SUGGESTIONS BASED ON OBSERVATIONS:

During the last decades of our independence, there has been thirty-fold expansion in the polytechnic education system. The unprecedented expansion notwithstanding the system design has remained more or less static. Changes in the system, if any have been marginal in nature. As a result, the system continues to produce more of the same kind of output. Meanwhile there have been major changes in the economic and industrial policy of the country, whereby the protection from international competition here – to fore enjoyed by the indigenous industry is now no longer available. Our industry is today facing fierce but healthy competition from multinationals and has to improve significantly the quality of its products and services, if it is to survive in the highly competitive environment.

The type of technical manpower required by the industry in the present scenario is quite different from the kind of output presently available from the polytechnics. As against the present pass-outs of polytechnics having undergone generalized diploma programme in various disciplines and possessing competencies for performing a supervisory role, what required is a shift to the development of highly specialized competencies amongst them at mastery level. The existing situation calls for re-engineering of the system using an abinitio approach to all aspects of technician education system for producing the desired type of output.

Peripheral changes in the existing system design may perhaps not solve the problem of mismatch between the desired and existing output and it may be necessary to have a fresh look at the design of the system. This would necessitate re-orienting the training programme and developing curriculum and instructional strategies in conjunction with the industry and by involving all the stakeholders of the system.
Based on the results of data analysis and interaction with the various stakeholders of polytechnics, following suggestions are made which, if implemented will enable the polytechnics to achieve their objectives more effectively.

7.1.1 Aims and Objectives of a Polytechnic

As meeting aims and objectives is one of the measures of organizational effectiveness, it is important to update and redefine the same for the sake of clarity amongst the managers of polytechnic system. The following are the suggested statements in this regard:

AIMS:

- To produce world class diploma engineers consistent with the needs of the industry, community and other sectors of employment.

OBJECTIVES:

- To offer quality, flexible, relevant and cost effective programmes for producing diploma engineers who will occupy multiple level positions in the horizontal and vertical bands of technical manpower spectrum and perform/ manage activities related to shop floor or field work in different sectors of employment.
- To develop desired organizational climate in the polytechnics through committed leadership and faculty development.
- To promote innovations and development for bringing improvement in teaching-learning process, instructional resource development etc by utilizing latest information technologies and instructional delivery system.
- To promote self - employment and entrepreneurship amongst polytechnic students.
- To undertake shop-floor oriented research and consultancy projects
- To assist the community in upgrading vocational skills of the youth and transfer of appropriate technology for improving the economy and quality of life of the people.
- Foster linkages with industry and community for sharing resources for mutual growth and development.
• To offer continuing education programmes for the professional and career
growth of working professionals on an on-going basis.

7.1.2 Long Term Planning For Polytechnic Education:

There has been considerable expansion of polytechnic education since independence. Almost all district headquarters have a polytechnic, producing generalized diploma holders in various fields of engineering and technology. It is suggested that instead of increasing the number of polytechnics, the consolidation may be undertaken by providing appropriate physical, human and informational resources for effective implementation of on-going programmes and projects in these polytechnics.

There is a need to design new courses, in consultation with the industries and other users of polytechnic products, in areas of technology using microelectronics, robotics, opto-electronics and other emerging manufacturing technologies. Emphasis may be laid on offering such need-based programmes in place of generalised diploma courses. Cooperative education may be encouraged to achieve quick results in this direction.

Such need based, new programmes in emerging areas of technology may, initially be started in the existing polytechnics taking advantage of available infrastructure. Efforts should be made for networking with the industries and other organizations for sharing resources in the form of expert lectures, practical training at shop - floor, industry based projects and training of teachers in industries. As the laboratory equipment today involve heavy budgetary requirement, duplicacy may be avoided and pooling of such resources may be encouraged at state level.

7.1.3 Polytechnic Curriculum:

Polytechnic curriculum should be based on competency profile of diploma engineers. It should be oriented towards technology applications and learning industrial field practices. The polytechnic curriculum should be based on competency profile of diploma engineers. It should be oriented towards
technology application and learning industrial/field practices. The curriculum besides teaching concepts, principles and practices should lay greater stress on developing practical skills by well planned laboratory and workshop experiences, ability of learning to learn, problem solving, diagnostic skills, understanding of national and international standards, basic skills of management, interpersonal and communication skills, ability to use computer software for various applications, techniques of time and conflict management, good house keeping, total quality management, positive attitude etc. Providing at least one semester of project oriented industrial/field training should form essential part of the polytechnic curriculum.

Polytechnic curriculum should also provide for “Electives” to take care of emerging areas, which students can select as per their interest and future employment potential.

7.1.4 Instructional Processes:

It is important to provide appropriate learning experiences to the students in such a way that appropriate competencies are developed. A shift, therefore has to take place from teaching to learning by providing well graded tutorial exercises, drawing work, laboratory and workshop experiences, project work etc.

A time has come when polytechnics should offer programmes on cooperative basis by seeking collaboration of specific industries without increasing the duration of programmes. It is, therefore suggested that providing field/industrial exposure, focusing on task analysis and problem solving oriented industrial experiences in collaborating industries will go a long way in creating necessary motivation, confidence and placement of polytechnic pass outs.

Therefore, the conventional method of teaching – learning which is presently dominated by classroom instruction has to be supplemented by well-planned practical experiences in the polytechnics and in the collaborating industries. This will require establishing linkages by respective departments with group of industries by having dialogue through personal visits etc.
7.1.5 Training and Re-training of Faculty:

Consistent efforts have to be made by the Directorates of Technical Education in each state to draw staff profile and identify training needs of each teacher. There is also a need to develop and maintain a data base for staff development programmes at state level for proper coordination to avoid mismatch between training provided and training needs of the teachers. Training – needs must be integrated with career growth of individual teachers for their proper motivation.

Though TTTI have made considerable efforts in offering variety of programmes to train and retrain polytechnic teachers but systematic planning of staff development has yet to take root at the state level. There is an urgent need to consider following aspects of training and re-training of polytechnic teachers:

- Mandatory induction programme (of nearly three months) in educational technology and curriculum processes for newly recruited teachers.
- At least three months of industrial training on regular basis, in a span of five years for the faculty of polytechnics.
- Training of polytechnic teachers in handling the computers for various engineering applications in a phased manner.
- Orientation of faculty of polytechnics for organizing practical work in the laboratories and workshops especially in the use of sophisticated and newly acquired equipment as a result of efforts made towards modernization of laboratories and workshops.
- Orientation of polytechnic teachers for providing meaningful project work related to real life field / industrial problems to the students.
- Short duration programmes in subject matter updating, particularly in emerging areas.
- Short programmes in institutional management, total quality management and entrepreneurship development.
- Study visits to industry and institutions of repute across the country and abroad.
7.1.6 Instructional Resource Development:

The quality of teaching-learning is seriously affected by the non-availability of appropriate instructional material: both print and non-print. Very few quality textbooks are currently available. The reference books, workbooks, data books and laboratory manuals etc are most scarce. Students are forced to take help from locally produced help books and guides, which are substantially poor in quality. The language is another barrier because many states have given option for Hindi medium in which no good text is available. This is seriously affecting the development of self-learning skill of students.

The status of non-print resources is equally bad. Very few agencies are engaged in developing video films, charts, slides, models, etc. For diploma programmes polytechnics are unaware of whatever little is available.

It is suggested that teachers must take up development of appropriate instructional material in their own area of interest. The teachers may develop students manuals graded exercises for tutorials, workbooks and Laboratory manuals for the benefit of students. Teachers should also undertake development of computer aided instruction packages and procure available multi-media in their subject area.

7.1.7 Establishment of Computer Centers:

As the present-day technology is resorting to use of microprocessors and computers in almost all the machines and equipment, the technical work force must be conversant with the operation and maintenance of such machines. It is, therefore, necessary that students must be exposed to use of different computer languages and available software pertaining to their branch of engineering. Keeping in view such a wide application of computers, it is suggested to strengthen computer facilities at each polytechnic.
7.1.8 Review of Norms and Standards:

Staff structure of teaching and supporting staff in the polytechnics should be revised by stating clearly the qualification and experiences for effective implementation of curriculum. Provision of recurring expenditure should be enhanced for the purchase of raw materials, repair and maintenance of equipment and buildings, TA/DA provisions etc.

7.1.9 Examination System:

The present system of examination is based on norm-referenced measurement, whereas it is required to have criterion-referenced measurement.

The examination should comprise of objective type questions, short answer questions in addition to problem solving and performance testing to ensure acquisition of desired competencies in the present context.

Viva-voce examination by involving experts from industry is another important consideration in evaluation of student's performance.

7.1.10 Implementing Total Quality Management (TQM):

TQM is a continuous process of bringing improvement in the teaching-learning process with focus on customer requirement. Effective education and training of faculty plays a vital role in implementing TQM in the polytechnics. Principals and Head of Departments have to provide leadership role in managing physical, human and informational resources for effective implementation of curriculum, leading to gainful employment of students. Tools will have to be designed to monitor effective implementation of TQM in the polytechnics. TQM principles should be practiced in various activities related to teaching-learning in polytechnics both by teachers and students.

7.1.11 Criteria for Accreditation:

AICTE has specified norms for granting approval of programmes and institutions. These norms mostly cover quantitative aspects of physical, human, informational and financial resources. This is not enough for achieving desired
level of standards and quality of instruction. Criteria for accreditation like: percentage of students finding employment through campus interviews, types of linkages the institution has established with industry, percentage of students going for self employment, overall reputation of the institution, organization of curricular and co-curricular activities etc can be some of qualitative factors. Polytechnics should follow and practice these quality standards.

7.1.12 Autonomy to Polytechnics:

Polytechnics should have autonomy to plan and effectively implement their programmes to achieve desired results. Selected polytechnics are given administrative and academic autonomy in a phased manner. To start with the polytechnics identified to be developed as ‘Centers of Excellence’ be granted such autonomy.

To sum up, a time has now come to consolidate the existing polytechnics, identify gaps in various aspects of the system (viz. input, process, output and management) and take corrective measures to bridge the gap(s).

Some selected polytechnics, which have necessary infrastructure, capability and leadership should be developed as ‘Center of Excellence’ to offer variety of programmes for professional and career growth of diploma engineers. These institutions should be converted into autonomous institutions to promote innovations and development.

Deliberate attempt need to be made to improve instructional process in the polytechnics laying greater stress on developing practical skills. Offering programmes on cooperative basis (in active partnership with industry) is the need of the day.

Norms and standards of polytechnic education, commensurate with effective curriculum implementation for different programmes need to be revised, making provision of enhanced recurring grant.

Training of teachers in industry, use of computers, skill of handling sophisticated machines and equipment will be called upon for providing appropriate learning experiences to students.
Polytechnic’s system of examination needs to undergo drastic changes for which deliberate thinking has to be done and suitable steps are taken accordingly.

7.2 POLICY INITIATIVES AND SUPPORT REQUIRED FOR INCREASING ORGANIZATIONAL EFFECTIVENESS OF POLYTECHNICS

Following are some of the aspects needing policy support for enhancing organizational effectiveness of polytechnics:

I. Greater autonomy of action is called for to offer flexible, credit based programmes corresponding to the needs of aspiring students and to the requirements of manpower development for multiple level diploma engineer positions in various sectors of employment. Autonomy is envisaged to enable the selected polytechnics to enter in partnership with industry in effective curriculum implementation, offering continuing education programme for working diploma engineers and craftsmen, organizing structured and supervised industrial experiences, involvement of practicing engineers in teaching-learning process, providing consultancy to industry, generating internal revenue for growth and development etc. Government will have to provide administrative and financial autonomy (within the overall budget allocations) to such selected polytechnics.

II. To enhance the status and image of polytechnic diploma holders, it is required to re-designate them as diploma engineers or technician engineers at all fora. AICTE, Ministry of Human Resource Development, Indian Society for Technical Education and Technical Teachers Training institutes have to promote calling polytechnic product as Diploma Engineers.

III. Selected polytechnics should be recognized and allowed to offer industry-oriented and practice based programmes at diploma, degree and post degree levels. Policy support is required for affiliating these polytechnics with technical universities to award such degrees.
IV. It has been recommended that for certain disciplines in engineering and technology, the entry qualification be raised from 10 + 2. AICTE has to take appropriate action to make such provisions of entry requirements to the polytechnics in specified disciplines.

V. Staff structure for the polytechnics will be different from that of engineering colleges. AICTE, thus, should revise staff structure of the polytechnics for effective implementation of different programmes.

VI. Administrative positions like that of Secretary, Technical Education and that of Director, Technical Education and Principals of polytechnics should be awarded for a minimum period of 5 years to support consistent qualitative improvement of polytechnic education System.

VII. Enhanced recurring grant by state governments should be provided to the polytechnics for improving teaching-learning process, establishing better linkages with the world of work, repair and maintenance of equipment and buildings, purchase of raw materials etc.

7.3 PROPOSED MODEL FOR RE-VAMPING THE POLYTECHNIC EDUCATION SYSTEM.

A hierarchal restructured organizational model for effective planning and management of polytechnic education system at National and State levels is suggested as shown in fig. 7.1 and 7.2. An interactive restructured model at National and State level have been suggested as shown in fig. 7.3.

Managerial Functions at Various levels:

MHRD/ AICTE

❖ National Policy decisions
❖ Technical Manpower Planning
❖ Budgetary provisions
❖ Coordination between various Ministries (namely Industry, Welfare, Finance etc.)
❖ Accreditation of programmes.
Figure 7.1: Proposed Restructured Model for Effective Management of Technician Education System

AT NATIONAL LEVEL

Ministry of Human Resource Development, Government of India

National Policy

All India Council for Technical Education, New Delhi

Directives for planning and implementation

Regional Technical Teachers' Training Institutes

AICTE Regional offices

Board of Apprenticeship Training
Figure 7.2: Proposed Restructured Model for Effective Management of Technician Education System

**AT STATE LEVEL**

- State Ministry of Technical Education
  - State Policies
  - State Directorates of Technical Education
    - Administrative Directions
    - Curriculum
  - State Board of Technical Education
- Polytechnics
  - Government
  - Aided
  - Private
  - Co-ed.
  - Women
- Trained Diploma Engineers for Employment
Figure 7.3: National and State Level Restructured and Interactive System Of Management

Employers from: Industry, Field Organisations, Institutions etc.

Needs

Ministry of Human Resource Development, Govt. Of India

AICTE & its Regional offices

State Technical Education Ministry

Regional TTTTs

DTEs AND BTEs

POLYTECHNICS

Offering need based courses

ENVIRONMENT / SOCIETY
AICTE- Regional Offices
❖ Implementing national policies
❖ Keeping controls and Checks regarding use of norms and standards
❖ Launching Schemes for Quality improvement
❖ Recognition of new institutions and courses

TTTIs
❖ Assistance to MHRD, AICTE, Directorates of Technician Education in planning and programming.
❖ Promote excellence in Polytechnic Education
❖ Offer need based staff development programmes
❖ Curriculum Design and Development
❖ Instructional Material Development
❖ Research and Development in Technician Education
❖ Assistance to polytechnics in overall growth and development.

DTEs
❖ State level planning : Long range and short range
❖ Implementing National policies
❖ Managerial functions pertaining to polytechnic education system
❖ Coordination between state and central agencies
❖ Monitoring growth and development of polytechnics in state.
❖ Promoting excellence in polytechnics.

State Boards of Technical Education
❖ Curriculum Design and Development
❖ Conducting examinations and Certification
❖ Coordinating evaluation system
❖ Admission to polytechnics
❖ Monitoring implementation of academic rules and regulations.

Polytechnics
❖ Management functions at polytechnic level
❖ Implementation of norms and standards laid by DTEs and SBTEs
❖ Fostering conducive academic and social climate in the polytechnic for effective teaching-learning leading to development of desired knowledge, skill and attitudes in students.
❖ Staff development activities
❖ Offer continuing education programmes
❖ Community Development activities
❖ Linkages with industries for mutual benefit
❖ Appropriate leadership for achieving excellence in polytechnics.
### 7.4 SUGGESTED ACTION PLAN FOR EFFECTIVE MANAGEMENT OF POLYTECHNIC EDUCATION SYSTEM:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Activity</th>
<th>Outcome</th>
<th>Initiative</th>
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</table>
| 1.      | Technical manpower survey                                      | Long term planning for meeting technical manpower requirement- airmen's | 1. AICTE/MHRD at National level.  
|         |                                                               |                                                                        | 2. DTEs at State level.                         |
| 2       | Job profile and competencies of technician engineers           | Identification of curriculum needs                                    | AICTE/TTTI                                      |
| 3       | Mission statement for polytechnic education system.           | Mission statement                                                     | AICTE/TTTI/ DTEs                                |
| 4       | Curriculum Designing and development                           | (a) Need based curriculum  
(b) Competency based modular course development | TTTI/SBTE/Polytechnics/Industries                    |
| 5       | Fixing norms and standards and accreditation policies        | Setting acceptance standards                                          | AICTE/TTTI/DTEs                                 |
| 6       | Setting criteria for staff selection and staff development    | Norms for staff                                                       | AICTE/DTE                                      |
| 7       | Policy for giving autonomy to polytechnics                    | Autonomy to polytechnics                                              | DTE/Polytechnics                                |
| 8       | Planning for implementation strategy and monitoring the quality of instructions. | Implementation of planned activities                                  | DTE/Polytechnics                                |
| 9       | Setting up procedure for coordination between different agencies and monitoring | Periodical Monitoring of the progress                                  | DTEs                                           |
| 10      | Updating / revision of curriculum                              | Dynamic curriculum                                                    | SBTE/TTTI                                      |
| 11      | Planning for continuing education projects                     | Continuing education facilities for working professionals             | DTE/TTTI/Polytechnics                          |
| 12      | Planning for achieving excellence                              | Continuous growth and development                                     | TTTI/DTEs/Polytechnics                         |
| 13      | Planning for removal of obsolescence and strengthening laboratories | Updating the facilities                                               | DTEs/Polytechnics                              |
7.5 Scope for Further Research

1. As various stakeholders were not clear about the relevancy, adequacy and sufficiency of the curriculum, there is a need to make an in-depth study in this regard. The outcome will be of great help to the concerned officials and teachers in developing a need based curriculum for technicians’ programmes.

2. Since each polytechnics has a unique status of organisational effectiveness, a local detailed study may be carried out to elaborate the gaps at each polytechnic level, in order to assist the polytechnic managers to plan and implement quality improvement programmes for achieving better organisational effectiveness and hence march towards excellence.

3. As the present examination system does not motivate students to learn desired technical skills and acquire problem solving capabilities in polytechnics and instead encourages rote-learning, there is a need to study the evaluation system and develop an appropriate student performance based assessment, which will encourage them to master desired competencies and practice learning to learn and problem solving techniques.