th>Std Error</th>
<th>‘t’ value</th>
<th>‘p’ value</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of Employee</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skilled</td>
<td>17.8667</td>
<td>11.8916</td>
<td>5.819</td>
<td>0</td>
<td>Significant</td>
</tr>
<tr>
<td>Unskilled</td>
<td>-17.2</td>
<td>12.3358</td>
<td>-5.4002</td>
<td>0</td>
<td>Significant</td>
</tr>
<tr>
<td>Types of Machine</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conventional</td>
<td>22.6</td>
<td>43.1671</td>
<td>2.0277</td>
<td>0.008</td>
<td>Significant</td>
</tr>
<tr>
<td>Automated</td>
<td>-22.6</td>
<td>43.1671</td>
<td>2.0271</td>
<td>0.008</td>
<td>Significant</td>
</tr>
<tr>
<td>Production cycle time</td>
<td>-0.345</td>
<td>8.5545</td>
<td>-0.1562</td>
<td>0.801</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Total production</td>
<td>-73326</td>
<td>215796</td>
<td>-1.02971</td>
<td>0.623</td>
<td>Not Significant</td>
</tr>
<tr>
<td>% Rejection</td>
<td>2.8733</td>
<td>5.4174</td>
<td>2.0542</td>
<td>0</td>
<td>Significant</td>
</tr>
<tr>
<td>Cost of mfg item in Rs.</td>
<td>1213.714</td>
<td>3976.132</td>
<td>1.142</td>
<td>0.713</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Turnover per year in cr</td>
<td>-667.613</td>
<td>2308.828</td>
<td>-1.1199</td>
<td>0.698</td>
<td>Not Significant</td>
</tr>
<tr>
<td>Total sales in % of production</td>
<td>-18.7333</td>
<td>11.8711</td>
<td>-6.1118</td>
<td>0</td>
<td>Significant</td>
</tr>
<tr>
<td>% Profit</td>
<td>-3.6667</td>
<td>2.7689</td>
<td>-5.1288</td>
<td>0</td>
<td>Significant</td>
</tr>
<tr>
<td>% Customer complaint</td>
<td>0.88</td>
<td>1.8501</td>
<td>1.8421</td>
<td>0.048</td>
<td>Significant</td>
</tr>
</tbody>
</table>

Table 4.4 Observation of Pilot data
From the table it can be seen that the % of skilled workers/employees has reduced after use of ICT but % of unskilled workers/employees has increased significantly. In case of machines, it can be seen that conventional % of machines has reduced and automated machines has increased after the use of ICT. Production cycle time has reduced, though not significantly. Total Production has increased, though not significantly. Percentage Rejection has significantly decreased. Cost of manufactured item has decreased, though not significantly. The annual turnover [in crores], which shows no significant increase. Total sales against percentage of production have significantly increased. The percentage of profit has significantly increased. Percentage of customer complaints is significantly reduced.

**Analysis of Section E**

It can be observed that for parameters 1, 2, 3, 4, 8 & 9 the respondent’s opinion is ranked at Agree. So it can be said that Order cycle time has reduced due to use of ICT, supplier evaluation performance has improved, customer complaints are reduced and rejection rate has also decreased.

For parameters 5, 6 & 7 respondents opinion is ranked at strongly agree. This shows that there is very much improvement in production performance. Overall equipment effectiveness has increased and there is huge reduction in cost of manufacturing.

For parameters 8 & 9 are ranked as agree. It indicates that employees’ skills have developed and ICT is helping in proper decision making.

Overall it can be said that overall performance parameters suggest that the performance outcome has improved significantly due to use of ICT.

**Analysis of Section F**

From the table it can be seen that respondent’s opinion for the parameters 1, 2, and 11 is ranked as Very High. While for all the remaining it is ranked at Moderate. Thus it can be commented that the greatest difficulty in the implementation of ICT in rural area is inadequate power supply. Additionally the rate of breakdown of machines,
malfunctioning of computers and the time taken for repairing is very high which affects the optimum use of ICT in rural areas. From the pilot study it is observed that, overall it can be stated that productivity has increased significantly with the use of ICT. Organizational performance has improved significantly. Inadequate power supply, repair facilities and technical support manpower affect the effective and optimum use of ICT in manufacturing industry in rural area.

4.9 Data collection

The main purpose of data collection is to select the data from the total population which has been decided from the research area. Questionnaire tool is used for data collection. Sufficient copies of questionnaire were prepared. Then researcher visited all the selected companies and collects the data. Most of the companies responded positively by filling up and returning the same. The experience was encouraging during the discussion between researcher and representative of the company data were collected about role and impact of information and communication technology in the manufacturing industries in the rural area of Nashik district. The researcher selected 110 manufacturing companies by using random sampling method from the rural area of Nashik district. Collected data was tabulated by using Microsoft Excel.

a) Primary Source: Primary data are collected from the Manufacturing industries / organizations through the structured questionnaire, discussion with company representative etc.

b) Secondary Data: Secondary data have been collected from the research paper and dissertations, scholar’s books of references, standard publication by institutes and organizations, report, Internet etc.