CHAPTER - II
REVIEW OF RELATED LITERATURE
CHAPTER - II

REVIEW OF RELATED LITERATURE

INTRODUCTION :

The synoptical discussion in the previous chapter was confined to the meaning and definition of technical education, its aims and purpose, the development of technical education in India from the pre-independence period to its present position, participation of women in technical education in India, problems and suggestions to tackle the problems of technical education in India. Likewise, a synopsis is also there describing the development of technical education in Assam from the pre-independence period to its present position, participation of women in technical education in Assam, the impact of the World Bank Project in the State of Assam. The present chapter includes the meaning and definition of technical education, its aims and purpose, development of technical education in India before Independence and after Independence, factors which help or hinder participation of women in technical education, technical education in Assam, World Bank Project and Assam, problems, suggestions etc. as reviewed from the related literature in technical education.

In order to highlight the special features of the present study an attempt has been made to arrange the related literature in a comprehensive manner. The main emphasis of this chapter is to bring to light those studies and other related materials which are applicable for the present study.

Many of the studies of international and national levels selected for the review, may not have direct bearing on the present study but they lead to a comparatively better conceptual understanding of technical education.

2.1. MEANING OF TECHNICAL EDUCATION :

Technical education is that type of education in which the trainee has to acquire some specific techniques on the basis of which he may convert raw materials into finished products. Through technical education one acquires a capacity to earn his living. By having this capacity, he starts production of some kind.
According to a UNESCO Monogram (1962) the term 'Technician' applies to persons working in occupations requiring knowledge of technology, a related sciences between that of skilled work and that of an engineer or technologist, occupations at the technician's level may call for inspection and maintenance, detailed development plans, supervision of production work, detailed construction, collaboration with the engineer is an essential part of the work of the 'Technician'.

The Huddersfield Conference on the Education and Training of Technicians (1966) identified technicians as being those people employed in the broad spectrum of occupations lying between the craftsman on the one hand and the professional (or technologist) on the other.

To Hugh Warren (1967) technicians are again classified as 'technician' and 'higher technician' which appears to be in agreement with the classification made by the National Society for Professional Engineers as 'industrial technician' and 'engineering technician'. Engineering technician is concerned with more of cognitive and perceptual skills that are used for visualising, problem solving and trouble shooting and the industrial technician may demand more of psycho-motor skills that are needed in routine productivity.

2.2. IMPORTANCE OF TECHNICAL EDUCATION:

In the present age of science and technology, the importance of technical education is very great.

According to S.N. Mukherjee (1976) the wave of enthusiasm in favour of technical education has been steadily rising in our country, (at individual as well as national level). This education is considered as essential for better earnings. Parents and students undergo great sacrifices and personal inconveniences for a degree or diploma in engineering because of the great opportunities it offers in life. In fact, India is today fully conscious of the importance of Machine, Material and Man and also of Management, Movement and Energy - these are the dominant forces which is the characteristics of twentieth century civilization. The modern wars have also shown that victory depends more upon skill than courage. The workshops are ineffective without millions of trained hands. India is trying to rise to the occasion. She has fully
realised that for the development of her vast material resources including her untapped mineral wealth, water power and agricultural potentialities and for the nationalization of her key industries, it is imperative to provide the greatest facilities for training up an army of technicians. The State as well as educationists are giving anxious thoughts to the organisation of technical education on a sound footing. Considering the need and importance of technical education for our country, plans are being elaborated and reforms are being proposed with a view to adapting technical education to the present and future needs of the country.

The Scientific Policy Resolution (1958) rightly states, "The key to national prosperity apart from the spirit of the people, lies in the modern age, the effective combination of three factors - technology, raw materials and capital, of which the first is perhaps the most important, since the creation and adoption of new scientific technique can, in fact, make up for any deficiency in natural resources and reduce the demands on capital".

2.3. PURPOSE AND AIDS OF TECHNICAL EDUCATION:

The aims of technical education is to develop an integrated personality in every person so that he can lead a happy life in an environment of material comfort. It should aim at training well educated and cultured citizens equipped with a knowledge of modern science and technology, capable of skilled work, physically fit and healthy, and imbued with a spirit of patriotism.

A Seminar on "Technical Education and its development" (1966-81) was held at Calcutta on January, 1965. The purpose and aims of technical education according to the opinions expressed in this seminar are the following:

Technical education should be broad-based, making it a field for further training of the individual so as to make him suitable for the requirements of industries and technical professions.

The aim of technical education should be:

1) To achieve technical competence.
2) To create a desire for learning continually and creating an ability for the same.
3) To provide a cultural background for the individual.
4) To train the personnel to the needs of the society.

According to Prof. N. Sidheswar and Prof. N. Rama Rao (1965), the aim and objectives of technical education should be such that it equips the trainee with all the necessary requisites to face the demand of his job or profession with confidence and ability. They classify the aims and objectives into two categories, viz, category A dealing with the essential or basic requirements common to almost all type of jobs such as to understand and harness nature, to develop the capacity for creative and analytical thinking, to make one aware of the obligations to the society in general and the profession in particular, and category B dealing with some specific equipments which may vary from one type of job to another such as to develop adaptability to men and machines, to train for leadership, to cultivate the habit of attention to detail, to develop an aesthetic sense, etc.

B.P. Sarkar (1965) has stressed that the main purpose of developing technical education should be to improve the standard of technical personnel so that economic design, manufacture, erection, commissioning and maintenance of industrial undertakings are possible without any technical supervision by foreign specialists.

According to Prof. J.P. Joshipara, (1965) the aim of technical education can be set out as to produce:

1) Persons capable of undertaking fundamental research in technology.
2) Persons who can correctly interpret such research work and use it in the solution of practical design problems.
3) Person capable of translating design into actual construction and manufacture of products.
4) Highly specialised technicians to handle electronic controls and computers, etc.
5) Skilled and semi-skilled craftsmen, and
6) Also to provide adequate knowledge of organisation, management, labour problems etc., to persons who, in the above categories have to handle such problems.
Permeating from these categories is the general requirement, which is the basis of all systems of education, that the system should not relegate the importance of human values to the background and stress only on the professional aspect of education. The aim should be to make the individual a useful member of the society first and then a useful member of his profession.

Prof. S.K. Dutta (1965) has emphasised that the aims of technical education is meant for preparing human agencies fit for basic functions like doing, guiding, thinking, creating and leading. It is enough if a skilled worker succeeds in doing things, a technician, is however, required for doing and guiding, a technologist or a non-technical technocrat must be fit for guiding and thinking, a design and research worker, on the other hand, may indulge in thinking and creating, whereas an industrial leader, of course, must excel in thinking, creating and leading.

S.P. Chaube (1993) has given the following aims of technical education.

1) Technical education should give to the trainee fundamental scientific knowledge and skill pertaining to the latest technology. With this type of knowledge and skill, we shall be able to equip ourselves with the latest technology in various areas. This position will add to the growth of our national prosperity.

2) Technical education should give to the trainee a correlated knowledge of general, scientific and special subjects. It must not aim to make him a specialist prematurely.

3) Technical education should be so planned as to train even the handicapped individuals in the society in order that they may also usefully adjust themselves in society and may also produce something if they want.

4) Technical education should be continual. It should be available till one becomes expert in a particular field.

5) Technical education last but not the least, should create in the trainee a sense of respect for manual work.
2.4. TECHNICAL EDUCATION IN INDIA BEFORE INDEPENDENCE

The issue of technical education has not come before us all of a sudden. It has been there, since ancient days. According to S.P. Chaube (1963), in India from the Vedic times, technical training was imparted from father to son. References to technical education in the Rig Veda and Atharva Veda have been found. Vivid description of construction of canals, bridges, vehicles incorporating fast speed and beautiful palaces have been found in the Rig Veda. During the Epic period (Ramayana and Mahabharata period) the technical education as prevalent in the Vedic age continued. The ruins of Mohenjodaro and Harappa reminds us of the technical skill of that period. During the Buddhist period, technical education was not neglected, despite of that period being dominated by religion.

During the Muslim period, technical education was not organised. The trainees used to learn the art under the strict personal control and supervision of the artisans concerned. The art of woodwork, architecture and drawing developed remarkably.

The formal technical education in India, as we know it today, may be dated back to the mid 19th century. A report by Sri A.P. Mac Donnel (1886), the then Home Secretary to the Government of India entitled, "Technical Education in India" offers the earliest account of the nature and scope of training facilities available in the country at that time. The following four Engineering Colleges are mentioned therein:

1) Madras Civil Engineering College, Madras Presidency, was established in 1862.
2) College of Science, Poona, Bombay Presidency, was established in 1854 as Poona Civil Engineering College.
3) Seebapore (Sibpur) College, Bengal Presidency.
4) Thompson Civil Engineering College, Roorkee was founded in 1845 by Mr. Thompson, the then Lt. General of North western provinces.

According to S.N. Mukherjee (1976) the Victoria. Jubilee Technical Institute (VJTI) was started in Bombay in 1887. The Indian Education Policy Resolution issued by Lord Curzon in 1904 advocated a new approach to the development of technical education in India. Another policy statement by Lord Curzon in 1913 said that, "no branch of education at present evokes greater public interest than technical and
industrial instruction. The Indian Institute of Science designed on a large scale has been established at Bangalore in 1911. The establishment of a Technological Institute for sugar manufacture and leather, for textiles etc. at Kanpur has been sanctioned. Industrial schools have been opened in several provinces".

In 1921, Lord Lytton appointed an Education Committee for considering the problems of technical education. According to the recommendations of this Committee technical institutes were opened at New Delhi, Kanpur, Dhanbad, Bangalore and Madras. Abbott-Wood Committee of 1937 also recommended for technical education but the outbreak of the World War II in 1939 put a stop to the scheme. The Delhi Polytechnic was established in 1941.

The Report of the Technical Education Committee of the Central Advisory Board of Education (1943) stressed the need for the development of technical institutions as an integral part of the national system. According to the Sargent Report (1944), "any scheme for the development of technical institution as an integral part of a national system must have a two-fold character. It must both form a link between education and industry and it must at the same time receive quite separate consideration as a form of mental training which is especially suited to certain types of intelligence, irrespective of their future occupation".

It was in response to the challenges to the post-war period that the All India Council for Technical Education was set up by the Government of India in November, 1945, on the recommendations made by the Central Advisory Board of Education that "to stimulate, co-ordinate and control the provision of educational facilities which industrial development in post-war period as well as the existing industry will need, there must be an All India body in Supreme Charge".

Thus, prior to the setting up of the All India Council for Technical Education in 1945, the technical institutions were run on private or provincial basis to meet the requirements of a particular industry or province.

2.5. TECHNICAL EDUCATION IN INDIA AFTER INDEPENDENCE

After Independence much importance was given to the progress and development
of technical education in the country. Efforts were made for the qualitative improvement as well as quantitative expansion of technical education in our country.

The University Education Commission (1948-49), under the chairmanship of Dr. Radhakrishnan gave the following suggestions for promotion of technical education in the country.

1) The engineering students should be given practical training at the concerned industrial centres.

2) Provision for higher education and research should be made in the field of engineering.

3) Rural Universities should be established in rural areas.

4) Necessary charges should be introduced in the technical and engineering courses according to the needs of the country.

The Secondary Education Commission (1952-53) also gave the following suggestions for the improvement of technical education.

1) A close relationship should be established between the industries and technical schools.

2) The current secondary schools should be converted into multi-purpose schools.

3) Various types of technical and vocational courses should be taught.

The Indian Education Commission (1964-66) also known as the Kothari Commission gave the following suggestions for reform of technical education in the country.

1) There is four times more need for technicians than engineers, so more technical schools (ITI's) and polytechnical institutes should be opened.

2) The trainees should get sandwich curriculum. They should also be given practical experience at relevant industries.
3) Brilliant B.Sc. graduates should be given training in electronics.

4) Chemical, aeronautics and space technology should be taught up to a high standard.

5) Education should be production-oriented. The technical students should get workshop experiences.

6) Refresher courses, in-service training, summer courses and comprehensive colleges should be organised for reforms in teacher education in the technical institutes.

The Report of the National Education Policy on Education (1986) emphasised the need for developing and promoting technical education in our country. The reorganisation of technical education should take into account the anticipated scenario by the turn of the century, with specific references to the likely changes in the economy, social environment, production and management processes, the rapid expansion of knowledge and the great advances in science and technology. In order to improve the situation regarding manpower information, the recently set up Technical Manpower Information system will be further developed and strengthened. In view of the present rigid entry requirements to formal courses restricting the access of a large segment of people to technical education, programmes through a distance-learning process, including use of the Mass Media, will be offered. Technical education programmes including education in Polytechnics, will also be on a flexible modular pattern based on credits, with provision for multi-point entry. A strong guidance and counselling service will be provided. Appropriate formal and non-formal programmes of technical education will be devised for the benefit of women, the economically and socially weaker sections, and the physically handicapped. To encourage students to consider "self-employment" as career option, training in entrepreneurship will be provided through modular or optional courses in degree or diploma programmes. In order to meet the continuing needs of updating curriculum in technical education, renewal should systematically phase out obsolescence and introduce new technologies or disciplines.

The Ramamurti Commission Report (1990) : In pursuance of its election manifesto, the National Front Government headed by Shri V.P. Singh, appointed on
May 7, 1990, a Committee with Acharya Ramamurti as its Chairman, to review the National Policy on Education (NPE), 1986.

According to this Commission's Report, the annual admission capacities of degree and diploma levels respectively are 37,000 and 75,000. About 38% of the degree level institutions and 30% of the diploma level institutions recognised by All India Council for Technical Education (AICTE) are concentrated in four states namely, Andhra Pradesh, Karnataka, Maharashtra and Tamil Nadu. Enrolment of girls in technical education institutions at degree levels is only about 12% while at diploma level it is about 17% Wastage is enormous. There is shortage of faculty.

The major recommendations made by the Ramamurti Commission Report (1990) regarding technical education are the following:

1) Improvement of quality and standards at all levels.
2) Upgrading of infrastructural facilities.
3) Establishment of effective linkages with industry, national laboratories, development sectors and other institutions/bodies.
4) Promotion of research and development (R & D).
5) Technology watch and assessment of manpower needs.
6) Measures to prevent brain drain.
7) Special programmes for SC/ST, women and the physically handicapped.

MODIFIED NPE, 1992:

The modified NPE, 1992 underlined the need for reorganising the technical and management education system to effectively deal with the changes in the economy, social environment, production and management processes and rapid expansion of knowledge and advances in science and technology. It laid specific guidelines for the qualitative and quantitative development of the technical and management education
sectors; establishment of linkages amongst the concerned agencies; manpower assessment and technical education forecasting, increasing effectiveness of technical education management system, proper delivery systems, measures to achieve greater cost effectiveness and generation of resources through suitable means of programme.

Modified NPE, 1992 on Technical Education for Women: Opportunities for technical education for women at all levels will be considerably increased. Women's access to technical education, will be improved qualitatively and quantitatively. Additional women Polytechnics will be established by the State Governments and Residential Polytechnics for women of a larger size will be set up under the central sector. The choice of trades/disciplines offered to women at Certificate/Diploma/Degree levels in all types of technical education institutions will be made keeping in view the objective of bringing about women's equality. Identification of certain skills and occupations as "suitable" or "relevant" for women, will no longer dictate the choice of subjects, either in the institutions meant exclusively for women or in the others. The selection of subjects will be based on the employment potential. Counselling services, will be provided to enable women to opt for "new subjects". All technical education institutions will be encouraged to start new formal programmes for women. For increasing opportunities for entry, incentives such as hostel facilities, stipends, scholarships, etc. will be provided particularly for courses in emerging technologies and programmes in which women's participation in the past has not been adequate. Formulation of guidelines for this purpose will be attended to by AICTE.

2.6. PROBLEMS OF TECHNICAL EDUCATION:

There are some problems in technical education which hampers the growth of technical education in our country. Dr. S.P. Chaube (1993) has remarked that the main problems of technical education are described as follows:

1) The Problem of Qualitative Improvement:

Education should be both quantitative and qualitative. It is true that quantitative improvement have been made in our technical education but adequate attention has not been paid to its qualitative side. Many of our technical institutions are being run in a very bad condition. There are no good workshops, laboratories, libraries and buildings. Well trained teachers are also very few.
2) **The Problem of creating Favorable Attitude Towards Manual Work**:  
   In our country, the person engaged in manual work is looked down upon as uncultured. Therefore, a labourer does not enjoy that respect in our society which a teacher, an advocate or a doctor does. Because of this situation rather a social stigma, our trainees in technical institutions do not like to engage themselves in those operations which require manual work. As a result, they do not get adequate practical experience and our technical institutions are not producing good skilled workers. Unless this situation is changed, no reform in technical education will yield the expected result.

3) **The Problem of Defective Curriculum**:  
   There is lack of productivity in the curriculum of technical education. It does not fulfil the local needs. The curriculum does not develop in the student a love for manual work. The curriculum also lacks in variety, it is rather monotonous. It does not have many purposes which should be a special feature of a technical institution.

4) **The Problem of Medium in Technical Education**:  
   The mother tongue has been accepted as the medium of instruction in the country upto the secondary stage. After passing this stage, when the student takes admission in some technical institution, he is given the training through English, because good books and equivalent glossary of technical terms are not available on the subject in his mother-tongue. This creates a great difficulty for the trainee. Consequently, many capable student are left behind, some even drop out.

5) **The Problem of Administration and Control**:  
   The Education Ministry (renamed as Human Resource Development Ministry) of Government of India is not responsible for technical education in the States. Various separate departments of the State look after this type of education. This situation has created the problem of administration and control.
6) **The Problem Relating to Research**

In the various Five Year Plans the Govt. of India has emphasised the problem of research in technical education, but we have not become self-dependent in this respect and we have still to copy western pattern. It is true that there is no harm in adopting certain processes and research styles, but the same should be according to our needs in the country. The foreign styles cannot meet our Indian needs. We have not yet succeeded in making such researches on the basis of which we may profitably use our full manpower. We are still manufacturing such machines which may be used as substitutes for manpower. Consequently, a major portion of our manpower lies idle and unemployed resulting in frustrations only.

7) **The Problem of Post Technical Education and Training**

This problem has not yet been attended to in our country. After getting the training, if the trainee remains unemployed for some time, he forgets all that he has learned in the technical field concerned. And those who are lucky enough to get some employment continue working for years according to the old method that they learnt several years ago. They hardly get any chance for acquainting themselves with the latest devices and techniques. Needless to add that they forget also the theoretical aspect of the training that they obtained.

8) **The Problem of Modernisation of Technology**

We in India, are blindly following the methods adopted by western countries. By modernisation we have begun to understand westernisation whereas our needs are different from the western ones. So we have to modernise our technology according to Indian needs. No one is giving attention to this pressing need. Under the influence of modernisation, we forget our Indian social values and circumstances. This has an adverse impact on the society.

9) **The Problem of Co-ordination Between Training Facilities and Job Opportunities**

Through our Five Year Plans we have developed opportunities for technical education. But the development of these opportunities has created the problem of
unemployment of technical hands. There is no co-ordination between training facilities and job opportunities which has created a major problem in the field of technical education.

S.N. Mukherjee (1976) stressed the following problems faced by technical education in our country:

1) Lack of Proper Administration and Control.
2) Inadequate Technical Manpower.
3) Lack of Accreditation and Co-ordination.
4) Lack of Better Programmes.
5) Problem of Medium of Instruction being English.
6) Paucity of Teachers.
7) Insufficient Workshop Practice.
8) Inadequate After-school Education.
9) Inadequate Research.
10) Lack of Co-operation between State, Industry and Technical Education.

Dr. D. Swaminathan, (1995) member, Planning Commission, Government of India has opined that the technical education system suffers from certain weaknesses and deficiencies. No doubt there has been a considerable quantitative expansion in technical education but quality suffered and there is a lack of relevance. The following are the major imbalances and distortions which need focussed attention:

1) The quantitative expansion has resulted in the lowering of standards and there exists a structural imbalance of skill requirement of the industry and business sectors and the traditional curriculum transacted by the educational institutions. These factors give rise to problems of unemployment and underemployment.

2) Wastage in the system is enormous. An analysis of the intake and out turn figures of recognised institutions shows that wastage is 30% at degree level, 35% at diploma level and 45% at postgraduate level.

3) The infrastructural facilities available in the majority of technical education institutions are extremely inadequate.
4) There is an acute shortage of faculty with about 25-40% of faculty positions remaining unfilled. No replacement is made for the vacancy created due to deputation of staff to higher studies/trainings.

5) In most of the institutions there is hardly any R & D activity.

6) The technical education institutions are functioning in isolation. Linkages and interaction between technical education institutions and user agencies, such as industries, R & D and design organisations and development sectors are not sufficiently strong and suffers from certain avoidable lacunae.

7) There has been an enormous increase in public expenditure on education but little attention has been paid to the strategies for raising non-budgetary resources and maximising peoples participation.

Gopal Krishna Dhar Senapati (1997) studied higher technical education in Assam since Independence. According to him the problems of technical education are the following:

1) The State of Assam carries the highest overall wastage rate of 43.13 percent in Engineering education of the State. Regional Engineering College (Silchar), Assam bears the highest wastage rate of 56.67 percentage. To avoid wastage in technical education in the State of Assam no attempt has been made to develop admission procedure in more scientific basis along with other measures required to be taken for the purpose.

2) There is an acute shortage of employment of degree and diploma holders in Engineering and diploma holders in Civil Engineering accounted for the highest percentage of unemployment. There is no backlog in respect of diploma holders in Textile Technology but there is no degree course in Textile Technology in the State.

3) There is a wide gap between theory and practice in engineering education which requires on-the-job training of students before they take up responsible assignments. Refresher programmes for Engineers and specialised courses in Engineering based on current needs of the country are needed to elevate the knowledge and expertise of engineers.
4) There is serious unemployment amongst engineers and technicians and at the same time, there is a shortage of highly trained engineers in some fields like Engineering Design, Advanced materials, Turbo Machinery, Computer science and Micro-Electronics, etc. There is a mismatch between production and demand. With the anticipated industrial growth and economic development by the turn of the century, it is urgently required to produce many more qualified engineers in different other trades than at present.

2.7. SUGGESTIONS TO TACKLE THE PROBLEMS OF TECHNICAL EDUCATION:

Efforts need to be made to solve the problems of technical education. We must make qualitative improvement as well as quantitative expansion in the field of technical education, through some critics still say that it is debatable in their view in favour of quality.

Dr. S.P. Chaube (1993) has given some suggestions for the solution of the problems of technical education. The suggestions are given below:

1) Technical education should be both quantitative and qualitative. The technical institutions which do not fulfil the minimum conditions should be closed. Those which are well managed and organised should be given adequate financial assistance for organising good workshops, laboratories and libraries. These good institutions should have close relationship with the relevant local industries.

2) A favourable attitude towards manual work should be created. Opportunities should be given to students and teachers in schools, colleges and Universities for doing various types of creative manual work. Workshops should be very well organised in order to give enough practical experience to each trainee.

3) The curriculum should be improved to fulfil the local needs. It should be production oriented. The curriculum should be varied and flexible. It should develop in the students a love for manual work. It should be estimated as to how many teachers and guides have to be appointed for a particular stage of technical education. It is on the basis of this estimate that arrangement for the equipment should be made.
4) In the technical institutions the regional languages should be accepted as the medium of instruction. The trainee should not be compelled to acquire proficiency in English, unless he himself insists for the same. For making regional languages as the medium of instruction, it is necessary to produce standard books in regional languages in the various areas of technical education. The teachers and guides for technical institutions should be so trained that they may be able to impart the training through the medium of the regional language.

5) Many problems of technical education will be automatically solved by solving the problem of its administration and control. The Education Ministry of the Government of India should take up the responsibility of technical education in the same way as it looks after general education.

6) The research work in the field of technical education should be carried out according to the needs and conditions in the country. We should make such technical researches with the help of which we may employ our manpower to the maximum extent. For this the Government should set up various types of experimental laboratories and research centres. The researchers should be given handsome stipends in order that capable persons may be attracted towards the same.

7) The problem of post-technical education and training may be solved through some measures such as correspondence courses, part-time training, close contact with the technical institutions and industries, short-term courses, refresher courses, etc.

8) No doubt, we should modernise our technology, but we have to Indianise them as well according to our own condition and needs. We have to modernise the technologies in such a way as to obtain the maximum production by using the minimum manpower input, capital and raw materials. In this process the manpower should be properly utilized and the maximum number of people should get employment.

9) For obtaining a balance and co-ordination between the technical facilities and job opportunities we should make an estimate of the manpower needed for the various areas. According to this estimate, we should give specialised technical education to a few selected persons. The technical institutions should be closely related to the relevant industries, because it is in these industries that the trained hands are to be employed. This programme should be prepared by the various states according to their own specific needs.
According to S.N. Mukherjee (1976), grave inadequacies, past and present, still exist in our technical education and can be ascribed to factors like insufficiency of funds, inadequate planning, poor teaching, wastage and stagnation. These will have to tackled, and we will have to pay attention for the solution of these problems. Some suggestions have been given by Mukherjee to solve these problems. These are:

1) We need a Statutory Board of Education in every State, co-ordinating the activities of various agencies of education towards a common goal.

2) The expansion of technical education in India should be done with caution and with full regard to the development of organized industries.

3) It is high time that a system of accreditation on a national level is introduced. This responsibility should be entrusted to the All-India Council for Technical Education, and the Central Government must be responsible for policies and other matters.

4) Training of technicians at lower and middle levels needs greater attention since trained workers are needed in industrial concerns in the interest of increased efficiency. It is for more necessary to start technical and trade schools to train the youths who come out of our elementary schools than to start engineering colleges and higher technological institutions.

5) There is need for better programmes in our technical institutions. We must have a pattern of engineering education which should produce all the high class engineers and scientists we need to man our design organizations and consulting services. New ideas and concepts have to be experimented and a new "personality" of technical education has to be built up. It is also necessary to evaluate the various courses of different levels to meet the changing needs. These should be carried out in cooperation with industry, and should aim at job analysis and specifications in terms of levels and duties of skills and responsibilities of technicians.

6) Regarding the medium of instruction, it will be necessary to make a switch over to the regional languages as early as possible. But English should continue as a compulsory language in the curricular of both technical schools and universities, and attempts should be made to provide adequate literature in technical subjects in Indian languages.
7) The salary and service conditions of teachers in technical institutions should be improved and the importance of the role of a teacher in the nation-building should be socially recognised. It will also be desirable to set up an All-India cadre for engineering colleges, as it is in vogue in other services. These steps will ensure the mobility of academically qualified and professionally experienced staff to the teaching profession.

8) The technical institution with its workshop and laboratory is, no doubt, the main centre of instruction, but real practical experience can be given in outside workshops, factories and farms only. Efficiency in technical training largely depends on a proper co-ordination of these two scenes of action. As such practical training and apprenticeship schemes should be properly organized and co-ordinated with education at workshops, schools and technical colleges. The Central and State Governments can spare some of their productive units for such purposes, and should see that technical institutions get adequate facilities for such a type of work.

9) After-school education for workers should be an essential programme in our country. Professional organizations must provide the necessary facilities for the continuing education of the practising engineers. They should hold frequent discussions on technical problems faced in day-to-day work as they will be very useful to enlighten the young engineer with an approach to practical problems.

10) There is an urgent need for concentrating attention on industrial research work, which is still in its infancy in this country. In a country like India, which has to withstand an ever-growing competition from foreign market, it is high time we modernised our industry and followed scientific methods of production in the interest of the country's economy.

11) Technical education is not a matter for educational institutions alone, as the entire co-operation of industrial organisations with technical institutes is necessary, if the instruction provided in technical schools and colleges is to be adequate and appropriate. A common alignment between industry and technical education is therefore very necessary. Technical education should be imparted in an industrial environment.

Prof. T.N. Barooah (1985) has suggested some measures for the solution of the problems that exist in technical education.
These measures are the following:

1) Reorganisation of technical education.
2) Curriculum development.
3) Correlation between industry and technical institutions.
4) Organisation of student welfare activities.
5) Proper utilisation of libraries.
6) Reorganisation of staff structure and need for staff development.
7) Proper use of teaching aids.
8) Proper organisation of the examination system.
9) Placement of the pass-outs of the technical institutions.
10) Autonomy of the State Council.
11) Necessity to create awareness about technical education.
12) Provision for continuing education.

2.8. FACTORS WHICH HELP OR HINDER PARTICIPATION OF GIRLS IN TECHNICAL EDUCATION:

According to this study, the factors which help education in technical fields are: family related factors; social factors, economic factors; information and guidance services; and flexibility of the education structure. The hurdles are: family related factors; lack of facilities; lack of information and guidance in schools and rigidity of the educational structure.

Gender bias is not a hindering factor in respect of employment or education in the technical field.

To Prof. B.P. Sarkar (1965) the main causes retarding the progress of technical education are the following:
1) Teaching profession is not lucrative enough to attract qualified and experienced engineers.

2) Research facilities and well equipped laboratories are not available.

3) Good technical books are not readily available. Most of the technical books in the English language are purely theoretical. Very seldom these books contain any data of practical importance. Only those which are published by the manufacturers contain some times important practical data or practical design methods. Thus, at present, little knowledge of practical aspects and their relation to theory is obtained at the institutions.

4) There is no way of associating our teaching staff with practical problems. This is a serious defect in our existing system. Due to this and in view of the fast progress in the field of technology, knowledge of our teaching staff becomes backdated, because opportunity is not provided to them to come in close contact with industries. Mutual co-operation of industries and institutions can alone rectify this defect.

5) Periodical changes are necessary in the syllabii to suit the industrial developments in India and the technological progress in other countries. But this has not been done.

6) According to the planned requirements of engineers, the number of students in each institution is increased without due increases in the capacity of the institutions. This, infact, has considerably lowered the standards because attention to individual students which is essential for increasing the standards, is not possible.

According to Prof. G.S.Chandran (1994), Central Project Adviser of the National Project Implementation Unit, World Bank Assisted Project for Strengthening Technician Education, the impediments to high polytechnic enrolment appear to be the following:

1) Lack of awareness, especially in the rural areas, of provisions available in Polytechnics.

2) Lack of awareness of employers.
3) No encouragement from parents.

4) Absence of career guidance in schools.

5) Ignorance about employment opportunities.

6) Drop-outs due to marriage.

7) Poor linkage between institutions and industry.

8) Irrelevant and obsolescent curriculum.

9) Absence of facilities in institutions.

10) Non-acceptance by male-dominated work force.

Prof. T.N. Barooah (1985) has enumerated the following factors which hinder the participation of women in technical education:

1) Defective selection procedure.

2) Lack of necessary aptitude.

3) Inadequacy of infrastructural facilities.

4) Ineffective teaching.

5) Poor level of attainments in English and Mathematics.

6) Rural background.

7) Inadequate financial resources.

Prof. S.A. Balu (1993), Ex-Principal TTTI, Bhopal was of the opinion that some factors in technical education hinders the growth and development of technical education for women. These factors are the following:
1) **Parent's and Family Considerations:**

Parents prefer sending sons to schools, more so to post-secondary institutions than daughters, due mainly to economic and social reasons. They consider male education as a better investment and female education a luxury as daughters become somebody else's asset after they are married off.

The costs of female education - to the parents-are high and the returns do not necessarily flow to the parents, as girls get married and move out to another family, may provide returns to the parents-in-law, who also do not attach values to such potential. Traditionally, parents consider it wrong to share any earnings of daughters. Costs to parents on female education is higher because of the need for greater security and privacy, costly dress, transportation, boarding and lodging costs etc. Parents are also doubtful of daughter's ability to get jobs or income as women face discrimination in the labour market.

Despite the provisions of 'equal pay for equal work', women are often treated as secondary and economically exploitable lower wage earners than men even though work contributions is equal. The concept of 'equal pay of equal work' needs to be applied not only in the context of women in development but also in the interests of motivating the workforce for higher levels of production. There is a general belief that girls are meant for helping in the household chores, which does not need much of formal education and boys need education to become wage earners. These traditional values accompanied by the economics of poverty make parents decide against the education of girls. There is a lack of awareness that acquisition of technical skills can bring in returns to the family and thereby contribute to improvement of the quality of life of the family. In the context of poverty levels, the savings of today are considered much more valuable than the possible higher returns of tomorrow and so parents decide against investing in female education.

2) **National and Socio-Economic Considerations:**

The desire to see a prosperous rural India, to attain a level of economic growth comparable atleast to other developing countries, to alleviate poverty, to create and sustain rural employment and convert the idle time available to the massive human resources in rural areas requires promotion of education of women for equipping them with knowledge and skills in productive occupations. But concerted efforts at
a national scale and requisite investments are lacking, macro-economic and fiscal policies rarely pay attention to promoting industries with potential for female employment in rural areas. Women mostly get employed as unskilled or semi-skilled workers at lower wages than man, in agricultural field, construction sites, cottage industry etc.

3) Educational Considerations:

That women are equally capable of acquiring knowledge and skills in all occupations barring a very few, has been amply demonstrated in many countries. Yet managements and industrial employers do not fully believe in it. The percentage of women in employment in industry or as teachers in co-ed technical institutions even in Police and Armforces is evidence to this belief. All information and resources focus more on men than on women.

The programme in vogue in technical institutions, meant for women, focus on traditional occupations of women, ignoring the fact that women can be competent in all occupations. Programmes in co-ed technical institutions are male focussed. They neither have the flexibility nor include courses that could enable women to transfer technology to their homes. That women can be more effective agents for technology transfer to homes and the community is not thought of in programme design. The extent to which programmes in technical institutions can provide for home based learning by girls, has not been adequately studied. Entrepreneurship development activities are focussed on males and more on the urban sector. Entrepreneurship development with greater attention to women needs to be promoted.

2.9. POSSIBLE POLICIES AND STRATEGIES FOR ENHANCING PARTICIPATION OF WOMEN IN TECHNICAL EDUCATION:

Late Prof. S.A. Balu (1993) had suggested some policies and strategies to enhance participation of women in technical education.

There is no doubt that promotion of technical education of women, with priority assigned to rural India, will bring in returns that would significantly augment economic growth and improve the quality of life of the rural folk. This however would require education and economic policies and strategies addressing the problems. Research is vital to understanding of the cultural and social restrictions and requirements.
Top priority would be assigned to research that would model and test more precisely how innovative education and economic policies could promote female education, productivity and maximize female technical education at minimum cost. In agrarian societies in rural India where women's economic prospects are very limited, it is necessary to demonstrate that women can earn more by instituting policies and programmes to improve access to labour markets, information and resources. Within this overall perspective, strategies which need to be explored are outlined below:

1) **Increasing Community Involvement**:

   In the planning of technical programmes for women and in determining technologies, forms and modes of training, follow-up activities for setting up productive industries, procurement of raw materials, marketing of products, involvement of the community is needed. The commitment of the community to gradually increasing participation of women in education and training programmes should be ensured through participatory approaches in planning, implementation, monitoring and review of programmes.

2) **Conducting Awareness Campaigns**:

   The costs and benefits of technical training, specially to women should be published through community-based seminars, publicity campaigns and mass media. Feeder schools should be deeply associated in the conduct of such campaigns. Success story of those beneficiaries who have undergone such training should be given wide publicity.

3) **Increasing Programme Flexibility**:

   Bringing institutions closer to homes through flexible credit-based programmes, providing for home-based learning for girls to the extent possible and courses concerning application of new and improved technology in the performance of household chores, improved sanitation, and innovations in traditional technologies should be made. Practice session of using and minor repairing of home-appliances, manually or electically operated, may be arranged.
4) **Improving Learning Resources**: Learning resources appropriate to home-based learning, instructional material without sex bias need to be developed.

5) **Increasing the Number of Female Teachers**: There should be concerted efforts to recruit female teachers for both co-ed and women technical institutions. Instead of recruiting female teachers for the teaching of a few technologies, attempts should be to have at least some female teachers for each technology.

6) **Making Girls Education Less Costly Than Boys**: Reducing parental burden of educating girls less than that of boys through fee waivers, scholarships and other incentive like book-grant, travel grant etc.

7) **Ensuring Girls' Security**: Free transport from home to school, separate common rooms, other amenities, separate lodging and boarding facilities at concessional rates, free medical treatment etc., might help in attracting more and more girls to technical programmes.

8) **Offering Continuing Education Programmes for the Benefit of Women Already in the Workforce**: A large number of women in rural areas are already in the workforce as semi-skilled and unskilled workers, which obviously indicates that there are no social or cultural restrictions on them being wage earners. Programmes in multiple modes and capsule courses should be offered to enable such women to gradually acquire higher levels of knowledge and skill enabling them to engage in more productive and income generating occupation. Technical institutions can play a vital role in this area.
9) **Promoting Action Research in this Area by Technical Institutions:**

The vicious cycle which discourages females from joining the mainstream of technical education should be broken. Success stories should be documented and disseminated. Potential in rural areas around institutions should be continuously studied and tapped. Research should encompass educational, socio-cultural and economic problems and issues.

The TTTI's along with NPIU, New Delhi conducted a National Seminar on 17th and 18th January, 1994 for devising strategies for enhancing participation of women in technician education. Some of the major recommendations related to strategies for enhancing women's participation in technician education of this Seminar are the following:

**I) National level:**

1) Intensification of technician education provisions of women through mass media.

2) Transfer of technology to rural women.

3) More effective linkages with industry, especially for training and employment of women students.

4) Special facilities to be provided to women employees by industry (transport, creches, etc.) if necessary by law.

5) Equal salaries/remuneration for equal work.

**II) State level:**

1) Enhancement in number of women in teaching and non-teaching positions in technician institutions.

2) Provision of necessary facilities and physical resources in Polytechnics to meet requirement of women students and personnel in Polytechnics.
3) Accommodation in girls' hostels close to Polytechnics.

4) Frequent updating of curriculum.

5) Reservation of women in admission to Polytechnics.

6) Women friendly courses in co-educational Polytechnics.

7) Promotion of entrepreneurship and self employment.

8) Filling up of vacancies in Polytechnics.

9) Greater involvement of women in policy/decision making.

10) Continuing education programmes for industry and community.

III) Polytechnic level :

1) Placement services.

2) Sandwich courses.

3) Atleast one lady officer/teacher in whom students can 'confide' in.

4) 'Earn while you learn' programmes for women.

5) Skills-Oriented and product-oriented training programmes for women.

6) Vocational career guidance and counselling services to pre-polytechnic institutions, Multi purpose High Schools and Pre-vocational centres, attached to High Secondary Schools.

A study entitled "A National Study on Women's Education and Employment in Technical Fields, Possibilities and Hurdles", was conducted by TTTI, Bhopal and NPIU, Delhi on March, 1994. Some of the major recommendations emanating from the findings of this study are summarised below:
National level:

1) All Polytechnics to be appraised of policies, programmes and policy directive relating to this area and monitoring mechanisms to be strengthened.

2) All business and industrial organisations to be appraised of the mandatory provisions regarding working conditions and facilities for women employees. Monitoring mechanisms to be strengthened, CII (Confederation of Industries of India) to be requested to facilitate.

Regional/State level:

Training programmes to be organised for Principals, TPOs, officers of Directorates of Technical Education, SPIU's in identified areas.

State level:

1) Technical courses to be reviewed in collaboration with business and industry considering needs of high/new technologies and appropriate technologies for the rural unorganised sector. Flexible course structures and instructional delivery systems to be developed to suit women students.

2) Hostel and transportation facilities to be provided on priority basis in Polytechnics with female students.

3) Career guidance, placement, information insemination and entrepreneurship development services to be strengthened. Position of TPO to be created in all Polytechnics, for this purpose and for taking care of welfare and redressal of women students' grievances.

Polytechnic level:

1) Strengthening of guidance and counselling services.

2) Information campaign focussed on schools.
2.10. TECHNICAL EDUCATION IN ASSAM:

Technical education before Independence was in its infancy in Assam. The first two industrial schools in our State were set up in 1907 by the Missionaries, one each at Kohima (Nagaland) and Shillong (Meghalaya). But there were no such institutions at the college level.

According to Prof. Siddheswar Saikia (1968) modern technical education had its beginning towards the later part of the nineteenth century with the establishment of the Williamson Artisan school at Jorhat and Williamson survey classes attached to Sibsagar High School. With the efforts of the then Director of Industries Rai Bhadur Kanak Lal Barua, and the then weaving superintendent, Rai Saheb N.M. Sundaram, the Government Weaving Institute of Guwahati was established in the year 1920. It was later renamed as Assam Textile Institute.

According to Indrajit Gupta (1975), the establishment of the Prince of Wales Institute of Engineering and Technology at Jorhat was one of the landmarks in the development of technical education in Assam. The Prince of Wales Institute of Engineering and Technology, is one of the oldest technical institutes of India and a pioneer technical institution in North-Eastern India. It was initially started on 23rd September, 1927. Late Bholanath Baruah, a timber merchant and one of the richest man of Assam donated a generous sum of rupees one lakh for its establishment. As means of security in case of any untoward failure of the institution, he exercised a Will in the name of Prince of Wales who visited India in the year 1921. This institution was formally opened by the Governor of Assam on 16th January, 1928, and named it as "The Prince of Wales Technical School". This institution was subsequently taken over by the Technical Education Department and its name was slightly changed to HRH (His Royal Highness), the Prince of Wales Institute of Engineering and Technology.

After Independence technical education in Assam has developed and progressed remarkably. It has received an impetus and is being reorganised more scientifically. The Assam Engineering Institute was started in January, 1948, at Chandmari, Guwahati. The establishment of the Assam Engineering College at Guwahati in 1955, was a landmark in the history of technical education in Assam. Another Engineering College was started at Jorhat in 1960. There is a Regional Engineering College at Silchar, which was established in 1967.
There were only two Polytechnics in the State by 1950-51. The creation of a separate Department of Technical Education in 1958 contributed much to the growth of technical education in Assam. In the later part of the Second Five Year Plan, two more Polytechnics were established, one at Silchar and the other at Nowgong. Again, in the last part of the Third Year Plan, two more Polytechnics were established, one each at Shillong (now Meghalaya) and Dibrugarh. But by 1970-71, there were six Polytechnics functioning in the State including the Girls' Polytechnic at Guwahati. The Girls' Polytechnic at Guwahati started functioning from January 1965. All these Polytechnics offer three years diploma in Civil, Mechanical and Electrical Engineering, except the Girls' Polytechnic which provides two-year courses in Civil Engineering, Draftsmanship, Secretarial Practice and stenography, while the Assam Engineering Institute at Guwahati opened Chemical Operators courses as well.

At present there are 3 Engineering Colleges and 9 Polytechnics in Assam. One IIT has also been established at North Guwahati (Kamrup).

2.11. WORLD BANK ASSISTED PROJECT FOR TECHNICIAN EDUCATION AND ASSAM (PROJECT REPORT):

The Project includes 264 Polytechnics in eight States and two Territories: Assam, Andhra Pradesh, Haryana, Himachal Pradesh, Maharashtra, Punjab, Tamil Nadu, West Bengal, the National Capital Territory (NCT) of Delhi and the Union territory (UT) of Pondicherry (which joined the Project in October, 1992). Total project cost at appraisal was US$ 362 million.

A mid-term review was conducted on August-September, 1995. The purpose of the mid-term review conducted jointly by the IDA team consisting of Messrs N. Corwell (team leader), S.K. Srivastava (Consultant-technical education) and R. Aggarwal (Consultant-architect) and the Government of India team led by professor D.P. Agarwal, National Project Director was to assess:

1) The extent to which the originally designed objectives and targets for the project are relevant today or need to be revised.

2) The extent to which the project is likely to accomplish its broad objectives nationally and statewide based on present achievements; and the extent mid-course
corrections are needed in some States to ensure a better match between accomplishments and the project's objectives.

Meetings were held with the Secretary, additional Secretary, the National Project Director (NPD) in the Department of Education, MHRD, GOI, the Chairman of All India Council for Technical Education (AICTE), the National Project Implementation Unit (NPIU). A wrap-up meeting was held with the Secretaries/Directors of Technical Education of the States under the project in Delhi on 14th September 1995.

Review of Project components in the State were conducted at meetings held at TTTI Bhopal, TTTI Calcutta and TTTI Madras and at NPIU, New Delhi. In each of these meetings, the State Secretaries and/or Directors of Technical Education and the Directors/Heads of State Project Implementation Unit (SPIUs) and their staff presented progress of the project in their States both in qualitative and quantitative terms.

After a slow start, particularly in civil works, the State of Assam has now geared up to complete the project by the scheduled date. Additional funds of Rs. 140.7 million are requested from GOI. The State level units are well staffed. 5 new Community Polytechnics, 1 Continuing Education Centre, 7 (of 9 proposed) Computer Centres, 1 Curriculum Development Centre, 8 LURCs, Industry Institute Interaction centre with 8 cells and 8 Maintenance cells have been established as proposed. The proposal to set up an LPDC is being dropped due to small requirements and limited capabilities of the State. All curricular have been revised. Multipoint entry and credit system is being introduced in all Polytechnics from 1995. All Polytechnics have signed MoUs with local industries. The State has continued to move ahead in staff development. About 60% teachers have been sent to various locations in India for training, higher education and extended industrial visits. The State has proposed to host an extension centre of TTTI Calcutta at Guwahati.

The percentage of women students has increased from 10% to 14% during the project period and 21.6% of faculty are women. However, action on the proposed new Polytechnic for women with both the new courses proposed is pending for lack of funds for construction. The State was advised by GOI to proceed with the Polytechnic as funds will be found for this important component from savings and reallocations.
An area of major concern is slow progress in the appointment of key additional staff at the Polytechnics. Only 8 of 45 staff required are appointed so far. It was also noted with great concern that the average pass rate in Polytechnics is only 19% at present. This situation should be reviewed by NPIU.

Civil works for a new Polytechnic and 10 extensions to existing Polytechnics are scheduled in the project with a budget allocation of Rs. 119.6 million. The State has a committed Rs. 119.7 million against which the State has spent only Rs. 33.6 million inclusive of retrospective financing of Rs. 14.2 million.

In addition to the schemes originally envisaged under the project and the enhanced requirement for civil works, the State requested for additional Rs. 30.0 million to repair existing Polytechnic buildings. It is recommended that this should be considered favourably as repairs conducted under the Project would enhance the life span of already deteriorating buildings.

A total 420 hostel seats for women have been envisaged under the project. However, the State has not yet completed a single hostel seat for women.

The State should pay special attention to allocating sufficient funds for civil works, ensuring timely delivery of drawings to contractors and utilize the dry seasons for speedy implementation of civil works so that all construction can be completed by June 30, 1997.

Against a budget allocation of Rs. 70.0 million for equipment, the State has committed Rs. 36.1 million of which Rs. 23.3 million (33% of budget allocation) have been utilized to date. Against a budget provision of Rs. 6.6 million for furniture, 7.05 million on vehicles and Rs. 5.5 million for books, the State has incurred expenditure of Rs. 1.9 million, 0.96, million, and Rs. 1.5 million respectively. The State has requested additional funds amounting to Rs. 17.8 million for equipment and Rs. 3.44 million for furniture.

2.12. REVIEW OF TECHNICAL EDUCATIONAL RESEARCH

According to 'Pragati' the Newsletter published by National Project Implementation Unit (NPIU) Nov. 1995, the following seminars and workshops were held in the field of Technical Education.
2.12.1 **SEMINARS AND WORKSHOPS** :

1) **Examination Reforms** :

TTTI, Chandigarh conducted a workshop on "Reforms in the State Board Examinations (terminal) of Punjab State Board of Technical Education and Training" on August 17 - 18th, 1994 in collaboration with Punjab State Board of Technical Education. 40 participants from various states and institutions at national level participated and 30 technical papers were presented.

2) **National Seminar on 'Curriculum Development'** :

The seminar was organised by TTTI, Chandigarh on 5th - 7th September, 1994 with a view to share the state of the art knowledge about curriculum development, to focus on enhanced employment and to determine the requirement of technical man-power in the next decade.

3) **National Seminar on Continuing Education on November 10 - 11th, 1994** :

The objective of the seminar was to create awareness and environment for effective implementation of Continuing Education in Polytechnics and Industries. 22 faculty members participated in the programme conducted by TTTI, Chandigarh.

4) **National Seminar on researches and innovation in Indian Entrepreneurship on December 8 - 9th 1994** :

The Seminar was conducted by TTTI, Chandigarh and was attended by over 40 delegates from Industries, Universities, Technical Colleges, Banks, Institutes promoting entrepreneurship, Polytechnics and management Institutions.

5) **National Seminar on Industry-Institute Interaction** :

This Seminar was conducted on 23 - 24th February, 1995 by SPIUI, Rajasthan in collaboration with Rajasthan and Haryana Chapter of ISTE.
6) **Workshop for Curriculum Development:**

The Bihar state C.D.C. organised a workshop for the purpose of curriculum development from 10th to 12th July, 1995 in Patna. Members from industries, user agencies, faculty and TTTI participated in the workshop.

7) **Joint Workshop:**

The first joint workshop of the TTTIs and NPIU to periodically evaluate the progress of the project was held at TTTI, Calcutta on June 19th - 21st, 1995. It was decided that continuous evaluation of the project jointly by TTTIs and NPIU would be conducted.

8) **Curriculum Development Workshops:**

TTTI, Madras has revised the curricular of 22 diploma courses of Andhra Pradesh through curriculum revision workshops. Also curricular of 7 diploma courses and 5 post diploma courses of Karnataka State were revised through workshops. Senior teachers of Polytechnics, officials of Directorate of Technical Education and resource persons from industry and institutes of higher learning were actively involved in the workshops.

9) **National Workshop on Developing Management Skills among Women Officers in SPIU'S:**

A national workshop on Management Development for women officers of SPIU'S was conducted at TTTI, Madras from 10th to 13th January, 1995.

Ten States namely, Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, Goa, Maharashtra, Madhya Pradesh, Uttar Pradesh, Rajasthan and Bihar participated in the workshop.

The workshop stressed upon the role and functions of the SPIU officers, provided them with experiential sessions of Entrepreneurship and Employability, curriculum needs analysis, Management case studies, Decision-making, self-confidence and Leadership skills. The participants were given practice sessions to prepare action for their respective state.
10) **National Workshop on Disbursement**:

NPIU, in collaboration with TTTI Bhopal, organised a National Workshop on Disbursement on 24th & 25th, 1995 at TTTI Bhopal. The Accounts officer/officers responsible for submission of reimbursement claims of the States were invited to participate. The workshop was organised to enable States to follow the desired procedures of the Bank more appropriately for submission of claims.

11) **Career Development for Teachers**:

A draft policy document for Polytechnic teacher's career development has been formulated at TTTI, Bhopal in a recent workshop under the auspices of AICTE and is now under consideration of National Board for Staff Development and Continuing Education, AICTE.

12) **Training Programmes for Teachers**:

a) The programme of Induction Training of Teachers was conducted by TTTI, Chandigarh from 24th to 28th October, 1994 under the Canada India Institutional Co-operation Project and was sponsored by ISTE. 22 faculty members from Polytechnics and Engineering Colleges participated in the programmes.

b) Five senior faculty members from Bihar attended in-country training on innovation and change in technical education at TTTI, Calcutta from 13th to 23rd February, 1995. The training programme was organised in collaboration with C.P.S.C., Manila. As a follow-up programme a seminar on Quality Circles was held at Pati Women's Polytechnic on 10th May, 1995.

c) TTTI, Madras has organised 82 short courses and workshops for the staff of the project Polytechnics in the Southern Region and 1425 staff participated in those courses. The areas of training include subject up-dating, computers and related programmes, Management development programmes, and industrial training.

13) **Satellite Based Teaching Experiment for Polytechnic System (STEP)**:

NPIU coordinated the Satellite Based Television Experiment for Polytechnics on micro-processors which was conducted from 20th to 25th March, 1995.
The Transportable Communication Terminal (TRACT) of ISRO was utilised for uplinking the lessons. Six interactive remote classrooms were set up at SP1U Ahmedabad, ISTE New Delhi and one centre each at the 4 TTTIs at Bhopal, Calcutta, Chandigarh and Madras. The hardware for this programme was provided by ISTE while the software was prepared by TTTIs. Each lecture was followed by interaction during which it was possible for participating viewers to ask questions through Fax or STD, Telephone and receive responses from experts. The teaching programme was conducted from Indira Gandhi National Open University (IGNOU) studio.

About 100 Polytechnic teachers participated in the programme and benefited from this week-long transmission of 25 lessons in micro-processors.

NATIONAL EXPERT-GROUP MEETING ON PROMOTING TECHNICIAN EDUCATION FOR WOMEN (8.4.1994) HELD AT NPIU, NEW DELHI:

According to 'Wited', Bi-annual Newsletter on Women in Technician Education, July 1994 published by Technical Teachers Training Institute (W.R.) Bhopal, the National Expert Group Meeting on promoting Technician Education for Women was held on 8th April 1994 at NPIU, New Delhi. The highlights of the National Expert Group Meeting are given below:

Major recommendations of National Seminar held at TTTI, Bhopal and the Research study on "Women's Education and Employment-Possibilities and Hurdles" were discussed and possibility of implementing them were also worked out.

The NPIU, on the basis of the research study identified following States which require intensive promotion of technician education for women:

1) Orissa.
2) Madhya Pradesh.
3) Uttar Pradesh.
4) Assam.
5) West Bengal.
6) Maharashtra.
7) Rajasthan.
8) Goa.
9) Andhra Pradesh.

The women officers at SPIUs of these States suggested the names of two Polytechnics (preferably co-ed Polytechnics). The group decided that the TTTIs along with the officers in SPIU of the selected States should work out a uniform plan of action and then each TTTI will implement the action plan for the selected Polytechnics in their region with the help and assistance from the SPIU officers looking after the subcomponent. Consequently a National Workshop was conducted at TTTI, Chandigarh on 4th and 5th May, 1994. This workshop was attended by all the Principals of four TTTIs and one faculty from each of the four TTTIs, eight SPIU officers looking after the promotion of technician education for women from selected States and NPIU officials.

It was also decided in the meeting that a training workshop to train SPIU officers in project States will be organised at TTTI, Madras.

Possibility of implementing the recommendations of the research study on "Women's Education and Employment of Technical Fields-Possibilities and Hurdles" was also discussed.

The issue of training of Principals and TPOs of Project States at TTTI, Bhopal was also discussed.

2.12.2. ACTIVITIES OF THE TECHNICAL TEACHERS TRAINING INSTITUTES:

According to 'Pragati', the Newsletters, published by National Project Implementation Unit (NPIU), January 1996, the activities of the four Technical Teachers Training Institutes are given below:
TTTI, Bhopal:

An MoU signed between group of industries at Pithampore and Indore, CII (M.P.), Department of Technical Education (M.P.) and TTTI Bhopal, binding them together for the management of Dhar Polytechnic. The Polytechnic is to focus on hi-tech programmes with flexible designs and to supplement laboratory and workshop support and to use industrial shop floors. The State is to finance the Polytechnic partially and the remaining finances to be generated primarily by supporting industry.

TTTI, Calcutta:

A sub-regional course on "Entrepreneurship Development for Women Technicians" was organised in collaboration with CPSC Manila, and Management and Training Services Division, Commonwealth Secretariat, London, from 6th to 17th November, 1995 at TTTI, Calcutta. The course was attended by 16 participants from different Colombo plan member countries. The participants shared experience of their countries to involve strategies for encouraging women technicians to take up entrepreneurship.

TTTI, Chandigarh:

(a) Eight training programmes of three days duration on "Management Information System", were organised from July to November, 1995 for all states of the northern region. Programmes were attended by 88 participants.

(b) On the request of Rajasthan and Punjab, a "Gender sensitive training programmes" for male Principals and heads of department of women Polytechnics organised at the institute from 13th to 15th November, 1995. A total of 20 persons from the northern region participated.

TTTI, Madras:

(a) A two-day Inter-TTTI-NPIU workshop was coordinated by TTTI, Madras on 27th and 28th July 1995 to identify critical concerns in the areas of Staff Development, Industry-Institute interaction, Continuing Education and Women Technician Education. The report came out with corrective measures and relevant action plans.
(b) Four educational TV Programmes on Earth Moving Equipments was produced in actual working situations to assist classroom instructions.

(c) Two training programmes was conducted in November/December, 1995 on Video production techniques. 28 Polytechnic teachers training with hands-on experience in using related equipment and producing sample video programmes participated.

**RESEARCH STUDIES BY TTTI, CHANDIGARH**

1) A study on "Impact of Induction programme for Newly Recruited Teachers on Teaching-learning" has been conducted for the State of Delhi. Major findings of the study indicate: (a) Most teachers perceive substantial increase in their knowledge and skill related to various aspects of teaching-learning; (b) Induction programmes be conducted at the beginning of the teaching career; (c) Major changes could not be affected due to non-availability of facilities and services at the Polytechnics.

2) A study on "Factors Contributing to the Unemployment of Diploma Holders in Civil Engineering" was taken up to obtain perception about possible avenues of employment. Major recommendations of the study are: (a) Reduce present intake of students in diploma courses in Civil Engineering; (b) Orient curriculum towards rural areas such as shelter, water supply.

According to "Pragati" the Newsletter published by National Project Implementation Unit (NPIU) on July, 1996, the activities of the four Technical Teachers Training Institutes are the following:

**TTTI, Bhopal**

Flexibility for effective implementation of Multi-point Entry and Credit system in the Polytechnics in Madhay Pradesh. A workshop was organised by TTTI Bhopal to (1) apprise the Principals and senior faculty of selected Polytechnics with developing strategies for effective implementation of MPE and CS. (2) prepare guidelines and documentation required for efficient implementation of the system.
TTTI, Calcutta:

To enhance programme on quality circle: A two-day intensive in-house programme on Quality Circle was conducted at Jalpaiguri, West Bengal, during 3/4/96 and 4/4/96. Faculty from Kurseong Polytechnic and Women's Polytechnic, Siliguri participated.

TTTI, Madras:

Environment workshop: A two-day workshop on Environmental Initiative was jointly organised by TTTI Madras and MEI Polytechnic, Bangalore. 35 teachers participated. Institutional Greening, Business-Industry-Institute Linkages and curriculum development for formal and non-formal courses for environmental development was the main theme of this workshop.

TTTI, Chandigarh:

a) The Instructional Resources Marketing Unit (IRMU) has been established at TTTI, Chandigarh to popularise use of instructional resources by technical teachers and students. A variety of instructional resource materials in the form of textbooks, curriculum document, teachers manual, training boards, charts, models, educational video films, etc., hitherto marketed by private publishers, are now readily available through IRMU.

b) Skill Upgradation of Laboratory Technicians and Workshop instructors. A crash programme is being launched for training laboratory and workshop instructors through industry oriented and practice based training programmes to upgrade their skills particularly with reference to the latest machines procured. Directorate of Technical Education may interact with the TTTI to design specific programmes for the Polytechnic personnel.

2.12.3. RESEARCH IN TECHNICAL EDUCATION IN THE STATE OF ASSAM:

According to 'Pragati', the Newsletter published by National Project Implementation Unit (NPIU) in April, 1996, the following innovations were taken up in the State:
In Assam, a State level committee was formed recently for monitoring the quality of construction. The actual monitoring by the committee has already started.

Full power have been delegated to the Directorate of Technical Education in respect of training/higher studies, within the country of all categories of staff, since the beginning of the project.

Assam Textile Institute in Guwahati designed and fabricated a combined Bobbin and Yarn Winding Machine and a semi-automatic loom with higher efficiency. These looms have been marketed within Assam and adjacent States under the brand name Shanti Loom.

The Institute took up a project on Product Development and Marketing of Eri Silk in order to diversify the application. Blending of Eri with wool, Polyester, ramie etc. and dying and printing on Eri products were developed.

The final products were made in collaboration with industrial units. During this design process, the institute made an outstanding achievement in the development of a new degumming process for Eri, which has reduced the time of degumming from 60 hours to 15 hours and also increased the realisation of yarn in spun silk process by about 25%. As a result the Institute got two Projects from Central Silk Board on Product Development and Marketing of Eri worth Rs. 2.00 Lakhs and Rs. 8.50 Lakhs in two phases.

Work is also on to improve the Amber Charkha for Eri and spinning in the rural sector.

2.13. IMPLICATIONS DRAWN FROM THE PREVIOUS LITERATURE: FOR THE PRESENT STUDY:

The review of research and related literature in the area of technical education in India and technical education in Assam, in particular, has far reaching implications for the present study. Prof. T.N. Barooah (1985) and Gopal Krishna Dhar Senapati (1997) studied technical education in Assam, which shows some guidelines for the present study. The World Bank Project Reports regarding
The review shows that there is no doctoral study on technical education for girls in the State of Assam.

Other studies pertaining to technical education at the international and national levels have implications for the present study. Prof. N. Sidheswar and Prof. N. Rama Rao (1965), Prof. B.P. Sarkar (1965), Prof. J.P. Joshipara (1965), Prof. S.K. Dutta (1965), Hugh Warren (1967), Prof. S.A. Balu (1993), Prof. G.S. Chandran (1994) and Dr. D. Swaminadhan (1995) studied technical education in India.

The study of the above referred literature strengthened the investigator's conviction to undertake a study of the girl students in the technical institutions of Assam.