How do we assess the engineering education system? Unlike a broad-based education in the arts or the basic sciences, the engineering education system is designed to train engineers for the engineering profession. Hence it has to meet the challenges and needs for engineers in the economy. As the nature of technology and industry changes, the education system needs to be responsive and adapt to the changing demands. There is a need for engineering educators to be conversant with existing practices in industry while also acting as agents to bring in innovation and improvements.

The chapter presents the following sections

4.1. Research design
4.2. Research Method
4.3. Sampling method
4.4. Data collection instrument
4.5. Pilot study
4.6. Data analysis and interpretation procedures
4.7. Limitations of the data

4.1. RESEARCH DESIGN

The researcher has selected Descriptive research- Cross-sectional design to study the perceptions of stake holders. As Descriptive research is a type of research that has the goal of describing what, how or why something is happening. Descriptive research is used to obtain information concerning the current status of the phenomena to describe "what exists" with respect to variables or conditions in a situation, and a cross-sectional study is the simplest variety
of descriptive that can be conducted on representative samples of a population. Simply put, it is a study that aims to describe the relationship between and other factors of interest as they exist in a specified population at a particular time, without regard for what may have preceded the status found at the time of the study. However, it is impossible either to establish causal relationships or to get reliable perspectives from such a study. Cross-sectional studies, also known as surveys, are a useful way to gather information on important issues.

**4.1.1. The Research Plan**

The following steps indicate the procedure adopted to carry out the study:

1) The area of study includes institutions affiliated to Jawaharlal Nehru University, Hyderabad region that have been established prior to 2003.

2) University affiliated colleges were classified into four classes i.e., Urban Accredited, Rural Accredited, Urban Non-Accredited, and Rural Non-Accredited, to compare among them the perceptions of the stakeholders.

3) Sample design

4) A Research Instrument (questionnaire) was constructed to study & analyze the perceptions of the stakeholders in JNTU university affiliated colleges. Three different sets of questionnaire were designed to study the perceptions of management, faculties and students. The instrument catered to investigate perception for quality management system, management, faculty, students, Examination system, infrastructural facilities & demographic data of their respective institution.

5) The designed questionnaire was pre tested through pilot study.

6) Questionnaire (see annexure A, B, and C) was distributed personally among the respondents in the selected institutions for the study.
7) The collected field data was then compiled analyzed & findings were given for the objectives of the research work.

The questionnaires were distributed personally as it could help the researchers to interact with the respondents and know the inherent feelings and perceptions of the respondents.

4.1.2. Researcher's Assumptions

Caelli, Ray & Mill, (2003)\textsuperscript{169} in the article ‘Clear as mud: Towards greater clarity in generic qualitative research,” opined that researcher should disclose his/her values and perspective so both the reader and the researcher can take those values into account in understanding the findings.

Within this research study, the researcher was principally responsible for the collection and analysis of data. The researcher would also bring into the research process a series of attributes, making his perception of data different from those of another researcher, thus, there is a need to make explicit any of the researcher's background experience that might influence the research and its findings as expressed by Merriam, (1998)\textsuperscript{170} in the book “Qualitative research and case study applications in education” and Stake, (1995)\textsuperscript{171} in his book “The art of case study research”.

The researcher therefore, declares that he was deeply involved in the issue he researched. The researcher's direct experience of working as faculty in engineering college positioned him within the object and the process of his inquiries with personal and professional experience forming a valuable 'touchstone’ similar to what is expressed in the book “Basics of qualitative research: Grounded theory procedures and techniques by Strauss & Corbin(1990)\textsuperscript{172}.

Like Edwards, (1999)\textsuperscript{173}, in the paper “Inside the whale: Deep inside research” the researcher was a 'deep insider' researcher for much of this inquiry, as he was associated
with industry and engineering institutions for more than 25 years. As a result of this experience and knowledge gained, the researcher claims the potential for a deeper understanding and greater insight than an 'outsider' researcher might bring to the task, while remaining mindful of the doubts, uncertainties, and dilemmas. There is little doubt when the researcher began the study in favour of more 'formal' quality assurance procedures for the assessment process and a proper monitoring of the way it should be implemented like the one adopted in industrial sectors. He had also been influenced by the attitudes of others related to the technical education, especially senior administrators. Even though the researcher was influenced, he discussed these issues with others such as his research supervisor and colleagues, and through his reading of the literature has undertaken a reflective process that gave him some distance.

The participants of the study are students, faculty and head of the institution, could be seen to inhibit free expressions and feelings. The researcher was very much aware that his credibility and rapport with head of the institution, faculty and students, in the engineering colleges may have had an effect on the research in terms of the conduct and support the researcher received, as researcher is a member of engineering college. The relationship between the respondents and the researcher could be described as professional and friendly.

Consequently, the trusting and collegial relationship based on a positive rapport necessary to commence and develop the investigation into the perception of stakeholders of the quality assurance process already existed. In this sense, the first step within the research process of getting to know the participants had already occurred well before data collection started. The researcher's intention was to use this existing relationship to remove any initial form of resistance by the participants about participating in this research study.
According to Glesne & Peshkin (1992)\textsuperscript{174} in the book “Becoming qualitative researchers: An introduction”, the friendly relationship between some of the respondents and the researcher could also have caused biases. Friendship may have biased data selection and minimised objectivity in three ways by subjectively selecting participants who are more likely to support the researcher's personal views, by ignoring the potential contribution to the data by participants whom the researcher did not know as closely and by not feeling free to make careful investigation for facts too deeply into a participant's causal factors for fear of adversely affecting their relationship.

However, it must be reemphasised that the nature of the researcher relationship with each of these participants was professional and friendly. It was not a social relationship or a personal friendship. While this limited the potential validity and authenticity risks to some degree, this problem was minimized by adopting three different questionnaires, which provided a capability to assess consistency and inconsistency in stakeholders' reports of their perceptions. A caution by Mertens (1998)\textsuperscript{175} in the book “Research methods in education and psychology: Integrating diversity with quantitative and qualitative approaches” that the validity of the information is contingent on the honesty of the respondents was also considered. The extent to which the respondents would trust the researcher to maintain confidentiality and the ways in which the researcher addressed this issue will be discussed in the section ethical considerations.

4.1.3. Ethical considerations

Stake (2005)\textsuperscript{176} in “The Sage Handbook of Qualitative Research” opined that in any type of study ethical dilemmas are likely to emerge with regard to the collection of data, the dissemination of findings, and in particular in the relationship between the researcher and
each of the participants. The standard data collection technique of survey questionnaire presented its own ethical dilemma. The researcher had to remember always that he was a guest in the private spaces of the respondents. Even though the data collected for this thesis were not politically, socially or physically sensitive in nature, ethical issues were considered important.

All participants, institutional heads, faculty and students were informed of the purpose and methods of the study as it is unethical in terms of human relationships to conduct an investigation when the subjects are unaware of the real purpose as expressed by Burns (2000)\(^{177}\) in the book “Introduction to research methods”.

In this study, the personal data of the respondents have been presented in an anonymous way. Participants' right to privacy was also made through the promise of confidentiality. This follows the advice from Cohen & Manion (1994)\(^{178}\) in the book “Research methods in education” that anonymity ensures that information provided by participants does not reveal their identity. A number of techniques were included to ensure anonymity and confidentiality of the findings. The use of codes instead of the participants' real names, ensure people other than the researcher cannot identify the participants from the information presented in this thesis. The names and locations of the engineering colleges were also concealed.

For the survey questionnaire, respondents were given an option regarding writing their name on the questionnaire to reduce the possibility of losing confidentiality through the involvement of many respondents. Data in this study was collected and analyzed only by the researcher. However, it has not been possible to guarantee total confidentiality nor anonymity of participants or information gathered as a result of this research project.
Institutional heads were not very open about their working with the researcher but the faculty and students have fully co-operated the researcher.

The researcher approached the Principals and the Heads of departments of the institutions where the data collection took place and informed them about the objectives of the research. They were very welcoming and consented to the request, researcher nevertheless still approached each of the respondents to get their consent and interestingly nobody withdrew through the study period even though they could do so.

Analysing the data may present another ethical problem. The researcher was the primary instrument of data collection since all data was filtered through the researcher's particular theoretical position and biases. Deciding what was important, and what should or should not have been attended to, was initially the researcher's decision. Thus, opportunities existed for excluding data contradictory to the researcher's views. While personal biases were not always apparent to the researcher, it was essential that he strove to be as non-biased, accurate and honest as possible in all stages of the study. Furthermore, the researcher always presented sufficient data to enable readers to draw their own conclusions.

Another consideration was the storage of data during and after the study. The forms of data collected from the survey questionnaires included a hard copy of respondents' questionnaires and computer disks containing data from the questionnaires will remain in the possession of the researcher and be accessed only by the researcher and his supervisor. Data will be kept for a period of time in accordance with the JNTU rules and regulations, after which they will be destroyed.

4.2. RESEARCH METHOD

To collect data for the study researcher used secondary data analysis by way of
documentary analysis to discuss the theoretical framework of secondary data which is incorporated in this research and a survey questionnaire to collect primary data on the perceptions of quality of technical education from the stakeholders of technical education.

4.2.1. Documentary analysis

The basic assumption behind documentary analysis, according to Cohen & Manion (1994)\textsuperscript{178}, is that individuals or groups often reveal their beliefs, values and ideas in the documents written by them, such as files, official departmental reports, minutes of meetings, circulars and memoranda. By analysing the contents of these documentary materials, appropriate content categories and ideas could be identified which could contribute to the understanding of a particular event or a phenomenon in a social setting through the occurrence of various words, statements, concepts and images.

Patton (2002)\textsuperscript{179} in the book “Qualitative research and evaluation methods” states that programme records provide a behind the scenes look at programme processes and how they came into being. Documentary analysis was used in this study due to the various advantages as stated by Patton (2002) and “Writing guide - Conducting content analysis” by Writing @CSU (2006)\textsuperscript{180}. Among the advantages are that documents have been written with a specific audience in mind, for a specific purpose. It allows for both quantitative and qualitative analyses, and provides valuable historical insights over time through analysis of texts. It was also an unobtrusive way of understanding and analyzing policies, guidelines and procedures formulated by the Directorate of Technical Education (DTE) and its Universities and affiliated engineering colleges in relation to quality assurance of the assessment processes. Documentary analysis provides insight into complex models of human thought and
language use, and assists in the design of the data collection instrument.

Documents were obtained from the DTE as well as the engineering colleges. The researcher had an open access to all documents and archival data through internet and personal visits. The researcher's selection was based on the principle to collect as many documents that were related to quality assurance initiatives of the assessment process. Documents and archival data included guidelines, proposals, policies, reports, meeting minutes and charts. They were collected in three ways. The first was making a request at the end of discussion for documents that informants mentioned and could provide. The second was to request documents from appropriate personnel who keep official records. The third was from the DTE library which is the internal repository for documents.

Documents and archival data were analysed throughout the study period. The researcher created a database for all data collected, including the, informants' details, documents and archival data titles and summaries of their content, as well as other notes.

4.2.2. Survey questionnaire

The second type of data collection strategy used in this study to collect primary data was the survey questionnaire. The data collection strategy was designed to achieve the outcomes to answer the research questions. In this study, the use of a survey as recommended by Borg and Gall (1989)\textsuperscript{181} in the book “Educational research: An introduction” and De Vaus (1991)\textsuperscript{182} in the book “Surveys in social research”, allowed the researcher to describe the characteristics of groups (sets of data), relationships between groups, and to identify possible causes for phenomena by comparing cases within the data.

In exploring the possibility of using a survey questionnaire in this study, the researcher considered a number of factors. The survey questionnaire is the most commonly used
descriptive method in educational research. Typically, according to Cohen & Manion (1994), they gather data at a particular point in time to 'identify standards which existing conditions can be compared' (p. 83). The data collection technique is used to measure variables in quantitative research, is usually used as a distinctive technique, and is a process of asking many people the same questions and examining the range of their answers.

The survey is considered by Berdie & Anderson (1974) in the book “Questionnaires: Design and use” and Hyman & Singer (1991) in the book “Taking society's measure: A personal history of survey research” to be a most appropriate data collection strategy to use when a large amount of information is needed from a larger group of respondents than is possible when using other designs. According to them, the survey is also an excellent means of generalizing findings obtained from a small sample to a larger population, but they do rely on self-reports of knowledge, attitudes, and behaviours.

4.3. SAMPLING METHOD

The respondents selected for survey was based on judgmental sampling technique. The individuals were selected because they were believed to be information rich sources that were able to provide reliable data in order to gain insights into the problem areas under investigation. The researcher himself selects units to be sampled based on the knowledge and professional judgment in order to select a more representative sample that can bring more accurate results than by using other probability sampling techniques.

4.3.1. Population

JNT University, Hyderabad has been according affiliation to the self-supporting colleges since 1995. As per the data available on JNTU website, for the academic year 2008-09, the JNT
University, Hyderabad has given affiliation to 251 engineering colleges which have been established on Self-supporting basis.

Under the JNTUH there are 10 districts and the distribution of total number of engineering colleges and the number of colleges offering the prime courses referred in the population are place in table.4.1, and illustrated in figure.4.1. Out of the 251 engineering colleges affiliated to JNTU Hyderabad there are 188 Engineering Colleges offering ECE, EEE, CSE & IT courses.

<table>
<thead>
<tr>
<th>SNO</th>
<th>DISTRICT</th>
<th>COLLEGES OFFERING CSE,IT,ECE,EEE</th>
<th>TOTAL NUMBER OF COLLEGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ADILABAD</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>HYDERABAD</td>
<td>27</td>
<td>33</td>
</tr>
<tr>
<td>3</td>
<td>KARIMNAGAR</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>KHAMMAM</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>MAHABUBNAGAR</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>MEDAK</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td>7</td>
<td>NALGONDA</td>
<td>24</td>
<td>32</td>
</tr>
<tr>
<td>8</td>
<td>NIZAMABAD</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>9</td>
<td>RANGA REDDY</td>
<td>69</td>
<td>104</td>
</tr>
<tr>
<td>10</td>
<td>WARANGAL</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td><strong>Total No. of Colleges</strong></td>
<td><strong>188</strong></td>
<td><strong>251</strong></td>
</tr>
</tbody>
</table>

Table 4.1: Data pertaining to the area under study
The study is carried out in the colleges which have been established prior to 2003 by considering the fact that the colleges with at least two passed out batches of students might equip them with quality and performance oriented systems.

4.3.2. Selection Criteria

The colleges established prior to 2003 were selected with an assumption that these colleges would have an effective quality system in place after two batches of engineering students have passed out of the college. It is observed that 92 engineering colleges were established prior to 2003. Out of 92 colleges, 03 colleges fall under the category of Urban Accredited, 06 colleges are under the category of Rural Accredited, 26 colleges fall under the category of Urban Non-Accredited, and 57 colleges fall under the category of Rural Non-Accredited.

4.3.3. Sample

A sample size of 15% of 92 engineering colleges established prior to 2003 and with at least two passed out batches of students was taken up for the study, i.e., 14 engineering colleges.
Selected fourteen engineering colleges belong to JNTU, Hyderabad region, and are considered to play key roles in the research and could provide relevant data.

Researcher considered three (03) Urban Accredited Colleges, three (03) Rural Accredited Colleges, four (04) Urban Non- Accredited Colleges, and four (04) Rural Non- Accredited Colleges. The primary data was collected through questionnaires and personal visit to these colleges. Questionnaires were distributed and explained to the institutional head, 10 faculty members and 20 students in each engineering college selected for study. Hence the data is to be collected from 14 institutional heads, 140 faculty members and 280 students. The details of student respondents is placed in table 4.2 and illustrated in figure 4.2, details of faculty respondents is placed in table 4.3 and illustrated in figure 4.3, and details of management respondents is placed in table 4.4 and illustrated in figure 4.4.

a). Students respondents from four types of colleges

Table 4.2: Distribution of student respondents

<table>
<thead>
<tr>
<th>College Type</th>
<th>No. of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>RURAL ACCREDITED</td>
<td>60</td>
</tr>
<tr>
<td>RURAL NON ACCREDITED</td>
<td>80</td>
</tr>
<tr>
<td>URBAN ACCREDITED</td>
<td>60</td>
</tr>
<tr>
<td>URBAN NON ACCREDITED</td>
<td>80</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>280</strong></td>
</tr>
</tbody>
</table>

![Student sample Distribution](image-url)
b). Faculty respondents from four types of colleges

Table 4.3: Distribution of faculty respondents

<table>
<thead>
<tr>
<th>College Type</th>
<th>No. of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>RURAL ACCREDITED</td>
<td>30</td>
</tr>
<tr>
<td>RURAL NON ACCREDITED</td>
<td>40</td>
</tr>
<tr>
<td>URBAN ACCREDITED</td>
<td>30</td>
</tr>
<tr>
<td>URBAN NON ACCREDITED</td>
<td>40</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>140</strong></td>
</tr>
</tbody>
</table>

Fig. 4.3: Distribution of faculty respondents

Table 4.4: Distribution of management respondents

<table>
<thead>
<tr>
<th>College Type</th>
<th>No. of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>RURAL ACCREDITED</td>
<td>3</td>
</tr>
<tr>
<td>RURAL NON ACCREDITED</td>
<td>4</td>
</tr>
<tr>
<td>URBAN ACCREDITED</td>
<td>3</td>
</tr>
<tr>
<td>URBAN NON ACCREDITED</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>14</strong></td>
</tr>
</tbody>
</table>
4.4. DATA COLLECTION INSTRUMENT

This subsection discusses methodological issues, which arose during the design and development of the data collection instrument (survey questionnaires). The implementation of the instruments is also discussed.

Acknowledging that 'to a large extent the success of a study depends on the quality of the data collection methods chosen', the researcher therefore designed and developed a self-administered and context specific questionnaire with 29 item to elicit the perception of quality of their institution and a supplementary section for collecting general information for students faculty and institutional, respectively with guidance from the findings from the documentary analysis and literature review. The researcher followed the recommendations by Lydeard (1991) in the book “The questionnaire as a research tool” listed a number of steps necessary for developing a questionnaire to be used as a research tool and they are as follows: (1) define the area of investigation, (2) formulate the questions, (3) choose the sample and maximise the response rate, (4) pilot and test for validity and reliability, and 5) recognise sources of error. Initially, the area of investigation was defined by reviewing the relevant literature. The questions were formulated from a number of sources, including the literature review and data obtained from semi-structured interviews. This was also to ensure the content validity of the
Measures to improve response rate in the data collection process were also employed. They included a cover letter with the questionnaire and method of questionnaire return. Several strategies were employed in this study to reduce measurement error and non-response. First, the questionnaire was kept to a minimum length of four pages and it was divided into two logical sections with each section clearly labelled.

The questionnaire comprised the following items: 1) covering letter, 2) instructions to respondents, 3) closed and open ended questions, and 4) demographic items. Each of these elements are discussed. The results of the pilot test undertaken to establish the validity and reliability of the questionnaire are also described. Refer to a copy of the instruments in annexure A for students, annexure B for faculty and annexure C for institutional at the end of the report.

A covering letter accompanied the questionnaire outlined the purpose and significance of the study, and the confidentiality of information (Annexure A, B, and C). In writing a covering letter, the researcher took into account the importance of ensuring that respondents understood the purpose of the study and believed the study was relevant to themselves as stakeholders of technical education. These strategies were employed to try and minimise respondents' negative states including fatigue, boredom, and discouragement.

When considering the possible structure of the questionnaire, the use of fixed alternative statements offered a major advantage to the researcher. Statements that are standardized with fixed alternatives meant that the responses of the subjects could be compared. For a response category, the five categories (Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree,) were considered the most appropriate response scale because the researcher wished to:
1) Obtain the opinion/attitude of the subjects, and

2) Measure different dimensions of particular concepts.

The researcher decided to include the ‘Undecided’ option because it is difficult to interpret the data if a large number of respondents leave an item blank. The ‘Undecided’ option was also included after taking into account respondents' feedback during the pilot study. The pilot survey respondents suggested the inclusion of an ‘Undecided’ category as a way to indicate whether the respondents were aware of the current quality assurance measures or not.

4.5. PILOT STUDY

Since the questionnaire was designed specifically for the purpose of this study it was imperative to pilot test it in terms of clarity of questions and statements, choice of words, missing items, effectiveness of instructions, and completeness of response sets, length and amount of time it would take to complete. The purpose of the pilot analysis was to test the data collection instrument for face validity and in particular, to check that the questions elicited appropriate responses.

A pilot study of the questionnaire was conducted using a purposive sample of a institutional head; four faculty and eight students from four branches of engineering of an engineering college where the researcher was working. This was carried out during the questionnaire design stage to reveal early problems, after being checked by the researcher's supervisor. A cover letter outlining the importance of the pilot questionnaire was attached. The participants in the pilot study were chosen because they had similar background and knowledge to the target population about the issues being investigated. They did not form part of the group to be surveyed. Verbal consent to participate in the pilot study was obtained from the respondents.
Respondents were asked if they felt uncomfortable answering any questions and if there were any ambiguous or difficult questions. They were also given the opportunity to make comments regarding the content of the questionnaire. Of the thirteen questionnaires distributed, all were completed and returned. A two hour meeting was organised in which their feedback was discussed.

The outcomes of the pilot study and the feedback from the meeting session indicated the need for some changes to be made. The four main concerns were: (1) failure to understand some questions and statements, (2) failure to understand some of the given instructions, (3) inappropriate choice of words, and (4) the absence of an ‘Undecided’ option, which respondents believed would not give a true indication of respondents' opinions. They believed respondents would be forced to choose between the four options when they actually did not have any knowledge about the statements. It could also have happened where respondents had no involvement in some of the processes mentioned in the questionnaire items. Minor alterations in wording were made to increase the clarity of several of the questions. The results of the pilot study have not been included in the final results. As the changes were editorial in nature and did not impact on the integrity of the questionnaire, the researcher took Anderson’s (1990) recommendation proposed in the paper “Introduction to statistical tools and techniques” not to subject the questionnaire to a second pilot study.

4.6. DATA ANALYSIS AND INTERPRETATION PROCEDURES

While it was presumed that the survey questionnaire is well suited for exploring the perceptions of stakeholders about the quality of technical education, it was also recognised that this method would produce large amounts of data, both relevant and important as well as unnecessary or irrelevant data, but this distinction was not immediately obvious during
data collection. This section describes the procedure used in data analysis and data interpretation for the data collection technique.

For the quantitative analysis, the preparation stage involved devising tables and forms so that the data could provide a fair summary of what had been studied and could be analyzed readily to answer the research questions. Simple descriptive statistics such as total, percentage and a measure of central tendency such as the arithmetic mean were calculated.

The basic data was analyzed using percentage method, and for inferential statistics Chi-Square test were used. Chi-square test is a statistical test commonly used to compare observed data with data we would expect to obtain according to a specific hypothesis.

4.7. LIMITATIONS OF THE DATA

1) The Present Study considers the private colleges affiliated to Jawaharlal Nehru University, Hyderabad and have been established prior to 2003.

2) Judgmental sampling technique was adopted and the geographical limitation was taken into consideration.

3) The study was limited to 14 institutions, 140 faculty and 280 students.